BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

FACTORS AFFECTING ADOPTION OF MOBILE LEARNING FOR THE TEACHING AND LEARNING OF COMBINED SCIENCE AT CHIWARIDZO SECONDARY SCHOOL.

BY

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ABSTRACT

This study explores the factors affecting the adoption of mobile technology in Combined Science education at Chiwaridzo secondary school. Using a quantitative research method which is a survey approach, the research investigates the impact of teacher training, infrastructure, and student engagement on mobile technology integration. The findings highlight that teacher training and infrastructure are significant predictors of successful mobile technology adoption, while student engagement plays a moderating role. Questionnaires were administered to 45 learner, 4 to combined science teachers and 1 to the school head. For data presentation and analysis Microsoft excel 2013 version for chart and table construction. The study provides recommendations for combined science teachers, parents (guidance), policymakers (MoPSE), school heads or administration and technology providers to support effective mobile technology integration, including targeted teacher training programs and infrastructure development. The research contributes to understanding the complexities of technology adoption in science education, informing strategies to enhance teaching and learning practices. The key words are mobile technology adoption, combined science education, teacher training, science teaching, and adoption factors.

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1 CHAPTER 1: THE PROBLEM AND ITS SETTINGS

1.1 Introduction

Due to circumstances that have arisen in the educational sector, institutions were into technological systems which included mobile learning technology. In order to help my reader understand the research, this chapter is going to cover background, significance, research questions, research objectives, delimitations, limitations, assumptions to the study and chapter summary.

1.2 Background to the study

ICT tool use in classroom is still on debate as there is no fixed agreed decision pertaining use. These includes mobile learning tools, devices, apps and platforms. Hwang, Chang and Chen (2020) asserts that the seamless integration of technology in education has changed the global learning landscape, presenting unparalleled opportunities for student engagement and knowledge acquisition. Markets and Markets (2020) supports the notion that, the worldwide mobile learning market is projected to reach $78.2 billion by 2025, underscoring the growing significance of mobile technology.

United Nations (2015), supports their Sustainable Development Goal 4 (SDG 4) which emphasizes on the adoption of technology in order to achieve a goal of the inclusive and equitable quality education and this is because through mobile devices, learners are able to discuss online unlike to gather in traditional classrooms for discussion, information can be shared through different apps, for example the teacher can upload a task on Google classroom , whatsapp and learners has equal access to the work.

UNESCO (2019) states that mobile learning has become an essential tool for realizing sustainable development goal 4(SDG 4) particularly in resource-constrained developing countries where access to traditional educational infrastructure is limited, learners have access to education no matter how scarce resources are and can have better learning environments in their homes unlike the hot- sitting and under the tree classrooms.

According to Komba and Mtega (2020) states that limited infrastructure, inadequate access to devices, and insufficient technical support affects the widespread of mobile technology. Furthermore, Agyei and Voogt (2020) advocates that, teacher attitudes, student readiness, and institutional support play critical roles in determining the success of mobile learning initiatives. More so, in the context of combined science education, mobile learning offers immense potential for enhancing learner engagement, motivation, and understanding (Ogunsola & Okere, 2020). However, a deeper understanding of the factors influencing mobile learning adoption in the African context is necessary to unlock its full potential.

1.3 Problem Statement

Mugwisi, Mugwisi and Mlanga (2022) supports the notion that despite the potential benefits of mobile learning, its adoption in Zimbabwean schools remains limited. Several factors, including infrastructure constraints, teacher resistance, and learner readiness, hinder the full adoption of technology for mobile learning in Combined Science (Katiyoo,Katiyoo &Kumar, 2020). Eartmer and Ottenbreit-Leftwich (2020), assumes that teachers' perceptions towards mobile learning technology is influenced by different factors such as teachers' content knowledge, teacher's confidence and school readiness and as well as parental support.

The study aims to investigate and identify the factors that influence the adoption of mobile learning technology among learners as well as to explore learners perceptions towards mobile learning technology as well as challenges faced while using mobile tools and devices in class for combined science. The findings of this study will contribute to deeper understanding of the role of mobile learning technology in enhancing science education in schools in Zimbabwe, inform policy to practice and support the effectiveness of mobile learning adoption.

1.4 Research objectives

i. To identify the factors that influence the full adoption of mobile learning technology among learners.
ii. To explore learners' perceptions towards mobile learning technology as well as challenges faced while using mobile tools and devices in class.
iii. Possible solutions on how to improve full adoption of mobile learning.

1.5 Research questions

i. How do pedagogical, technological, institutional and Psychological factors affect the use of mobile devices and tools for learning?

ii. What are the learners' perceptions towards the use of mobile devices and tools in learning as well as challenges faced while using mobile tools in class?

iii. What are the possible ways to improve the adoption of mobile learning?

1.6 Significance of the study

This study will contribute to the existing body of knowledge on mobile learning adoption in Zimbabwe, providing insights into the factors that facilitate or hinder the full adoption of technology for mobile learning in Combined Science. The study on "factors that affects adoption of technology for mobile learning in combined science at Chiwaridzo secondary school" is crucial for different stakeholders like curriculum designers, teachers, learners, government and policy makers but this study is mainly focused on learners, teachers and curriculum designers.

Firstly, the study can help to inform teachers in some potential ways such as professional development and lCT based teaching methods. Teachers have to go for workshops for lCT teacher training programs so as to prepare for mobile learning adoption and this will include teaching on how to use or operate mobile digitals. Secondly, the study can provide valuable insights and recommendations for the curriculum designers by guiding them with assessments and evaluation, curriculum development and mobile learning pedagogies. Anderson and Krathwohl (2020) advocates that the curriculum designers are being guided on curriculum developments,for example, the study findings can inform the development of science curricula that in cooperate mobile learning effectively, ensuring that learners develop essential skills. This is beneficial because it enables the advance school preparations such as installation of mobile apps in their data bases, purchasing of mobile devices, informing parents on the issue, teacher training, and pupil training on the use.

Lastly, Mishra and Koehler (2020) proposes that the integration of lCT in mobile learning helps to improve science learning outcomes, through the study findings which will inform the development of lCT- enabled learning platforms, aids through videos, simulations which will help them to recall

information better during examinations learners will also have access to carry out online discussions with other learners globally and will improve performance.

More so, UNICEF (2020) reported that through the study findings on factors that affect adoption of technology for mobile learning in combined science can greatly benefit learners by having access to digital resources they are able to have access to online educational platforms, applications and digital libraries and this can greatly help them to have quality, current and relevant information thus increasing scores in their science area with effective use of gadgets. To sum up, the findings will help other learners in research purposes. For example when the research is uploaded on the university website (library) or placed in a library, other learners can refer to it when carrying researches for backgrounds, literature reviews and for providing a foundation for further investigations. To conclude, exploring the factors that affect full adoption of technology for mobile learning in combined science, the study will provide valuable thoughts that can greatly benefit various stakeholders for schools in Zimbabwe

1.7 Assumptions

The researcher assumes that learners and teachers at Chiwaridzo secondary have access to mobile tools especially mobile gargets either through permanent ownership or via hot spotting of gadget from their relatives and they have also faced challenges with the use and operation of mobile gadgets due to lack of skills.

1.8 Delimitations

The study is to be conducted at Chiwaridzo government secondary school. Under geographical location, it is a school which is a located in the province of Mashonaland and this is not going to completely explore all the views of secondary schools in Zimbabwe as the study focuses on the context of this school. The study is also delimited to subject area which is combined science. Combined science comprises of biology, chemistry and physics, however the views and challenges of other learning areas are not to be in-cooperated. More so, the study directly targets a specific group which are mainly teachers and learners and indirectly to parents.

1.9 Limitations

A number of limitations should be considered when interpreting the result of this research findings. The following limitations are expected to be encountered during the course of research

Confidentiality and privacy of information withheld and reliance to be placed on the available information supplied by respondences, however to overcome this, the researcher is to explain to the respondences that their responses will not be shared with anyone but rather as privacy.

The researcher is likely to face resource shortages such as limited access to funding which is difficult for developing countries like Zimbabwe to fund the researcher, the researcher may have limited access to research equipment and software because there is need for specialized equipment and software to collect and analyze data.

Chiwaridzo is a local government school which has its own infrastructure, school run which is different from other schools, however conclusions drawn from the school will not represent other educational institution.

1.10 Definition of terms

i. Mobile learning (m-learning):

   Refers to the use mobile devices, such as smartphones, tablets, and laptops, to access learning materials and participate in educational activities.

ii. Mobile device:

   Portable electronic devices, such as smartphones, tablets, and laptops used for learning.

iii. Full adoption:

   Refers to utilization and integration of mobile technology completely in learning and becomes an essential part in education.

iv. Combined science:

   A curriculum which is made up of three specific science subjects such as biology, physics and chemistry.

1.11 Chapter summary

In conclusion in Zimbabwe there is no agreement on the use of gadgets in secondary schools, for example some schools do not permit the use gadgets at school but rather at homesteads which will greatly affects performance of pupils and thus the necessity of the study. The following chapter is focused on the review of the related literature.

2 CHAPTER TWO: REVIEW OF THE RELATED LITERATURE

2.1 Introduction

This chapter is focused on reviewing the literature related to this study. The chapter presents the literature on the factors influencing the adoption of technology for mobile learning combined science. The chapter further focuses on the literature on learners' perceptions towards mobile learning. This is then followed by a literature review exploring the challenges. Before concluding the chapter explores the potential solutions to the challenges.

2.2 Factors Influencing the Full Adoption of Mobile Learning Technology

The adoption of mobile learning technology is influenced by multiple factors, including technological, pedagogical, institutional, and psychological elements.

i. Technological Factors

The availability of reliable internet connectivity, device affordability, and software usability significantly impact the adoption of mobile learning. Research by Park (2011) highlights that students in low-income regions struggle with high data costs and limited access to digital devices, hindering their full participation in mobile learning. Similarly, Al-Emran, Elsherif and Shaalan (2016) found that mobile device compatibility and security concerns influence students' willingness to engage with mobile learning tools. A study conducted by Prinsloo and Slade (2016) on mobile learning in South African universities found that students in rural and peri-urban areas struggled with expensive data costs and lack of reliable internet, which hindered their ability to access online learning platforms. The study suggested that mobile learning adoption rates were significantly lower in these areas compared to urban centers with better digital infrastructure. Furthermore, According to Mtebe and Raisamo (2014), a survey of higher education learners in Tanzania and Kenya showed that affordability of mobile devices was a major concern, with many learners unable to purchase smartphones or tablets necessary for mobile learning. The study also found that limited institutional support and unreliable internet discouraged the adoption of mobile learning.

ii. Pedagogical Factors

The design and implementation of mobile learning must align with pedagogical goals. Studies by Traxler (2018) indicate that educators' digital literacy and instructional approaches determine the effectiveness of mobile learning. Teachers who receive training on integrating mobile learning into their curriculum demonstrate higher success in fostering student engagement.A study conducted by Looi et al. (2010) in Singapore examined the implementation of mobile learning in secondary schools. The study found that when teachers were trained to integrate mobile devices into their teaching practices, student engagement and learning outcomes improved significantly. According to Looi et al. (2010) the researchers emphasized that the success of mobile learning depended on aligning the technology with pedagogical goals and providing teachers with the necessary skills and support.

iii. Institutional and Psychological Factors

Institutional support, including policies that promote mobile learning, is crucial for widespread adoption (Teo, 2011). Psychological factors, such as students' motivation and self-efficacy, also play a role.

2.3 Learners' Perceptions and Challenges in Mobile Learning

Students generally perceive mobile learning (m-learning) as a convenient and flexible educational tool that aligns with their dynamic lifestyles. Sánchez-Prieto et al. (2017) found that learners value the ability to access learning materials anytime and anywhere, which fosters personalized learning experiences. This flexibility allows learners to engage with content at their own pace, catering to individual learning preferences and schedules. For instance, a study by Al-Emran et al. (2018) revealed that students in higher education institutions viewed mobile learning as a means to overcome time and location constraints, enabling them to balance academic responsibilities with personal commitments.

The convenience of mobile learning is further amplified by the ubiquity of smartphones and tablets, which have become integral to learners' daily lives. According to Traxler (2007), mobile devices serve as portable learning hubs, providing instant access to educational resources, communication tools, and collaborative platforms. This aligns with the findings of Cheon et al. (2012), who noted that learners perceive mobile learning as a practical solution for on-the-go

learning, particularly in contexts where traditional classroom settings are inaccessible. However, learners' perceptions of mobile learning are not uniform and often vary based on their prior exposure to and familiarity with technology. Sánchez-Prieto et al. (2017) observed that tech-savvy students, who are accustomed to digital learning environments, exhibit greater enthusiasm and confidence in using mobile learning tools. In contrast, learners with limited technological experience may feel overwhelmed or hesitant, which can hinder their engagement. This disparity is supported by the work of Wang et al. (2009), who found that learners' self-efficacy and prior technology use significantly influence their acceptance of mobile learning.

A study by Liu et al. (2010) highlighted that student in developing countries, where access to technology may be limited, often view mobile learning as a transformative opportunity to bridge educational gaps. Conversely, in developed countries, where technology is more pervasive, students may have higher expectations for the functionality and quality of mobile learning tools. Moreover, the design and usability of mobile learning applications significantly impact learners' perceptions. According to a case study by Alrasheedi et al. (2015) demonstrated that learners were more inclined to adopt mobile learning when the interface was user-friendly and the content was relevant to their coursework.

2.4 Challenges Faced by Learners

Despite its numerous advantages, mobile learning (m-learning) is not without challenges. Learners often encounter significant obstacles that hinder the effective integration of mobile learning tools in educational settings. These challenges include technical issues, cognitive load, and teacher resistance, each of which has been extensively documented in the literature.

Technical Issues

Technical problems remain one of the most pervasive barriers to the successful implementation of mobile learning. Poor network connectivity, device compatibility issues, and slow-loading educational apps can disrupt the learning process and frustrate both learners and educators (Ifenthaler & Schweinbenz, 2016). For instance, in developing countries, where internet infrastructure is often unreliable, learners face frequent disconnections and delays when accessing online resources (Kukulska-Hulme et al., 2017). A study by Gikas and Grant (2013) revealed that while learners appreciated the flexibility of mobile learning, they also struggled with maintaining

focus in an environment filled with social media and other non-academic apps. Additionally, technical glitches, such as poor internet connectivity or device compatibility issues, can frustrate users and diminish their overall experience (Kukulska-Hulme, 2012). Even in developed regions, technical glitches such as app crashes or insufficient device storage can impede seamless learning experiences (Al-Emran et al., 2020). A study by Crompton et al. (2017) highlighted that learners in rural areas of South Africa often struggled with inconsistent internet access, which limited their ability to participate in mobile learning activities. This digital divide exacerbates educational inequalities, as learners without reliable access to technology are left at a disadvantage. According to Sharples et al. (2015), the success of mobile learning depends heavily on the robustness of the technological infrastructure. Without consistent and reliable access to mobile networks and devices, the potential of m-learning cannot be fully realized.

i. Cognitive Load

Another significant challenge is the cognitive load imposed by mobile learning tools. While these tools offer flexibility and accessibility, over-reliance on mobile devices can lead to distractions and superficial learning (Teo, 2018). The constant influx of notifications, combined with the multitasking nature of mobile devices, can fragment learners' attention and reduce their ability to engage in deep, meaningful learning (Kirschner & De Bruyckere, 2017). A study by Kuznekoff et al. (2015) found that learners who used their mobile devices for non-academic purposes during lectures scored significantly lower on comprehension tests compared to those who used their devices solely for learning activities. Sweller et al. (2019) argue that mobile learning environments must be carefully designed to minimize extraneous cognitive load. This can be achieved by incorporating principles of cognitive load theory, such as reducing unnecessary multimedia elements and providing clear, structured content.

ii. Teacher Resistance

Teacher resistance is another critical barrier to the widespread adoption of mobile learning. Many educators remain skeptical about the efficacy of mobile learning tools, citing concerns over classroom management, academic integrity, and the potential for increased learner distraction (Traxler, 2018). Some teachers also feel inadequately trained to integrate mobile technologies into

their teaching practices, leading to reluctance or outright opposition (Ertmer et al., 2012). In a case study conducted by Pegrum et al. (2013), teachers in Australian schools expressed concerns about the difficulty of monitoring learners' use of mobile devices during class. They feared that learner would misuse the devices for non-academic purposes, such as social media or gaming. According to Ertmer and Ottenbreit-Leftwich (2010), overcoming teacher resistance requires a combination of professional development, institutional support, and a shift in pedagogical mindset. Teachers need to be equipped with the skills and confidence to effectively integrate mobile learning tools into their teaching practices.

iii. Equity and Access

Not all learners have equal access to mobile devices or high-speed internet, creating disparities in learning opportunities (Selwyn, 2017). This digital divide is particularly pronounced in low-income communities and developing countries, where economic constraints limit access to technology (West & Bleiberg, 2013). A report by UNESCO (2020) highlighted that during the COVID-19 pandemic, students in low-income households were disproportionately affected by the shift to online and mobile learning due to a lack of access to devices and reliable internet.

iv. Privacy and Security Concerns

The use of mobile learning tools often involves the collection and storage of personal data, raising concerns about privacy and security (Selwyn, 2016). Students and educators may be hesitant to adopt mobile learning technologies if they perceive them as vulnerable to data breaches or misuse. A study by Zheng et al. (2018) found that learners were less likely to engage with mobile learning platforms that required extensive personal information, citing concerns about data privacy.

2.5 Solutions to Improve the Full Adoption of Mobile Learning

i. Enhancing Infrastructure and Connectivity

A critical barrier to the full adoption of mobile learning is the lack of reliable digital infrastructure, particularly in underserved and rural areas. Governments and educational institutions must prioritize investments in robust digital infrastructure to ensure equitable access to mobile learning resources. Ally & Tsinakos (2014) highlight the importance of expanding broadband access to bridge the digital divide, particularly in developing regions where connectivity remains a

significant challenge. For instance, initiatives like India's Digital India Campaign and Kenya's National Broadband Strategy have demonstrated how government-led infrastructure projects can improve internet access and support mobile learning (UNESCO, 2017). Selwyn (2011) argues that infrastructure development must go beyond mere connectivity to include affordable access to devices and software. For example, programs like One Laptop Per Child (OLPC) have shown that providing low-cost devices to students can significantly enhance access to mobile learning opportunities. In Brazil, the Banda Larga nas Escolas program connected public schools to high-speed internet, enabling the integration of mobile learning tools into the curriculum. This initiative not only improved access but also demonstrated the importance of public-private partnerships in scaling infrastructure (World Bank, 2018).

ii. Teacher Training and Curriculum Integration

The successful integration of mobile learning into education systems heavily depends on the preparedness of educators. Teachers need ongoing professional development to effectively incorporate mobile technologies into their teaching practices. Lai (2019) emphasizes that structured training programs can increase teachers' confidence and willingness to use mobile technology in classrooms. For example, Singapore's ICT Master plan for Education includes comprehensive training for teachers, ensuring they are equipped to leverage mobile learning tools effectively (UNESCO, 2017). Ertmer & Ottenbreit-Leftwich (2013) argue that teacher training should focus not only on technical skills but also on pedagogical strategies for integrating mobile learning into the curriculum. This dual focus ensures that technology is used meaningfully to enhance learning outcomes. In Finland, the Finnish National Agency for Education provides teachers with continuous professional development opportunities, including workshops on mobile learning tools and strategies. This has led to high levels of mobile learning adoption in Finnish schools (OECD, 2019).

iii. Student-Centered Learning Approaches

Mobile learning applications must be designed with students' needs in mind to ensure engagement and effectiveness. Interactive and adaptive learning technologies can significantly enhance motivation and retention rates.Sharples et al. (2015) advocate for the use of gamification and adaptive learning technologies in mobile learning applications. For example, platforms like

Duolingo and Kahoot have successfully used gamification to make learning more engaging and effective. Hwang & Tsai (2011) highlight the importance of personalized learning experiences in mobile learning. Adaptive learning technologies, such as those used in Khan Academy, tailor content to individual learners' needs, improving both engagement and outcomes. In South Korea, the Smart Education Initiative has developed mobile learning platforms that incorporate gamification and adaptive learning. These platforms have been widely adopted in schools, leading to improved student engagement and performance (Kim et al., 2018).

iv. Policy Implementation and Institutional Support

Government policies and institutional support are crucial for creating an enabling environment for mobile learning adoption. Policies that provide incentives and remove barriers can significantly accelerate the integration of mobile learning into education systems.Venkatesh & Davis (2000) recommend that institutions provide incentives such as subsidized devices and free access to educational platforms to encourage widespread adoption. For example, the E-Rate Program in the United States provides funding to schools and libraries to improve internet access, supporting the use of mobile learning tools (FCC, 2020). Traxler (2016) argues that policies should also address issues of digital literacy and equity. For instance, the European Digital Education Action Plan includes initiatives to improve digital skills among learners and teachers, ensuring that mobile learning is accessible to all (European Commission, 2020). In Rwanda, the government's One Laptop per Child initiative, combined with policies promoting digital literacy, and has led to significant improvements in mobile learning adoption. This has been particularly impactful in rural areas, where access to traditional educational resources is limited (World Bank, 2019).

3 CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a comprehensive overview of the procedures employed for data collection and analysis in this study. The chapter begins by elucidating the research approach adopted to address the study's objectives. Subsequently, it outlines the research design, justifying its alignment with the study's goals. Following this, the chapter details the study's target population and sample demographics, explaining the criteria for participant selection. It then explores the sampling techniques applied to ensure representativeness and rigor. The discussion transitions to the methodologies, techniques, and tools deployed for data collection, including surveys and document analysis. It further elaborates on the strategies for quantitative data analysis, emphasizing their role in deriving meaningful responses. Ethical considerations, including informed consent and confidentiality, are thoroughly addressed to underscore the study's adherence to research integrity. The chapter concludes with a summary of the key points discussed, reinforcing the methodological coherence of the investigation.

3.2 Research design.

To establish a clear foundation for this study, it is essential to define the concept of a research design. Creswell (2014) posits that a research design refers to the overall strategy that a researcher employs to integrate the different components of a study in a coherent and logical way, ensuring that the research problem is effectively addressed. Given the complex nature of investigating the factors influencing the full adoption of mobile learning in Combined Science, this study employed survey research design, specifically involving collection of data through self-report measures such as questionnaires. The rationale for this design is supported by contemporary scholars who argue that surveys enhances the validity and reliability, reduces errors and biases, increase data quality and response rate of research findings, (Sudman &Bradburn,1982;Fowler,2014). The decision to adopt survey research design was informed by the need to: collect data through self-report measures (questionnaires) and to capture quantitative data (survey responses, adoption rates, and technology usage metrics) provides measurable evidence of trends and correlations in mobile learning adoption (Kumar, 2019).

3.3 Data collection methods

In this regard, the study employed primarily data collection methods which are questionnaires and surveys to comprehensively examine factors affecting adoption of mobile learning in Combined Science. The primary method included surveys (quantitative), so as to address dimensions of the research problem.

Surveys

Surveys were administered to Combined Science students, teachers and the school headmaster to quantify their attitudes, usage patterns, value, skills, trust and access with mobile learning tools. Kumar (2012) defines surveys as systematic tools to collect standardized data from a target population about "beliefs, behaviors, or knowledge." A structured questionnaire comprising Likert-scale and open-ended questions was used to ensure reliability and ease of analysis (Creswell, 2014).The likert scale was drafted in line with the level of agreements of respondents.

3.4 Research Population and Sample

3.4.1 Population of the Study

The population of a study constitutes the entire group of individuals or elements that are the focus of the research (Taherdoost, 2016). For this study, the target population comprised the following key stakeholders involved in mobile learning for Combined Science at Chiwaridzo Secondary School: Combined Science Teachers – Educators responsible for delivering the Combined Science curriculum using mobile learning technologies. Combined Science learners– Learners engaged in mobile-assisted science education at the secondary school level. School Headmaster/Administrator –one in full control on how the school is to be run.

3.4.2 Sample of the study and sampling techniques

A sample refers to a subset of the population selected to represent the entire group in a research study (T.Etikan et al., 2016). According to K.Taherdoost (2016), sampling is crucial in research because it allows investigators to collect data efficiently while maintaining the validity and reliability of findings, particularly when studying large populations. The study had a sample of 50 participants, these were derived from 45 learners, 4 teachers and 1 Headmaster.

Learners were selected through stratified and convenience sampling methods. Through stratified method, they were divided into 2 subgroups according to their grade level and in each subgroup a random sample was picked so as to ensure generalization. Stratified sampling ensures inclusion of every subgroup to represent a larger population in the study findings (Levy & Lemeshow, 2013, pg.230). Learners at Chiwaridzo Secondary School were also selected through convenience sampling, a non-probability approach where participants are chosen based on their immediate availability and willingness to participate (Elfil & Negida, 2017). This method was adopted due to its practical advantages, including time efficiency, cost-effectiveness, and logistical feasibility, which were critical considerations for the study's scope. For the selection of science teachers, the study employed purposive sampling (also termed judgmental sampling), wherein participants are deliberately chosen based on their specific expertise and relevance to the research objectives (Babbie, 2010). This approach allowed the researcher to leverage professional judgment to identify educators with direct experience in mobile learning integration, ensuring the sample's alignment with the study's focus. The same purposive sampling technique was applied to select the Headmaster, as their institutional leadership role provided unique insights into policy implementation and resource allocation for technology adoption. Purposive sampling technique was used for both teachers and the school head to gather valuable insights and relevant information from these key figures.

3.5 Data collection procedure

The data collection process for this study was conducted as follows:

i. Permission and Authorization:

   Initially, the researcher seeks formal authorization from the authorities at Chiwaridzo Secondary School to conduct field research on their premises. This step ensured compliance and cooperation with the school's administration.

ii. Scheduling and Coordination:

   Appointments were precisely arranged to time the convenience and availability of the participants. This scheduling ensures that participants are adequately prepared for their involvement in the study.

iii. Participant Selection:

Participants were chosen using the sampling techniques previously mentioned, ensuring a representative and diverse sample that aligns with the research objectives.

iv. Pilot testing:

Pilot test was conducted using a sample of 20 participants (excluded from the main sample) to ensure question clarity, data validity and reliability.

v. Questionnaire Distribution:

Convenience sampling was employed when distributing printed questionnaires to the participants. This approach is aimed at making the process more accessible and convenient for the participants. The participants were requested to complete the questionnaires and return them to the researcher.

vi. Data Collection:

Subsequently, the researcher gathered the complete questionnaires, ensuring that all data collection instruments are collected for further processing and analysis.

3.6 Data analysis

Data presentation, as defined by Creswell (2013), is the process of visually conveying the relationships among two or more datasets to facilitate decision-making. In the context of this study, data was presented through tables, graphs, narratives, and pie charts. Additionally, a portion of the data collected from the field will also be presented in the form of bar and pie charts.In this study, data was analyzed using tabular, graphical and percentage analysis. The summarized large data sets extracted from the findings will be utilized for decision making through discussion of the results.

3.7 Validity and Reliability/Trustworthiness of the Study

Ensuring the validity and reliability of research findings is critical to maintaining the credibility and rigor of any study (Creswell & Creswell, 2018). Validity refers to the accuracy with which a study measures what it intends to measure, ensuring that the results reflect the true characteristics of the phenomenon under investigation (Creswell, 2014). Reliability, on the other hand, pertains to the consistency and stability of research findings, indicating whether the study can produce similar results under comparable conditions (Kumar, 2019).

To uphold these principles in this study on mobile learning adoption in Combined Science, the following measures were implemented:

i. Ensuring Validity

External Validity: While the study focused on Chiwaridzo Secondary School, findings were contextualized within broader literature on mobile learning in sub-Saharan Africa (e.g., Boateng et al., 2016) to assess generalizability.

ii. Ensuring Reliability

Internal Consistency: Cronbach's alpha was calculated for Likert-scale survey items (e.g., technology acceptance questions).

iii. Test-Retest Reliability: A pilot study with 20 students (excluded from the main sample) was conducted to refine instruments and ensure question clarity.

iv. Trustworthiness (Qualitative Rigor)

3.8 Ethical considerations

Research ethics encompass a set of principles guiding research design and practices (Kumar, 2012). In this study, various research ethics principles were followed, including confidentiality, informed consent, and voluntary participation.

Confidentiality, as Grover (2015) defines it, involves the researcher knowing the identity of research subjects but taking steps to safeguard their identity from discovery by others. Creswell (2013) extends this concept, asserting that confidentiality entails the principle and practice of keeping sensitive information private unless explicit consent is granted by the data owner for sharing it with others. To ensure confidentiality in this research, pseudonyms were used for participants, effectively safeguarding their identities and ensuring that the source of information remains undisclosed.

Regarding informed consent, participants receive a comprehensive explanation of the research's purpose, objectives, goals, and the intended use of the collected information. This process ensures that participants possess a detailed understanding of the research and engage in the study willingly. In accordance with Creswell (2013), informed consent upholds the right of participants to partake in the study without any coercion or pressure.

The study also upholds the principle of voluntary participation, adhering to Kumar's (2012) definition that voluntary participation signifies individuals freely choosing to be part of the data collection process without any form of coercion or inducement. Participants are not compelled or incentivized to take part in the research.

In summary, this research strictly adheres to ethical principles, encompassing confidentiality, informed consent, and voluntary participation, thereby ensuring that the study is conducted with integrity and that participants' rights and privacy are upheld throughout the research process.

3.9 Chapter summary

In summary, this chapter has provided a comprehensive roadmap for the data collection and analysis processes key to our investigation. It commenced by establishing the fundamental framework for the study, firmly based on the chosen research methodology. The study navigated through the details of the research approach and design, offering a clear understanding of the study's organizational structure. The research extended to the characterization of the study's participant demographics, describing the composition of the research population. The research then explored the realm of sample selection, carefully considering various approaches that guided our choices and informed our research methodology. The chapter unveiled careful and detailed approach for data collection, encompassing methodologies, techniques, and tools thoughtfully selected to acquire reliable and comprehensive data. Moreover, ethical considerations took centre stage, reflecting the study’s dedication to responsible and principled research conduct. This chapter has paved the way for the subsequent phases of the study.

4 CHAPTER 4: PRESENTATION OF DATA, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter is focused on the presentation, analysis, and discussion of the data collected during the field research. The data presented in this was collected through questionnaires administered to selected groups of participants, including students, combined science teachers, and the school's Headmaster at Chiwaridzo Secondary School. In order to uphold the principle of confidentiality, the study did not disclose the names of the participants within this chapter. The organization of the data presentation aligns closely with the predefined research objectives. The chapter begins by presenting the biographical information of the participants, providing a comprehensive overview of the individuals involved in the study. Subsequently, the chapter transition into a section focused on Factors Influencing Full Adoption of Mobile Learning at Chiwaridzo Secondary School. Moving forward, the chapter then presents the chapter summary.

4.2 Biographic data of participants

The sample is made up of 50 participants.45 of them were learners and the rest were combined science teachers (5).

4.2.1 Biographic data of learners who participated in the study

This section looked at the characteristics such as gender, age, teachers' qualification level and professional area of study.

4.2.1.1 Gender of learners

The participants comprised mostly of learners who were females 78% (35) and the rest were males as shown in Figure 4.1. The gender distribution of students of Combined Science at Chiwaridzo Secondary School indicates a slight male dominance, with males constituting 22% and females accounting for 78%. This vast gap suggests a commendable level of gender balance in participation, although there is still room for improvement to achieve full parity. The presence of both male and female participants in nearly equal proportions reflects efforts towards inclusivity and equal opportunity in science education. However, the slight underrepresentation of females may point to lingering gender-based challenges such as societal perceptions, stereotypes, or structural barriers that can affect girls' and women's full engagement in science-related fields. Promoting targeted interventions such as mentorship programs, science clubs for girls, and gender-

sensitive teaching practices could help bridge the gap and foster a more equitable environment for all learners and educators in the Combined Science discipline.

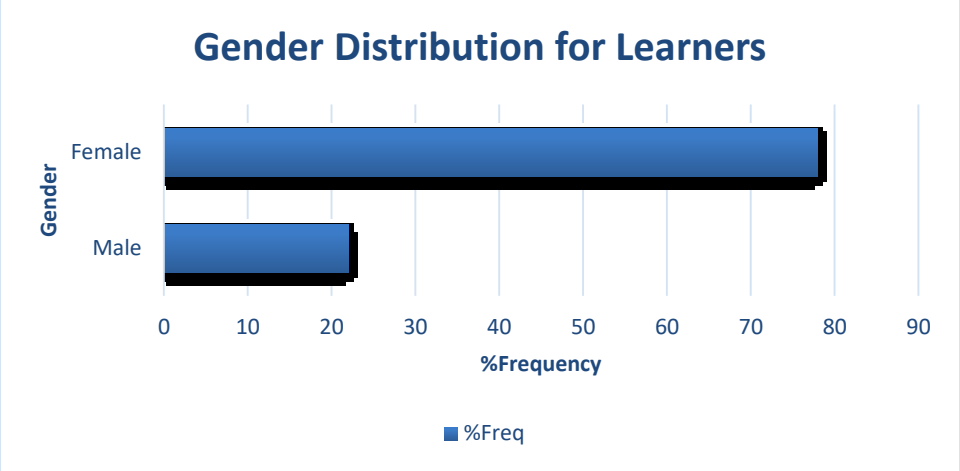

Figure 4.1 Gender Distribution for learner participants

4.2.1.2 Age of students

The age distribution of learners in Combined Science reveals that the majority fall within the 15–16 years (80%) as reflected in Figure 4.2. This suggests that Combined Science is predominantly studied by older learners, likely due to its placement in the upper levels of the secondary school curriculum. The notable presence of (9%) learners aged 17 and above may also indicate delayed academic progression, possibly caused by factors such as grade repetition, late school enrolment, or disruptions in schooling and the remaining 10% are learners of 14 years and below.

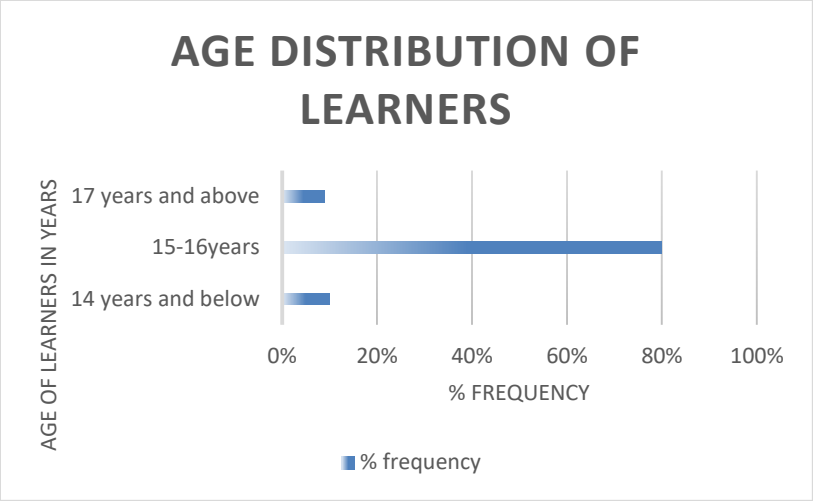

Figure 4.2 Age Distribution of learner participants

Only 10% of the learners are within the 14 and below age bracket, typically associated with early enrolment due to academic excellence and self-confidence for higher grades. This wide age range highlights the need for differentiated teaching strategies that cater to varying levels of maturity and academic readiness. Additionally, a few elderly learners makes a proportion of 9% falls within the range of 17 years and above. This generally indicates a delayed enrolment in combined science attributable to personal interests, repetition of subject as it is a basic requirement for professional readiness and need for foundational knowledge. This cluster calls for remedial or flexible learning approaches to support those who may have experienced setbacks.

4.2.2 Biographic data of teachers who participated in the study

Age of teachers

The age distribution of teachers shows a fairly balanced spread across all age groups, with a slight dominance of those in the 31-40years 2 (40%) of the sample population, 51 and above of year's category2 (40%), who make up 8% of the teaching staff. This group likely represents experienced educators who have spent a considerable number of years in the profession, contributing to institutional memory and mentoring of younger teachers. Meanwhile, 1(20%)makes up younger teaching population. This suggests a moderate inflow of younger teachers into the profession, which is important for succession planning and they bring new, fresh ideas and teaching methods.

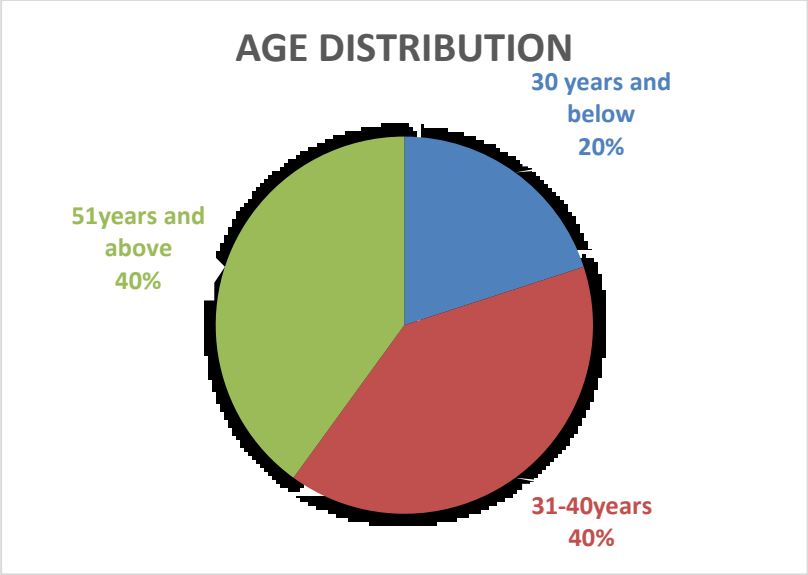

Figure 4.3 Age distribution for teacher participants

Gender distribution teachers

The sample comprised of 5 participants of which 4(80%) were females and the rest were males. This clearly indicated that female are dominant in the profession of science, might be to gender disparities in recruitment but however is crucial for women empowerment.

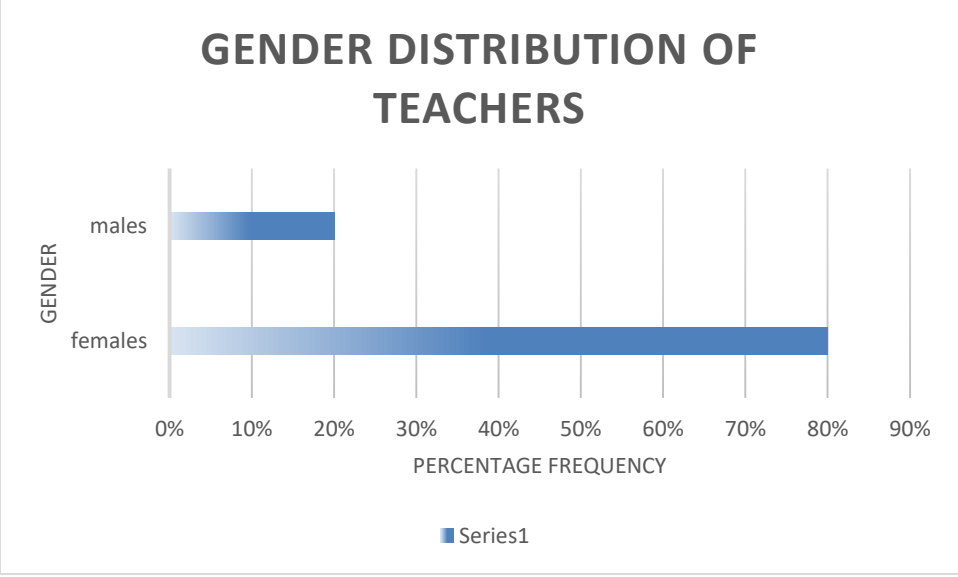

Figure 4.4: Gender distribution of teachers

Teachers' Qualification

Table 4.1 Qualification Spread for Teacher Participants

PARTICIPANT	level of qualification	Profession area
1	Diploma	Combined science
2	Degree	Biology
3	Degree	physics
4	Degree	Chemistry
5	Degree	Chemistry

4.1.SECTION A: Factors Influencing Full Adoption of Mobile Learning.

The findings on the Factors Influencing Full Adoption of Mobile Learning were gathered through a series of questions covering various areas. In the first section questions were asked on students about the attitude. The table below illustrates responses from students.

Table 4.2: learners' responses towards attitude

Items	1	2	3	4	5
My attitude towards m-learning is positive	0(0%)	0(0%)	17(38%)	13(29%)	15(33%)
Economic challenges influence my attitude towards m learning	4(9%)	2(4%)	7(16%)	15(33%)	13(29%)
I see Mobile learning is as an innovative approach.	0(0%)	1(2%)	8(18%)	9(20%)	27(60%)
High internet costs are a barrier to my usage of mobile services.	4(9%)	4(9%)	11(24%)	9(20%)	17(38%)
I am not a fan of mobile learning	29(64%)	4(9%)	5(11%)	1(2%)	6(13%)
Exposure improves ease use of mobile technology.	1(2%)	0(0%)	9(20%)	11(24%)	24(53%)

The responses from all learners at Chiwaridzo Secondary School indicate generally positive attitudes toward mobile learning. However, economic challenges appear to significantly shape these attitudes, as noted by a near total of 62%% of learners who agree, that might be due to financial constraints affecting their engagement with mobile learning. learners also recognize the innovative nature of mobile learning, with 60% of learners in strong agreement of supporting this view. The internet costs remained at neutral with the majority of 38% of learners identifying this as to be accessible. Interestingly, 53% admitted to not being enthusiastic about mobile learning. Lastly, a major percentage of 53% learners acknowledge that exposure can improve the ease of using mobile learning —indicating a need for more training and familiarization. Overall, while attitudes are generally favorable, economic challenges continue to hinder the effective use of mobile learning in Combined Science education.

Follow up questions were then asked on perceived digital literacy. The responses from learners on this are summarized by the following table.

Table 4.3: Learners responses on perceived digital literacy

Items	1	2	3	4	5
Typing skills influence my usage of mobile devices for combined science teaching and learning	1(2%)	6(13%)	12(27%)	7(16%)	19(42%)
Web search skills enhances my ability to find relevant combined science information	0(0%)	2(4%)	6(13%)	10(22%)	27(60%)
My computer literacy skills assists interaction with friends through mobile devices	2(4%)	8(18%)	15(33%)	19(42%)	1(%)
Internet literacy influence my usage of mobile devices	1(2%)	0(0%)	19(42%)	1(2%)	24(53%)
Digital technology assists me in completing combined science assignments	0(0%)	0(0%)	1(2%)	8(18%)	36(80%)

The findings indicate a general consensus of learners on the importance of digital skills in supporting the teaching and learning of Combined Science. A significant majority of the learners agreed that typing skills influence the use of mobile devices for educational purposes, with 42% of learners in strong agreement. This reflects the increasing reliance on mobile devices for tasks

such as note-taking, online research, and assignment completion. Similarly, web search skills were recognized as essential for accessing relevant Combined Science information, with 60% of learners in strong agreement. This suggests a shared understanding of the value of internet search proficiency in facilitating subject-specific learning.

However, opinions arose on the role of computer literacy in supporting interaction through mobile devices, only 50% of learners agreed, indicating potential gaps in the practical use of mobile technologies for communication and collaboration. This may point to limited training or exposure to such tools within the school environment. In terms of internet literacy, 53% of learners strongly agreed that it influences the educational use of mobile devices. The slightly higher agreement among learners could be attributed to their more frequent engagement with online platforms for learning and social interaction.

Lastly, learners (80%) strongly agreed that digital technology skills assist in completing Combined Science assignments. This demonstrates an appreciation of the value of digital competence in enhancing academic performance. Overall, the results suggest that while digital skills are widely acknowledged as important by learners, there is a need to strengthen practical application and training—particularly in areas like communication and effective technology to fully realize the benefits of mobile and digital learning in science education.

The following section presented technical support. The statements asked are presented and answered as illustrated by the following table.

Table 4.4: Learners responses towards technical support

Items	1	2	3	4	5
I expect to get help when accessing mobile services	1(2%)	2(4%)	9(20%)	19(42%)	14(31%)
Support is available at home when challenges with mobile services arise	3(7%)	5(11%)	24(53%)	10(22%)	3(7%)
Clear instructions or guidelines improve the use of mobile services	0(0%)	1(2%)	18(40%)	23(51%)	3(7%)
I hope for prompt feedback when requesting help from the teacher.	1(2%)	0(0%)	12(27%)	9(20%)	22(49%)

The responses reveal an understanding among learners regarding the importance of technical support in facilitating the use of mobile services for learning. A majority of learners (42%) agreed and 31% strongly agreed that assistance is expected when accessing mobile services, highlighting the general need for accessible support mechanisms. Additionally, a sum of 29% of learners indicated that support is readily available at home when challenges with mobile services arise, this seemed to a challenge as learners need to be equipped with technical skills.

When it comes to guidance, a fair majority of learners acknowledged that clear instructions improve the use of mobile services, 51% of learners in agreement. This underscores the importance of providing structured and user-friendly directions when integrating mobile technologies into educational practices. Expectations around prompt feedback showed the moderate levels of agreement, particularly among learners. Only 49% of learners were in strong agreement that prompt assistance is expected after requesting help from a teacher. This may be due to delays in response times, limited communication channels, or unclear responsibilities in providing support. Overall, the findings suggest that while there is recognition of the need for technical support, there are notable gaps in availability, especially at the learners level, and in the responsiveness of support systems.

The following section presented on social Influence. The following table shows the responses to the questions asked.

Table 4.5: Learners responses towards social influence

Items	1	2	3	4	5
My mobile devices usage is influenced by peer usage.	1(2%)	1(2%)	6(13%)	14(31%)	23(51%)
Influential people view mobile device use as productive and result oriented.	5(11%)	2(4%)	10(22%)	7(16%)	21(47%)
My fellow peers frequently use mobile devices to access educational and combined science resources.	4(9%)	2(4%)	9(20%)	16(36%)	14(31%)
Important individuals support my usage of mobile devices.	2(4%)	5(11%)	8(18%)	3(7%)	27(60%)

The data reveals that students generally agree that social influence plays a role in the use of mobile devices in education. A majority of learners (51%) strongly agreed that the use of mobile devices is influenced by peer usage, suggesting that observing peers engaging with technology can motivate others to adopt similar behaviors.

Furthermore, a strong belief in the productivity of mobile device use was evident, with 67% of learners agreeing that influential people view mobile device use as productive and result-oriented. This suggests that positive attitudes from respected individuals (such as educators, parents, or school leaders) can reinforce the perceived value of mobile technology in education.In terms of actual usage patterns, 36% agreed and 31% strongly agreed that peers frequently use mobile devices to access educational apps and resources related to Combined Science. This indicates that digital tools are becoming increasingly common in academic support, especially among learners.

Lastly, 60% of learners agreed that people important to them support the use of mobile devices. This demonstrates a strong social support of technology integration, suggesting that learners are likely to continue or increase their use of mobile devices when there is encouragement from trusted or authoritative individuals.

The following section presented perceived trust items. The table below illustrates responses from students.

Table 4.6: Learners responses towards perceived trust

Items	1	2	3	4	5
I trust mobile technology for learning combined science.	1(2%)	0(0%)	8(18%)	21(46%)	15(33%)
I trust mobile devices used to access combined science information.	0(0%)	0(0%)	13(29%)	15(33%)	27(60%)
I am willing to rely medium for sharing combined science notes.	3(7%)	6(13%)	8(18%)	10(22%)	18(40%)
Mobile devices use improves my understanding of combined science concepts	0(0%)	3(7%)	3(7%)	9(20%)	30(67%)
I consider online Combined science resources accessed via mobile devices trustworthy	15(33%)	12(27%)	9(20%)	6(13%)	3(7%)

The results indicate a generally high level of trust in mobile technology among learners, though with some notable variations across specific aspects. A majority expressed trust in mobile technology for learning Combined Science, with 46% agreed and 33% of learners in strong agreement which makes a total population of 79% agreement.

Trust in the mobile devices used to access information was even stronger, with 60% of learners endorsing confidence in the reliability of their devices.

When it comes to using mobile devices as a medium for sharing and receiving Combined Science notes, generally merged agreements makes 62 % of learners expressed agreements, suggesting that most learners find mobile tools dependable for communication and collaboration.

The highest level of trust was observed in the belief that using mobile devices enhances the understanding of Combined Science concepts, with an even higher total of 87% of learners agreeing. This reflects a strong perception that mobile learning positively contributes to conceptual understanding.

However, the lowest levels of trust were seen in the perception of the reliability of online Combined Science resources, with only 13% and 7% of learners agreeing. This indicates some doubts about the credibility or accuracy of online materials, which may be due to concerns over misinformation, content quality, or the lack of guidance in evaluating digital resources.

A section on the perceived value followed and the responses to the questions are presented as follows:

Table 4.7: Learners responses towards perceived value

Items	1	2	3	4	5
Mobile technology enhances my combined science learning experience.	0(0%)	0(0%)	6(13%)	16(35%)	23(51%)
Mobile learning improves my understanding of complex combined science concepts.	0(0%)	0(0%)	4(9%)	13(29%)	28(62%)
Mobile learning is a valuable tool for completing my combined science tasks.	3(7%)	7(16 %)	3(7%)	8(18%)	32(71%)
Mobile learning saves time when completing my combined science tasks.	3(7%)	2(4%)	9(20%)	6(13%)	25(56%)

I can use less effort when completing combined science assignments.	4(9%)	3(7%)	0(0%)	28(62%)	10(22%)
Mobile technology is important for my success in combined science learning	0(0%)	4(9%)	25(56 %)	13(29%)	3(7%)

The responses indicate a strong perception on learners that mobile technology adds significant value to the learning and teaching of Combined Science. A majority of both learners in agreement(35%) and those strongly agreed(51%) supports mobile technology enhances the overall learning experience, suggesting widespread recognition of its benefits in improving engagement and accessibility. Similarly, 62% of learners strongly agreed that mobile learning helps in understanding complex Combined Science concepts, indicating that both groups find mobile tools effective for simplifying and clarifying challenging content.

In terms of practical application, 71% of learners view mobile technology as a valuable tool for completing Combined Science tasks, reflecting its usefulness in supporting assignments, projects, and other academic responsibilities. Additionally, 56% of learners believe that mobile learning is time-saving when completing Combined Science activities, suggesting improved efficiency through digital platforms. However, while the majority of respondents agree, the slightly lower percentage among learners may imply varying levels of digital access or comfort.

With regards to the effort required, 62% of learners agreed that mobile technology reduces the effort needed to complete assignments. This finding shows that many participants see mobile learning as a means to streamline academic tasks, although there are notable challenges such as digital literacy gaps or technological limitations.

The following section presented Access to Technology. The statements asked are presented and answered as illustrated by the following table.

Table 4.8: Learners responses towards access

Items	1	2	3	4	5
I have access to mobile device for learning combined science	1(2%)	3(7%)	2(4%)	16(35%)	23(51%)
The school provides me with sufficient access to mobile devices for combined science learning	28(62%)	8(18%)	7(16%)	2(4%)	0(0%)
I can easily access online resources and educational apps for combined science on mobile devices	2(4%)	3(7%)	6(13%)	27(60%)	7(16%)
Ihave access to reliable internet at home supports the use of mobile technology.	11(24%)	13(29%)	8(18%)	6(13%)	7(16%)

The data generally reflects positive responses towards access to technology. A majority of learners were in agreement with a total of 86%.This clearly indicates that device availability is not a barrier to the studies of combined science.

More so 60% of learners agreed that online resources and educational apps are easily accessible on mobile devices. This supports the notion that they are well equipped with device and internet literacy skills.

However, lowest levels of learners agreed that the institutions provide them with mobile devices with 4%.A few learners 16% agreed on the availability of reliable internet and this is affiliated with high data and internet installation costs.

4.2.SECTION B: Factors Influencing Full Adoption of Mobile Learning.

The findings on the Factors Influencing Full Adoption of Mobile Learning were gathered through a series of questions covering various areas. In this section questions were asked on teachers about the value of mobile technology. The table below illustrates responses from teachers.

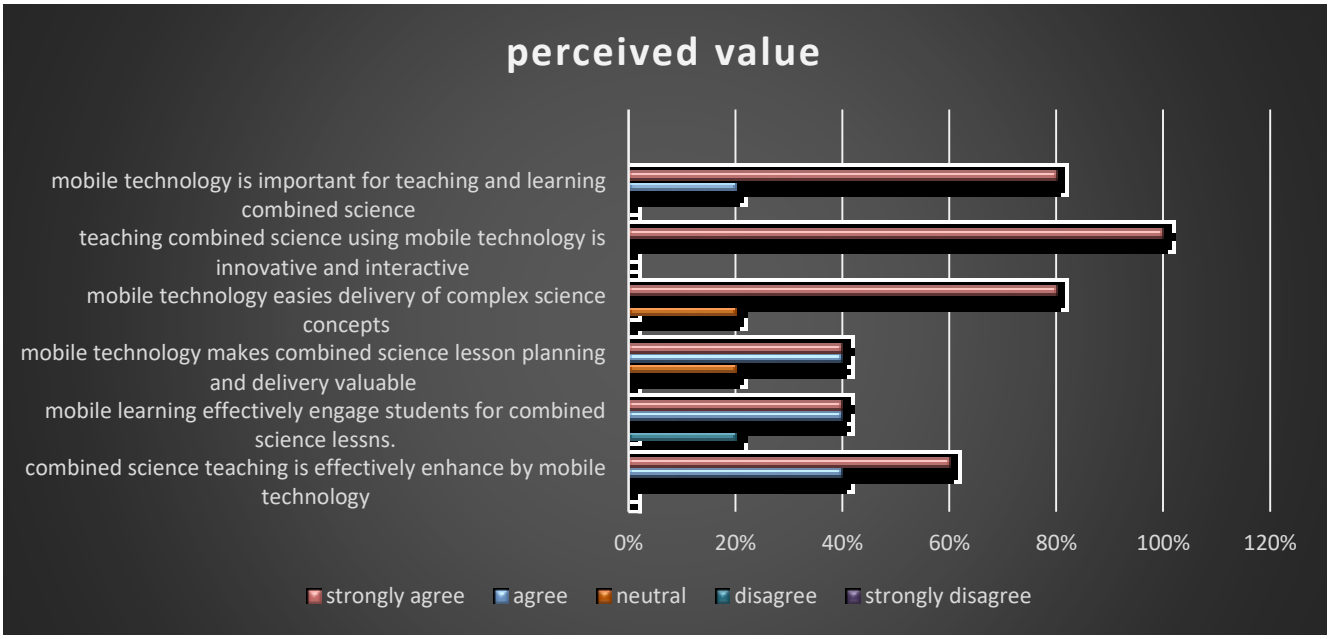

Figure 4.5: Teacher perceived value of mobile technology

The teachers' response highlights a strong perception amongst teachers that mobile technology adds value to the teaching and learning of combined science.80% of teachers are in strong agreement in support of the importance of mobile technology in the teaching and learning of combined science. All teachers (100%) agreed that mobile technology is and innovative way of teaching combined science and the delivery is done in an interactive way which will motivate learners to develop interest in the subject.

To add, a significant majority of 60% teachers strongly believed that mobile technology is an effective tool for the enhancement of combined science teaching as mobile devices provides access to recent educational resources and information.More so it is revealed that a total of 80% are in agreement that mobile technology makes combined science lesson planning and delivery a valuable and this indicates a strong endorsement of mobile technological benefits. However, 20% of the teachers disagreed, suggesting there is need for teacher training to equip with skills.

Follow up section are responses from teachers on the access of mobile technology. The graph below illustrates the trends.

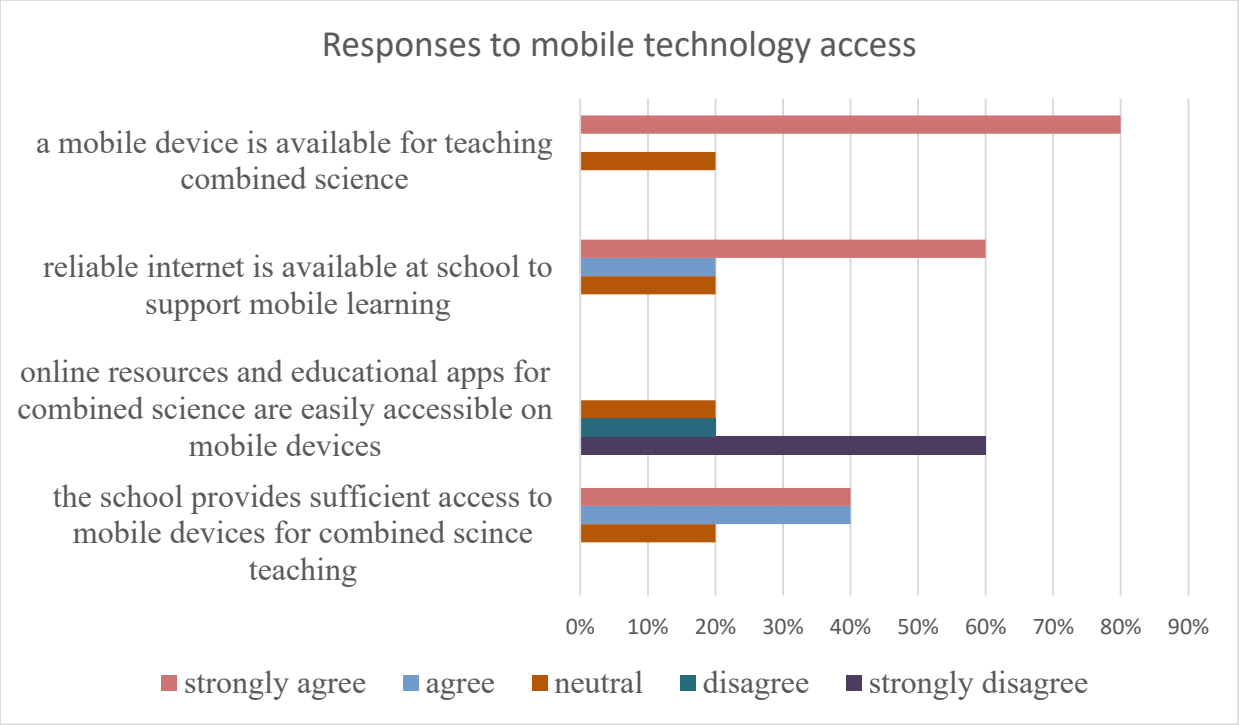

Figure 4.6: Teachers responses to mobile technology access.

Moving forward are responses to reflect on access to technology towards m-learning. Teachers' responses are summarized in the graph below.

The data represents generally positive responses towards mobile technology access.the response highlights a strong agreement, 80% of teachers have acess to mobile device -this is benneficial for implementing technology enhanced teaching for combined science.20% of teachers falls on the neutral zone and might be due to uncertainity about device availability for lesson, need for training and support.

Majority of teachers believed that there is sufficient provision of mobile technology access by the school as 40% are in strong agreement plus 40% in agree which makes a total of 80% agreement while 20% are on neutrality which indicates device availability for specific lessons and device access disparities amongst teacher classes.

To add,highlighted results shows that there is a reliable internet access at school as 80% agreed(60%+20%),the results shows that there is a strong internet infrastructure at school which supports the teacher use of mobile technology.Whereas there is 20% neutrlity which might be due to poor internert connectivity in some school areas.However the results indicates that there is significant disatisfaction amongst teachers pertaining the provision of mobile devices by the school as 60% strongly disagreed plus and this hinders teachers mobile technology intergration in combined science.

Going forward are responses by teachers on trust towards mobile learning.

Table 4.9: Teachers perceived trust responses

items	1	2	3	4	5
Mobile technology is trusted for combined science teaching	0(0%)	0(0%)	0(0%)	2(40%)	3(60%)
Mobile devices for accessing combined science information are trusted	0(0%)	1(20%)	0(0%)	1(20%)	3(60%)
Mobile devices are a reliable medium for sourcing combined science information	0(0%)	1(20%)	0(0%)	1(20%)	3(60%)
Use of mobile devices improves understanding of combined science concepts	0(0%)	0(0%)	1(20%)	2(40%)	2(40%)
Online combined science resources and information are considered trustworthy	3(60%)	1(20%)	0(0%)	0(0%)	1(20%)

Exitedly the results generally indicates that most teachers trust mobile learning technology in their teaching.a total of 100% teachers are in agreement of trusting mobile technology in their teaching.This is beneficial as there is reliance and integration of mobile technology into the combined science curricula.A proportion of 80% afirmed confidence and reliability on mobile technology as responses indicates a strong trust on combined science information obtained through mobile devices,however 20% of teachers disagreed and might be due to lack of device literacy skills.

When it comes to sourcing combined science information a strong proportion of 80% teachers expressed agreements(60% strongly agreed +20% areed).the response supports the notion that mobile devices are dependable for communication and fosters collaboration,however 20% of teachers disagreed and might be due to lack of device literacy skills.

Lastly 80% of teachers approved that use of mobile devices easies their understanding of complex combined science concets thhus enhancing qualitydelivery of lessons.However the lowest levels of trust were perceived by teachers,60% disagreed on having confidence with the online combined science resources and information obtained through mobile devices,this indicates inaccuracy of combined science sources and poor content quality.

A section on needs on technical support when accessing mobile technology followed and responses to the questions are presented on the table below:

Table 4.10: Teachers responses on technical support

items	1	2	3	4	5
Help is expected when accessing mobile services	1(20%)	0(0%)	0(0%)	1(20%)	3(60%)
Assistance is expected when facing challenges in accessing mobile services	0(0%)	0(0%)	3(60%)	1(20%)	1(20%)
Clear instructions or guidelines improve use of mobile services	0(0%)	0(0%)	1(20%)	3(60%)	1(20%)
Prompt help feedback is expected through school website contact details	0(0%)	0(0%)	0(0%)	2(40%)	3(60%)

Overally,the results indicates a positive requirement on technical support.majority expects for help when accessing mobile services as 60% of teachers are in strong agreement and 20% agreed.the results also indicated the strong emphasis on need for clear guidance and instructions as 60% agreed,20% strongly agreed and 20% are on neutral.there is also a strong emphasis on timely support when accessing mobile services on school contact details and websites as the majority of teachers reponded(60% strongly agreed and 40% agreed).The results underscore for the need in technical support for teachers to effectively adopt mobile technology so there is need for educationa institutions to priotize developing effective technical support systems.

The following are responses to digital literacy amongst teachers.

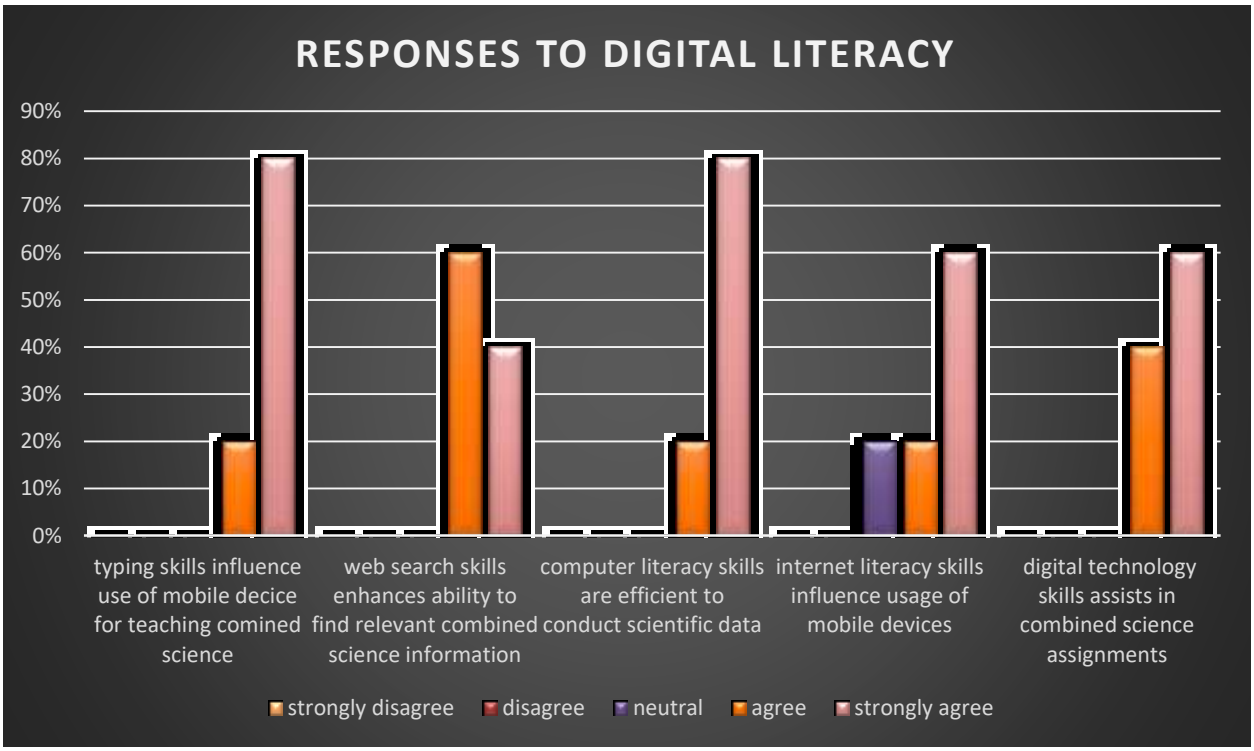

Figure 4.7: Teachers responses to digital literacy.

The research findings highlight the importance of digital literacy skills for effective teaching and learning of Combined Science using mobile devices. A strong majority (80%) agree that typing skills are crucial for using mobile devices in teaching, emphasizing the need for teachers to develop efficient typing abilities.100% of teachers (60% agree, 40% strongly agree) recognize the importance of web search skills in finding relevant information on Combined Science, underscoring the value of these skills in enhancing teaching practices.

100% of teachers (80% strongly agree, 20% agree) affirm that computer literacy skills are essential for efficiently conducting scientific data analysis, highlighting the critical role of these skills in scientific inquiry.80% of teachers (60% strongly agree, 20% agree) believe that internet literacy influences the use of mobile devices, while 20% remain neutral, indicating a general recognition of its importance.100% of respondents (40% agree, 60% strongly agree) acknowledge the importance of digital technology skills, emphasizing the need for teachers to develop proficiency in using digital tools.

The findings suggest that digital literacy skills are crucial for effective teaching and learning of Combined Science using mobile devices. Educational institutions should prioritize professional development programs that focus on skill construction among teachers to enhance the ability of mobile technology integration into combined science teaching.

5 CHAPTER 5: DISCUSSION OF FINDINGS, CONCLUSION AND RECOMENDATIONS.

5.1 INTRODUCTION

This chapter presents discussion of key findings, conclusion and recommendations for the study on factors affecting the adoption of mobile learning in the teaching and learning of combined science. The study aimed to investigate the technical, pedagogical, institutional, student related and teacher related factors.

5.2 DISCUSSION OF FINDINGS

The results indicate that students' prior experience with mobile learning and their attitudes towards technology significantly influenced their adoption of mobile learning as this is in presented on item (i) table 4.2. This aligns with findings of Cheon et al.2012, who argued that students perceive mobile learning as a practical solution for on the go learning especially in areas where traditional classrooms are a constrain.

However economic challenges tends to be a barrier to adoption of mobile technology as 62% of learners agreed on this from table 4.2 item(ii).More so, high internet costs are a barrier to the usage for learners as 58% of them agreed in affordability failure, the notion is being revealed by the works of UNESCO (2020) who asserts that during COVID-19 pandemic, students in low income earners and developing countries ,were disproportionally affected by the shift to online and mobile learning due to lack of access to devices and reliable internet.Following are digital skills, majority of learners supported that skills are influential adoption and use of mobile technology of combined science as shown in table 4.3(i,ii,iv,v).The findings suggest that digital literacy skills are crucial for effective teaching and learning of Combined Science using mobile devices as a strong majority of both learners refer to (figure 4.7) and teachers (table 4.10) agreed .This is consistent with previous studies by, Traxler (2018) indicate that educators' digital literacy and instructional approaches determine the effectiveness of mobile learning. With refer to table 4.4, the learners' responses revealed an understanding among them regarding the importance of technical support in facilitating the use of mobile services for learning. Item (I,iii and iv) clearly represents majority of learners in support of the need for prompt feedback for help, requires clear instructions for the use of mobile services.

However item (ii) from the table 4.4 reflects reliable support at home to overcome challenges as a barrier to mobile technology adoption.The survey results from table 4.5 indicate learners' expectations and perceptions with regards to social influence. These included positive perception on peer usage influential factors (i), peer frequent use (iii) and important individual influential (iv) The study revealed that learners and teachers perceived trust are significant predictors of mobile learning adoption. Table 4.6 reflects a majority of learners in agreement that m-technology is trusted for combined science learning and these includes trusting devices as a reliable medium for sharing combined science information. More so table 4.9 results generally indicates that most teachers trust mobile learning technology in their teaching. However the online resources accessed via mobile tools are viewed as less trustworthy by learners, refer to table 4.6 item (v) and from table4.9 item (v) teachers responses reflects less trust on online resources.the findings consistent with Kirschner & De Bruyckere (2017)who advocates that while not directly measured, the lower trust in online content and need for clear instructions suggest learners may feel overwhelmed without structured guidance.

Moreso, the findings from table 4.7 items (i-v) highlights learners and teachers perceived value of mobile technology. Majority of learners' valued mobile technology positively as it enhances combined science learning experience, improves understanding of complex combined science concepts, the findings strongly reflect the consensus on mobile learning improving understanding of complex concepts, which directly aligns with Davis (1989) and Ifenthaler & Schweinbenz (2016), who argue that users are more likely to adopt technology they believe enhances performance. Both learners and teachers view mobile technology as valuable tool for completing combined science tasks, and saves time when completing combined science tasks and requires less effort when completing combined science assignments.In conclusion mobile technological access played a role as a crucial factor. Table 4.8 data generally reflects positive responses towards access to technology. A majority of learners were in agreement with a total of 86% from item(i).This clearly indicates that device availability is not a barrier to the studies of combined science as they shows interest. Item (ii) also reflects that learners are able to easily access educational resources via mobile devices.

However item (iv) reflects less agreements on the availability of reliable internet at homesteads and this tends to be a barrier to adoption. The school insufficient provision of sufficient access to mobile devices seem to be a challenge refer to item(ii).fig 4.6 finds that teachers struggles in accessing online resources via mobile devices (60% in disagreement) and is prior to lack of digital, internet literacy skills due to inadequate digital experience. The findings demonstrate factors influencing adoption and perceptions for both students and teachers regarding mobile learning in Combined Science. However, challenges related to economic instability, access, technical support, high internet cost, lack of computer literacy skills, lack of exposure, content trustworthiness, digital literacy skills amongst teachers and support systems must be addressed to fully realize the benefits of mobile learning.

5.3 CONCLUSIONS

The study finds that economic instability, limited access to devices and affordable internet connectivity are the most significant challenges to the adoption of mobile learning for Combined Science in the study area. Despite the growing access of mobile phones in Zimbabwe, the cost of data, unreliable networks, and the lack of personal devices for all students creates unequal learning environment, which affects learners in rural and low-income earning.

The study also concludes that some teachers' digital literacy levels and the availability of relevant, practical training programs are fundamental to their willingness and ability to integrate mobile learning into Combined Science instruction. Many teachers, while open to the idea of m-learning, lack the necessary skills to effectively select, adapt, and utilize mobile resources for teaching purposes.

Finally, the study concludes that despite the identified challenges, the pedagogical benefits of mobile learning for Combined Science is widely recognized by both teachers and students. Its ability to provide interactive simulations, virtual labs, videos, access to current scientific information, personalized learning pathways, and foster critical thinking skills presents a transformative opportunity for science education. However, this potential remains largely underexploited due to the previously mentioned challenges. Realizing this potential, strategic

solutions that address both the technological and human factors are required. Therefore the researcher encourages follow up recommendations.

5.4 RECCOMENDATIONS

Based on the conclusions drawn from this study, the following recommendations are put forth for various stakeholders to facilitate and enhance the adoption of mobile learning for the teaching and learning of Combined Science in Zimbabwean secondary schools.

5.4.1 For the Ministry of Primary and Secondary Education (MoPSE)

Curriculum Integration Support: Provide guidance and resources for integrating mobile learning seamlessly into the Combined Science curriculum, ensuring alignment with learning objectives and assessment methods. Invest in Digital Infrastructure: Prioritize investment in affordable and reliable internet infrastructure for all secondary schools, particularly those in rural areas. This could include exploring public-private partnerships, subsidized data plans for educational purposes, and the establishment of school-based Wi-Fi hotspots.

5.4.2 For School Administrators and Headmasters

Allocate Resources for Mobile Learning: Budget for the acquisition of shared mobile devices (e.g., tablets, smartphones) for school use, ensuring devices are maintained and accessible to students. Create a Supportive Learning Environment: Develop school-level policies that encourage the constructive use of mobile devices for learning, while mitigating potential distractions. This could include designated m-learning zones or specific class guidelines. Organize workshops or awareness campaigns for parents to educate them about the benefits of mobile learning and address concerns regarding screen time and appropriate use.

5.4.3 For Combined Science Teachers

Embrace Professional Development: Actively participate in workshops and training programs aimed at enhancing digital literacy and m-learning pedagogical skills. Explore and Adapt Mobile Resources: Proactively research and experiment with various mobile applications, virtual labs, and online platforms relevant to Combined Science content. Adapt these resources to suit local contexts and curriculum requirements. Educate students on responsible and effective mobile learning practices, emphasizing digital citizenship and media literacy.

5.4.4 For Parents and Guardians

Support Device Access (where possible): If feasible, provide children with access to suitable mobile devices for educational purposes. Engage with children regarding their mobile learning activities, monitoring their progress and ensuring healthy screen time habits. Maintain open communication with teachers and school administrators regarding the challenges and successes of mobile learning.

5.4.5 For Content Developers and Technology Providers

Develop Localized and Affordable Content: Create mobile learning applications and digital resources specifically tailored to the Zimbabwean Combined Science curriculum and local context, considering data efficiency and offline access. Ensure that educational applications are intuitive, easy to navigate, and accessible for users with varying levels of digital literacy. Offer readily available and responsive technical support for schools and individual users encountering issues with mobile learning platforms or devices.

5.5 Suggestions for Further Research

Research the most effective models for professional development in mobile learning for science teachers in Zimbabwe, including blended learning approaches, peer mentorship, and sustained support systems. Investigate effective strategies for engaging parents and communities in supporting mobile learning initiatives and addressing their concerns. Extend similar research to other subject areas within the Zimbabwean curriculum to understand cross-curricular factors affecting mobile learning adoption.

5.6 Summary

This study has shed light on the multifaceted factors influencing the adoption of mobile learning for the teaching and learning of Combined Science in Zimbabwean secondary schools. While the potential benefits are immense, significant challenges related to infrastructure, digital literacy, and socio-economic factors currently hinder its widespread and effective integration. Addressing these factors systematically and collaboratively by all stakeholders is crucial for unlocking the transformative power of mobile learning in shaping a more accessible, engaging, and effective science education system for the 21st century in Zimbabwe. The insights gained from this research

provide a foundational understanding upon which future efforts can be built, paving the way for a more technologically empowered educational landscape.

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7 APENDIX

My name is Ashwine Govera, registration number B214123B.I am a student at Bindura University of science education pursuing diploma in science education. I am conducting a research titled:

> "**Factors affecting adoption of m-learning for the teaching and learning of combined science**".

The purpose of the study is to identify the factors that influence the full adoption of mobile learning technology among learners, explore learners' perceptions towards mobile learning technology as well as challenges faced while using mobile tools and devices in class and to implement possible solutions on how to improve full adoption of mobile learning in combined science.

Please note that the information gathered in this study will be treated with confidentiality through the use of pseudonyms. As such, the principle of anonymity will prevail.

Your participation in this study is much appreciated, feel free to give your honest views.

Indicate your willingness to participate in the study by ticking the option that best applies to you below:

Yes ☐ No ☐

If you indicated No, Thank you so much and your participation ends here. Otherwise, you can proceed with the questionnaire.

Appendix 1 : STUDENT QUESTIONNAIRE

SECTION A: DEMOGRAPHIC INFORMATION

5. **Select your age range:**

◯ 14 years and below ◯ 15 -16 years ◯ 17 years and above

6. Tick the Gender that applies to you

◯ Male ◯ Female

7. Select the level of education you are in:

◯ Form 1 ◯ Form 2 ◯ Form 3 ◯ Form 4

SECTION B: Factors Influencing Full Adoption of Mobile Learning.

Respond to the following instructions based on the likert scale with the scale as follows

Strongly disagree (**1**) disagree (**2**) neutral (**3**) agree (**4**) strongly agree (**5**)

B1 **Statements to reflect your attitude towards m-learning** *(please choose one per row)*

Attitude items	**1**	**2**	**3**	**4**	**5**
My attitude towards using m-learning is high	◯	◯	◯	◯	◯
My attitude towards using m-learning services has been changed by economic situation in my country	◯	◯	◯	◯	◯
Engaging with m-learning is an innovative idea	◯	◯	◯	◯	◯
Using mobile services for combined science is associated with high internet costs	◯	◯	◯	◯	◯
I am not really a fan of mobile learning	◯	◯	◯	◯	◯
With exposure it would be easy to use mobile learning	◯	◯	◯	◯	◯

B2 **Statements to reflect your digital literacy towards m-learning** *(please choose one per row*

Perceived digital literacy items	***1 2 3 4 5***
My typing skills influence my usage of mobile devices for learning combined science	○ ○ ○ ○ ○
My web search skills are efficient to find relevant combined science information	○ ○ ○ ○ ○
I am equipped with computer literacy skills to interact with my friends through mobile devices	○ ○ ○ ○ ○
My internet literacy influence my usage of mobile devices	○ ○ ○ ○ ○
My ability to use digital technology assists in combined science assignments	○ ○ ○ ○ ○

B3 **Statements to reflect your needs on technical support when accessing m-learning** *(please choose one per row)*

Technical Support items	***1 2 3 4 5***
I expect to get help when accessing mobile services	○ ○ ○ ○ ○
When facing challenges in accessing m-services, I will be easily get assisted at home	○ ○ ○ ○ ○
I work better with clear instructions or guidelines on mobile services	○ ○ ○ ○ ○
I would anticipate feedback to be prompt once I request help from my teacher	○ ○ ○ ○ ○

B4 **Statements to reflect how your friends, classmates, family etc. influences m-learning** *(please choose one per row)*

Social Influence items	***1 2 3 4 5***
I would use mobile devices if people if my friends use them	○ ○ ○ ○ ○

People who influence my behaviour think accessing, managing mobile device s is productive and result oriented	○ ○ ○ ○ ○
My friends and classmates often use mobile devices to access educational apps and online resources to help them with combined science information.	○ ○ ○ ○ ○
People who are important to me think I should use mobile devices.	○ ○ ○ ○ ○

B5 **Statements to reflect your level of trust towards m-learning** *(please choose one per row)*

Perceived trust items	***1 2 3 4 5***
I trust mobile technology for learning combined science	○ ○ ○ ○ ○
I trust the mobile devices that I use for accessing combined science information.	○ ○ ○ ○ ○
I am willing to rely my mobile device as a media medium for sharing and receiving combined science notes	○ ○ ○ ○ ○
I believe using mobile devices helps me to understand better combined science concepts	○ ○ ○ ○ ○
I am confident with the online combined science resources and information that I get on my mobile device	○ ○ ○ ○ ○

B6 **Statements to reflect your perceived value towards m-learning** *(please choose one per row)*

Perceived Value items	***1 2 3 4 5***
I can enhance my combined science learning experience using mobile technology	○ ○ ○ ○ ○

My understanding of complex concepts in combined science is improved through mobile learning	◯ ◯ ◯ ◯ ◯
I find mobile learning technology to be a valuable tool for completing combined science tasks	◯ ◯ ◯ ◯ ◯
I find mobile learning time saving when completing combined science tasks	◯ ◯ ◯ ◯ ◯
I can use less effort when completing combined science assignments using mobile learning technology	◯ ◯ ◯ ◯ ◯
I think mobile learning technology is crucial for my success in combined science	◯ ◯ ◯ ◯ ◯

S**tatements to reflect your access to technology towards m-learning** *(please choose one per row)*

Access to technology items	***1***	***2***	***3***	***4***	***5***
I have access to a mobile device that I can use for learning combined science	◯	◯	◯	◯	◯
My school provides me with sufficient access to mobile devices for learning combined science	◯	◯	◯	◯	◯
I can easily access online resources and educational apps for combined science on my mobile device	◯	◯	◯	◯	◯
My home has a reliable internet access that supports the use of mobile learning technology	◯	◯	◯	◯	◯

Appendix 2 : TEACHERS AND HEADMASTERS' QUESTIONNAIRE

SECTION C: DEMOGRAPHIC INFORMATION

1. **Select your age range:**

   ◯ 30 years and below ◯ 31 -40 years ◯ 41-50years

   ◯ 51years and above

2. Tick the Gender that applies to you

   ◯ Male ◯ Female

3. Select your level of qualification :

   ◯ Diploma ◯ Degree ◯ Masters ◯ PhD

4. Select your profession area

   ◯ Combined science ◯ biology ◯ physics ◯ chemistry

   ◯ Others (*specify)*……..

C1 **)Statements to reflect your perceived value towards m-learning** *(please choose one per row)*

Perceived value items	*1*	*2*	*3*	*4*	*5*
I can effectively enhance my teaching in combined science with mobile technology	○	○	○	○	○
I can effectively engage my students in combined science lessons using mobile learning	○	○	○	○	○
Mobile technology is a valuable tool for combined science lesson planning and delivery	○	○	○	○	○
mobile learning makes the delivery of complex topics easier	○	○	○	○	○
I can teach combined science in an interactive and innovative way using mobile technology	○	○	○	○	○
I think mobile technology is crucial for effective teaching and learning in combined science	○	○	○	○	○

C2) **Statements to reflect your access to technology towards m-learning** *(please choose one per row)*

Access to technology items	*1*	*2*	*3*	*4*	*5*
I have access to a mobile device that I can use for learning combined science	○	○	○	○	○
My school provides me with sufficient access to mobile devices for teaching combined science	○	○	○	○	○
I can easily access online resources and educational apps for combined science on my mobile device	○	○	○	○	○
My school has a reliable internet access that supports the use of mobile learning technology	○	○	○	○	○

C2 **Statements to reflect your level of trust towards m-learning** *(please choose one per row)*

Trust items	*1*	*2*	*3*	*4*	*5*
I trust mobile technology for teaching combined science	○	○	○	○	○
I trust the mobile devices that I use for accessing combined science information.	○	○	○	○	○

I am willing to rely my mobile device as a source of information for combined science	◯ ◯ ◯ ◯ ◯
I believe using mobile devices helps me to understand better combined science concepts	◯ ◯ ◯ ◯ ◯
I am confident with the online combined science resources and information that I get on my mobile device	◯ ◯ ◯ ◯ ◯

C3 **Statements to reflect your needs on technical support when accessing m-learning** *(please choose one per row)*

Technical support items	***1***	***2***	***3***	***4***	***5***
I expect to get help when accessing mobile services	◯	◯	◯	◯	◯
When facing challenges in accessing m-services, I will be easily get assisted	◯	◯	◯	◯	◯
I hope for clear instructions or guidelines on mobile services	◯	◯	◯	◯	◯
I would anticipate feedback to be prompt once I request help through the contact details on the school website	◯	◯	◯	◯	◯

C4 **Statements to reflect your digital literacy towards m-learning** *(please choose one per row*

Digital literacy items	***1***	***2***	***3***	***4***	***5***
My typing skills influence my usage of mobile devices for learning combined science	◯	◯	◯	◯	◯
my web search skills are efficient to find relevant combined science information	◯	◯	◯	◯	◯
I am equipped with computer literacy skills to conduct scientific data.	◯	◯	◯	◯	◯
My internet literacy influence my usage of mobile devices	◯	◯	◯	◯	◯
My ability to use digital technology assists in combined science assignments	◯	◯	◯	◯	◯

.....The end, thank you.....