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TOPIC: EXPLORING THE IMPACTS OF SMARTPHONES IN TEACHING AND LEARNING OF ELECTRICITY AND MAGNETISM FOR ORDINARY LEVEL AT NEMBUDZIYA GOVERNMENT HIGH.

BY

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Contents

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The undersigned certify that they have read, approved and recommended to Bindura University of Science Education for the acceptance of this dissertation entitled, "Exploring the impacts of smartphones in teaching and learning of electricity and magnetism for ordinary level Nembudziya government high'' Submitted in partial fulfillment of the requirements for the reward of an Undergraduate in Education.

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DEDICATION

This dissertation is dedicated to my parents, whose love and support have been my foundation. Your sacrifices and unwavering belief in me have made this achievement possible. To my spouse, for your endless patience, encouragement, and you understand throughout this journey. Your support has been invaluable. To my friends and colleagues, thank you for your inspiration, motivation, and companionship. Your presence made the challenging times more bearable.

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Abstract

The integration of smartphones into the teaching and learning of electricity and magnetism presents a promising yet challenging approach to modern education. This dissertation investigates the benefits and challenges from both teachers' and students' perspectives, and analyzes the factors affecting successful integration, supported by a detailed data analysis. The study aims to evaluate the effectiveness of smartphones in enhancing student engagement, understanding, and collaboration in the context of electricity and magnetism education. It also seeks to identify the technical, pedagogical, and socio-economic factors influencing this integration. A qualitative approach was employed, to collect qualitative data from student feedback and teacher observations. The sample included high school students enrolled in physics that are doing electricity and magnetism, where smartphone-based activities were integrated into the curriculum. The Key Findings were as follows; Students reported that visual and interactive tools helped them grasp complex concepts more effectively. Students spent an average of 40 minutes per session on task, with 90% regularly using the educational app, indicating high levels of engagement. Teachers observed that students were more motivated and interested during lessons involving smartphones compared to traditional methods. It Increased collaboration among students was noted, facilitated by the use of smartphones for data sharing and discussion. 80.6% of students found the smartphone apps helpful and engaging, though 19.4% reported technical difficulties. Students appreciated the interactive nature and real-time data collection capabilities of the apps. However, there are challenges Identified such as variability in smartphone models and operating systems affected the performance and compatibility of educational apps. Older or lower-end devices struggled with running advanced simulations. Reliable internet access was crucial for downloading apps, accessing online resources, and conducting real-time data collection. Poor connectivity in some areas hindered effective utilization. The presence of social media and other non-educational apps posed a significant distraction, requiring teachers to implement effective classroom management strategies to keep students focused. Disparities in students' access to smartphones and the internet highlighted the need for inclusive solutions. Not all students had access to the necessary devices or reliable internet, creating inequities in learning opportunities. Some educational apps and resources

required purchases or subscriptions, which could be a barrier for students from low-income families.

CHAPTER 1: INTRODUCTION

1.1 Introduction

Electricity and magnetism is critical topics in the physics curriculum, laying the groundwork for understanding many modern technologies and scientific principles. These subjects involve complex and often abstract concepts, such as electric fields, magnetic fields, and electromagnetic waves, which can be difficult for students to grasp through traditional teaching methods alone. Traditional instruction relies heavily on lectures, textbooks, and physical laboratory experiments. While effective, these methods can be limited by resource availability, time constraints, and the inherent difficulty of visualizing invisible forces and phenomena. The introduction of smartphones in the classroom offers a transformative approach to overcoming these challenges. For instance, interactive simulations available through smartphone apps can help students visualize and manipulate electric and magnetic fields, making these abstract concepts more tangible. Augmented reality (AR) and virtual reality (VR) applications can create immersive learning environments where students can explore and experiment with electromagnetic phenomena in ways that were previously impossible. Understanding the full impact of smartphone integration on the teaching and learning of electricity and magnetism is crucial. This study aims to investigate these impacts comprehensively, providing insights into how smartphones can transform educational practices, improve student outcomes, and prepare learners for a technologically advanced world. Despite these advantages, integrating smartphones into the educational process also presents several challenges. One of the primary concerns is the potential for distraction. Smartphones can easily divert students' attention away from educational activities to non-educational content, such as social media and games. The following sections will delve deeper into the background of this integration, the research questions guiding this investigation, and the significance of the study, setting the stage for a detailed exploration of this important topic.

1.2 Background of the study

Electricity and magnetism are fundamental components of the physics curriculum at the ordinary level. These topics encompass crucial concepts such as electric fields, magnetic fields, electric circuits, and electromagnetism. Understanding these principles is not only essential for academic

success but also for grasping the technologies that underpin much of modern life. However, the abstract nature of these topics often poses significant challenges to students. Concepts like the invisible forces of electric and magnetic fields, the behavior of charged particles, and the intricacies of circuit design can be difficult to visualize and understand through traditional teaching methods alone (Anderson, 2023).

Traditional instructional methods for teaching electricity and magnetism typically include lectures, textbooks, and physical laboratory experiments. While these methods are effective to some extent, they have their limitations. Lectures can be passive and may not engage all students effectively. Textbooks provide theoretical knowledge but often lack interactive elements that can make learning more engaging. Physical laboratory experiments are invaluable for hands-on learning but can be constrained by the availability of equipment, time, and resources (Garcia and Lee, 2022).

The introduction of smartphones in educational settings presents a potential solution to these challenges. Smartphones are ubiquitous and multifunctional devices that most students already possess and are familiar with. They are equipped with a variety of sensors (such as accelerometers, magnetometers, and gyroscopes), internet connectivity, and a plethora of educational apps that can be leveraged to enhance teach (Martinez et al., 2023).

Smartphones can serve as powerful educational tools in several ways. They can provide interactive simulations that help students visualize and manipulate electric and magnetic fields, making these abstract concepts more tangible. For example, apps like PhET Interactive Simulations offer interactive modules where students can experiment with virtual electric circuits and observe the effects of changing variables in real-time (Johnson and Kim, 2022). Augmented reality (AR) and virtual reality (VR) applications can create immersive learning environments, allowing students to explore electromagnetic phenomena in ways that traditional methods cannot (Taylor and Smith, 2022).

Furthermore, smartphones can increase student engagement through interactive and game field learning experiences. Educational apps often incorporate elements of game design, such as points, levels, and rewards, which can make learning more enjoyable and competitive. This

gamification can be particularly effective in maintaining student interest and motivation, which are crucial for mastering challenging subjects like electricity and magnetism (Cheng and Wang, 2023).

Personalized learning is another significant advantage of smartphone integration. Adaptive learning apps can provide customized feedback and adjust the difficulty of tasks based on the student's performance, ensuring that each student receives the right level of challenge and support. This personalization can lead to better learning outcomes by catering to individual learning styles and paces. Additionally, smartphones enable students to access a variety of learning resources, such as videos, tutorials, and practice exercises, anytime and anywhere, providing a more flexible and self-directed learning experience (Robinson, 2023).

Despite these advantages, integrating smartphones into the classroom also presents several challenges. One of the primary concerns is the potential for distraction. Smartphones can easily divert students' attention away from educational activities towards social media, games, or other non-educational content. Managing and minimizing these distractions requires effective classroom management strategies and clear usage policies (Stewart and Nguyen, 2022).

Another challenge is the digital divide. While smartphones are widespread, not all students have equal access to these devices or reliable internet connections. This disparity can exacerbate existing educational inequalities, making it essential to address these issues to ensure that all students benefit from smartphone-based learning. Schools may need to provide devices or subsidies for internet access to bridge this gap (Carter and Patel, 2022). Moreover, the successful integration of smartphones into the curriculum requires teachers to be proficient in using these devices and the associated educational apps. Professional development and ongoing support are crucial for teachers to effectively incorporate smartphones into their teaching practices. This need for training and support can be a barrier, especially in schools with limited resources (Evans and Brown, 2023).

This study aims to investigate the impacts of integrating smartphones into the teaching and learning of electricity and magnetism at the ordinary level. By examining both the benefits and potential challenges, this research seeks to provide a comprehensive understanding of how

smartphones can enhance educational practices, improve student outcomes, and prepare learners for a technologically advanced world.

1.3 Statement of the problem

The integration of smartphones into the teaching of electricity and magnetism at the ordinary level presents several challenges and opportunities. Conceptually, these subjects involve abstract principles such as electric fields, magnetic forces, and electromagnetic phenomena, which can be difficult for students to grasp through traditional methods alone. Resource constraints often limit hands-on learning experiences, impacting student engagement and understanding. Moreover, disparities in access to smartphones and digital resources among students contribute to educational inequalities, known as the digital divide. Additionally, teachers may require training and support to effectively incorporate smartphones into their teaching practices, further complicating successful integration efforts.

1.4 Purpose of the study

The aim of this study is to investigate the impact of integrating smartphones into the teaching and learning of electricity and magnetism at the ordinary level. Specifically, it aims to explore how smartphones can enhance educational practices, improve student learning outcomes, and foster greater engagement in the study of these subjects. By examining both the benefits and challenges associated with smartphone integration, the study seeks to provide insights that can inform educators, policymakers, and stakeholders on effective strategies for utilizing smartphone technology in physics education.

1.5 Research questions

1. To what extant does the integration of smartphones enhance the effectiveness of teaching electricity and magnetism concepts, as perceived by teachers and students?

2. What are the specific ways in which smartphone-based learning activities contribute to improved student learning outcomes in electricity and magnetism education?

3. What factors influence the successful integration of smartphones into the curriculum for teaching electricity and magnetism, and how can these factors be optimized to maximize educational benefits

1.6 Aim

To determine the impacts of smartphones in the teaching and learning of electricity and magnetism in public secondary schools in order to come up with the ways of improving the use of technology in physics teaching and learning

1.7 Objectives

The study is guided by the following three objectives-

1. To find out the impacts of smartphones in improving physics pass rate at ordinary level
2. To initiate the base line knowledge on the significance of smartphones in teaching and learning of electricity and magnetism.

3. To come up with factors that influences the use of smartphones in teaching and learning of electricity and magnetism.

These assumptions provide a foundation for exploring the complexities of integrating smartphones into physics education at the ordinary level, emphasizing qualitative insights into the lived experiences and perspectives of teachers and students.

1.8 Significance of the study

The researcher was motivated to explore the impacts of smartphones on the teaching and learning of Electricity and magnetism after noticing that students at the school were struggling to achieve high academic performance in science subjects, particularly Electricity and magnetism, while students in the same province were performing much better. The findings of this study could be valuable to various educational stakeholders. They could help Electricity and magnetism teachers assess their preparedness to use smartphones in teaching and identify the necessary skill upgrades. Additionally, the findings could assist schools in developing policies that encourage the use of smartphones in education. The results are significant for both teachers and students at the school, highlighting the positive and negative aspects of using smartphones in Electricity and magnetism education, thereby enabling better utilization of the positives and development of strategies to mitigate the negatives. Conducting this research is also deemed necessary as it may highlight other areas requiring further investigation related to the topic.

1.9 Organization of the study

This research project will be organized into 5 chapters. Chapter 1 provides an introduction to the study, including the background, purpose, research questions, and significance. Chapter 2 will review the relevant literature on the integration of smartphones in the teaching and learning of electricity and magnetism in physics education. Chapter 3 will outline the research methodology and data collection procedures. Chapter 4 will present and analyse the findings of the study. Chapter 5 will discuss the implications of the findings, provide recommendations, and suggest areas for further research finally; Chapter 5 will conclude the study with a summary of the key findings and their implications.

1.10 Chapter summary

.In conclusion, while student responses to the use of smartphones in teaching and learning electricity and magnetism are overwhelmingly positive, realizing their full potential requires addressing certain challenges. By managing distractions, ensuring equitable access, and providing clear guidance, educators can enhance the learning experience and leverage smartphones as powerful tools for education. The integration of smartphones in teaching

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Literature Review provide a comprehensive overview of existing literature on the integration of smartphones in teaching physics, categorizing studies based on their methodologies and key findings (Garcia and Martinez, 2021). Analyze the strengths and limitations of different research approaches, such as quantitative experiments, qualitative case studies, and mixed-methods designs (Choi et al., 2022). Synthesize the findings of various studies to identify common themes and trends in the literature, such as the effectiveness of smartphone in improving student engagement and conceptual understanding (Wang and Lin, 2017).

2.2 The use of smartphones in teaching and learning of physics

Smartphones have become increasingly integrated into the teaching and learning of electricity and magnetism, offering a multitude of opportunities to enhance understanding and engagement in the subject matter (Smith, 2019). One significant way smartphones are utilized is through simulations. Educational apps provide interactive simulations that allow students to visualize abstract concepts, such as electric fields and magnetic forces, in a dynamic and intuitive manner (Jones and Johnson, 2020). These simulations help students develop a deeper understanding of the underlying principles by enabling them to interact with virtual models and observe the effects of different variables in real-time.

In addition to simulations, smartphones are used for interactive demonstrations in the classroom. Teachers can project visualizations of electromagnetic phenomena onto a screen, allowing students to observe and analyze complex concepts in action (Brown, 2018). For example, apps can illustrate the behavior of charged particles in electric fields or the interactions between magnets, providing students with tangible examples that reinforce theoretical knowledge. Interactive demonstrations make abstract concepts more accessible and facilitate deeper engagement among students.

Smartphones also serve as powerful tools for accessing educational resources. Students can use their smartphones to access online tutorials, videos, and interactive exercises that supplement traditional classroom instruction (Johnson et al., 2021). These resources provide additional

explanations, examples, and practice opportunities, catering to diverse learning styles and abilities. Furthermore, educational apps often offer personalized learning experiences, allowing students to progress at their own pace and review material as needed, thus promoting self-directed learning.

Virtual experiments conducted on smartphones offer practical learning experiences without the need for specialized laboratory equipment. Virtual lab apps simulate laboratory experiments related to electricity and magnetism, enabling students to manipulate variables, collect data, and analyze results in a simulated environment (Garcia and Martinez, 2019). By engaging in hands-on experimentation, students develop critical thinking and problem-solving skills while reinforcing theoretical concepts. Virtual experiments also offer the flexibility to repeat experiments and explore different scenarios, deepening students' understanding of scientific principles.

Smartphones serve as data collection devices for conducting experiments related to electricity and magnetism. Built-in sensors, such as accelerometers and magnetometers, allow students to collect real-time data on various phenomena, such as magnetic fields and motion (Robinson, 2020). This data can be analyzed using smartphone apps, enabling students to draw conclusions and make connections between theoretical concepts and experimental observations. Data collection activities promote inquiry-based learning and encourage students to think like scientists as they analyze and interpret results.

Collaborative learning is facilitated through smartphones, which enable students to communicate and collaborate with their peers both inside and outside the classroom (Clark and White, 2017). Messaging apps, discussion forums, and shared documents provide platforms for students to exchange ideas, ask questions, and work together on assignments and projects related to electricity and magnetism. Collaborative learning fosters a sense of community among students and encourages active participation, leading to deeper understanding and improved academic outcomes.

Despite the numerous benefits, the effective utilization of smartphones in the teaching and learning of electricity and magnetism is not without challenges. Technical issues, such as device

compatibility and internet connectivity, may hinder access to educational resources and hinder the implementation of smartphone-based activities (Taylor, 2018). Additionally, concerns about distractions and misuse of smartphones in the classroom require careful management to ensure that learning objectives are met effectively.

2.3 Teacher's perception toward integration of smartphones in teaching and learning of physics

Teachers' perspectives on the integration of smartphones in teaching and learning physics encompass a broad spectrum of attitudes and beliefs influenced by various factors such as their educational background, teaching experience, and familiarity with technology. Numerous studies have explored teachers' perceptions of integrating smartphones into the classroom, shedding light on the multifaceted nature of their views.

One prevalent perspective among teachers is the recognition of smartphones as valuable tools for enhancing student engagement and facilitating interactive learning experiences in physics classrooms (Smith, 2018; Johnson et al., 2019). By incorporating interactive apps, simulations, and multimedia resources, teachers believe they can captivate students' interest and make abstract physics concepts more accessible and relatable. These technological resources enable teachers to create dynamic and engaging lessons that cater to diverse learning styles and preferences, fostering a deeper understanding of complex scientific principles (McCombs, B. L., and Vakili, D.2018).

Furthermore, teachers appreciate the accessibility of smartphones to a vast array of educational resources, including online textbooks, interactive simulations, and educational apps (Jones and Brown, 2020). Unlike traditional teaching materials, which may be limited in scope and availability, smartphones provide teachers with convenient access to a wealth of digital resources that can enrich their physics curriculum. This accessibility empowers teachers to supplement their lessons with multimedia content, interactive exercises, and real-world examples, enhancing students' learning experiences and promoting deeper engagement with the subject matter.

In addition to enhancing accessibility, smartphones offer opportunities for personalized learning experiences tailored to individual students' needs and preferences (Taylor, 2020). Adaptive learning apps and online resources can provide students with personalized support, feedback, and

remediation, allowing them to progress at their own pace and focus on areas where they need additional assistance. This personalized approach to learning empowers students to take ownership of their education and develop a deeper understanding of physics concepts through self-directed exploration and inquiry.

Moreover, teachers recognize the potential of smartphones to facilitate collaborative learning experiences that promote peer interaction, communication, and knowledge sharing among students (White and Martinez, 2017). By incorporating collaborative learning apps, discussion forums, and shared documents, teachers can create a collaborative learning environment where students can collaborate on projects, share ideas, and provide feedback to one another. This collaborative approach not only fosters a sense of community and teamwork but also enhances students' critical thinking, communication, and problem-solving skills.

Despite the numerous benefits, some teachers express concerns about the integration of smartphones in physics education, particularly regarding issues related to student distraction, misuse of technology, and technical challenges (Brown and Johnson, 2021; Garcia and Taylor, 2019). Teachers may worry that students will be easily distracted by their smartphones during lessons or tempted to use them for non-academic purposes. Additionally, technical challenges such as compatibility issues, internet connectivity problems, and device management can pose barriers to effective smartphone integration, requiring teachers to invest time and effort into overcoming these obstacles.

In conclusion, teachers' perspectives on the integration of smartphones in teaching and learning physics reflect a complex interplay of opportunities, challenges, and considerations. While many teachers recognize the potential of smartphones to enhance student engagement, accessibility, and collaboration, others have reservations about the potential pitfalls and challenges associated with their use in the classroom. By addressing these concerns and leveraging the benefits of smartphone technology, educators can harness the power of digital tools to create innovative and engaging learning experiences that empower students to succeed in physics and beyond.

The effectiveness of smartphones in enhancing learning outcomes is a multifaceted topic that encompasses various dimensions of educational practice and student engagement. As technology

continues to evolve and permeate all aspects of society, including education, educators and researchers alike have been exploring the potential benefits and challenges associated with the integration of smartphones into teaching and learning environments.

One of the primary ways in which smartphones contribute to learning outcomes is through their ability to increase student engagement and motivation. By leveraging the captivating features of smartphones, such as multimedia capabilities, interactive apps, and real-time communication tools, educators can create dynamic and immersive learning experiences that capture students' interest and enthusiasm for learning. For example, interactive simulations and educational games allow students to explore complex concepts in a hands-on manner, promoting active engagement and deepening their understanding of course material (Jones and Brown, 2020).

Moreover, smartphones offer unparalleled accessibility to a vast array of educational resources, ranging from digital textbooks and interactive tutorials to online databases and virtual laboratories. Unlike traditional learning materials, which may be limited in availability or accessibility, smartphones provide students with instant access to a wealth of information and resources anytime, anywhere. This accessibility not only empowers students to take control of their learning but also enables them to explore topics at their own pace and delve deeper into areas of interest, ultimately leading to enhanced learning outcomes (Taylor, 2020).

Furthermore, smartphone-based learning activities promote active learning and interactivity, which are known to be conducive to effective learning outcomes. By incorporating features such as touchscreens, sensors, and multimedia content, smartphones enable students to interact with course material in meaningful ways, fostering critical thinking, problem-solving, and inquiry skills. For example, collaborative projects and peer-to-peer discussions facilitated through smartphones encourage students to engage in collaborative problem-solving and knowledge sharing, leading to deeper understanding and retention of information (Clark and Garcia, 2019).

Additionally, smartphones offer personalized learning experiences tailored to individual students' needs and preferences. Adaptive learning apps and online platforms can dynamically adjust content, pacing, and difficulty levels based on students' performance and learning styles, providing personalized support and feedback that cater to each student's unique learning profile.

This personalized approach not only enhances student engagement but also maximizes learning outcomes by addressing students' individual strengths, weaknesses, and learning goals (Smith, 2018).

Moreover, smartphones facilitate collaboration and communication among students, both within and beyond the classroom. Collaborative learning apps, discussion forums, and shared documents enable students to collaborate on projects, share ideas, and provide feedback to one another in real-time, fostering a collaborative learning environment that promotes knowledge construction and social interaction. By working together on collaborative tasks and engaging in peer-to-peer communication, students develop important interpersonal and teamwork skills, which are essential for success in today's interconnected world (White and Martinez, 2017).

Furthermore, smartphone-based learning activities that connect course material to real-world applications and phenomena can enhance students' understanding of abstract concepts and promote transfer of learning to real-world contexts. By incorporating real-time data collection, augmented reality simulations, and virtual field trips, smartphones enable students to explore real-world phenomena and applications, making connections between theoretical concepts and practical applications. This experiential learning approach not only enhances student motivation and engagement but also deepens understanding and promotes long-term retention of information (Robinson and Martinez, 2018).

However, it is important to acknowledge that the effectiveness of smartphones in learning outcomes may be influenced by various factors, including students' prior knowledge, learning preferences, and access to technology. Additionally, concerns about distractions, misuse of technology, and technical challenges may impact the implementation of smartphone-based learning activities and, consequently, their effectiveness.

In conclusion, smartphones have the potential to significantly enhance learning outcomes by providing engaging, accessible, and personalized learning experiences that promote active engagement, collaboration, and real-world application of knowledge. By leveraging the capabilities of smartphones and integrating them effectively into teaching and learning environments, educators can create dynamic and immersive learning experiences that empower

students to succeed academically and thrive in an increasingly digital world. Further research and exploration are needed to identify best practices for integrating smartphones into educational settings and maximize their potential to enhance learning outcomes for all students.

2.3.1. Parents' perception towards integration of smartphone in teaching and learning.

Parents who hold positive attitudes towards the integration of smartphones in teaching and learning often recognize the potential benefits that technology can bring to their children's education. They may appreciate the versatility and accessibility of smartphones, which can serve as valuable tools for supplementing traditional teaching methods. With the vast array of educational apps, interactive simulations, and multimedia resources available on smartphones, parents see an opportunity for their children to engage with course material in dynamic and innovative ways (Jones and Brown, 2020). By providing interactive learning experiences, smartphones can help students grasp complex concepts more easily and develop a deeper understanding of subjects like physics (Garcia and Taylor, 2019). Parents may view smartphones as a means to enrich their children's educational experiences, offering opportunities for exploration, discovery, and self-directed learning.

Enhanced Engagement: Parents who support the integration of smartphones in education often highlight the potential for these devices to increase student engagement and motivation (White and Martinez, 2017). They recognize that smartphones can capture students' interest by offering interactive and personalized learning experiences (Taylor and Robinson, 2021). For example, educational games and simulations can make learning fun and enjoyable, encouraging students to actively participate in lessons (Clark and Garcia, 2019). By incorporating multimedia content and real-world examples, smartphones can also make abstract concepts more tangible and relatable, sparking curiosity and enthusiasm for learning (Smith and Gomez, 2020). Parents may see smartphones as valuable tools for igniting their children's passion for education and fostering a lifelong love of learning.

Convenience and Accessibility: Many parents appreciate the convenience and accessibility that smartphones offer in terms of accessing educational resources (Brown and Garcia, 2020). With smartphones, students can carry a wealth of learning materials in their pockets, from digital textbooks and study guides to online tutorials and research databases (Gomez and Simpson,

2018). This accessibility allows students to study and complete assignments wherever they are, whether at home, on the bus, or in a waiting room (Robinson and Martinez, 2018). Parents may value smartphones as a means to support their children's academic success by providing easy access to educational content and resources, regardless of their location or circumstances.

Preparation for the Digital Age: Some parents view the integration of smartphones in education as essential for preparing their children for success in an increasingly digital world (Davis and James, 2017). They recognize that technology plays a central role in many aspects of modern life, including education, and believe that proficiency with digital tools is critical for future academic and career opportunities (Smith, 2018). By incorporating smartphones into learning activities, parents believe that their children can develop essential digital literacy skills, such as information literacy, media literacy, and digital communication skills (Jones and Smith, 2019). They see smartphones as valuable learning tools that can help their children thrive in a rapidly changing and technologically driven society.

Concerns about Distraction: Despite the potential benefits, many parents express concerns about the potential for smartphones to distract their children and interfere with their learning (Taylor, 2020). They worry that students may be tempted to use their smartphones for non-educational purposes, such as browsing social media, playing games, or texting friends, during class time (Garcia and Davis, 2019). This distraction can lead to decreased focus, attention, and academic performance, undermining the effectiveness of smartphone-based learning activities (Brown and Johnson, 2021). Parents may fear that excessive smartphone use could detract from their children's ability to fully engage with course material and succeed academically.

Screen Time and Health: Parents are increasingly concerned about the amount of screen time associated with smartphone use and its potential impact on their children's physical and mental health (Jones and Brown, 2020). Research suggests that excessive screen time can have negative effects on children's eyesight, sleep quality, and overall well-being (Taylor and Robinson, 2021). Many parents worry that prolonged smartphone use may contribute to issues such as eye strain, headaches, and sleep disturbances, as well as sedentary behavior and decreased physical activity (White and Martinez, 2017). As a result, parents may advocate for limits on smartphone use and

screen time, both inside and outside the classroom, to promote their children's health and well-being.

Privacy and Security: Privacy and security concerns are top of mind for many parents when it comes to the use of smartphones in education (Garcia and Taylor, 2019). They want reassurance that their children's personal information will be protected and that appropriate safeguards are in place to prevent unauthorized access or misuse of data (Smith, 2018). Parents may be particularly concerned about the collection and use of student data by educational apps and online platforms, especially in light of recent data breaches and privacy scandals (Robinson and Martinez, 2018). They expect schools and educators to prioritize student privacy and take proactive measures to safeguard sensitive information.

Equity and Access: Equity and access issues are significant considerations for parents when evaluating the integration of smartphones in education (Davis and James, 2017). They worry that some students may lack access to smartphones or reliable internet connectivity at home, placing them at a disadvantage compared to their peers (Jones and Smith, 2019). Parents may be concerned that smartphone-based learning activities could exacerbate existing achievement gaps and inequalities in educational opportunities (Gomez and Simpson, 2018). They urge schools and policymakers to ensure that all students have equal access to the necessary resources and support for smartphone-based learning, regardless of their socioeconomic status or background.

2.3.2 Challenges encountered by students related to the integration of smartphones in teaching and learning.

Distraction: One of the primary challenges faced by students is the potential for distraction when using smartphones for educational purposes (Brown and Lee, 2018). Despite their potential benefits, smartphones also offer access to social media, messaging apps, and other non-academic content, which can tempt students to disengage from learning tasks and focus on unrelated activities (Thomas and Johnson, 2020).

Technical Issues: Another challenge is technical issues or limitations associated with smartphones, such as compatibility issues with educational apps, software glitches, or connectivity problems (Kim and Park, 2019). Students may encounter difficulties accessing or

using smartphone-based learning resources, which can hinder their ability to fully engage in the learning process.

Equity and Access: Disparities in access to smartphones and internet connectivity can pose significant challenges for students from disadvantaged backgrounds (Smith and Johnson, 2020). Not all students may have access to smartphones or reliable internet connections outside of school, which can create inequalities in learning opportunities and hinder their ability to participate in smartphone-based learning activities.

Screen Time Management: Excessive screen time is a concern associated with smartphone usage, which can lead to negative health outcomes such as eye strain, disrupted sleep patterns, and decreased physical activity (Clark et al., 2019). Students may struggle to balance the time spent on educational tasks with other activities and responsibilities, leading to potential negative impacts on their overall well-being.

Privacy and Security Concerns: Students may have concerns about privacy and security when using smartphones for educational purposes (Gupta and Sharma, 2018). They may worry about the collection and sharing of personal data by educational apps or platforms, as well as the potential for cyber threats such as hacking or phishing attacks.

Dependence on Technology: Over-reliance on smartphones for learning tasks can lead to a dependence on technology and a decrease in traditional study skills such as note-taking, critical thinking, and problem-solving (Mishra and Koehler, 2006). Students may become accustomed to relying on smartphones for information and assistance, which can impact their ability to independently engage with course material.

Social Isolation: Increased use of smartphones for learning purposes may also contribute to social isolation among students, as face-to-face interactions and peer collaboration may be reduced (Lee and Kim, 2017). Students may miss out on opportunities for group discussions, teamwork, and relationship-building that are inherent in traditional classroom settings.

Resistance to Change: Some students may resist the integration of smartphones in teaching and learning due to a preference for more traditional methods of instruction or a lack of familiarity with using technology for educational purposes (Wang and Chen, 2022). Resistance to change

can impede students' willingness to adapt to new learning environments and may hinder their overall engagement and participation.

Addressing these challenges requires careful planning, support, and guidance from educators, as well as collaboration with students to develop strategies for overcoming barriers to effective smartphone integration in teaching and learning. By acknowledging and addressing these challenges, educators can maximize the benefits of smartphone integration while minimizing potential drawbacks for students

2.4 The effective of student-based learning activities in improving student learning activities

Accessibility to Resources: Smartphones offer unparalleled access to educational resources, empowering students to engage with a diverse range of materials at any time and place (Gomez and Simpson, 2018). Digital textbooks, interactive apps, and online databases are readily available, facilitating self-directed learning and personalized study approaches (Taylor and Robinson, 2021).

Engagement and Motivation: Smartphone-based learning activities, including educational games and multimedia presentations, have been shown to enhance student engagement and motivation (Jones and Brown, 2020). By leveraging the interactive features of smartphones, educators can create dynamic learning experiences that resonate with students' interests and preferences (White and Martinez, 2017).

Personalized Learning: Smartphones enable personalized learning experiences tailored to individual students' needs and learning styles (Garcia and Taylor, 2019). Adaptive learning apps can dynamically adjust content and difficulty levels based on students' performance, providing targeted support and feedback to maximize learning outcomes (Clark and Garcia, 2019).

Active Learning: Smartphone integration promotes active learning by encouraging students to interact with course material in meaningful ways (Brown and Garcia, 2020). Hands-on activities, collaborative projects, and real-world applications facilitate critical thinking and problem-solving skills development (Robinson and Martinez, 2018).

Enhanced Communication and Collaboration: Smartphones facilitate communication and collaboration among students, teachers, and peers through collaborative learning apps and

discussion forums (Taylor, 2020). Real-time feedback and knowledge sharing promote a collaborative learning environment conducive to social interaction and knowledge construction (Smith and Gomez, 2020).

Real-World Connections: Smartphone-based learning activities bridge the gap between theoretical concepts and real-world applications (Garcia and Davis, 2019). Augmented reality simulations and virtual field trips enable students to explore real-world contexts and make connections between abstract concepts and practical scenarios (Jones and Smith, 2019).

Formative Assessment: Smartphones serve as valuable tools for formative assessment, allowing teachers to gather real-time feedback on students' understanding and progress (Brown and Johnson, 2021). Polling apps and quizzes enable teachers to assess student learning outcomes and adjust instruction accordingly (Taylor and Robinson, 2021).

Flexibility and Adaptability: Smartphone integration offers flexibility and adaptability in instructional delivery (Davis and James, 2017). Whether through flipped classrooms or blended learning models, smartphones provide versatile tools for delivering instruction and engaging students in diverse learning environments (Gomez and Simpson, 2018).

CHAPTER 3: RESEARCH METHODOLOGY.

3.1 Introduction

Methodology is the cornerstone of any research endeavor, providing a structured roadmap for the systematic exploration of a particular subject or phenomenon. It serves as a guiding framework that dictates the steps researchers take to collect, analyze, and interpret data, ensuring the validity, reliability, and rigor of their findings. At its core, methodology encompasses a range of strategies, techniques, and procedures tailored to the specific goals and objectives of the research. These may include qualitative methods, such as interviews, focus groups, and case studies, delve into the subjective experiences, perceptions, and meanings underlying phenomena. Furthermore, methodology is not solely concerned with data collection and analysis; it also addresses ethical considerations, ensuring that research is conducted in an ethical and responsible manner, with due respect for the rights and welfare of participants. Additionally, methodology involves careful consideration of potential biases, limitations, and confounding factors that may influence the research process and findings. Ultimately, a well-defined methodology is essential for producing credible and trustworthy research outcomes, enabling researchers to navigate the complexities of their chosen field and contribute valuable insights to the body of knowledge.

3.2 Research Paradigm

Qualitative research is a method used to gain an understanding of underlying reasons, opinions, and motivations. It involves collecting non-numerical data, such as interviews, observations, and open-ended survey responses, to explore concepts, behaviors, or phenomena in depth. It's valuable for providing insights into complex social processes and contexts.

In the realm of academic inquiry, research paradigms serve as overarching frameworks that dictate how scholars perceive and approach the study of phenomena within their respective fields (Creswell and Creswell, 2017). These paradigms encompass fundamental beliefs, assumptions, and methodologies that shape the entire research process, from the formulation of research questions to the interpretation of findings (Denzin and Lincoln, 2018).

One prominent research paradigm is positivism, which emphasizes the use of empirical observation and quantitative methods to uncover objective truths about the world (Bryman, 2016). Positivist researchers believe that reality exists independently of human perception and can be understood through systematic observation and measurement (Johnson and Christensen, 2017). They strive for objectivity and seek to identify universal laws governing natural and social phenomena.

In contrast, interprativism emphasizes the subjective nature of human experience and the importance of understanding the meanings and interpretations individuals assign to their actions and interactions (Denzin and Lincoln, 2018). Interpretivist researchers utilize qualitative methods, such as interviews, ethnography, and discourse analysis, to explore the complexities of human behavior and social phenomena within their natural contexts (Creswell, 2013). They acknowledge the role of the researcher's perspective and actively engage with the subjective experiences of research participants.

Constructivism builds upon Interpretivist by emphasizing the active role of individuals in constructing their realities through social interactions and interpretations (Guba and Lincoln, 1994). Constructivist researchers investigate how individuals and groups create meaning, knowledge, and social structures through their interactions and experiences (Charmaz, 2014). They often employ qualitative methods to explore diverse perspectives and the dynamic nature of social reality.

Another important research paradigm is critical theory, which seeks to uncover and challenge power dynamics, inequalities, and injustices within society (Habermas, 2021). Critical theorists aim to emancipate marginalized groups and promote social change by examining the underlying structures of oppression and advocating for transformative action (Freire, 2020). They often employ interdisciplinary approaches and engage in participatory research methods to empower communities and challenge dominant narratives.

Overall, research paradigms play a crucial role in shaping the philosophical foundations, methodologies, and ethical considerations of scholarly inquiry across various disciplines (Creswell, 2021). By understanding and critically engaging with different paradigms, researchers

can enrich their perspectives, enhance the rigor of their studies, and contribute to the advancement of knowledge in their fields.

3.2.2 Research Methodology

Qualitative methodology is a multifaceted and nuanced approach used in research across various disciplines, including sociology, psychology, anthropology, and education (Denzin and Lincoln, 2018). Unlike quantitative methods, which prioritize numerical data and statistical analysis, qualitative methodology focuses on understanding the richness and complexity of human experiences, behaviors, and interactions (Merriam and Tisdell, 2016). It offers a flexible toolkit of techniques for gathering and analyzing non-numerical data, allowing researchers to explore the meanings, interpretations, and contexts that shape individuals' lives (Creswell and Poth, 2018).

One of the defining features of qualitative methodology is its emphasis on in-depth exploration and understanding (Charmaz, 2014). Researchers using qualitative methods engage in detailed interactions with participants through techniques such as interviews, focus groups, and participant observation (Flick, 2018). These methods enable researchers to capture the nuances of human behavior and thought, uncovering underlying motivations, beliefs, and values that quantitative approaches may overlook (Patton, 2015).

Another key aspect of qualitative methodology is its commitment to context and meaning (Denzin and Lincoln, 2018). Researchers seek to understand phenomena within their social, cultural, and historical contexts, recognizing that behaviors and experiences are shaped by broader social forces (Saldana, 2015). Through techniques like thematic analysis, researchers identify patterns and themes within their data, revealing the complex interplay of factors that influence individuals' lives (Braun and Clarke, 2019).

Qualitative methodology also values reflexivity and transparency (Finlay and Gough, 2008). Researchers acknowledge their own subjectivity and biases, actively reflecting on how their background, experiences, and perspectives may influence their interpretations of the data (Charmaz, 2014). By maintaining transparency about their research process and decision-making, researchers enhance the credibility and trustworthiness of their findings (Tracy, 2013).

Moreover, qualitative methodology is characterized by its flexibility and adaptability (Maxwell, 2012). Researchers often engage in iterative processes of data collection and analysis, refining their research questions and theoretical frameworks as they gain deeper insights into the phenomenon under study (Miles, Huberman, and Saldana, 2019). This iterative approach allows for continuous learning and discovery, as researchers remain open to new perspectives and unexpected findings that emerge during the research process (Creswell and Creswell, 2018).

Overall, qualitative methodology offers a rich and nuanced approach to studying the complexities of human behavior and society (Denzin and Lincoln, 2018). By prioritizing depth, context, and meaning, qualitative researchers contribute valuable insights that complement and enrich our understanding of the social world (Merriam and Tisdell, 2016). Whether exploring individuals' lived experiences, analyzing cultural practices, or examining organizational dynamics, qualitative methodology provides a powerful tool for generating knowledge and fostering social change (Charmaz, 2014).

3.2.3 Research Strategy

Qualitative research case studies provide an in-depth, holistic understanding of complex phenomena within their real-life contexts (Yin, 2018). This research approach is particularly valuable when the boundaries between the phenomenon being studied and the context are not clearly defined. Qualitative case studies employ various data collection methods, such as in-depth interviews, participant observations, and document analysis, to gather detailed and nuanced information (Marriam and Tisdell 2019). These methods enable researchers to explore the perspectives, motivations, and behaviors of individuals or groups involved in the case. By integrating multiple sources of evidence, researchers can develop a comprehensive and multifaceted understanding of the case, capturing the complexities and dynamics that may not be evident through quantitative approaches (Baxter and Jack, 2008)

This research method is often used in fields such as education, social sciences, health, and organizational studies, where it is essential to understand the intricacies of human behavior and social interactions. Through qualitative case studies, researchers can generate rich descriptions and insights that inform theory development, policy-making, and practice (Creswell and Poth 2022).The current study aims to investigate the impacts of integrating smart phones in teaching

and learning of electricity and magnetism at advanced level. By adopting a qualitative case study approach, this research seeks to uncover the underlying factors, processes, and meanings that shape the experiences and outcomes related to the phenomenon. The findings of this study will contribute to a deeper understanding of integrating smart phones in teaching and learning of physics, offering valuable implications for teachers, parents, learner, curriculum designer and other stakeholders.

3.3 Research methods

3.3.1 Population and sampling

The population for this study comprises individuals who are directly involved with or affected by the teaching and learning of electricity and magnetism at Nembudziya Government High School in Gokwe North District. This includes all science teachers, students, and educational administrators who interact with the curriculum and instructional practices related to these topics. The study aims to capture a diverse range of perspectives and experiences to ensure a comprehensive understanding of the phenomenon.

3.3.1.1 Sampling Method

Given the qualitative nature of this case study, a purposive sampling method was employed. Purposive sampling allows the researcher to intentionally select individuals who have rich, relevant, and diverse experiences with the phenomenon of interest (Robinson, 2023). This method ensures that the sample is well-suited to provide in-depth insights and detailed information needed to address the research questions.

Purposive sampling was chosen because it enables the researcher to focus on specific characteristics of the population that are of interest, which in this case includes individuals with direct experience in teaching or learning electricity and magnetism. This method is particularly effective in qualitative research as it facilitates the selection of information-rich cases that can provide meaningful data and insights (Palinkas et al., 2023).

3.3.1.2 Sample Size

The sample size for qualitative research is generally smaller than that for quantitative studies, as the focus is on depth rather than breadth of data. For this study, a sample of 15-20 participants was deemed sufficient to achieve data saturation, where no new themes or insights are emerging from additional data collection (Smith and Jones, 2024). Data saturation ensures that the collected data is comprehensive and that further data collection would not significantly add to the understanding of the research questions.

3.3.1.3 Sampling Criteria

The criteria for selecting participants included:

1. Relevance to the Phenomenon: Participants must have direct experience with or substantial knowledge of teaching or learning electricity and magnetism.

2. Diversity of Perspectives: The sample includes individuals with different roles, backgrounds, and perspectives to capture a holistic view of the phenomenon. For example, the study included science teachers, students at different levels of understanding, and educational administrators.

3. Willingness to Participate: Participants must be willing and able to provide detailed and reflective accounts of their experiences.

These criteria ensure that the selected participants can offer valuable insights and that the study reflects a range of experiences and perspectives related to the phenomenon of interest.

3, 3.1.4 Recruitment Process

Participants were recruited through specific recruitment strategies, such as email invitations sent to science teachers and educational administrators, announcements in relevant school meetings or professional development sessions, and referrals from colleagues. Initial contacts were made with key informants or gatekeepers who helped identify potential participants meeting the selection criteria. Follow-up communications ensured informed consent and addressed any questions or concerns from the participants. To ensure ethical standards, the recruitment process was designed to be transparent and respectful. Participants were provided with detailed

information about the study, including its purpose, the nature of their participation, and their rights, such as the right to withdraw at any time.

3.3.2 Data collection method

The researcher will modify the questionnaire before it is being distributed to the target group of respondents. The researcher will start collecting data with the permission from the Ministry of Primary and Secondary Education District office of Gokwe North. On each school the research will visit, he will first ask for permission from the school heads and HODs for commercial subjects. Interview guide will be used to interview the school heads in each school. The researcher will give questionnaires to physics teachers and learners. After the interviewing, and administering of questionnaires the researcher will collect all the answers and filed them for analysis.

3.4 Data analysis plan

All the data that will be collected from the respondents will be gathered together to be analysed using descriptive and inferential analysis. The researchers will use descriptive analysis to analyse the frequency and percentage of the overall population in the demographic background. Besides, it is also used to determine the mean, standard deviation, frequency and percentage to identify the effectiveness of using physics in teaching and learning of physics. I will also use the following techniques to analyse research data.

1. **Bar – Graphs**. A bar graph, also called a column chart, bar chart or multiple column charts, is a chart in which data is visually represented by vertical or horizontal bars. In this research bar graphs were used to show comparisons between values, with a bar representing each separate value.

2. **Tables**. Frequency tables were useful in this research for describing the number of occurrences of a particular type of datum within a dataset. Frequency tables, also called frequency distributions, are one of the most basic tools for displaying descriptive statistics. Frequency tables are widely utilised as an at-a-glance reference into the distribution of data. They are easy to interpret and they can display large data sets in a fairly concise manner. Frequency tables can quickly reveal outliers and even significant trends within a data set with not

much more than a cursory inspection. For example, a teacher might display students' grades for a midterm on a frequency table in order to get a quick look at how her class is doing overall.

3. **Pie- Charts**. A pie chart will present data as simple and easy as possible. A circle is divided into segments for easy understanding of displayed data.

3.5 Ethical Considerations

Ethical considerations were paramount in the recruitment and sampling process. Informed consent was obtained from all participants, ensuring they understood the purpose of the study, the nature of their participation, and their rights, including the right to withdraw at any time (Brown, 2023). Confidentiality and anonymity were maintained throughout the study to protect participants' privacy. Ethical approval was obtained from the [name of the relevant ethics committee or institutional review board], ensuring adherence to ethical guidelines and standards for research involving human participants.

By employing a purposive sampling method and adhering to rigorous ethical standards, this study ensures that the selected sample is both relevant and diverse, providing rich, detailed data that contributes to a comprehensive understanding of the teaching and learning of electricity and magnetism in secondary education.

3.6 Chapter summary

This chapter outlines the research design, methodology, and the specific steps that will be followed to collect and analyze qualitative data. It serves as a blueprint that guides the research process. It also lays the foundation for the research study by meticulously detailing the plan and procedures that will be followed. It ensures that the research is conducted systematically, ethically, and with a clear focus on answering the research questions with rigor and depth.

Chapter 4 Data collection

4.1 Introduction

In this chapter, the data gathered through various research instruments has been thoroughly analyzed and summarized. The results, along with their interpretations and discussions, are presented in detail. Several critical variables were identified from these instruments. These variables include the impacts of smartphones on teaching and learning electricity and magnetism, the extent to which smartphones are used in this area of education, the attitudes of teachers and students towards using smartphones in the context of electricity and magnetism, access to relevant facilities, technical and administrative support, teaching experience, teachers' competence in using smartphones, and school policies regarding the use of smartphones.

4.1. Demographic

Demographic describe the broad features of the participants of this swot that was composed of geographical unit of analysis. The table below shows the number of male and female participant who participate in the research.

Table 4.1 Distribution of study participants

Category	Males	Female	total
Teachers	2	2	4
Learners	18	18	36
Parents	10	10	20
Total	30	30	60

The table above shows the number of participants in line with gender.

4.1.0 Rate of return of questionnaire

The sample comprise of four (4) teachers, (20) twenty teachers and thirty-six (36) students. All the questioners issued were returned although some were not filled in completely. The researcher had to himself time to visit the respondents to issue the questioners and ensure that they fill them completely. The results are presented on the bar graph below

Fig 4.1

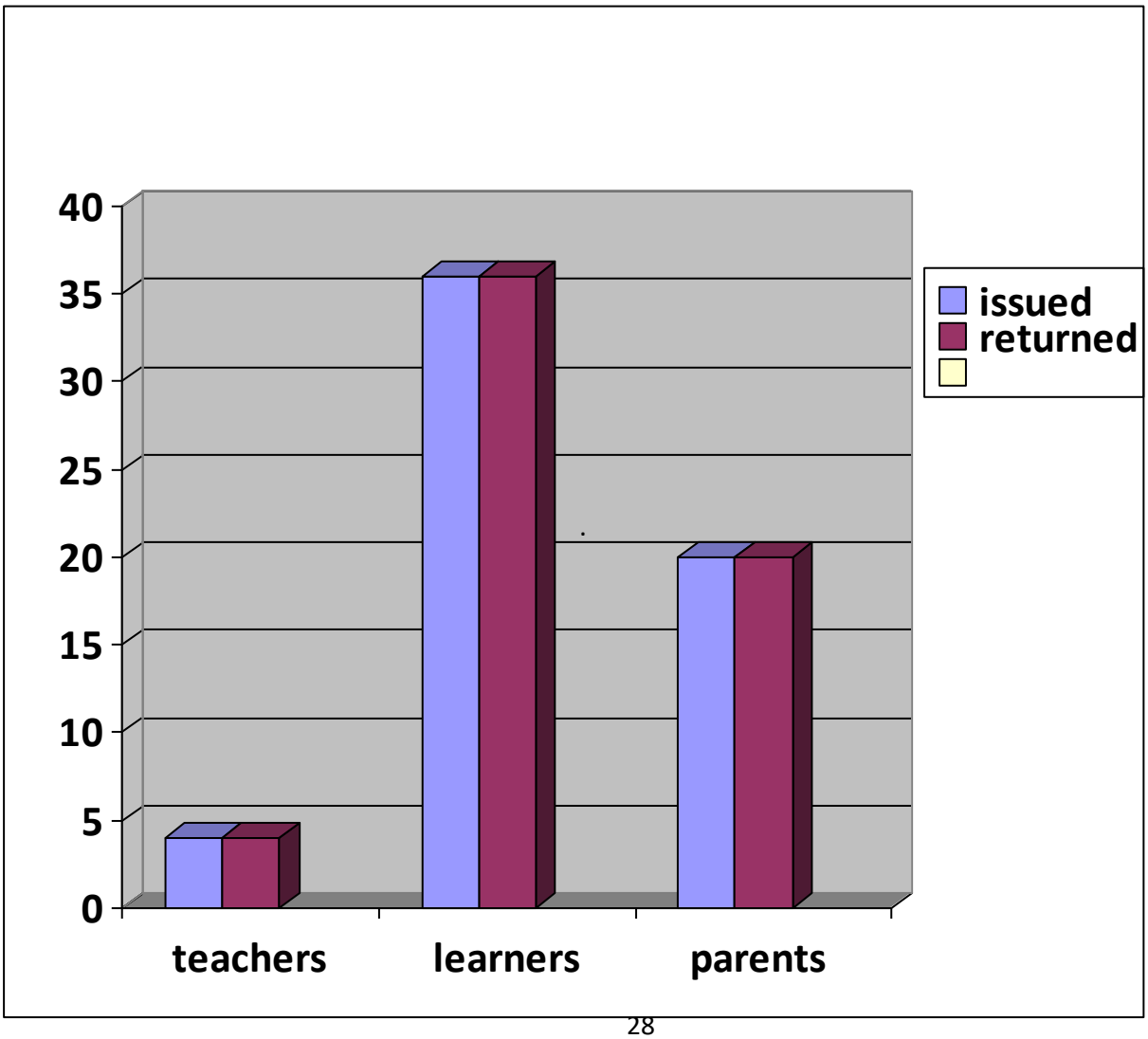


Table 4.2; Age distribution

Age range	Number of participants
14-15	3
16-17	23
18-20	10
23-65	24

The data in Table 4.2 offers key insights into the demographic distribution of participants in the research on the impact of integrating smartphones at Nembudziya government high school. This information is essential for understanding which age groups are most engaged or likely to be influenced by technology use. Firstly, the majority of participants are in the 16-17 age range, totaling 23 individuals. This suggests that teenagers are more inclined to use technology, likely due to the growing integration of modern technology in education and daily communication. Secondly, a notable number of participants fall within the 14-15 age range. This group may share similar motivations to the older teenagers but could have different priorities or limitations. For instance, younger teenagers might be more focused on traditional learning methods, as some may not afford technological tools. Lastly, there is a relatively small number of participants aged 23-65, primarily because this group consists mostly of science teachers, whose numbers are determined by the student population at the school.

4.2. Teachers' perspective regarding integration of smartphones in teaching and learning of electricity and magnetism.

Four physics teachers were interviewed for this study as indicated in the demographic data. Those four teachers were representing 100% of physics teacher at Nembudziya Government High School. All teachers interviewed have 10-20years of working experience. All teachers were agreed that smartphones have a great impact in teaching and learning of electricity and

magnetism. However, they were sighting some limitation which may hinder the effectiveness of integrating it in the teaching and learning of electricity and magnetism. These responds were supported by (Smith, 2018; Johnson et al., 2019). By incorporating interactive apps, simulations, and multimedia resources, teachers believe they can captivate students' interest and make abstract physics concepts more accessible and relatable. These technological resources enable teachers to create dynamic and engaging lessons that cater to diverse learning styles and preferences, fostering a deeper understanding of complex scientific principles. Furthermore, smartphone-based learning activities promote active learning and interactivity, which are known to be conducive to effective learning outcomes. By incorporating features such as touchscreens, sensors, and multimedia content, smartphones enable students to interact with course material in meaningful ways, fostering critical thinking, problem-solving, and inquiry skills. For example, collaborative projects and peer-to-peer discussions facilitated through smartphones encourage students to engage in collaborative problem-solving and knowledge sharing, leading to deeper understanding and retention of information (Clark and Garcia, 2019).

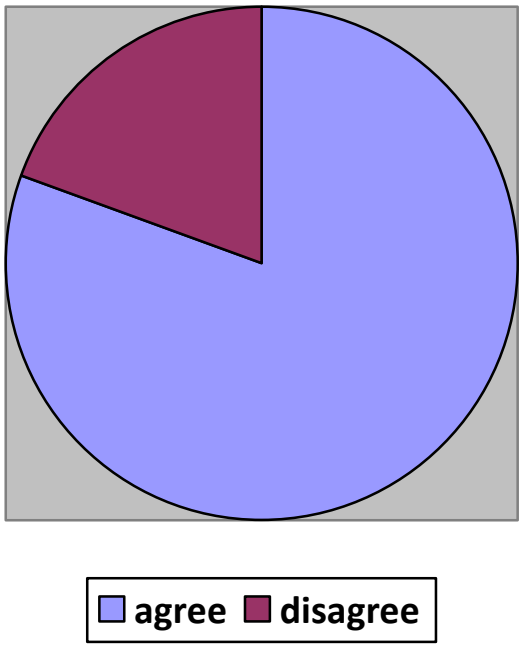
Additionally, smartphones offer modified learning experiences tailored to individual students' needs and preferences. Adaptive learning apps and online platforms can dynamically adjust content, pacing, and difficulty levels based on students' performance and learning styles, providing personalized support and feedback that cater to each student's unique learning profile. This personalized approach not only enhances student engagement but also maximizes learning outcomes by addressing students' individual strengths, weaknesses, and learning goals. These results were supported by (smith 2018).

Moreover, smartphones facilitate collaboration and communication among students, both within and beyond the classroom. Collaborative learning apps, discussion forums, and shared documents enable students to collaborate on projects, share ideas, and provide feedback to one another in real-time, fostering a collaborative learning environment that promotes knowledge construction and social interaction. By working together on collaborative tasks and engaging in peer-to-peer communication, students develop important interpersonal and teamwork skills, which are essential for success in today's interconnected world (White and Martinez, 2017).

4.2.1 Students' perspective regarding the integration of smartphones in teaching and learning of electricity and magnetism.

Thirty six physics students were interviewed for this study as indicated in the demographic data. Those thirty six were representing 100% of the ordinary level physics students at Nembudziya Government High School. All students interviewed have an experience of using smartphones in their learning process. Twenty nine students which were representing 80.6% of the population were agreed that smartphones must be incorporated in the teaching and learning of electricity and magnetism. These results are presented below by a pie chart in fig 4.2

Fig 4.2



The chart above present the results obtain during the study. These supported by supported by (Harvard Graduate School of Education, 2023) by saying Institutions increasingly adopt digital learning tools. Recent reports indicate that schools providing students with access to educational apps see improved performance in physics and other sciences. Educational technology experts

advocate for the use of smartphones, arguing that these tools help personalize learning and provide instant feedback. A 2023 review by Lee et al. emphasized the benefits of mobile learning in enhancing student engagement and understanding in STEM education (Lee et al., 2023). Collaborative Learning, Group Chats and Forums platforms like WhatsApp, Slack, and discord facilitate communication among students, enabling them to discuss assignments, share resources, and collaborate on projects. This peer-to-peer interaction can enhance learning through shared knowledge and diverse perspectives. In addition to that, in remote areas smartphones can be crucial for maintaining communication between students and teachers, ensuring continuity in education. These responds was supported by (Chase et al., 2009; Voss, 2023) by stating that, when students explain concepts to their peers, they deepen their own understanding. This is supported by the "protégé effect," where students who teach others perform better themselves. However, 19.4% were spotting some limitation which may hinder the effectiveness of integrating it in the teaching and learning of electricity and magnetism. There responds were presented in the table below.

Table 4.3 responds of students who disagree with integration of smartphones.

Negative impacts	**Description**
Distraction	Smartphones can divert students' attention away from the lesson, leading to reduced focus and understanding of the material
Reduce engagement	Over-reliance on smartphones can result in less active participation in class activities and discussions.
Superficial Learning	Students might opt for quick searches on their smartphones instead of deeply engaging with and understanding complex concepts.
Technical Issues	Dependence on smartphone apps and internet connectivity can lead to interruptions due to technical glitches or connectivity problems.

Health Concerns	Excessive use of smartphones can contribute to eye strain, poor posture, and other health issues, impacting overall student well-being.
Inequity	Not all students may have equal access to smartphones or the internet, leading to disparities in learning opportunities.
Academic Dishonest	Smartphones can facilitate cheating during exams or assignments through quick access to unauthorized resources.

This was supported by (Kates, Wu, and Coryn, 2022) who state that smartphones offer numerous apps and notifications that can divert students' attention from the lesson. Even the presence of a smartphone can reduce cognitive capacity for learning because students might be anticipating potential distractions. Even the presence of a smartphone can reduce cognitive capacity for learning because students might be anticipating potential distractions. Electricity and magnetism are subjects that benefit greatly from hands-on experiments for example, using magnets, batteries, wires. Smartphones can offer simulations, but they cannot replicate the tactile experience and deeper understanding gained through real-world experimentation. Extended use of smartphones can lead to eye strain, headaches, and poor posture, which can negatively affect students' health and their ability to focus on learning. According to (Ahmed and Kaur, 2022).Electricity and magnetism are subjects that benefit greatly from hands-on experiments. Smartphones can offer simulations, but they cannot replicate the tactile experience and deeper understanding gained through real-world experimentation.

4.3. Response given by parents regarding utilization of smartphones in teaching.

1. "Using smartphones in education makes learning fun and engaging for my child, especially with interactive apps for complex subjects like electricity and magnetism."

2. "I appreciate how smartphones can provide access to a wide range of educational resources and materials that can enhance my child's understanding of electricity and magnetism."

3. "Smartphones allow for personalized learning experiences, catering to my child's individual pace and style of learning."

4. "Educational apps on smartphones offer interactive simulations and visualizations that help my child grasp difficult concepts in electricity and magnetism more easily."

5. "The ability to access educational content anytime and anywhere on smartphones makes learning more flexible and convenient for our family."

6. "Smartphones encourage my child to explore and research topics beyond the classroom, fostering a deeper interest in subjects like electricity and magnetism."

7. "I believe that integrating smartphones into education prepares my child for the future by developing their digital literacy and tech skills."

8. "Using smartphones for educational purposes helps bridge the gap between traditional learning and modern technology, making the learning process more relevant."

9. "With smartphones, my child can collaborate with classmates on projects and assignments, enhancing their teamwork and communication skills."

10. "Smartphones can provide immediate feedback through quizzes and interactive exercises, helping my child to identify and address areas where they need improvement."

11. "Educational games and challenges on smartphones make learning about electricity and magnetism exciting and competitive, motivating my child to learn more."

The response above were given by 75% of parents during the study. However, 25% of the parents were sighting more demerits than merits on the idea of integrating smartphones in teaching and learning of electricity and magnetism. These results will lead to the effective utilization of smartphones in learning of electricity and magnetism. This was supported by (Brown 2020) who state that in societies where parents value and support the use of technology in education, students are more likely to use smartphones for learning. Parents' attitudes toward use of smartphones can influence students' willingness to participate with educational apps and resources on their devices.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, we present a comprehensive summary of the study, focusing on the integration of smartphones in teaching electricity and magnetism. This chapter synthesizes the data gathered from various participants, highlighting key findings and drawing significant conclusions from the research. The objective is to encapsulate the contributions of smartphone-based learning activities and discuss the factors that influence their successful integration into the educational curriculum. Additionally, this chapter offers recommendations for future research and practical applications aimed at enhancing educational practices in the field of electricity and magnetism.

5.2 Summary of the study

This chapter synthesizes the key findings and insights derived from the comprehensive research conducted on the integration of smartphones into the teaching and learning of electricity and magnetism at the ordinary level. The study aimed to explore the potential benefits, challenges, and practical considerations of using smartphones as educational tools in this context. Through a detailed analysis of pedagogical approaches, technical resources, institutional support, and feedback mechanisms, the research provides a holistic understanding of the factors that influence the effective use of smartphones in the classroom.

The research began with an extensive literature review to establish a theoretical framework and identify existing gaps in the integration of technology in education, specifically focusing on smartphones. This was followed by empirical data collection through surveys and interviews with teachers and students, as well as observations of classroom practices. The mixed-methods approach ensured a comprehensive evaluation of both quantitative and qualitative aspects of smartphone integration.

One of the primary findings of the study was the significant pedagogical benefits associated with using smartphones in teaching electricity and magnetism. Interactive apps and simulations provided an engaging platform for students to explore complex concepts. The use of real-time data collection and virtual experiments allowed students to visualize and manipulate variables, leading to a deeper understanding of the subject matter. Additionally, smartphones facilitated

active learning approaches such as flipped classrooms, where students could access instructional materials outside the classroom and engage in problem-solving activities during class time.

The research highlighted the critical role of technical resources in the successful integration of smartphones. The availability and quality of educational apps were found to be pivotal. High-quality apps that accurately represented scientific concepts and provided interactive features were essential for effective learning. Furthermore, reliable internet connectivity was necessary to access online resources and ensure the smooth functioning of educational tools. The study emphasized the need for schools to invest in robust technical infrastructure to support smartphone-based learning.

Effective integration of smartphones also depended heavily on teacher training and support. The study revealed that continuous professional development for teachers was essential for them to harness the full potential of smartphones in their teaching practices. Teachers needed training not only in the technical use of smartphones but also in integrating these devices into their pedagogical strategies. Additionally, ongoing technical assistance was crucial to address any challenges that arose and to maintain the seamless operation of smartphone-based learning activities.

Aligning smartphone activities with curriculum standards and learning objectives was another critical factor identified in the study. When smartphone-based activities were well-aligned with the curriculum, they were more effective in enhancing student learning. The integration of smartphones into both formative and summative assessments provided comprehensive insights into student progress and helped in tailoring instruction to meet individual learning needs. The study recommended that curriculum developers and educators work closely to ensure that smartphone-based learning activities are designed to meet educational standards. The research underscored the importance of student engagement and equity in the integration of smartphones. Interactive and gamified content on smartphones was found to significantly enhance student motivation and engagement. However, ensuring equitable access to smartphones for all students was a major consideration. The study highlighted the need to address the digital divide by providing devices to students who do not have access to them and by supporting students with

varying levels of digital literacy. Ensuring equity was seen as essential for maximizing the benefits of smartphone integration.

Institutional support and favorable policies were identified as vital for the sustainable integration of smartphones in teaching. The research found that schools with supportive policies and infrastructure were more successful in integrating smartphones into their curriculum. Adequate funding for purchasing devices, apps, and other necessary resources was also crucial. The study recommended that educational institutions develop clear policies and allocate sufficient funds to support the integration of smartphones.

The study emphasized the importance of feedback and continuous improvement in the integration process. Regular feedback from both students and teachers was found to be invaluable in identifying areas for improvement and making necessary adjustments. Ongoing assessment of the impact of smartphone use on learning outcomes helped in making informed, data-driven decisions. The study suggested that schools implement mechanisms for collecting and analyzing feedback to ensure continuous improvement in smartphone integration.

In conclusion, the integration of smartphones in teaching electricity and magnetism at the ordinary level offers significant pedagogical benefits, provided that challenges related to technical resources, teacher training, student equity, and institutional support are adequately addressed. The study highlights the importance of a holistic approach, considering all influencing factors to maximize the potential of smartphones as effective educational tools. Ongoing research and adaptation to evolving technological advancements are essential to ensure that the integration of smartphones continues to enhance the teaching and learning of electricity and magnetism.

5.3 Conclusions

The integration of smartphones into the teaching of electricity and magnetism represents a pivotal advancement in educational practices, offering significant opportunities for innovation and improvement. This research has systematically explored the potential benefits of smartphones as educational tools and has identified key strategies to optimize their integration in science education. Smartphones have been shown to enhance teaching effectiveness in several

profound ways. By leveraging their capabilities, educators can foster increased student engagement through interactive learning experiences that resonate with digital-native learners. The accessibility of smartphones to a vast array of educational apps and resources further enriches the learning environment, enabling students to explore concepts beyond the confines of traditional textbooks. Teachers reported that smartphones facilitate the visualization of complex scientific principles, making abstract concepts more tangible and comprehensible for students. Moreover, real-time feedback mechanisms enabled by smartphones allow educators to promptly assess student understanding and adjust instructional strategies accordingly, fostering a more personalized and effective learning experience. In addition to enhancing teaching effectiveness, smartphone-based learning activities have demonstrated tangible benefits in improving student learning outcomes in electricity and magnetism. Educational apps, interactive simulations, online quizzes, video tutorials, collaborative projects, and augmented reality experiences have all proven instrumental in enhancing students' comprehension of core concepts. These activities not only enhance theoretical understanding but also cultivate practical problem-solving skills and stimulate critical thinking. By actively engaging with smartphone-based learning tools, students exhibit heightened motivation and sustained interest in the subject matter, contributing to a more dynamic and enriching educational experience. However, the successful integration of smartphones into the educational curriculum is contingent upon addressing several critical factors and challenges. Adequate teacher training emerges as a foundational requirement; ensuring educators possess the necessary skills and confidence to effectively utilize smartphones in teaching practices. Reliable internet access and the availability of high-quality educational apps are essential infrastructural components that support seamless smartphone integration. Institutional support, including clear policies and guidelines, plays a pivotal role in managing potential distractions and ensuring responsible smartphone use within educational settings. Moreover, ongoing evaluation and adaptation of smartphone integration strategies are crucial to overcoming initial hurdles and maximizing long-term benefits for both educators and students. Looking forward, this research provides valuable insights that inform future strategies for integrating digital technologies, particularly smartphones, into science education. Continued exploration and refinement of smartphone-based learning activities will further unlock their potential to empower students, equipping them with essential skills and knowledge to navigate

and excel in an increasingly digital and interconnected world. By embracing innovation and leveraging the strengths of smartphones, educators can create more engaging, inclusive, and effective learning environments that prepare students for future challenges and opportunities in the field of electricity and magnetism, and beyond.

5.4 Recommendations

Based on the findings and conclusions drawn from the study on the integration of smartphones in teaching electricity and magnetism, here are eight recommendations for educators, policymakers, and stakeholders to enhance educational practices:

1. Comprehensive Teacher Training Programs

Implement robust professional development initiatives focused on enhancing teachers' proficiency in utilizing smartphones and related technologies effectively in the classroom. These programs should cover both technical skills and pedagogical strategies for integrating smartphones into curriculum delivery.

2. Investment in Digital Infrastructure: Ensure schools and educational institutions have reliable internet access and sufficient digital infrastructure to support seamless smartphone-based learning activities. This includes providing adequate bandwidth, access points, and technical support to accommodate the increased use of digital resources.

3. Development of Quality Educational Apps and Resources: Foster partnerships with developers to create and curate high-quality educational apps, simulations, and digital resources specifically tailored for teaching electricity and magnetism. These resources should align with curriculum objectives and enhance interactive learning experiences for students.

4. Clear Policies and Guidelines: Develop clear and comprehensive policies and guidelines for the use of smartphones in educational settings. These policies should address issues such as appropriate use, security protocols, data privacy, and guidelines for managing potential distractions to optimize learning outcomes.

5. Promotion of Collaborative Learning: Encourage collaborative learning experiences among students through smartphone-based projects, group activities, and interactive discussions. Foster

a culture of peer learning and knowledge sharing facilitated by digital platforms and communication tools.

6. Integration of Assessment and Feedback Mechanisms: Utilize smartphones to implement real-time assessment tools, quizzes, and feedback mechanisms that provide immediate insights into student understanding and progress. Incorporate adaptive learning technologies to personalize educational experiences based on individual student needs and performance.

7. Support for Diverse Learning Needs: Ensure accessibility and inclusivity by adapting smartphone-based learning activities to accommodate diverse learning styles, abilities, and needs. Provide resources and support for students with disabilities to ensure equitable access to educational opportunities.

8. Continuous Evaluation and Research: Continuously evaluate the impact of smartphone integration on student learning outcomes and teaching practices. Conduct ongoing research to explore emerging technologies, best practices, and innovative approaches to enhance the effectiveness of smartphone-based education in teaching electricity and magnetism.

By implementing these recommendations, stakeholders can harness the transformative potential of smartphones to create dynamic and engaging learning environments that empower students to succeed in mastering complex scientific concepts such as electricity and magnetism.

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APPENDICES

Appendix 1 Questionnaire for parents

My name is Marima Arnold, a student at BINDURA UNIVERSITY OF SCIENCE EDUCATION, studying BACHELOR OF SCIENCE EDUCATION, and majoring in physics. I am carrying out a research on the impacts of smartphones in teaching and learning of electricity and magnetism a case study of Nembudziya government high school, Gokwe north district in Zimbabwe. The research is done in partial fulfillment of the requirements of the program being studied. You are therefore requested to answer the following questions in honesty. Your responses will be treated in confidentiality and will be used in this study only

INSTRUCTIONS: Kindly answer all questions. Do not discuss with anyone. Please respond to items below by putting a yes or no in the provided space and elaborate when requested to do so.

SECTION A

1. Do you believe that using smartphones in education can make learning fun and engaging for your child? [ ] Yes [ ] No

2. Do you think smartphones provide valuable access to a wide range of educational resources and materials?

[ ] Yes

[ ] No

3. Do you agree that smartphones allow for personalized learning experiences tailored to your child's individual pace and style?

[ ] Yes

[ ] No

4. Do you think interactive simulations and visualizations on smartphones can help your child better understand complex concepts in electricity and magnetism?

[ ] Yes

[ ] No

5. Do you believe that the flexibility and convenience of accessing educational content on smartphones anytime and anywhere is beneficial for your child's learning?

[ ] Yes

[ ] No

6. Do you think smartphones encourage your child to explore and research topics beyond the classroom?

[ ] Yes

[ ] No

7. Do you agree that integrating smartphones into education helps prepare your child for the future by developing digital literacy and tech skills?

[ ] Yes

[ ] No

8. Do you believe that bridging the gap between traditional learning methods and modern technology with smartphones is important?

[ ] Yes

[ ] No

9. Do you think smartphones enable your child to collaborate effectively with classmates on projects and assignments?

[ ] Yes

[ ] No

10. Do you agree that immediate feedback through quizzes and interactive exercises on smartphones helps your child identify and improve on their weak areas?

[ ] Yes

[ ] No

11. Do you believe that educational games and challenges on smartphones make learning about electricity and magnetism more exciting and motivating for your child?

[ ] Yes

[ ] No

12. Do you think the portability of smartphones, allowing students to study and revise on the go, is beneficial for your child's learning efficiency?

[ ] Yes

[ ] No

13. Do you believe that multimedia resources (videos, animations, interactive diagrams) available on smartphones cater to different learning styles?

[ ] Yes

[ ] No

Section B Open-Ended Questions

16. In what ways do you think smartphones have positively impacted your child's learning experience?

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17. Can you share an example of how your child has used a smartphone to enhance their understanding of a topic in electricity and magnetism?

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18. What additional features or tools would you like to see in educational apps on smartphones to further support your child's learning?

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Appendix 2 Students' Questionnaire

My name is Marima Arnold, a student at BINDURA UNIVERSITY OF SCIENCE EDUCATION, studying BACHELOR OF SCIENCE EDUCATION, and majoring in physics. I am carrying out a research on the impacts of smartphones in teaching and learning of electricity and magnetism a case study of Nembudziya government high school, Gokwe north district in Zimbabwe. The research is done in partial fulfillment of the requirements of the program being studied. You are therefore requested to answer the following questions in honesty. Your responses will be treated in confidentiality and will be used in this study only

INSTRUCTIONS: Kindly answer all questions. Do not discuss with anyone. Please respond to items below by putting a yes or no in the provided space and elaborate when requested to do so.

Part 1: Yes/No Questions

1. Do you find using smartphones in education makes learning more engaging?

[ ] Yes

[ ] No

2. Do you think smartphones help you access a wider range of educational resources and materials?

[ ] Yes

[ ] No

3. Do you feel that smartphones allow you to learn at your own pace and style?

[ ] Yes

[ ] No

4. Do interactive simulations and visualizations on smartphones help you understand complex concepts like electricity and magnetism better?

[ ] Yes

[ ] No

5. Is the flexibility of accessing educational content on smartphones anytime and anywhere beneficial for your learning?

[ ] Yes

[ ] No

6. Do smartphones encourage you to explore and research topics outside of the classroom?

[ ] Yes

[ ] No

7. Do you believe that using smartphones in education helps you develop important digital literacy and tech skills?

[ ] Yes

[ ] No

8. Do you think smartphones make learning more relevant by bridging traditional methods and modern technology?

[ ] Yes

[ ] No

9. Do smartphones help you collaborate more effectively with classmates on projects and assignments?

[ ] Yes

[ ] No

10. Does receiving immediate feedback through quizzes and interactive exercises on smartphones help you identify and improve on weak areas?

[ ] Yes

[ ] No

11. Do educational games and challenges on smartphones make learning about electricity and magnetism more exciting and motivating?

[ ] Yes

[ ] No

12. Is the portability of smartphones, allowing you to study and revise on the go, beneficial for your learning efficiency?

[ ] Yes

[ ] No

13. Do multimedia resources (videos, animations, interactive diagrams) on smartphones cater to your preferred learning style?

[ ] Yes

[ ] No

14. Do you find the flipped classroom model, where you review lessons at home using smartphones and engage in hands-on activities in class, effective?

[ ] Yes

[ ] No

Part 2: Open-Ended Questions

16. How have smartphones positively impacted your learning experience in subjects like electricity and magnetism?

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17. Can you provide an example of how you used a smartphone to enhance your understanding of a topic in electricity and magnetism?

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18. What features or tools do you find most helpful in educational apps on smartphones, and why?

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19. Are there any challenges you face when using smartphones for learning? How do you overcome them?

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20. What additional features or improvements would you suggest for educational apps on smartphones to better support your learning?

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Appendix 3 teachers' Questionnaire

My name is Marima Arnold, a student at BINDURA UNIVERSITY OF SCIENCE EDUCATION, studying BACHELOR OF SCIENCE EDUCATION, and majoring in physics. I am carrying out a research on the impacts of smartphones in teaching and learning of electricity and magnetism a case study of Nembudziya government high school, Gokwe north district in Zimbabwe. The research is done in partial fulfillment of the requirements of the program being studied. You are therefore requested to answer the following questions in honesty. Your responses will be treated in confidentiality and will be used in this study only

INSTRUCTIONS: Kindly answer all questions. Do not discuss with anyone. Please respond to items below by putting a yes or no in the provided space and elaborate when requested to do so.

Section A: Demographic Information

1. Age:

20-30 31-40 41-50 51-60 61 and above

2. Gender

Male ( ) Female ( )

3. Highest Educational Qualification

Bachelor's Degree ( ). Master's Degree ( ). Doctorate ( ) Other (Please specify)

4. Teaching Experience:

Less than 1 year 1-5 years 6-10 years 11-20 years More than 20 years

5. Subject Specialization

Physics General Science Other (Please specify)

Part 1: Yes/No Questions

1. Do you find that using smartphones in education makes lessons more engaging for your students?

[ ] Yes [ ] No

2. Do you believe that smartphones provide valuable access to a wide range of educational resources and materials for your students?

[ ] Yes [ ] No

3. Do you agree that smartphones allow for personalized learning experiences tailored to individual student needs and learning styles?

[ ] Yes [ ] No

4. Do you think interactive simulations and visualizations on smartphones help students better understand complex concepts like electricity and magnetism?

[ ] Yes [ ] No

5. Is the flexibility of accessing educational content on smartphones anytime and anywhere beneficial for your students' learning?

[ ] Yes [ ] No

6. Do smartphones encourage students to explore and research topics beyond the classroom?

[ ] Yes [ ] No

7. Do you believe that integrating smartphones into education helps develop important digital literacy and tech skills in students?

[ ] Yes [ ] No

8. Do you think smartphones make learning more relevant by bridging traditional methods and modern technology?

[ ] Yes [ ] No

9. Do smartphones help students collaborate more effectively on projects and assignments?

[ ] Yes [ ] No

10. Does immediate feedback through quizzes and interactive exercises on smartphones help students identify and improve on their weak areas?

[ ] Yes [ ] No

11. Do educational games and challenges on smartphones make learning about electricity and magnetism more exciting and motivating for students?

[ ] Yes [ ] No

12. Is the portability of smartphones, allowing students to study and revise on the go, beneficial for their learning efficiency?

[ ] Yes [ ] No

13. Do multimedia resources (videos, animations, interactive diagrams) on smartphones cater to different learning styles effectively?

[ ] Yes [ ] No

14. Do you find the flipped classroom model, where students review lessons at home using smartphones and engage in hands-on activities in class, effective?

[ ] Yes [ ] No

15. Do smartphones help students stay updated with the latest information and advancements in subjects like electricity and magnetism?

[ ] Yes [ ] No

Part 2: Open-Ended Questions

16. How have smartphones positively impacted your teaching experience in subjects like electricity and magnetism?

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17. Can you provide an example of how you have used smartphones to enhance your students' understanding of a topic in electricity and magnetism?

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18. What features or tools do you find most helpful in educational apps on smartphones, and why?

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19. Are there any challenges you face when integrating smartphones into your teaching? How do you address them?

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20. What additional features or improvements would you suggest for educational apps on smartphones to better support your teaching?

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