BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

TOPIC

An Investigation into the Challenges Experienced by Teachers in the use of Information and Communication Technologies in Biology Teaching and Learning: A Case study for Muzondidya Cluster Schools in Zaka District.

BY

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APROVAL FORM

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DECLARATION

I, Chikati Watson do hereby declare that this project is my own work and the information that I used from the published or unpublished sources have been acknowledged in text and also on the reference list. This project has not been previously submitted at the Bindura University of Science Education or at any other university and it is therefore submitted in the partial fulfillment of the requirement of the degree in Science Education at Bindura University.

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PROJECT TITLE:

An Investigation into the Challenges Experienced by Teachers in the use of Information and Communication Technologies in Biology Teaching and Learning: A Case study for Muzondidya Cluster Schools in Zaka District.

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ABSTRACT

The integration of Information and Communication Technology (ICT) tools in biology education is crucial for enhancing teaching and learning experiences. However, various challenges can thwart the effective adoption of ICT tools among teachers, learners, and parents. This study investigated the challenges faced by teachers, learners, and parents in using ICT tools in biology education. The findings exposed that teacher struggled with limited technical expertise, inadequate infrastructure, and difficulty in integrating ICT into the curriculum. Learners faced distractions, decreased attention span, and limited opportunities for hands-on experimentation. Parents tussled with limited understanding of ICT tools, concerns about physical and mental health, and difficulty in monitoring their child's ICT use. The study highlights the need for teacher training, infrastructure development, and parental engagement to overcome these challenges and exploit the potential of ICT tools in education especially biology.

DEDICATION

I dedicate this study to my family that is my wife and kids who supported me through thick and thin. Not forgetting my friends, colleagues from my biology class and fellow workmates for encouraging me. The other special dedication progresses to the school administration especially the Head for an unconfined and bountless support.

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My acknowledgements embark to my project supervisor, all lecturers and accompanying staff who guided me through my intriguing journey.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The study aimed at finding out the difficulties faced by teachers in using Information and Communication Technology (ICT) in classroom teaching-learning of biology in selected secondary schools within Muzondidya cluster in Zaka. This introduction highlights the significance of ICT to biology teaching or gives a brief overview of the importance of ICT in education. The introduction then indicates that research on the challenges teachers face in using ICT will be discussed and its significance explained. This clearly sets the pace for the next sub-section which is a continuation of this introduction that gives the aims and objectives of the research as well as its goals and purpose. It also creates a platform whereby the teacher's views, opinions and perceptions of the research being carried out are explained. This is very paramount because it is these views that are sought to be established as right or wrong at the end of the research. From the onset, the introduction has succeeded in creating some sense of awareness and demand for research on the subject under investigation.

The research gives this as a problem which has not been properly addressed despite the ever evolving and advancing ICT solutions for education. This section creates a very good start for the reader of this research. The reader has been given a focus of the research findings as well as the enhancement of teaching through ICT in general. Some knowledge on the levels of students' achievements and lack of clear research on the same has been exposed as a problem within the first introductory section of the research. The use of ICT in the classroom is very important in providing opportunities for students to learn to operate in an information age. Studying the obstacles to the use of ICT in educational institutions may assist educators to overcome these barriers and become successful technology adopters in the future. (Crossley, S.A. & McNamara, D.S, 2019)

The did find out whether the teachers have a strong desire to integrate ICT into teaching-learning process even though with difficulties. The major barriers are lack of genuine software,

inadequate computer in the classroom, low speed internet, lack of motivation from both teacher and student side to use ICT, lack of proper training skills, unavailability of latest ICT equipment, lack of expert technical staff, poor administrative support, poor course curriculum etc. (Charles Buabeng-Andoh, 2012). Suggestions are made for ongoing professional development of teachers to model new pedagogies and tools for learning with the aim of enhancing the teaching-learning process. It is important for teacher trainers and policy makers to understand the barriers and cost-effectiveness of different approaches to ICT use in teacher training so that training strategies can be appropriately explored to make such changes viable to all. (Adams, M Burns.M,1999).Evidence has been collected through distribution of a modified- adopted survey questionnaire that is qualitative data analysis of non-numeric data such as interview transcripts, notes video and audio recordings, image and texts. It is hoped that the out come of this research provides proper information and recommendation to those responsible for integrating new technologies into the school teaching and learning process. (Cleaver. S, 2014)

1.2 BACKGROUND OF THE STUDY

Education is widely regarded as a channel of economic prosperity. It is the key to scientific and technology advancement. Information communication technology (ICT) plays a vital role in enhancing the quality of Education (Hadah, & Draxler, 2017). With the development of new technologies and emphasis on the competence-based curriculum in coupled with changing education policies globally the use of ICT in education is very important. As the ministry of primary and secondary education puts more emphasis directed at science, technology, engineering and mathematics (STEM), there arises the need to do research on the important problems that may negatively drag its effective implementation. (Brantley-Dias, L., & Ertmer, P. A, 2013).

There is a mismatch between the complementing resources and inappropriate combination of ICT resources result into reduced diffusion of technology as well as poor ICT understanding in these educational institutions. Unreliability of equipment- Even the basic ICT equipments and computers possessed by rural schools are unreliable and undependable. The schools lack up-to-date hardware and software availability. Old and obsolete equipments are major hindrances to ICT adoption and application. (Hadah, & Draxler,2017)

Rural schools face issues related to technical know-how, absence of ICT service centers, shortage of trained technical personnel. Whether provided by in-school staff or external service providers, or both, technical support specialists are essential to the continued viability of ICT use in a given school. Without on-site technical support, much time and money may be lost due to technical breakdowns. One of the major obstacles to optimizing computer use in schools has been the lack of timely technical support. (Johnson, A. M,&Jacovina, M. E, 2016)

Rural schools usually face trouble with respect to the availability of ICT related resources such as supporting infrastructure, uninterrupted electricity, supplementary resources like multimedia, projectors, scanners, smart boards, and so on. Despite being a non integral component of the ICT, internet is lacking in most rural schools. Most schools cannot afford the high fees charged by internet providers and even where there is internet, slow or erratic connectivity destroys the very essence and impact of ICT.Other external factors inhibiting the usage of ICT in rural schools are social and cultural factors inherent to these regions, lack of initiative by community leaders, corruption and burglary. (Moyo, L, 2009)

1.2 STATEMENT OF THE PROBLEM

Despite the importance of hands-on experiments and technology integration in biology education, rural schools face significant challenges in accessing and utilizing adequate Information and Communication Technology (ICT) resources, resulting in a decline in student interest, practical skills, and academic

This challenge mirrors the struggles faced by biology educators in rural schools, where:

1. Limited laboratory resources hinder hands-on experiments.

2. Inadequate ICT infrastructure restricts access to digital resources.

3. Teacher training and technical expertise are insufficient.

These challenges lead to:

1. Low uptake of physics and biology among rural students.

2. Reduced student interest and engagement.

3. Poor academic performance.

4. Brain drain: exporting talent overseas for better opportunities.

1.3 SIGNIFICANCE OF THE STUDY

"Education authorities were expected to assess whether they were meeting student and teacher needs, aligning with their mission to deliver high-quality education. This process prompted a comprehensive review of school policies governing ICT utilization in teaching and learning."The study also provides a deeper understanding on the challenges faced by teachers on the use of ICT in teaching. The study would improve the use of ICT in teaching and learning of Zimbabwean schools. "Furthermore, it was anticipated that this research would provide a foundation for subsequent investigations in related fields. The study's outcomes informed and supported the Ministry of Primary and Secondary Education

Education since it will produce a guide for the implementations of ICT in teaching and learning of Biology.

Finally, the study would contribute to the existing theory and practice relating to ICT technology use in teaching and learning.

1.4 OBJECTIVES

This research shall also look at how information and communications technology (ICT) could improve student learning when teachers are digitally literate and understand how to integrate it into curriculum. Schools use a diverse set of ICT tools to communicate, create, disseminate, store, and manage information and thinking skills in the administration of a competent based curriculum in rural secondary schools in Zimbabwe.

The research should also seek to find out the problems that are faced by teachers and learners in rural schools when using ICT tools and possible solutions to the problems. It should also seek to gather information from the heads, HODs from various departments and different subject teachers on the challenges of using ICT tools to serve the learning purposes. This research shall also consider the availability of the computer laboratory as an ICT learning classroom, and its importance in the learning process including the availability of computers

and other ICT resources and establish if the school administration gives consideration and priority to them. (Adams, M., & Burns, M, 1999) (I suppose what is highlighted

1.5 RESEARCH QUESTIONS

The following problems arose when the research topic was proposed;

1. What essential ICT tools and resources are required to effectively implement a competence-based curriculum in science education for rural secondary schools?

2. What are the primary challenges that rural secondary schools encounter when integrating ICT tools into biology teaching and learning?

3. To what extent does internet connectivity impact the effective use of ICT tools by teachers in rural secondary schools?

1.6 PURPOSE OF THE STUDY

The researcher should assess the challenges of using ICT tools in teaching and learning of biology. The aim was to identify the main obstacles teachers face when using ICT and to explore the impacts of these challenges on biology teaching and learning. By understanding the challenges and investigating the factors that lead to these challenges. By understanding the nature of the obstacles and the underlying reasons for these challenges at the individual, organizational and systemic levels, the education authorities can provide appropriate support and put in place strategies to facilitate and sustain ICT initiatives in biology education. For example, the research can guide the development of ICT teacher support networks and online resources, as well as facilitate the dissemination of effective teaching materials and resources using online platforms and social media. (Mwanda.G, Mwanda.S,R Midigo.R, and Maundu.J, 2017)

1.7 LIMITATIONS OF THE STUDY

The study was carried out during the teaching and learning period of the researcher, this is one year. Time and the money of printing the data collection tools like observational check list and other resources were the limiting factors of the study.

1.7 DELIMITATIONS

The research was carried out in Zaka district around the cluster of Muzondidya zonal schools.

1.8 ASSUMPTIONS

"This research study was predicated on the assumption that respondents would provide honest and accurate answers to the questionnaires, yielding valid and reliable data for analysis. Furthermore, the study's timeliness and relevance to the respondents' experiences were expected to foster genuine responses, ultimately contributing to meaningful outcomes that addressed the research question."

1.9 DEFINITION OF TERMS

According to oxford dictionary a challenge is defined as a call to someone to participate in a competitive situation or fight to decide who is superior in terms of ability or strength.

A teacher is a teaching professional who is meant to help the students to gain knowledge, competence, and virtue. (Albirini, A, 2013).

ICT refers to information and communication technology and involves the use of various technological tools for teaching and learning purposes, such as smart phones, tablets, internet and computer simulations. (Norma 2013)

1.10 CONCLUSION

The chapter outlined the background of the study, its objectives, limitations and significance were also highlighted. The next chapter is going to review the related literature

CHAPTER 2

2.1 Introduction

Challenges in using ICT in teaching and learning integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties. These difficulties are known as "challenges" (Schoepp, 2005). A challenge is defined as "any condition that makes it difficult to make progress or to achieve an objective" (Word Net,1997, as cited in Schoepp, 2005, p.2). The following are some of the key challenges that have been identified in the literature regarding teachers' use of ICT tools in classroom.

2.2 Limited accessibility and net work connection

Several research studies indicate that lack of access to resources, including home access, is another complex challenge that prevent teachers from integrating new technologies into education. (Malaysian Online Journal of Educational Technology Volume 4, Issue 2 www.mojet.net).

"Numerousauthorsrch studies have identified various reasons for the lack of access to technology. For instance, Sicilia's study (2005) revealed that teachers cited difficulty in accessing computers as a significant barrier. Other studies have similarly highlighted factors such as

insufficient infrastructure (O'Brien et al., 2007). The authors gave reasons like "computers had to be booked inadvance and the teachers would forget to do so, or they could not book them for several periods in a row when they wanted to work on several projects with the students" (p.50). In other words, a teacher would have no access to ICT materials because most of these were shared with other teachers. According to Becta (2004), the inaccessibility of ICT resources is not always merely due to the non-availability of the hardware and software or other ICT materials within the school. It may be the result of one of a number of factors such as poor resource organization, poor quality hardware, inappropriate software, or lack of personal access for teachers (Becta,2004).

The challenges related to the accessibility of new technologies for teachers are wide spread and differ from country to country. Empirica's (2006) European study found that lack of access is the largest barrier and that different challenges to using ICT in teaching were reported by teachers, for example a lack of computers and a lack of adequate material. Similarly, Korte and Hüsing (2007, p.4) found that in European schools there are some infrastructure barriers such as broad band access not yet being available. They concluded that one third of European schools still lack broad band Internet access. Pelgrum (2001) explored practitioners' views from 26 countries on the main obstacles to ICT implementation in schools.He concluded that four of the top ten barriers were related to the accessibility of ICT.These barriers were insufficient unit of computers, insufficient peripherals, insufficient numbers of copies of software, and insufficient immediate Internet access.Toprakci(2006) found that low numbers of computers,oldness or slowness of ICT systems, and scarcity of educational software in the school were barriers to the successful ICT implementation in Turkish schools. Similarly, Al-Alwani (2005) found that having no access to the Internet during the school day and lack of hardware were hampering technology integration in Saudi schools. Recent research on Syrian schools indicated that insufficient computer resources were one of the greatest impediments to technology integration in the classroom (Albirini, 2006). "Existing literature underscores the multifaceted nature of challenges impeding effective ICT integration in educational settings. Becta (2004) drew attention to issues of accessibility and network connectivity, whereas Prayer-koro (2014) highlighted deficiencies in support for cultivating ICT-enabled pedagogical competencies."

2.3 School with limited technical support

Lewis (2003) suggested that without both good technical supporting the class room and whole-school resources, teachers cannot be expected to over come the obstacles preventing them from using ICT. Pelgrum (2001) postulated that in the view of primary and secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Extending the research of Sicilia (2005), technical problem was identified to be a major barrier for teachers. These technical barriersincluded waiting for websites to open, failing to connect to the Internet, printers not printing, malfunctioning computers,

and teachers having to work on old computers. "Technical barriersimpeded the smooth delivery of the lesson or the natural flow of the class room activity" (Sicilia, 2005, p.43). Korte and Housing (2007) argued that ICT support or maintenance contracts in schools help teachers to

use ICT in teaching without losing time fixing software and hardware problems. The Becta (2004) report stated "if there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns" (p.16). Many of the respondents to Becta's survey (2004) indicated that technical faults might discourage them from using ICT in their teaching because of the fear of equipment breaking down during a lesson. In teaching, several studies indicated that lack of technical support is a main barrieto using technologies. According to us Gomes (2005), ICT integration in teaching needs a technician and if one is unavailable the lack of technical support can be an obstacle. In Turkey, Toprakci (2006) found that the lack oftechnical support was one of two significant barriers to ICT integration in science education in schools and might be considered "serious". Saudi Arabia, science teachers would agree to introduce computers into teaching, except that they believe they will encounter problems such as technical service or hardware problems (Almohaissin,2006). Sicilia (2005) argued that whatever kind of technical support andaccessteachingstaffhaveand whether they have twenty years of experience or are novices to the profession, technical problems generate barriers to the smoothless on delivery by teachers.

2.4 Lack of effective training

Building on the theoretical framework established by One finding of Pelgrum's (2001) study was that there were not enough training opportunities for teachers in using ICTs in a classroom environment. Similarly, Beggs (2000) found that one of the top three barriers to teachers' use ofICT in teaching was the lack of training. Recent research in Turkey found that the main problem with implementing new ICT in education was the insufficient amount of in-service training for teachers (Özden, 2007), and Toprakci (2006) concluded that limited teacher training in ICT use in Turkish schools is an obstacle. According to Becta (2004), the issue of training is certainly complex because it is important to consider several components to ensure training effectiveness. These were time for training, pedagogical training, skills training, and an ICT use in initial teacher training. Correspondingly, recent research by Gomes (2005) relating to various subjects concluded that lack of training in digital literacy, lack of pedagogic and didactic training in how to use ICT in the classrooma nd lack of training concerningtechnology use in specific subject areas were obstacles to using new technologies in classroom practice. Some of the Saudi Arabian studies reported similar reasons for failures in using educational technology, the weakness of teacher training into the use of computers, the use of a "delivery" teaching style instead of investment in modern technology (Alhamd,

Alotaibi, Motwaly, & Zyadah, 2004), as well as the shortage of teachers qualified to use the technology confidently (Sager, 2001). Providing pedagogica ltraining for teachers, rather than simply training them to use ICT tools, is an important issue (Becta,2004). Coxetal. (1999a) argue that if teachers are to be convinced of the value of using ICT in their teaching, their training should focus on the pedagogical issues.The results of the research by Coxetal.(1999a)showed that after teachers had attended professional development courses in ICT they still did not know how to use ICT in their classrooms; instead they just knew how to run a computer and set up a printer.They explained that this is because the courses only focused on teachers acquiring basic ICT skills and did not often teach teachers how to .developthe pedagogical aspects of ICT. In line with their search by Coxetal. (1999a), Balanskat et al. (2006) indicated that inappropriate teacher training is not helping teachers to use ICT in their classrooms and in preparing lessons. They assert that this is because training programs do not focus on teachers' pedagogical practices in relation to ICT but on developing ICT skills. Fundamentally, when there are newtools and approaches to teaching, teacher training is essential (Osborne & Hennessy, 2003) if they are to integrate these into their teaching. However, according to Balanskat et al. (2006), inadequate or in appropriate training leads to teachers being neither sufficiently prepared nor sufficiently confident to carryout full integration of ICT in the classroom. Newhouse (2002) stated "teachers needto not only be computer literate but they also need to develop skills in integrating computer use into their teaching and learning programmes" (p.45).

2.5 Limited time

In light of these findings, it is essential to consider Al-Wani (2005) as cited in Becta et Al (2004), who asserted that many teachers have competence and confidence in using computers in the classroom, but they still make little use of technologies because they lack the time. A significant number of researchers identified time limitations and the difficulty in scheduling enough computer time for classes as a barrier to the teachers' use of ICT in theirteaching.

According to Sicilia (2005), the most common call like reported by all the teachers was the lack of time they had to plant echnology lessons, explore the different Internet sites, or look at various aspects of educational software Becta's study (2004) found that the problem of lack of time exists for teachers in many aspects of their workbas it affects their ability tocomplete tasks, with some of the participant teachersbspecifically stating which aspects of ICT require more time. These include the time needed to locate Internet advice, prepare lessons, explore and practice using the technology, deal with technical problems, and receive adequate training.

2.6 Lack of teachers' competency

This study supports the findings of Becta (2004) when he argued that, another challenge directly related to teacher confidence is teachers' competence in integrating ICT into pedagogical practice. On the other notion, the Australian research, Newhouse (2002) proposed that many teachers lacked the knowledge and skills to use computers and were unenthusiastic about the changes and 43 Malaysian Online Journal of Educational Technology Volume 4, Issue 2 www.mojet.net integration of supplementary learning associated with bringing computers into their teaching practices. Currently Becta (2004) supported on the limited accessibility and network connection, Prayer-koro (2014) noted that there are some gaps on lack of support for developing ICT- related pedagogical skills.nt research has shown that the level of this barrier differs from country to country. In the developing countries, research reported that teachers' lack of technological competence is a main barrier to their acceptance and adoption of ICT (Pelgrum, 2001; Al-Oteawi, 2002). In Syria, for example, teachers' lack of technological competence has been cited as the main barrier (Albirini, 2006) Likewise, in Saudi Arabia, a lack of ICT skills is a serious obstacle to integration of technologies into science education (Al- Alwani,2005; Almohaissin,2006). Empirica(2006) produced a reporton ICT use in European schools. The data used for there portcame from the Head Teachers and Classroom Teachers Survey carried out in 27 European countries. The findings show that teachers who do not use computers in classrooms claim that "lack of skills" area constraining factor preventing them from using ICT for teaching. Another world-wide survey conducted by Pelgrum (2001), of nationally representative samples of schools from 26countries, found that teachers' lack of knowledge and skills is a serious obstacle to using ICT in primary and secondary schools. There results of a study conducted by Balanskat et al. (2006) have shown that "in Denmark many teachers still chose not to use ICT and media in teaching situations because of their lack of ICT skills better than for pedagogical/didactics reasons" while "in the Netherlands...teachers' ICT knowledge and skills is not regarded any more as the main barrier to ICT use" (p.50). Hence, lack of teacher competence may be one of the strong barriers to integration of technology into education. It may also be one of the factors involved in resistance to change

Factors that could influence the use of ICT in teaching

2.7 Teachers' perception

Different studies have identified that teachers' attitudes and perception influence more on the integration of ICT in education (Sánchez, Marcos, González, & GuanLin, 2012, Player-Koro, 2012). This is in line with many educational theories explaining that the use of ICT in education is started by its acceptance, which could be associated with teachers' attitudes (Koohang, 1989). Positive perception encourages teachers to adopt and use technology in their classrooms regardless of some challenges that may be found in this practice (Mustafina, 2015). Additionally, teachers with positive perception are likely to use available resources at maximum level while teachers with negative attitudes always remain complaining about theshortageof adequate materials to start using ICT in education (Norma, 2013). For the successful implementation of this contemporary paradigm, positive attitudes and good perception on its usefulness should be developed in teachers through provision of adequate trainings to the integration of ICT in their teaching practices. The study of Al-zaidiyeen, Mei, Leong & Fook, (2010) has found that the main predictor of teachers' ability to use in education is their attitudes toward itsuse. Teachers' attitude is the most critical factors for influencing the use of ICT in teaching and learning process. In this line, the study of Prospery (2018) has found that positive attitudes towards ICT use have to be promoted as a necessary condition for integrating ICT in teaching and learning

2.8 Technical and administrative support

Supporting this notion studies have shown that Priscilla (2012) viewed technical and administrative support to be very important in enhancing the use of ICT in classrooms. This is ensured through the provision of trainings for equipping teachers with relevant skills in using ICT in education and motivating teachers to use ICT in their daily activities. ICT related technical support was found to be helpful as it has been found that it lacks may affect teachers' willingness in adopting and integrating ICT in teaching practices (Charles, 2012). Technical support is also needed for troubleshooting issues. In this regard, teachers should be trained on some basic techniques usedin fixing some simple technical problems. This can reduce their anxiety towards the use of ICT in teaching and learning process. In this context, school leaders should adopt strategiesthat will facilitate teachers to use ICT as the basic tool in their daily teaching practices (Charles, 2012). School authorities are the ones to set and discuss with teachers the visions and ICT policies in

their schools and how the available resources may be shared appropriately. Similarly, school authorities have to keep a follow up on the implementation of ICT in education policy so that

they might identify early the challenges encountered by teachers and find out the possible solutions as well. Motivation on using ICT in education should be more effective if it starts from school leaders. School administrators play a great role in integrating ICT in education through acquisition and coordination of all resources required for ICT use in teaching and learning process.

2.9 Teachers' professional development

In an effort to address these gaps recent research has focused on for teachers' professional development which was found to play a great role. Professional development increases teachers' skills, morale and motivation (Baylor & Ritchie, 2002). In line with the integration of ICT in education, teachers have to be trained on different aspects of using ICT in classroom for reducing their anxiety hence increasing their confidence and ICT use willingness. These trainings should be tailored in relation to the teachers' needs in terms of integrating ICT in education. In this context, teachers have to be trained on trends of ICT in education, best application and web platforms for both teachers and students and how to create engaging an interactive multimedia content and presentation (Manuel, 2008). In addition, teachers may be trained on the best way of integrating ICT in education as well as how to use ICT in students' motivation and innovations in classroom (Mukuna, 2014). For teaching Biology, teachers need to be trained in the areas of using virtual laboratories, simulations and video presentation, sorting

and treating data during teaching and learning process. Even though teachers' trainings are at the heart of effective implementation of any education program, it has been found that teachers' trainings on using ICT in education are still low and inadequate (Afshari, Bakar, Su-Luan, Samah, & Fooi, 2009). The study of Baylor & Ritchie (2002) revealed that most of ICT teachers' trainings focus on general ICT skills but little consideration is given to specific skills for effective integration of ICT in teaching different subject. This may be the reason behind their nonsystematic use of ICT in the teaching and learning process as they don't have enough skills for integrating ICT in their daily teaching practices. Similarly, Belay, Khatete, & Chomba, (2020) have found that the trainings provided to the majority of Biology teachers were not adequate to help them in integrating ICT in teaching Biology.

2.10 Age and Gender

Based on Global Gender Gap Report, the gap among men and women is found all over the World in different forms of life (World Economic Forum, 2019). This gap has also been recognized in the ICT aspect where males dominate females in using ICT for different purpose (Laura, Laura, Joseph & Jeremiah, 2014). The level of integrating ICT in the teaching and learning process has been found to be different between men and women. The study of Birgin, Çoker, & Çatl, (2010) has found that the level of using internet in women is lower compared to that of men. Consequently, women miss some opportunities for accessing useful information and online services. This low level of using ICT in women, was reported to be caused by their negative attitudes towardthe new technology. In addition, it has been found that female teachers show lower computer skills and competencies compared to male teachers (Umar, Tarmizi, & Yusoff, 2014). In this line, educational institutions have to establish a clear plan for facilitating women to upgrade their skills and competences so that they may be involved in implementation of ICT in education policy effectively. The study has also shown that males are more experienced in using ICT in education due to their positive attitudes towards its use, less computer anxiety and more confidence in using ICT than females (Volman, Van, Heemskerk, & Kuiper, 2005). In addition, the integration of ICT in teaching and learning has been also found to be influenced by the age of teachers. The young teachers have shown positive attitudes towards the use of ICT in teaching activities compared to the old teachers (Cathrine, 2008).

2.11 Availability of ICT resources

Furthermore, for integrating ICT in education in schools both hardware and software are needed. Several studies identified the lack and insufficiency of computers as one of the important obstacles in integrating ICTin the teaching and learning process (Pelgrum, 2001). On the other hand, Mumtaz, (2006) states that the lack of hardware and software is the one reason for teachers to not use ICT in classrooms. Connectivity to electricity and internet facilities are also highly needed during the implementation of ICT in the teaching and learning process hence it can be difficult to use computers without electricity. In addition, internet is needed for teachers to get enriched content from different sources. connectivity are in short supply, which continues to be a challenge in many African developing (Mathevula & Uwizeyimana, 2014). Based on the findings from different studies discussed above, it has been found that the effective use of ICT can influenced by different factors. In this regard, the present study, sought to investigate the level at which Biology teachers in Rulindo District used ICT in teaching Biology and the challenges preventing the successful use of this current policy.

Based on the literature review, the following gaps were identified such as lack of context-specific research: Previous studies (Sicilia, 2005; O'Brien et al., 2007) focused on general technology integration, whereas this study explores ICT-specific challenges in biology education., limited focus on rural settings: Existing research (Kirschner & Wubbels, 2012; Ertmer, 2005) concentrated on urban or suburban areas, neglecting rural conAnalysis insufficient teacher perspectives: Studies (Kozma, 2005) primarily examined student or administrative views, whereas this research prioritizes biology teachers' experiences,outdated findings Research (Sicilia, 2005; O'Brien et al., 2007) was conducted over a decade ago, making it essential to investigate current challenges.

This study addresses these gaps by investigating ICT challenges specific to biology education, focusing on rural secondary schools, centering on biology teachers' experiences, providing up-to-date insights.By addressing these gaps, this study aims to contribute to a deeper understanding of ICT integration challenges in biology education, informing targeted interventions and policy decisions.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This study explored the challenges faced by biology teachers in using ICT tools, with a focus on identifying the specific challenges, their causes, and their effects on teaching and learning. The study employed a mixed-methods approach, combining both qualitative and quantitative data collection and analysis methods. The findings of this study provided valuable insights into the challenges faced by biology teachers in using ICT tools and inform strategies for addressing these challenges, ultimately enhancing the effective integration of ICT in biology teaching and learning."

Here are the research paradigm and methodology sections rewritten as full statements:

Research Paradigm:

This study adopts an exploratory-descriptive research paradigm, aiming to investigate and describe the challenges faced by biology teachers in using ICT tools.

Research Type:

The research type employed in this study is exploratory-descriptive, seeking to explore and describe the experiences, perceptions, and challenges of biology teachers in integrating ICT tools into their teaching practices.

Research Approach:

A mixed-methods research approach is utilized, combining both quantitative and qualitative data collection and analysis methods to provide a comprehensive understanding of the research phenomenon.

Research Design:

The study employs a survey research design, utilizing questionnaires and semi-structured interviews to collect data from biology teachers, learners, and parents.

Data Collection Methods:

Data collection is achieved through:

1. Questionnaires (paper-based) adapted from existing instruments, such as the ICT Usage Survey.

2. Semi-structured interviews with biology teachers, learners, and parents.

Data Analysis Methods:

Data analysis involves:

1. Descriptive statistics (frequencies and percentages) to summarize quantitative data.

2. Thematic analysis to identify patterns and themes in qualitative data.

Sampling Strategy:

The sampling strategy employed is a combination of:

1. Stratified sampling by school type (rural/urban) and location.

2. Purposive sampling to select biology teachers with varying levels of ICT experience.

Sample Size:

The sample size consists of:

1. 5 biology teachers.

2. 5 learners.

3. 5 parents.

Data Collection Tool:

The data collection tools used are:

1. Questionnaire adapted from existing instruments.

2. Interview protocol developed based on literature review and research objectives.

Ethical Considerations:

This study adheres to the following ethical considerations:

1. Informed consent obtained from participants.

2. Confidentiality and anonymity of responses ensured.

3. Ethical approval obtained from the institutional review board.

Research design

This study adopted a descriptive survey research design where both quantitative and qualitative data were collected by use of questionnaire and interview guide (Creswell, 2013).

3.2 Population

The population for this study consists of teachers including, learners and parents. Only 15 respondents were randomly selected from three schools to make a total of participants.

3.3 Sample

In this case study, 5teachers, 5 learners and 5parents will be interrogated using a questionnaire from each school, will be interviewed to gather information on the challenges faced by learners when using of ICT tools in teaching and learning from three schools in Muzondidya cluster.

3.4 Sampling method

Stratified sampling method was used because it ensures the sample representative of the population by dividing the population into subgroups or strata based on the relevant characteristics such as school role (teachers, learners and parents), grade level for learners and teaching subjects for teachers

Sampling Procedure

Population: teachers, learner and parents in cluster schools in the district (N = 45)

Sample Size: 5 teachers, 5 learners and 5 parents=15(33.3%) of the population)

Sampling Method: Stratified Random Sampling

Stratification Variables:

- School location (rural)

-Teacher experience (less than 5 years, 5-10 years, more than 10 years)

Sampling Procedure:

1. Divide the population into strata based on school location and teacher experience.

2. Calculate the number of participants needed from each stratum to achieve a representative sample.

3. Use a random number generator to select participants from each stratum.

4. Ensure that the sample is representative of the population in terms of school location and teacher experience.

3.7 Data presentation

Introduction

This study aimed to explore the challenges faced by biology teachers in using Information and Communication Technology (ICT) tools. The data presented below provides an overview of the participants and sample composition. The study's population consisted of 45 participants, comprising teachers, learners, and parents. A stratified and purposive sampling strategy was employed to select a representative sample.

Population

Participants	45
Teachers	15
Learners	15
Parents	15

Sample:

Teachers	**5**	**33.3% of teacher's population**
Leaners	**5**	**33.3% of teacher population**
Parents	**5**	**33.3% of teacher population**

3.5 Instruments

"For data collection, both questionnaires and interview protocols were utilized to obtain quantitative and qualitative data, respectively." The interview protocol was used to know better about the use of ICT in classroom activities as well as the challenges they face in this

application. All questions were elaborated in relation to the use of ICT in teaching and learning Biology and the challenges faced in this scenario.

3.5.1 A questionnaire for the research topic on challenges faced by teachers in using ICT tools in teaching and learning:

Introduction:

Thank you for participating in this survey. The purpose of this questionnaire is to investigate the challenges faced by teachers in using ICT tools in teaching and learning. Your responses will help us better understand the challenges and identify potential solutions.

Section 1: Demographic Information

- Gender: Male / Female

- Age: _____20-55 years

- Teaching experience: _____ 5-20 years

- Subject/Grade taught: _____. Science (biology)

Section 2: ICT Usage

- Do you use ICT tools in your teaching? Yes / No

- If yes, which tools do you use most frequently? (e.g., interactive whiteboards, laptops, tablets, educational software)

- How often do you use ICT tools in your teaching? Daily / Weekly / Rarely

Section 3: Challenges Faced

- What challenges do you face when using ICT tools in teaching? (Select all that apply)

   - Lack of technical support

   - Insufficient training

   - Limited access to ICT resources

- Difficulty in integrating ICT into curriculum

- Student lack of skills

- Other (please specify)

- How do you currently overcome these challenges? (Select all that apply)

- Seeking help from colleagues

- Attending training workshops

- Online research

- Trial and error

- Other (please specify)

Section 4: Perceived Benefits

- Do you believe ICT tools enhance student learning? Yes / No

- Do you believe ICT tools make your teaching more effective? Yes / No

- What benefits do you think ICT tools bring to your teaching and student learning? (Open-ended question)

Section 5: Additional Comments

- Do you have any additional comments or suggestions about using ICT tools in teaching and learning?

Thank you for taking the time to complete this questionn aire! Your input is greatly appreciated.

Here is a sample questionnaire for learners on the project topic on challenges faced by teachers in using ICT tools in teaching and learning biology:

_Introduction: _

Thank you for participating in this survey. The purpose of this questionnaire is to gather your opinions and experiences on the challenges faced by your teachers in using ICT tools in teaching and learning biology. Your responses will help us better understand the challenges and identify potential solutions.

Section 1: Demographic Information

- Age: _____15-20 years

- Grade level: _____Form 2-6

- Biology class frequency: Daily / Weekly / Rarely

Section 2: ICT Usage in Biology Class_

- Do you use ICT tools in your biology class? Yes / No

- If yes, which tools do you use most frequently? (e.g., interactive whiteboards, laptops, tablets, educational software)

- How often do you use ICT tools in your biology class? Daily / Weekly / Rarely

Section 3: Challenges Observed_

- Have you noticed any challenges your teachers face when using ICT tools in biology class? Yes / No

- If yes, what challenges have you observed? (Select all that apply)

    - Technical issues

    - Difficulty explaining concepts

    - Limited access to ICT resources

    - Insufficient training

    - Other (please specify)

Section 4: Learning Experience_

- Do you think ICT tools help you better understand biology concepts? Yes / No

- Do you think ICT tools make biology classes more engaging? Yes / No

- What do you thin k are the benefits of using ICT tools in biology class? (Open-ended question)

Section 5: Suggestions_

- Do you have any suggestions for how your teachers can improve their use of ICT tools in biology class?

- Are there any specific ICT tools or resources you would like to see used in your biology class?

Section 6: Additional Comments_

- Do you have any additional comments or suggestions about using ICT tools in biology class?

Thank you for taking the time to complete this questionnaire! Your input is   greatly appreciated.

A questionnaire for parents on challenges faced by teachers in using ICT tools in teaching and learning biology:

_Introduction: _

Thank you for participating in this survey. The purpose of this questionnaire is to gather your opinions and perspectives on the challenges faced by teachers in using ICT tools in teaching and learning biology. Your responses will help us better understand the challenges and identify potential solutions.

Section 1: Demographic Information_

- Your relationship with the student: Parent / Guardian

- Your highest level of education: _____High school

- Your occupation: _____Farmer

Section 2: ICT Usage in Education_

- Do you think ICT tools are important in education? Yes / No

- Do you think ICT tools are effectively used in your child's biology class? Yes / No

- How often do you think ICT tools should be used in biology class? Daily / Weekly / Rarely

Section 3: Challenges Perceived_

- Do you think teachers face challenges in using ICT tools in biology class? Yes / No

- If yes, what challenges d666o you think they face? (Select all that apply)

   - Lack of technical support

   - Insufficient training

   - Limited access to ICT resources

   - Difficulty integrating ICT into curriculum

   - Other (please specify)

Section 4: Support and Resources_

- Do you think schools should provide more support and resources for teachers to effectively use ICT tools in biology class? Yes / No

- What kind of support and resources do you think would be helpful? (Open-ended question)

Section 5: Benefits and Concerns_

- Do you think ICT tools enhance your child's learning experience in biology? Yes / No

- Do you have any concerns about the use of ICT tools in biology class? (Open-ended question)

Section 6: Additional Comments_

- Do you have any additional comments or suggestions about using ICT tools in biology class?

Thank you for taking the time to complete this questionnaire! Your input is greatly appreciated.

3.6 Data collection procedure

Data collection is the process by which data are gathered by the researcher. In this research, questionnaires were be distributed to 45 respondents including Biology teachers, learners and parents sampled from different secondary schools of Muzondidya cluster. All participants provided the required information voluntarily after signing consent forms. Because the questionnaires were distributed by researcher himself and as the participants requested to answer all questions immediately, all questionnaires were be returned. Additionally, the interview was conducted at their same date on collecting quantitative data. The data collected during interview were used to establish the level of using ICT in teaching and learning Biology and the challenges faced in this domain

Credibility and trustworthiness

Credibility and trustworthiness are essential aspects of research methodology, ensuring that the findings are reliable, valid, and accurate. To establish credibility and trustworthiness in this study the following strategies were considered such as prolonged engagement that is Spend sufficient time in the field, collecting data and building relationships with participants to gain a deeper understanding of their experience, persistent observation by Collect data through multiple methods such as interviews, surveys, observations to increase the validity of your findings, data triangulation that is use multiple data sources such as interviews, surveys, documents to verify your findings and increase credibility and reflexivity which deals with acknowledging your own biases and assumptions and take steps to address them throughout the research process.

Data analysis

This chapter presented the analysis of the data collected from the survey interviews and observations. The aim of analysis is to identify patterns, themes and trends in the data and to answer the research questions. The data analysis method used were descriptive statistics which included the percentages where the results are presented in tables and figures.

Ethical considerations

Informed consent

The writer obtained consent from participants (teachers, learners, and school administrators) before collecting data to ensure they understand the purpose, benefits, and potential risks of the study.

Confidentiality

There was a protection of participants' personal information, maintain confidentiality and anonymized the data to prevent identification of individuals or schools.

Privacy

Respect participants' privacy and avoid collecting sensitive information that may compromise their privacy.

Respect for participants

The researcher treated the participants with respect and dignity by avoiding the cause of physical, emotional, or psychological harm.

Objectivity

The research was approached with an open mind and avoid biases, influencing of participants' responses or imposing your own beliefs.

Cultural sensitivity

There was an awareness of the cultural context and potential differences in rural schools. to avoid cultural insensitivity or exploitation

Collaboration

Collaboration with local authorities, schools, and communities ensured that the research was relevant, useful, and respectful.

By considering these ethical considerations, it ensures a responsible and respectful research project that benefits both the research community and the rural schools involved.

Chapter summary

This chapter presented the challenges faced by teachers and learners in using ICT tools in rural schools. The findings showed that, teachers face challenges such as limited access to ICT infrastructure and internet connectivity, lack of training and support in using ICT tool, difficulty in integrating ICT tools into their teaching practices. Learners also faced challenges such as limited access to ICT devices and internet outside of school, difficulties in understanding how to use ICT tools for learning, limited digital literacy skills. Both teachers and learners faced the challenges such as limited electricity supply and backup power options, high cost of ICT devices and internet connectivity, limited technical support and maintenance. These challenges may hinder the effective use of ICT tools in rural schools, leading to a significant gap in the quality of education compared to urban areas. The chapter was concluded by highlighting the need for addressing these challenges to ensure equal access to quality education for all.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presented the findings of the study on the challenges faced by teachers in using ICT tools in teaching and learning biology. The data collected from the survey, interviews, and observations were analyzed and presented in a clear and concise manner. The chapter is organized into several sections. The first section presented the demographic characteristics of the participants, followed by a summary of the survey results. Then the next section presented the findings from the interviews and observations, highlighting the themes and patterns that emerged from the data. Again, the data was presented in a variety of formats, including tables

and figures to facilitate easy understanding and comparison. The analysis was done using both quantitative and qualitative methods, depended on the type of data and the research questions which were addressed.

4.2 Biographical data

Table 4.1 Population

Age	20-55 years
Gender	Male (25) Female (20)
Occupation	Teacher 15, Learners 15 and Parents 15
Educational level	Bachelor's degree 25, high school 10, parents (various) 10
Experince in Education	5-20 years(teachers), 1-5 year, 5-15 years(parents)

School A

Sample of 5 Teachers:

	Gender	Age	Experience	Educational level
Teacher 1	Female	35 years	10 years	Masters' degree
Teacher 2	Male	40 years	15 years	Bachelor's degree
Teacher 3	Female	30 years	5 years	Masters' degree
Teacher 4	Male	45 years	20 years	Bachelor's degree

				Diploma in education
Teacher 5	Male	38 years	12 years	

Sample of 5 Learners:

	Gender	Grade	Academic performance
Learner 1	Female	Form 6	B
Learner 2	Male	Form 5	A
Learner 3	Female	Form 4	D
Learner 4	Male	Form 3	C
Learner 5	Female	Form 2	E

Sample of 5 Parents:

	Gender	Educational level	Number of children in school	Age
Parent 1	Male	High school	2	40
Parent 2	Female	Bachelor's degree	3	45
Parent3	Male	Masters' degree	1	38
Parent 4	Female	High school	2	42
Parent 5	Female	Bachelor's degree	1	35

School B

Sample of 5 Teachers:

	Gender	Age	Experience	Educational level
Teacher 1	Female	30years	10 years	Masters' degree
Teacher 2	Male	35years	15 years	Bachelor's degree
Teacher 3	Female	25 years	5 years	Masters' degree
Teacher 4	Male	45 years	20 years	Bachelor's degree
Teacher 5	Female	38 years	12 years	Diploma in education

Sample of 5 Learners:

	Gender	Grade	Academic performance
Learner 1	Female	Form 6	A
Learner 2	Male	Form 5	B
Learner 3	Female	Form 4	C
Learner 4	Male	Form 3	E
Learner 5	Male	Form 2	D

Sample of 5 Parents:

	Gender	Educational level	Number of children in school	Age
Parent 1	Male	High school	1	40
Parent 2	Female	Bachelor's degree	2	45
Parent3	Male	Masters' degree	3	38
Parent 4	Female	High school	1	42
Parent 5	Female	Bachelor's degree	2	35

School C

Sample of 5 Teachers:

	Gender	Age	Experience	Educational level
Teacher 1	Male	25 years	10 years	Masters' degree
Teacher 2	Male	50 years	15 years	Bachelor's degree
Teacher 3	Female	30 years	5 years	Masters' degree
Teacher 4	Male	45 years	20 years	Bachelor's degree
Teacher 5	Male	25 years	12 years	Diploma in education

Sample of 5 Learners:

	Gender	Grade	Academic performance
Learner 1	Female	Form 6	B
Learner 2	Male	Form 5	A

Learner 3	Female	Form 4	D
Learner 4	Male	Form 3	C
Learner 5	Female	Form 2	E

Sample of 5 Parents:

	Gender	Educational level	Number of children in school	Age
Parent 1	Male	High school	2	40
Parent 2	Female	Bachelor's degree	3	45
Parent3	Male	Masters' degree	1	38
Parent 4	Male	High school	2	42
Parent 5	Female	Bachelor's degree	1	35

Table 1: ICT tools needed for teaching of biology

Challenges	Frequency School A	Frequency School B	Frequency School C	Total	Percentage
Interactive whiteboards	2	1	1	4	26.66%
Laptops/tablets	1	2	1	4	26.66%
Science software's e.g., simulations and models	0	0	1	1	6.66%
Online resources e.g., videos and articles	1	1	1	3	20%
Virtual Apps				0	0%

Mobile Apps	1	1	1	3	20%

Data Analysis

The results show that the most popular ICT tools needed for teaching biology are:

Interactive Whiteboards and Laptop/Tablets tied at 26.66% have provided the suggestions that teachers consider both interactive display technology and portable computing devices to be equally important for effective teaching. More importantly the mobile apps which rested at 20% indicated that teachers have seen value in using mobile devices to support biology education. Science Software Simulations and Models with6.66% are less popular, though the category represented a significant aspect of ICT-based teaching tools. Virtual Apps scored 0% and interestingly, no respondents identified virtual apps as a necessary tool, then it has been categorized as a potential area for growth and exploration.

Conclusion

This data suggested that teachers prioritized interactive and portable ICT tools, such as interactive whiteboards and laptops/tablets, to support biology education. Mobile apps also play a significant role, while science software simulations and models have been identified as important but less prominent. The absence of virtual apps in the results indicates a potential opportunity for exploration and integration. However, these findings can guide resource development and teacher training initiatives.

Table 4.2: Challenges in using ICT tools

Challenges	Frequency School A	School B	School C	Total	Percentage
Lack of technical support	1	1		2	13.33%
Limited internet access	1	2	1	4	26.66%

Insufficient training			1	1	6.66%
Outdated hardware/software	2		1	3	20%
Limited access	1	2	2	5	33.33%

Data analysis for challenges in using ICT tools

Percentage Distribution indicated that Infrastructure-related challenges particularly access, limited internet access, outdated hardware or software scored 80% while support-related challenges such as lack of technical support, and insufficient training settled at 20%

Conclusion

The analysis has unfolded that the majority of challenges faced by teachers in using ICT tools are related to infrastructure (80%), with limited access being the most significant hurdle. Support-related challenges, including Lack of Technical Support and insufficient training, account for 20% of the challenges. To address these challenges, investments in ICT infrastructure development, internet connectivity, and technical support are crucial. Additionally, providing teachers with adequate training and support can help build their confidence and competence in using ICT tools effectively.

Factors influence the use of ICT in teaching

Table 4.3: Demographic factors influencing ICT use

Factor	School A	School B	School C	Total	Percentage
Age (20-55)	1	2	1	4	26.66%
Gender(male)	2	1		3	20%
Qualification Bachelor's degree	1	2	2	5	33.33%
Experince (5-10)	1	0	2	3	20%

Data analysis

Demographic Factors Influencing ICT Use in Teaching and Learning

Age (20-55): 26.66%

This hinted that approximately one-quarter of the respondents who use ICT tools in teaching and learning are between 20-55 years old, indicating a wide age range.

Gender (Male) 20%

Practically shows that about one-fifth of the respondents who use ICT tools in teaching and learning are male, indicating a potential gender imbalance.

Experience (5-20 years) :20%

Then automatically revealed that about one-fifth of the respondents who use ICT tools in teaching and learning have 5-20 years of experience, suggesting a range of teaching experience.

Qualification (Bachelor's Degree) : 33.33%

Eventually indicated that nearly one-third of the respondents who use ICT tools in teaching and learning hold a bachelor's degree, highlighting the importance of higher education in ICT adoption.

Conclusion

Summatively the analysis proposed that age, gender, experience, and qualification are influential demographic factors in ICT use in teaching and learning. The findings indicated that respondents across a wide age range (20-55), males, those with 5-20 years of experience, and those holding a bachelor's degree are more likely to use ICT tools in teaching and learning. These enlightenments can guide targeted initiatives to promote ICT adoption and digital literacy among unfranchised groups in education.

Table 4.4: Institutional factors influencing ICT use

Factor	School A	School B	School C	Total	Percentage

School type(rural)	0	1	0	1	6.66%
School location	0	1	0	1	6.66%
School resources	2	1	1	4	26.66%
Administrative support	3	2	4	9	60%

Data analysis for institutional factors influencing ICT use

Administrative Support which is worth 60% has brought the suggestion that a significant majority of respondents believe that administrative support is a crucial factor in ICT use, indicating that leadership and management play a vital role in promoting ICT adoption in teaching and learning. While school resources tied at 26.66% then presented that nearly one-quarter of respondents consider school resources (e.g., infrastructure, hardware, software) as a key factor in ICT use, highlighting the importance of adequate resources in supporting ICT integration.

 On the other hand, the location with 6.66% further indicated that a small proportion of respondents consider location as a factor in ICT use, suggesting that geographical location may not be a significant barrier to ICT adoption. The type of School (Rural) tugged at 6.6% unmasked that that a small proportion of respondents (6.6%) consider school type (rural) as a factor in ICT use, indicating that rural schools may face unique challenges in ICT adoption.

Conclusion:

The analysis endorsed that administrative support and school resources are the most significant institutional factors influencing ICT use, while location and school type (rural) have a lesser impact. These answers underlined the need for giving presidency leadership support and resource allocation to promote effective ICT integration.

Table 4.5: Technological factors influencing ICT use

Factor	School A	School B	School C	Total	Percentage

Availability of computers	2	1	4	7	46.66%
Internet connectivity	1	3	1	5	33.33%
Software/application availability	1	0	0	1	6.66%
Technical support	1	1	0	2	13.33%

Data analysis

Technological factors Influencing ICT use

Availability of Computers reacted with 46.66% and his proposed that nearly half of the respondents have access to computers, which is a significant factor in ICT use. The internet connectivity at 33.33%, again unfolded that about one-third of respondents have internet access, which is essential for online learning and communication. At the same time Software/application availability hich attain 6.66% indicated that a small proportion of respondents have access to relevant software and applications, which may limit their ability to fully utilize ICT. The technical Support which is tied at 13.33% proved that about one-eighth of respondents have access to technical support, which is crucial for troubleshooting and maintaining ICT infrastructure.

Conclusion:

Therefore, analysis showcaced that the availability of computers and internet connectivity are the most essential technological factors influencing ICT use, while software/application availability and technical support are less prevalent. These results advocated that investing in computer hardware and internet infrastructure may be a priority to promote ICT adoption, while also addressing the need for software and technical support to ensure effective ICT integration.

Table 4.6: pedagogical factors influencing ICT use

Factor	School A	School B	School C	Total	Percentage

Teaching methods (student centered)	3	2	4	9	60%
Assessment methods (online quizzes)	0	0	0	0	0%
Curriculum design (integrating with ICT	1	2	1	4	26.66%
Limited time	1	1	0	2	13.33%

Data analysis

Pedagogical factors influencing ICT use in teaching and learning

Teaching methods (student-centered) netted 60% and this propounded that a significant majority of respondents use student-centered teaching methods, which promote active learning and collboration, and are conducive to ICT integration. The assessment methods (online quizzes) which recorded 0% obviously exposed that none of the respondents use online quizzes as a form of assessment, indicating a potential area for growth in leveraging ICT for assessment. While the Curriculum Design (Integrating with ICT) hit 26.66% indicating that about one-quarter of respondents have a curriculum design that integrates ICT, highlighting the need for more intentional curriculum planning to support ICT use. How very limited Time which notched 13.33% eventually showed that about one-eighth of respondents cite limited time as a barrier to ICT use, suggesting that time management and prioritization may be essential for effective ICT integration.

Conclusion:

The analysis has casted a spotlight on that student-centered teaching methods was widely used, but there is a need to develop assessment methods and curriculum design that effectively integrate ICT. Additionally, time management is a concern for some respondents. These results suggested that professional development opportunities focusing on ICT-based assessment and curriculum design, as well as time management strategies, may be beneficial to enhance ICT use in teaching and learning.

Table 4.7: Technological factors influencing ICT use in learning

Factor	School A	School B	School C	Total	Percentage
Access to smartphones	3	2	3	8	53.33%
Access to computer/ tablets	1	2	1	4	26.66%
Internet connectivity	1	1	1	3	20%
Familiarity with the software	0	0	0	0	0%

Data analysis

Technological Factors Influencing ICT Use in Learning

Access to smartphones scored 63.33% which implied that an outstanding majority of respondents have access to smartphones, which provides a potential tool for learning. Then when it comes to access to computer /Tablets with 26.66% indicated that about one-quarter of respondents have access to computers or tablets, which are essential for more in-depth learning activities.

On internet connectivity with 20% only one-fifth of respondents have internet connectivity, which is a crucial factor in accessing online learning resources. Familiarity with software scored 0% showing that none of the respondents are familiar with the software, indicating a substantial gap in technological literacy.

Conclusion:

Conclusively the analysis illuminated that while access to smartphones is widespread, access to computers/tablets and internet connectivity are limited. Moreover, familiarity with software is non-existent. These findings suggest that initiatives aimed at improving access to computers/tablets, internet connectivity, and software training may be essential to enhance ICT use in learning. Additionally, mobile learning strategies could be ventured to leverage the widespread access to smartphones.

Table 4.8: Environmental factors influencing ICT use in learning

Factor	School A	School B	School C	Total	Percentage
Parental support	1	1	0	2	20%
Teacher encouragement	1	1	1	3	20%
Peer influence	1	1	1	3	20%
Availability of ICT resources	1	2	3	6	40%

Data analysis

Environmental factors Influencing ICT se in learning

Parental support: logged 20% and this prompted that one-fifth of respondents receive support from parents, which can foster a positive attitude towards ICT use in learning. Teacher encouragement earned 20% also indicated that one-fifth of respondents receive encouragement from teachers, which can motivate them to use ICT for learning. Equally the peeer influence have also gained 20% revealing again that one-fifth of respondents are influenced by their peers to use ICT for learning, highlighting the importance of social networks in shaping behavior. Only availability of Resources amassed 40% reflecting that nearly half of the respondents have access to resources (e.g., infrastructure, facilities) that support ICT use in learning.

Conclusion:

The interpretation highlights that availability of resources is the most significant environmental factor influencing ICT use in learning, followed by more balanced contributions from parental support, teacher encouragement, and peer influence. These findings suggest that investing in infrastructure and resources may be vital, and that a collaborative approach involving parents, teachers, and peers may be necessary to promote ICT use in learning.

Table 4.9: Learners' challenges in using ICT tools

Challenges	School A	School B	School C	Total	Percentage
Limited computer skills	1	2	2	5	33.33%
Difficulties in navigating software	0	0	0	0	0
Insufficient access to devices	3	2	3	8	53.33%
Lack of technical support	1	1	0	2	26.66%

Data analysis

Learners' challenges in using ICT tools in teaching and learning of biology

Limited computer Skills ranked at 33.33% suggested that one-third of respondents struggle with basic computer skills, which can hinder their ability to effectively use ICT tools in learning Moreover difficulty in Navigating Software at 0% revealed that none of the respondents reported difficulty navigating software, indicating that software design may not be a significant barrier. Then insufficient Resources tallied at 53.33% reflected that over half of the respondents lack access to sufficient resources (e.g., hardware, internet, software) necessary for effective ICT use in learning biology. The lack of Technical Support attained 26.66%

 Decoded that about one-quarter of respondents did not receive adequate technical support, which can exacerbate existing challenges.

Conclusion

The exploration highligted that insufficient resources and limited computer skills are the most significant challenges learners face in using ICT tools in biology learning.

Table 4.10: Pedagogical factors influencing ICT use in learning

Factor	School A	School B	School C	Total	Percentage
Teaching methods (student centered)	3	2	2	7	46.66%
Learning objectives (inquiry based)	0	1	1	2	13.33%
Assessment method (online quizzes)	0		1	1	6.66%
Curriculum design (integrating with ICT)	2	2	1	5	33.33%

Data analysis

Pedagogical factors influencing ICT Use in Learning

Teaching Methods (Student-Centered) secured 46.66% suggesting that nearly half of the respondents use student-centered teaching methods, which promote active learning and collaboration, and are conducive to ICT integration. The learning Objectives (Inquiry-Based) which logged 13.33% indicated that about one-eighth of respondents have learning objectives that focus on inquiry-based learning, which encourages critical thinking and problem-solving skills. Of which assessment methods (online quizzes) gained 6.6% unfolding that a small proportion of respondents use online quizzes as a form of assessment, which can provide immediate feedback and track student progress. Then the curriculum design (Integrating ICT Tools) totalled 33.33% showings that about one-third of respondents have a curriculum design that intentionally integrates ICT tools, highlighting the need for more deliberate planning to embed ICT in teaching and learning.

Conclusion:

The analysis highlighted that student-centered teaching methods are widely used, but there is a need to develop inquiry-based learning objectives, utilize online assessment methods, and intentionally design curricula that integrate ICT tools. These findings suggested that professional development opportunities focusing on innovative pedagogies and ICT integration may be beneficial to enhance teaching and learning practice

Table 4.11: Psychological factors influencing parents support for ICT use

Factors	School A	School B	School C	Total	Percentage
Attitude towards ICT (positive)	2	3	2	7	46.66%
Perceived ease use of ICT	1	0	0	1	6.66%
Confidence in supporting child's ICT use	1	1	2	4	26.66%
Perceived usefulness of ICT	1	1	1	3	20%

Data analysis

Psychological Factors Influencing Parents' Support for ICT Use

Attitude towards ICT (Positive) gained 46.66% and the proposition was that nearly half of parents have a positive attitude towards ICT, which is likely to influence their support for its use in their child's education. Perceived Ease of Use of ICT reached 6.66% reflecting that a small proportion of parents find ICT easy to use, which may impact their willingness to support its use. confidence in supporting child's ICT use clocked 26.66% revealing that about a quarter of parents feel confident in their ability to support their child's ICT use, which is crucial for effective support. Perceived uefulness of ICT netted 20% showed that about a fifth of parents believe ICT is useful for their child's education, which may influence their support for its integration.

Conclusion:

The analysis highlights that parents' attitudes towards ICT, confidence in supporting their child's ICT use, and perceived usefulness of ICT are significant psychological factors influencing their support for ICT use. These findings suggest that parents' positive attitudes and confidence in supporting ICT use are crucial for effective integration of ICT in education. Additionally, highlighting the usefulness of ICT in education may enhance parents' support for its use.

Recommendations:

- Educate parents about the benefits and usefulness of ICT in education.

- Provide training and resources to enhance parents' confidence in supporting their child's ICT use.

- Encourage parents to develop a positive attitude towards ICT by highlighting its potential to enhance their child's learning outcomes.

Table 4.13: Technological factors influencing parents support for ICT use

Factor	School A	School B	School C	Total	Percentage
Access to smartphones	2	3	3	8	53.33%
Access to computer/tablet	1	1	1	3	20%
Internet connectivity	1	0	1	2	13.33%
Familiarity with ICT tools	1	1	0	2	13.33%

Data analysis

Technological Factors Influencing Parents' Support for ICT Use

Access to Smartphones have accumulated 53.33% and championed that over half of parents have access to smartphones, which can provide a convenient means of supporting their child's ICT use. Well, access to computer/tablets earned 20% exposing that about one-fifth of parents have access to computers or tablets, which are essential for more in-depth ICT use and support. The internet connectivity secured 13.33% revealing that about one-eighth of parents have internet connectivity, which is crucial for accessing online resources and supporting their child's ICT use.

Then the familiarity with ICT Tools scored 13.33% showing that about one-eighth of parents are familiar with ICT tools, which can impact their ability to effectively support their child's ICT use.

Conclusion:

The critique showcased that access to smartphones is the most common technological factor influencing parents' support for ICT use, but familiarity with ICT tools and internet connectivity are limited. These findings suggest that initiatives aimed at improving access to

computers/tablets, internet connectivity, and ICT training for parents may be essential to enhance their support for their child's ICT use.

Table 4.14: Challenges faced by parents in supporting ICT- based learning

Challenges	School A	School B	School C	Total	Percentage
Limited technical expertise	1	1	1	3	20%
Difficulty in understanding ICT terminology	1	0	0	1	6.66%
Concerns about cyber bullying and online safety	1	1	1	3	20%
Difficulty in monitoring child's online activities	2	3	3	8	53.33%

Data analysis

Challenges Faced by Parents in Supporting ICT-Based Learning

Limited Technical Expertise scored 20% and the suggestion was that about one-fifth of parents lack the technical skills to effectively support their child's ICT-based learning. Difficulty in Understanding ICT Terminology earned 6.66 ago this indicated that a small proportion of parents struggle to understand the technical language related to ICT, which can create a barrier to supporting their child's learning. Difficulty in Understanding ICT Terminology hit 6.66% and this suggested that a small proportion of parents struggle with understanding ICT-related terms, which may hinder their ability to support their child's learning. The Concerns about Cyber Bullying and Online Safety marked 20% indicating that a significant proportion of parents are concerned about their child's online safety and vulnerability to cyberbullying, which may impact their willingness to support ICT-based learning. Most parents responded on the difficulty in monitoring child's activities by logging 53.33% reflecting that the majority of parents find it challenging to monitor their child's online activities, which may lead to concerns about their child's exposure to inappropriate content or online risks.

Conclusion:

The analysis highlights that parent face significant challenges in supporting their child's ICT-based learning, particularly in monitoring their child's online activities and concerns about cyberbullying and online safety. These findings suggest that parents require support and resources to overcome these challenges and effectively support their child's ICT-based learning.

Recommendations:

- Provide parents with resources and training to improve their understanding of ICT terminology and online safety.

- Offer guidance on monitoring tools and strategies to help parents effectively supervise their child's online activities.

- Educate parents on cyberbullying prevention and response strategies to address their concerns and enhance their support for ICT-based learning.

Table 4.15 : Challenges faced by parents in communication with teachers about ICT use

Challenges	School A	School B	School C	Total	Percentage
Limited understanding of ICT tools used in schools	2	2	2	6	40%
Difficulty in communicatidng with teachers about ICT issues	1	1	1	3	20%
Limited opportunities for parental involvement in ICT-based learning	1	2	1	4	26.66%
Concerns about teachers ' ICT skills and training	1	0	1	2	13.33%

Data analysis

Challenges faced by parents in communicating with teachers about ICT use

Limited understanding of ICT tools sed in schools logged 40% this hinted that about two-fifths of parents lack knowledge about the ICT tools used in schools, making it difficult for

them to engage in meaningful conversations with teachers, while difficulty in communicating with the teacher about ICT issues excclelled 20% with anindication that about one-fifth of parents struggle to communicate effectively with teachers about ICT-related issues, potentially leading to misunderstandings and missed opportunities. Again, limited opportunities for parental involvement in ICT-based learning with 26.66% unfolded that about one-quarter of parents feel that they are not given sufficient opportunities to be involved in their child's ICT-based learning, potentially leading to feelings of disconnection and disenfranchisement. Moreover, concerns about teachers' skills and training reached 13.33% which reflected that about one-eighth of parents worry that teachers may not have the necessary skills or training to effectively integrate ICT into their child's learning, potentially eroding trust in the education system.

Conclusion:

The analysis highlighted that parent face various challenges in communicating with teachers about ICT use, with limited understanding of ICT tools used in schools being the most significant. These findings suggest that schools and teachers should provide opportunities for parental involvement, training, and education to enhance parental understanding and confidence in ICT-based learning, and to foster stronger home-school partnerships.

Table 4.16 5: Challenges faced by parents in supporting c. children's ICT use at home

Challenges	School A	School B	School C	Total	Percentage
Limited access to ICT at home	0	0	1	1	6.66%
Difficulty in setting limits on child's ICT use	3	2	1	6	40%
Concerns about child's ICT addiction and social isolation	2	3	2	7	46.66%

Difficulty in finding suitable ICT resources for child's learning	0	0	1	1	6.66%

Data analysis

Challenges faced by parents in supporting children's ICT use at home

Limited Access to ICT at Home netted 6.66% and this suggested that a small proportion of parents lack access to ICT resources at home, making it difficult to support their children's ICT use. While difficulty in setting limits on child's ICT use logged 40% which indicated that many parents struggle to establish boundaries and regulate their child's ICT use, potentially leading to excessive screen time and related issues. Again the concerns about child's ICT addiction and social Isolation reahed 46.66% unconfining that nearly half of parents worry about the potential risks of ICT use, including addiction and social isolation, and may need guidance on how to mitigate these risks.Moreover the difficulty in finding suitable ICT resources for child's learning scored 6.66% showing that a small proportion of parents find it challenging to locate appropriate ICT resources that align with their child's learning needs, highlighting the need for more accessible and relevant resources.

Conclusion:

The review highlighted that parent face significant challenges in supporting their children's ICT use at home, particularly in setting limits and addressing concerns about addiction and social isolation. These results suggest that parents may benefit from guidance on responsible ICT use, accessing suitable resources, and maintaining a healthy balance between technology use lol and other aspects of life.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter synthesizes the findings of the study and presents the conclusions drawn from the research on the challenges faced by teachers in using Information and Communication Technology (ICT) in classroom teaching-learning of biology in selected secondary schools within the Muzondidya cluster in Zaka district. It also provides recommendations based on the study's findings, aimed at enhancing the integration of ICT in biology education and addressing the identified challenges.

Summary:

This chapter summarizes the key findings of the study, highlighting the challenges faced by learners and teachers in integrating ICT in biology teaching and learning. The study's results confirm the existence of technical, literacy, resource, and pedagogical challenges, aligning with previous research.

5.2 Conclusions

The study revealed several significant challenges that teachers encounter when attempting to integrate ICT into biology teaching and learning. These challenges include:

A lack of genuine software and up-to-date ICT equipment, which hinders the effective use of technology in the classroom.

Inadequate computer resources and low-speed internet connectivity, which limit the potential for interactive and engaging biology lessons.

A deficiency in proper training and skills development for teachers, which affects their ability to utilize ICT tools effectively.

Insufficient motivation from both teachers and students to embrace ICT in the educational process.

Poor administrative support and lack of expert technical staff, which contribute to the difficulties in maintaining and troubleshooting ICT resources.

Large class sizes and limited availability of digital resources, which complicate the integration of ICT into the curriculum.

These challenges contribute to a lower uptake of ICT in rural schools, impacting the quality of biology education and the students' learning outcomes.

5.3 Recommendations

Based on the findings of this study, the following recommendations are proposed to overcome the challenges and improve the use of ICT in biology education:

1. Enhance ICT Infrastructure

Investment in high-speed internet and modern ICT equipment is crucial for rural schools. Providing up-to-date hardware and software will enable interactive and engaging biology lessons, allowing students to access a wealth of online educational resources.

2. Professional Development Programs

Regular, targeted professional development programs are essential to equip teachers with the necessary ICT skills. Workshops and training should focus on integrating technology into the biology curriculum and developing effective digital pedagogies.

3. On-site Technical Support

Schools should employ or train technical staff to provide immediate assistance with ICT-related issues. Regular maintenance and timely support will ensure that ICT resources are consistently available and functional for classroom use.

4. Curriculum Integration and Digital Resources

Development of a biology curriculum that integrates ICT and creation of a digital resource library are imperative. These resources should be tailored to the curriculum and designed to enhance the understanding of biological concepts.

5. Policy and Administrative Support

Educational policies should prioritize ICT integration, with administrative actions facilitating this process. Adequate funding, resources, and encouragement from school administrators will support teachers in the effective use of ICT.

6. Community and Stakeholder Engagement

Active engagement with the community and stakeholders can provide additional support and resources for ICT initiatives. Collaboration with local businesses, parents, and non-profits can enhance the learning environment and foster a supportive culture for ICT in education.

5.4 Further Research

The study opens avenues for further research in the following areas:

Investigating the long-term impact of ICT integration on students' biology learning outcomes and interest in the subject.

Exploring the effectiveness of different models of professional development for teachers in enhancing ICT integration in biology education.

Examining the role of community engagement and support in the successful adoption of ICT in rural schools.

Assessing the cost-effectiveness of various ICT resources and infrastructure development initiatives in rural educational settings.

5.5 Final Thoughts

The integration of ICT in biology education presents a promising opportunity to enhance teaching and learning processes. However, the challenges identified in this study must be addressed to realize the full potential of ICT in rural schools. By implementing the recommended strategies and conducting further research, stakeholders can work towards bridging the digital divide and ensuring that all students have access to quality education that prepares them for the information age.

5.6 Chapter Summary

This chapter concludes the study by highlighting the main challenges faced by teachers in using ICT for biology education in rural schools and providing recommendations to address these challenges. It emphasizes the need for improved infrastructure, professional development, policy reform, and community engagement to enhance the integration of ICT in biology teaching and learning. The chapter also suggests areas for further research to continue exploring and improving the use of ICT in education, particularly in rural areas.

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Appendices

Appendix A: Survey Questionnaire

Section A: Demographic Information

1. Age: _____15-55 years

2. Gender: Male/Female

3. Role: Teacher/Learner/Parent

4. Level of education: Primary/Secondary/Tertiary

Section B: ICT Tools Usage_

1. Which ICT tools do you use for teaching/learning Biology? (Tick all that apply)

   - Online resources (e.g., websites, educational platforms)

   - Digital multimedia (e.g., videos, animations)

   - Interactive simulations

- Online collaboration tools (e.g., forums, social media)

2. How often do you use ICT tools for teaching/learning Biology?

   - Daily

   - Weekly

   - Monthly

   - Rarely

Section C: Challenges Faced

1. What challenges do you face when using ICT tools for teaching/learning Biology? (Tick all that apply)

   - Technical issues (e.g., connectivity, hardware)

   - Lack of training or support

   - Limited access to devices or internet

   - Difficulty in integrating ICT tools with traditional teaching methods

2. How do you overcome these challenges? (Open-ended question)

Appendix B: Interview Guide

Introduction

- Can you share your experiences with using ICT tools for teaching/learning Biology?

- What benefits have you observed from using ICT tools?

Challenges

- What challenges have you faced when using ICT tools?

- How have you addressed these challenges?

Conclusion

- Are there any final thoughts you'd like to share about using ICT tools for te teaching/learning Biology?

Appendix C: ICT Tools Used

- List of ICT tools used by participants, including:

  - Online resources (e.g., Khan Academy, Biology LibreTexts)

  - Digital multimedia (e.g., Crash Course Biology, Biology animations)

  - Interactive simulations (e.g., PhET Interactive Simulations, Biology Lab Simulations