

BINDURA UNIVERSITY OF SCIENCE EDUCATION

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**AN ASSESEMENT OF TEACHERS EXPERIENCES ON THE USE OF ICT IN TEACHING
AND LEARNING OF BIOLOGY AT ORDINARY LEVEL:**

**A CASE STUDY OF THREE SECONDARY SCHOOLS IN ZVIMBA DISTRICT
MASHONALAND WEST PROVINCE**

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A Case Study of Three Secondary Schools

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DEDICATION

I dedicate this project to my children Lindsay and Churandy Gundani, not forgetting the most encouraging wife Loreen Gundani a man could wish to have. I cannot spare my friend Marikopa Noah who constantly assisted me with ideas to make this research a success.

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ABSTRACT

This study was conceived on the realization that despite efforts to integrate ICT in the teaching and learning of biology in secondary schools, use of ICT is still very low among secondary schools in Zvimba. It is set assess the teacher's experiences on the use of ICT in the teaching and learning of Biology at Ordinary level. The study employed a case study approach where a total number of 16 participants; 3 school heads, 10Biology teachers and 3 heads of departments of the three selected schools were involved. Data collection was achieved through use of questionnaires and structured interviews. Microsoft Excel was used to analyze the data collected. Main findings of the study showed that some teachers are integrating ICT in the teaching and learning of Biology whilst other are not due to unavailability of ICT gadgets as well as lack of technical knowhow in the selected schools. Therefore, the study recommends improved accessibility to computers and adequate training on use of computer technologies as well as development of a policy framework to guide on the path to effective computer integration into instruction process.

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CHAPTER 1

1.0 Introduction

This chapter is generally giving an overview of the issue under investigation through the essential elements of the study and it is going to come in the form of background of study, statement of the problem, research questions, objectives, assumption of the study, significance of the study, limitations of study, delimitations of study, definition of key terms and the chapter summary.

1.1 Background of the study

The integration of Information and Communication Technology (ICT) in education has become a pivotal component in enhancing teaching and learning processes globally. As educational institutions strive to adapt to the demands of the 21st century, the use of ICT in classrooms has been recognized as a means to foster engagement, improve access to resources, and facilitate innovative teaching practices (UNESCO, 2011). This trend is particularly relevant in the teaching of science subjects, such as Biology, where visual and interactive tools can significantly enhance understanding and retention (Mumtaz, 2000).

Globally, the adoption of ICT in education has been met with varying degrees of success. Developed nations have largely embraced technology in their educational frameworks, with substantial investments in infrastructure and training for educators. For instance, studies indicate that countries like Finland and Singapore have successfully integrated ICT into their curricula, resulting in improved student outcomes and teacher effectiveness (OECD, 2015). The ICT sector, according to Pelgum (2002) is developing fast in well-developed countries. Bangladesh like other developed countries, has adopted ICT tool for development, although Bangladesh got its main frame computer in 1963, mobile phones and personal computers only started to penetrate the market in large quantities in 1997 (Choy, Wong & Gao 2009). Operators like internet service providers (ISPs) were allowed to use very small aperture terminal satellite systems for overseas communication resulting in internet connectivity being opened in the country (Pilgrum 2002). Conversely, many developing nations face challenges such as inadequate infrastructure, limited access to technology, and insufficient training for teachers, which hinder the effective use of ICT in classrooms (Hennessy et al., 2010).

In Africa, the situation presents a mixed landscape. While some countries are making strides in ICT integration, others struggle with significant barriers. According to a report by the African Union (2018), many African nations have initiated policies to enhance ICT in education, recognizing its potential to transform learning environments. However, challenges such as poor internet connectivity, lack of resources, and insufficient teacher training persist (Kozma, 2005). For instance, initiatives in countries like Kenya and South Africa show promise, with pilot programs demonstrating positive student engagement through ICT (Mncube&Harber, 2013). Nonetheless, the digital divide remains a critical issue, exacerbating educational inequalities across the continent

In Zimbabwe, the landscape of ICT in education reflects both the challenges and opportunities present in the broader African context. The Zimbabwean government has recognized the importance of ICT in enhancing educational quality and has implemented several initiatives aimed at integrating technology into schools (Ministry of Primary and Secondary Education, 2016). Despite these efforts, the effective use of ICT in teaching and learning, particularly in subjects like Biology, is impeded by infrastructural deficits, limited access to digital resources, and a lack of comprehensive training for teachers (Nyoni, 2019). Research indicates that while some educators are eager to incorporate ICT into their teaching, many lack the necessary support and resources to do so effectively (Chihota et al., 2020).

In recent years the use of mobile phones, personal computers, laptops and scanners has witnessed tremendous growth (Mhlanga 2006). Zimbabwe is one of the struggling countries in Africa in terms of using electronic gadgets. The number of those who access the internet cafes might be disturbed by the cost of computers (Mhlanga 2006). Chitape (2016) pointed out that, despite the fact that a growing population is computer literate, their awareness of the opportunity that the internet presents for them is limited. Lack of ICT in rural areas is one of the main challenges in the development field in the education sector in rural schools (Tezci 2011). Unlike their counterparts in a set up rural, youths do not have the opportunity to gain computer skills. As a result urban learners are more likely to be well versed with ICT than the generation of youth growing up in rural areas as revealed by Staples, Pugach and Himes (2005). While ICT continues to advance in the urban areas of Zimbabwe, rural schools still experience a lag in its implementation Parawira (2016). In a recent study by Ncube (2016), access to ICT facilities is a major challenge facing most

Zimbabwean rural schools with a ratio of 1 computer to 150 students against the ratio of 1:15 students in urban areas. ICT have changed the pedagogy in education offering more student-centered learning activities, Consortium (2017).

The purpose of this study sought to examine the use of technology by Biology teachers in Zvimba District Secondary Schools in Mashonaland West Province Zimbabwe. According to Tezci (2011) overall, the key issues and challenges found to be significant in using ICT by teachers were; - limited accessibility and network connection; -limited technical support, and-limited time and lack of teachers' competency .Many teachers pointed that, they have less number of computers in the school to prepare for class work (Munda, 2013). They also noted problems emanating that hardware trouble shooting, software malfunction and unexpected power failure are challenges of using ICT. By exploring the challenges and successes faced by teachers, the research sought to contribute to the body of knowledge regarding ICT integration in education, particularly in the Zimbabwean context. Understanding these experiences is crucial for developing strategies that enhance the effective use of technology in classrooms and ultimately improve educational outcomes for students.

The decision to conduct research on teachers' experiences with Information and Communication Technology (ICT) in teaching Biology at the secondary school level can be informed by several key indicators. These indicators highlight both the potential benefits of ICT integration and the challenges faced by educators in this area. Increased emphasis on ICT in Education Policies is one of the indicators were many educational systems globally, including those in Zimbabwe, have recognized the importance of ICT in enhancing learning outcomes. Policies promoting ICT integration in education indicate a commitment to modernizing teaching practices (Ministry of Primary and Secondary Education, 2016). Research is needed to evaluate how these policies are being implemented at the classroom level and to understand teachers' experiences in this context. In addition, variation in teacher proficiency with ICT Tools was also an indicator since there is a notable variation in teachers' proficiency and comfort levels with ICT. Research has shown that while some educators are well-versed in using technology, others may lack the necessary skills or confidence to integrate ICT effectively into their teaching (Hennessy et al., 2010). This disparity can significantly impact the quality of instruction and student engagement, warranting an assessment of teachers' experiences.

Furthermore, numerous studies have documented challenges associated with ICT integration in education, such as inadequate training, lack of resources, and limited technical support (Mumtaz, 2000). These challenges can hinder teachers' ability to utilize ICT effectively in their classrooms. Understanding these barriers from the teachers' perspective is crucial for developing targeted interventions and support systems.

On top of the above, the effectiveness of ICT in enhancing student engagement and learning outcomes has been a topic of much discussion. Some studies suggest that technology can improve students' understanding and retention of complex scientific concepts (Kozma, 2005). However, the success of these outcomes often depends on how well teachers can integrate ICT into their teaching practices. Researching teachers' experiences can provide insights into the actual impact of ICT on student learning in Biology.

There is also the issue of rapid technological advancements, the rapid pace of technological advancements means that new tools and platforms are constantly emerging. Teachers must adapt to these changes to provide relevant and effective instruction (UNESCO, 2011). An assessment of teachers' experiences with various ICT platforms used in Biology education can help identify which tools are most beneficial and how they can be effectively utilized.

There is need for professional development. The necessity for ongoing professional development in ICT for teachers has been widely acknowledged. Research indicates that teachers who receive adequate training are more likely to integrate technology effectively into their teaching (Mncube&Harber, 2013). Identifying teachers' experiences can highlight gaps in professional development offerings and inform future training programs.

There is a growing trend towards student-centered learning approaches that promote active engagement and collaboration (Brusilovsky&Millán, 2007). ICT tools can facilitate such approaches, but their effectiveness often hinges on teachers' ability to use them creatively and effectively. Exploring teachers' experiences can provide valuable insights into how ICT is being utilized to foster student-centered learning in Biology.

1.2 Statement of the problem

The integration of Information and Communication Technology (ICT) in education has been widely recognized as a critical factor in enhancing teaching and learning processes, particularly in

subjects like Biology. However, the effective implementation of ICT tools in the classroom remains a significant challenge for many teachers. This study aimed to assess teacher experiences regarding the use of ICT in teaching and learning Biology at the Ordinary level, focusing on three key objectives.

Firstly, it is essential to identify school teachers' experiences in implementing ICT tools in the teaching and learning of Biology. Understanding these experiences can provide insights into how teachers perceive the effectiveness of ICT in enhancing student engagement and comprehension. Previous research indicates that teachers' perceptions significantly influence their willingness to integrate technology into their teaching practices (Hennessy et al., 2010).

Secondly, the study seeks to determine the challenges faced by school teachers in using ICT tools for teaching and learning Biology. Despite the potential benefits of ICT, many educators encounter obstacles such as inadequate training, lack of resources, and insufficient technical support (Mumtaz, 2000). Identifying these challenges is crucial for developing targeted interventions that can facilitate more effective ICT integration in the classroom.

Lastly, the research will identify the specific ICT platforms that teachers are using during the teaching and learning of Biology. Understanding which tools and platforms are favored by educators can help in assessing their effectiveness and in providing recommendations for future training and resource allocation. Studies have shown that the choice of ICT tools can significantly impact teaching outcomes and student learning experiences (Kozma, 2005)

In today's digital age, the integration of Information Communication Technology (ICT) in education has become a crucial aspect of teaching and learning. As Biology education continues to evolve, it is essential to investigate the experiences and perspectives of teachers regarding ICT integration in the teaching and learning of Biology at the Ordinary level. Ultimately, this study has the potential to contribute to the development of a more effective, engaging, and student-centered Biology education that prepares students for success in the 21st century. The study holds substantial significance for various stakeholders, including educators, students, policymakers, and educational institutions.

1.3Significance of the study

1.3.1 Teachers

For educators, the findings can help identify gaps in teachers' ICT skills and inform targeted professional development initiatives. Understanding their experiences can lead to innovative teaching strategies that effectively integrate ICT, enhancing student engagement and understanding of Biology. Additionally, sharing experiences can foster a collaborative environment where teachers support each other in overcoming challenges related to ICT use.

1.3.2 Learners

For students, assessing how ICT impacts teaching methods can highlight ways to improve learning outcomes in Biology, making the subject more accessible and engaging. Exposure to ICT in Biology lessons helps students develop essential digital skills, preparing them for further education and the workforce. Moreover, understanding how technology influences student motivation can lead to more dynamic and interactive learning experiences, increasing interest in the subject.

1.3.3Policymakers

Policymakers can benefit from this research by gaining evidence on the effectiveness of ICT in education, guiding resource allocation and investment in technology for schools. Insights on ICT use can also contribute to developing curricula that incorporate technology; ensuring education systems remain relevant and effective. Furthermore, the findings can help address disparities in technology access, promoting equity in education and ensuring that all students benefit from ICT-enhanced learning environments.

1.3.4 Educational institutions

For educational institutions, the study can highlight the need for improved ICT infrastructure, prompting investments in necessary tools and resources. The findings can inform strategic

planning processes regarding technology integration in teaching and learning, aligning with modern educational standards. Institutions that effectively integrate ICT based on research findings may enhance their reputation as progressive educational providers, attracting more students and funding.

1.3.5 Researchers

Researchers will add to the existing body of knowledge on ICT in education specifically in Biology teaching and learning. The findings and the recommendations provide for further research and exploration in this area

1.3.6 Researcher

The research will be beneficial to me as the researcher. The research exposed me to plenty of literature and contribute the existing body of knowledge on ICT integration in Biology education. The research enabled me to develop professionally as it enhanced my expertise in ICT integration, Biology education and research methodology.

1.4 Objectives

This research aimed at exploring the three key objectives which are:

To identify school teachers' experience in implementing ICT tools in teaching and learning in classroom.

To determine challenges of using ICT tools in teaching and learning in the classroom among school teachers

To identify ICT platforms teachers are using when teaching and learning.

1.5 Research questions

What are the teachers experiences regarding the integration of ICT in the teaching and learning of Biology?

What are the benefits of using ICT tools in teaching and learning of Biology in the classroom?

What are the challenges faced by teachers when using ICT tools in teaching and learning in the classroom among school teachers?

What are the ways of addressing challenges faced when using ICT in teaching and learning in the classroom?

1.6 Assumptions

Openness from teachers

Assuming that ever information which is going to be gathered is true, correct and relevant

Risk of being given falsified information due to internal reasons

Getting unconditional cooperation of Biology teachers in the district.

1.7 Delimitations

The study was based in Zvimba Biology teachers and their experience on the use of ICT in teaching and learning of biology. The study was carried out in secondary schools that offer science subjects at ordinary and advanced level. The communities of the school differ in terms of financial resources, infrastructure and student behavior. Some schools are in urban areas, some in peri-urban areas and some in rural areas. Schools in urban areas have access to computers and good internet facilities compared to those in peri-urban, rural and remote areas. The research into the experience of teachers on integration of ICT in teaching biology was relatively new and hence little information on the subject was accessed. In addition, teachers and students who are indulged in the traditional method of teaching and learning biology still need copying up for the new era of technology. Teachers require experience to handle ICT, implementing computers and the internet is expensive.

1.8 Limitations

The study was limited by the time available for data collection and analysis due to other academic commitment and work. Given the complexity of assessing teachers' experiences, the duration may not allow for an in-depth exploration of all relevant factors. This constraint led to reliance on a smaller sample size or less comprehensive interviews, potentially affecting the richness of the data collected.

Financial limitations have restricted the scope of the research. Budget constraints impacted the ability to conduct extensive surveys, purchase necessary resources for data collection, or provide

incentives for participants. This resulted in a narrower focus or fewer participants than originally intended; this can affect the generalizability of the findings.

The study was further limited by the sample size and selection criteria for participants. The selected teachers represent a limited geographical area and specific schools, the findings might not be a representative of the broader teaching community. Additionally, voluntary participation could have introduced bias, as those who chose to participate may have more positive or negative experiences than the average teacher.

The availability of Information Communication Technology (ICT) resources in schools vary significantly. Some schools have better access to technology than others; this disparity might have influenced teachers' experiences and perceptions, leading to inconsistent data that does not reflect the overall landscape of ICT use in Biology education.

Teachers' experiences with ICT are inherently subjective and may be influenced by personal biases, teaching styles, and previous training. This subjectivity can affect the consistency and reliability of the data collected, making it challenging to draw definitive conclusions from the findings.

The fast-paced evolution of technology means that the experiences captured in this study may quickly become outdated. As new tools and platforms emerge, the relevance of the findings may diminish, limiting their applicability to future ICT integration in education.

External factors such as changes in educational policy, curriculum requirements, or societal attitudes toward technology in education can also impact teachers' experiences. These factors may create an unpredictable environment that influences the study's outcomes and the generalisability of its findings.

While this study aims to provide valuable insights into teachers' experiences with ICT in teaching Biology, these limitations must be acknowledged. Addressing these constraints in future research could help produce more comprehensive and representative findings.

1.9 Definition of terms

Information Communications Technology(ICT) is defined by Chitate (2016) as the convergence of audiovisual and telephone networks with computer networks through a single cabling or link system .Teaching can be defined as engagement with learners to enable their understanding and

application of knowledge, concepts and processes (Supon&Ruffini 2009). It includes design, content selection, delivery, assessment and reflection. To teach is to engage students into learning; thus teaching consists of getting students involved in the active construction of knowledge. Good teaching requires commitment to a systematic understanding of learning (Mapiye, 2012).

According to White, James and Yi-Fang (2005), learning can be defined as relatively permanent change in one's knowledge or behavior because of the experience. White, James and Yi-Fang (2005) added that learning can be defined as the acquisition of knowledge.

Musante and Potter (2012) defined biology as a natural science which cooperates the study of life and living organisms including their physical and chemical structure, function, development and evaluation.

1.10 Summary

The chapter revealed that biology is a subject that can be taught in the classroom environment by the use of ICT, though teachers have their own experience on the use of ICT. Chapter one did set objectives that will give directions in the carrying out of the study. It was also about the assumptions of the researcher on the study and also the importance of the study. This chapter was focusing on the scope of the study, hindrances of the study that is limitations. This was also taking into consideration the meanings of different words that the researcher will be using throughout the research. The next chapter will be highlighting what other sources are saying pertaining to the teachers' experience on the use of ICT in the teaching and learning of biology.

CHAPTER 2 Review of Related Literature

2.1 Introduction

This chapter seeks to review previous researches done by other authors on the similar study. Literature was reviewed under the following subheadings: Benefits of ICT tools in teaching and learning in the classroom, challenges faced when teaching using ICT tools and ways of addressing challenges faced when using ICT in teaching and learning at global, continental and national level. The chapter also covered the theoretical framework.

2.2 Theoretical Framework: Constructivist theory

Constructivist theory provides a robust framework for understanding the teaching and learning of Biology, particularly in the context of ICT integration. The theory was propounded by Jean Piaget who focused on cognitive development and Vygotsky who highlighted the importance of social interaction in learning. By fostering active, collaborative, and contextual learning experiences, teachers can enhance student engagement and understanding (Johnson et al. 2016). Assessing teachers' experiences with ICT through a constructivist lens can reveal valuable insights into effective teaching practices and highlight areas for improvement, ultimately contributing to the development of more effective educational environments in Biology (Johnson & Johnson, 2017).

The assessment of teachers' experiences with ICT in the constructivist framework involves examining how they perceive and utilize technology in their instructional practices. This can include:

Professional Development: Evaluating the effectiveness of training programs that prepare teachers to integrate ICT into their Biology teaching. Teachers' experiences in these programs can provide insights into their confidence and competence in using technology (Hwang and Wu, 2012).

Pedagogical Strategies: Analyzing how teachers adapt their instructional strategies to incorporate ICT tools that align with constructivist principles. Observations and reflections can reveal the extent to which teachers facilitate active and collaborative learning (Vygotsky, 1978; Piaget, 1954).

Barriers to Integration: Identifying challenges teachers face in integrating ICT, such as lack of resources, insufficient training, or resistance to change. Understanding these barriers can help inform future professional development and support initiatives (Johnson et al ,2016)

Impact on Student Learning: Assessing how teachers perceive the impact of ICT on student engagement, understanding, and achievement in Biology. Surveys and interviews can provide valuable insights into the effectiveness of ICT in facilitating constructivist learning environments.(Huang et al.,2019)

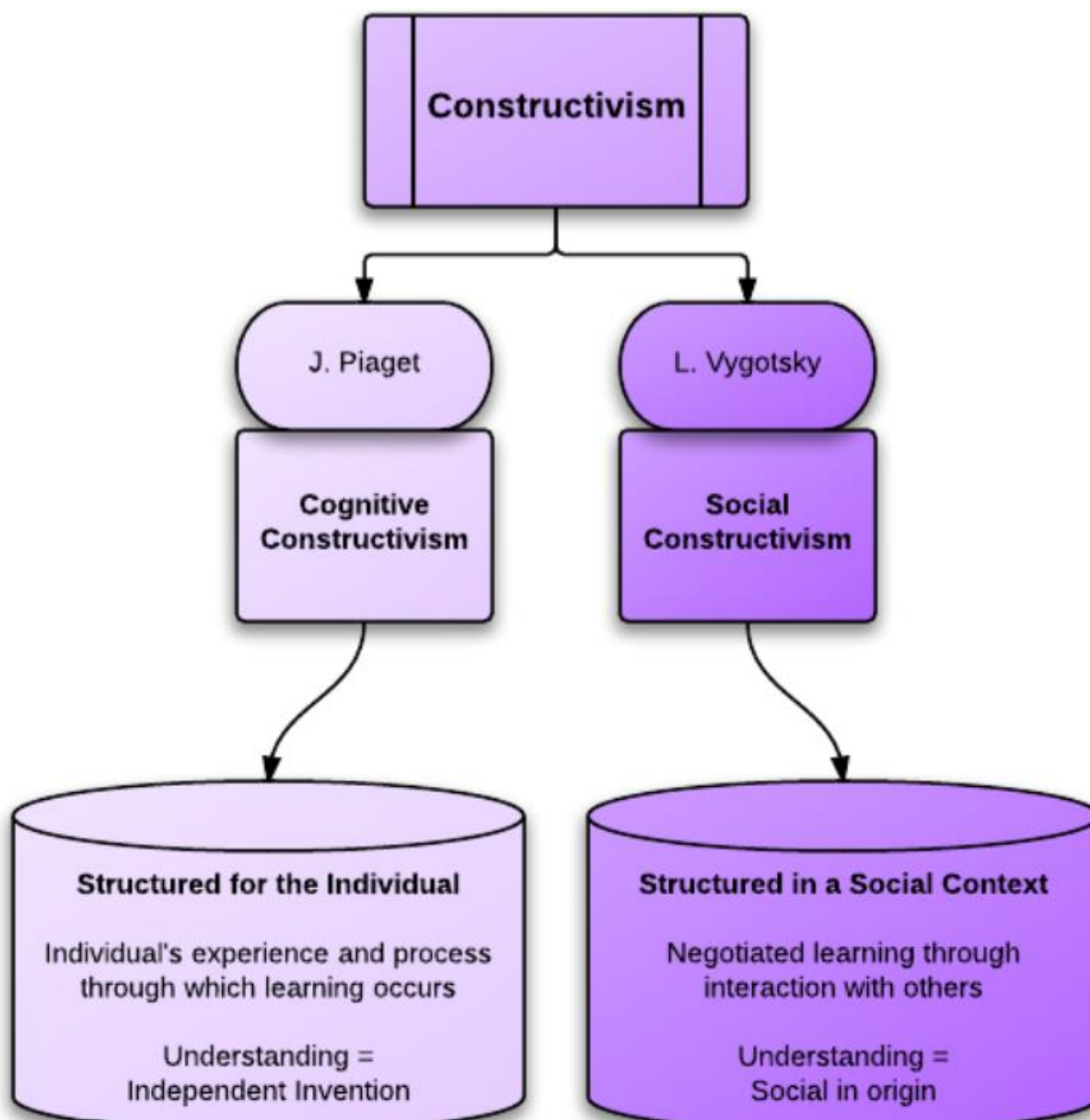


Fig 2.1 Constructivist Theory.

2.3 Review of related literature

The integration of Information and Communication Technology (ICT) tools in education has transformed teaching and learning processes in various subjects including Biology. This literature review aims to assess teacher experiences with ICT in the context of Ordinary level. By examining existing research, this chapter will highlight benefits and challenges associated with ICT use in teaching and learning, as well as strategies educators can employ to effectively incorporate technology into their practice.

2.3.1 What are the benefits of using ICT tools in teaching and learning in the classroom?

Globally, the use of ICT in education has transformed traditional teaching methodologies, making learning more interactive and engaging. One of the primary benefits is increased student engagement. Research indicates that when ICT tools are integrated into the curriculum, students tend to show higher levels of interest and participation in lessons. For instance, interactive simulations and virtual labs allow students to visualize complex biological processes, which can enhance understanding and retention of knowledge (Mtebe & Bagarukayo, 2024). Moreover, ICT facilitates differentiated instruction, catering to diverse learning styles and paces. Teachers can utilize various digital resources, such as videos, animations, and interactive quizzes, to meet the individual needs of students. This adaptability is crucial in subjects like Biology, where concepts can vary significantly in complexity (Kisanjara & Maguya, 2024). Additionally, the collaborative nature of many ICT tools encourages teamwork among students, fostering a sense of community and shared learning experiences (Alvarez-Alvarez & Mischel, 2024).

In the African context, the integration of ICT in Biology education presents both opportunities and challenges. Countries like South Africa and Kenya have made significant strides in incorporating technology into their educational systems. In South Africa, the Department of Basic Education has implemented various ICT initiatives aimed at improving teaching and learning outcomes. Studies show that the use of ICT tools in Biology classes has led to improved student performance and engagement, particularly in rural areas where traditional resources may be limited (Chigona, 2024). Similarly, in Kenya, the introduction of digital learning platforms has revolutionized Biology education. The use of mobile technology and e-learning resources has made it possible for students to access a wealth of information beyond the classroom. This accessibility is particularly beneficial in a subject like Biology, where real-time data and research can enhance learning (Mfaume, 2024). However, challenges such as inadequate infrastructure and limited teacher training in ICT usage remain significant barriers to effective implementation.

In Zimbabwe, the integration of ICT in Biology education is still in its nascent stages, but there are promising developments. The Zimbabwean government has recognized the importance of ICT in education and has initiated programs to enhance digital literacy among teachers and students. Research indicates that the use of ICT tools in Biology classes has the potential to improve student engagement and understanding of complex biological concepts (Zenda et al., 2024).

A study conducted in Zimbabwean secondary schools highlighted that teachers who utilized ICT tools reported higher levels of student participation and enthusiasm during Biology lessons. The interactive nature of ICT resources, such as virtual dissections and online simulations, allows students to explore biological concepts in a hands-on manner, which is particularly effective in a subject that often relies on visual and practical understanding (Muzira et al., 2024). However, the study also pointed out challenges such as inconsistent electricity supply and limited access to technology in rural schools, which hinder the widespread adoption of ICT in Biology education.

The benefits of using ICT tools in the teaching and learning of Biology are evident across various contexts. Globally, ICT enhances student engagement, facilitates differentiated instruction, and promotes collaboration. In the African context, countries like South Africa and Kenya demonstrate the positive impact of ICT on educational outcomes, despite facing infrastructural challenges. In Zimbabwe, while the integration of ICT in Biology education is still developing, initial findings suggest significant potential for improving student learning experiences. Addressing the challenges of infrastructure and training will be crucial for maximizing the benefits of ICT in Biology education in Zimbabwe and beyond.

2.3.2 What are the challenges faced by teachers in using ICT tools in teaching and learning?

The integration of Information and Communication Technology (ICT) in education has the potential to enhance teaching and learning experiences. However, teachers across various contexts face numerous challenges when implementing these tools in the classroom.

Globally, teachers encounter several barriers when integrating ICT into their teaching practices. One of the primary challenges is the lack of adequate training and professional development. Many teachers report feeling unprepared to use ICT tools effectively due to insufficient training programs that do not equip them with the necessary skills (Mndzebele, 2013). Additionally, the availability of ICT resources varies significantly, with many schools lacking essential infrastructure such as reliable internet access and modern devices, which hampers effective teaching (Adomi & Kpangban, 2010).

Another significant challenge is the resistance to change among educators. Some teachers are accustomed to traditional teaching methods and may be reluctant to adopt new technologies,

fearing that they may complicate their teaching processes rather than enhance them (Mtebe & Bagarukayo, 2024). Furthermore, the rapid pace of technological advancement can leave educators struggling to keep up, leading to a gap between available tools and teachers' competencies in using them effectively (Kisanjara & Maguya, 2024).

In the African context, the challenges of using ICT in education are compounded by infrastructural issues and socio-economic factors. For instance, in Nigeria, teachers face significant obstacles such as inadequate electricity supply, which limits the use of ICT tools in classrooms (Chigona, 2024)

Additionally, the lack of funding for ICT initiatives means that many schools cannot afford the necessary equipment or maintenance, further exacerbating the problem (Mfaume, 2024).

Similarly, in Kenya, while there has been progress in integrating ICT into education, teachers still report challenges related to inadequate training and support. Many educators feel overwhelmed by the demands of integrating technology into their teaching without sufficient guidance or resources (Mtebe & Bagarukayo, 2024) A study carried in Rwanda by Kamonyo,E., Mbarute ,E. and Nzarirwa in 2022 show that there is need for educators to be developed professionally if there is to be an effective use of ICT tools by teachers. Moreover, the disparity between urban and rural schools in terms of access to ICT resources creates inequities in educational opportunities, making it difficult for all students to benefit equally from technology-enhanced learning (Mfaume, 2024).

In Zimbabwe, the challenges faced by teachers in using ICT tools for teaching are multifaceted. A significant barrier is the lack of infrastructure, particularly in rural areas where access to reliable electricity and internet connectivity is limited (Zenda et al., 2024).This lack of infrastructure not only affects the availability of ICT tools but also impacts teachers' ability to integrate these tools into their lessons effectively.

Furthermore, teachers in Zimbabwe often report insufficient training in ICT usage. Many educators have not received adequate professional development opportunities to enhance their digital literacy and pedagogical skills related to ICT integration (Muzira et al., 2024) This gap in training leads to a lack of confidence among teachers when using technology in the classroom, which can hinder the effective implementation of ICT tools in teaching Biology and other subjects. Additionally, the socio-economic context in Zimbabwe poses challenges, as many schools struggle with limited

funding for ICT resources. Teachers often have to rely on outdated technology or lack access to essential tools, which can diminish the effectiveness of their teaching (Zenda et al., 2024)

The challenges faced by teachers in using ICT tools in teaching and learning are significant and varied across different contexts. Globally, issues such as inadequate training, resistance to change, and resource availability hinder effective ICT integration. In the African context, infrastructural challenges and socio-economic factors further complicate the situation, as seen in Nigeria and Kenya. In Zimbabwe, the lack of infrastructure and insufficient training for teachers are critical barriers that need to be addressed to enhance the use of ICT in education.

2.3.3 What are the ways for addressing challenges faced when using ICT in teaching and learning?

The integration of Information and Communication Technology (ICT) in education has the potential to enhance teaching and learning experiences significantly. However, educators often face various challenges that hinder effective ICT implementation in the classroom.

Globally, the challenges of ICT integration in education are well-documented. One of the primary strategies to address these challenges is through professional development and training. Research indicates that ongoing training programs can significantly enhance teachers' confidence and competence in using ICT tools effectively. For instance, a study in the United States highlighted that teachers who participated in structured ICT training reported improved skills and a greater willingness to integrate technology into their teaching practices (Ertmer & Ottenbreit-Leftwich, 2010)

Another critical approach is the improvement of infrastructure. Many schools, particularly in developing regions, face issues such as inadequate internet connectivity and lack of access to modern devices. Governments and educational authorities must prioritize investments in ICT infrastructure. For example, in Finland, significant investments in educational technology have led to improved access and integration of ICT in classrooms, resulting in enhanced learning outcomes (Kivunja, 2014).

In the African context, the challenges of using ICT in education are compounded by infrastructural issues and socio-economic factors. One effective strategy to address these challenges is through

collaborative partnerships. For instance, in Kenya, the government has partnered with private organizations to improve internet access in schools, facilitating better use of ICT tools in classrooms (Mtebe & Bagarukayo, 2024). Such partnerships can provide the necessary resources and support for schools to enhance their ICT capabilities.

Additionally, curriculum integration is vital. By embedding technology into lesson plans and learning activities, educators can create more engaging and relevant learning experiences for students. In South Africa, studies have shown that when ICT is integrated into the curriculum, teachers are more likely to utilize technology effectively, as it aligns with their pedagogical goals (Mtebe & Bagarukayo, 2024).

In Zimbabwe, the challenges faced by teachers in using ICT tools for teaching are multifaceted. A significant barrier is the lack of infrastructure particularly in rural areas where access to reliable electricity and internet connectivity is limited (Zenda et al., 2024). Addressing infrastructural challenges is essential for successful ICT integration. The government and educational authorities must prioritize investments in ICT infrastructure to ensure that all schools have access to the necessary resources.

Furthermore, supportive leadership and policies are crucial for fostering an environment conducive to ICT integration. School administrators play a vital role in promoting a culture of technology use by providing resources, support, and encouragement to teachers. In Zimbabwe, schools with strong leadership support for ICT initiatives have experienced higher levels of teacher engagement and successful technology integration (Muzira et al., 2024).

Lastly, peer collaboration among teachers can help address challenges related to ICT integration. Professional learning communities (PLCs) allow teachers to share experiences, resources, and strategies for using technology effectively. In Zimbabwe, teachers who participated in collaborative groups reported increased confidence and improved practices in ICT integration (Zenda et al., 2024).

Addressing the challenges faced by teachers in using ICT in the classroom requires a multifaceted approach. Professional development, infrastructure improvement, curriculum integration, supportive leadership, and collaboration among educators are all essential strategies that can

enhance the effective use of technology in teaching and learning. By implementing these strategies, educational institutions can create an environment that supports teachers in overcoming barriers to ICT integration, ultimately benefiting student learning outcomes.

A method can simply be described as the way in which one does something (Arubayi 2015). The method a teacher uses to bring the desired outcome in the teaching and learning process cannot be overlooked (Arubayi 2015). All the methods of teaching science can be classified into two types which are teacher-centered and learner-centered. According to Harrison and Killion (2007), teacher centered methods focus on telling, memorizing, and recalling information. Pariwa (2016) pointed, student participation is limited wherein they only ask questions or answer questions. Most of the time learners are passive listeners and receive the knowledge. The teacher is center of the process that goes on in the classroom (Craswell 2009). Learner-centered, emphasizes on need, requirement, interest and capability of students. The students are active participants where their skills and abilities are developed. The climate in the classroom is conducive where flexibility is there. According to Harrison (2007), teacher and students jointly explore the different aspects of the problem. The function of the teacher is to create a problematic situation, provide materials and resources for the students which help to solve the problem. The teacher then assists in identifying issues, state hypotheses, clarify and test hypotheses and draw conclusions, (Harrison & Killion, 2007). There are various methods available for achieving effectiveness and the teacher has full responsibility for selecting the most appropriate method for the prevailing circumstances in order to achieve the aims of teaching science in secondary schools. According to Arubayi (2015), these methods are laboratory, practical work, demonstration, project, and guided discovery and inquiry methods. Arubayi (2015) commented that in laboratory method, the laboratory is an indispensable tool in the teaching of science which provides students with a place or setting, to attack and solve problems, collect data, prove ideas and carry out an investigation which emphasizes learning by “doing”. This laboratory method of teaching is made up of different types of activities ranging from the experimental investigations to confirmatory exercises and skill learning. Harrison and Killion (2007) postulated that the major objectives found in laboratory work are as follows; the development of skills, concepts, cognitive abilities and understanding of the nature of science. The skills such as manipulative, inquiry, investigation, organizational and communicative, can be developed from laboratory experiences. Genome (2012) added that concepts such as hypothesis, theoretical models and taxonomic category are developed and cognitive abilities such as critical

thinking, problem solving, application, analysis, synthesis, evaluation, decision making, and creativity are developed through laboratory experiences. Arubayi (2015) suggested that practical work is another teaching method in science. Genome (2012) supported that good quality practical work can engage students, help them to develop important skills, help them to understand the process of scientific investigation and develop the understanding of the concepts. Practical works are very important because can help the learner, clarify and extend the learner's experience of natural phenomenon. It provides opportunities for students to practice the correct use of apparatus which is very important in teaching of biology. Demonstration method according to Arubayi (2015), is another method of teaching science. He described this method of instruction as a showing procedure, to explain, to teach and inform students. Harrison and Killion (2007) added that demonstration method is a visible presentation of ideas, skills, attitudes, processes and other intangibles. Genome (2012) postulated that for a successful lesson and for it to be very effective during the demonstration method, the lesson should be planned ahead of time, have all necessary materials and equipment needed for the demonstration lesson and participants should be given clear and simple instructions. Project method is another example of a method of teaching science in secondary schools. Uzoka (2012) pointed that project method is any activity that is done by learners mentally and physically but in real life situation under the guidance of a teacher. In other words, according to Green (2012), the great aim is to allow students to have first-hand experience on how to do something. According to Arubayi(2015), inquiry based approach, is another way used in learning of science. This approach has a potential to increase intellectual engagement and foster deep understanding through the development of hands-on, minds-on and research based disposition towards teaching and learning (Lu, Hou& Huang 2010).

2.4 Summary

This chapter revealed the related literature concerning the research. It focused on the use of ICT and teacher perception in teaching and learning of biology. It focused on the literature on the barriers which hinder the use of ICT in secondary schools. It also focused on teacher attitudes, experience and confidence in ICT use. The next chapter is on research methodology. It will present the research design, population, sampling procedure, research design, population, sampling procedure, research instrument, data collection, and presentation procedure.

CHAPTER THREE Research Methodology

3.1 INTRODUCTION

The thrust of this chapter is to describe and underline the methodological parameters of the research which define the direction of the research. The research methodology was discussed under the following subheadings: research paradigm, research approach, research design, target population, sample size and sampling procedure, data collection methods, data collection tools, reliability and validity of data, ethical considerations as well as the summary chapter.

3.2 Research paradigm

Guba and Lincoln (2017) define a paradigm as a basic set of beliefs or worldview that guides research action or an investigation. Similarly, Denzin and Lincoln (2016), define paradigms as human constructions, which deal with first principles or ultimate indication where the researcher is coming from so as to construct meaning embedded in data. A scientific or quantitative research tends to use positivism as a conceptual framework for research. Quantitative research always follows positivist approach because positivists believe in the empirical hypothesis testing (Creswell, 2017). In pure sciences, positivism is preferred because of its empirical nature to study facts.

In quantitative research, the research follows a probabilistic model that is determined by previous research. Positivists believe that the findings of one study can be generalized to another study of a similar kind regardless of the fact that it is conducted in a different environment and situations (Fadhel 2018). In this research, positivist paradigm was used. Comte (2018 – 2019), referred the positivist paradigm as a worldview to research, which is grounded in what is referred to in research methods as the scientific method of investigation. Comte (2019) postulated that experimentation, observation and reason based on experience ought to be the basis for understanding human behavior, and therefore, the only legitimate means of extending knowledge and human understanding.

According to Creswell and Poth (2018) positivist research paradigm is used to search for cause-and-effect relationships in nature. It is chosen as the preferred worldview for research, which tries

to interpret observations in terms of facts or measurable entities (Tarisayi, 2022). Research located in this paradigm relies on deductive logic, formulation of hypotheses, testing those hypotheses, offering operational definitions and mathematical equations, calculations, extrapolations and expressions, to derive conclusions (Walliman 2015). It aims to provide explanations and to make predictions based on measurable outcomes.

The positivist paradigm refers to the researcher's attempts to explain the phenomena they study in the most economical way possible (Fadhel, 2017). Finally, the generalisability assumption tells us that results obtained from a research project conducted within the Positivist paradigm, in one context, should be applicable to other situations by inductive inferences (Wright et al 2017). Using the positivist research paradigm, the researcher should be able to observe occurrences in the particular phenomenon they have studied, and be able to generalise what can be expected elsewhere in the country.

3.3 Research Approach

The researcher opted for a quantitative approach. The quantitative research approach include pragmatic knowledge claims sequential, concurrent and transformative (Creswell and Clark 2016). Quantitative research is a systematic investigation that primarily focuses on quantifying relationships, behaviors, and phenomena. This approach employs mathematical, statistical, and computational techniques to analyze numerical data, allowing researchers to derive meaningful insights and make informed decisions (Creswell, 2014). The characteristics of quantitative research include objectivity, measurability, and generalizability. Objectivity is achieved through the use of standardized instruments, minimizing researcher bias and ensuring that data is collected uniformly across all participants (Creswell, 2014). Measurability is another key characteristic, as quantitative research focuses on quantifying variables, enabling researchers to assess relationships and differences statistically (Shields & Rangarajan, 2013). Generalizability is also a crucial aspect, as quantitative research often aims to generalize findings from a sample to a larger population through random sampling techniques (Trochim, 2006).

Quantitative research encompasses several methodologies, including descriptive research, correlational research, and experimental research. Descriptive research aims to describe characteristics of a population or phenomenon, often using surveys and observational methods to

collect data without manipulating variables (McLeod, 2019). Correlational research examines the relationship between two or more variables without implying causation, using statistical techniques to determine the strength and direction of relationships (Field, 2013). Experimental research involves manipulating one or more independent variables to observe their effect on a dependent variable, characterized by random assignment and control groups, allowing for causal inferences (Creswell, 2014).

The advantages of quantitative research include statistical analysis, clarity and precision, and large sample sizes. Statistical analysis allows researchers to test hypotheses and validate findings with a high degree of confidence (Field, 2013). Clarity and precision are achieved through numerical data, making it easier to communicate findings to a broader audience (Trochim, 2006). Large sample sizes enhance the reliability and validity of results, allowing researchers to generalize findings to a larger population (Shields & Rangarajan, 2013).

However, quantitative research also has limitations. One major limitation is the lack of context, as quantitative studies often fail to capture the context in which data is collected, leading to a superficial understanding of complex phenomena (McLeod, 2019). Another limitation is the rigidity of quantitative research, which may limit the exploration of unexpected findings or insights that emerge during the research process (Creswell, 2014). Additionally, statistical data can be misinterpreted or manipulated, leading to misleading conclusions if not carefully analyzed (Field, 2013). The researcher chose the quantitative research approach is a valuable method for collecting and analyzing numerical data to understand relationships and phenomena. Its objectivity, measurability, and generalizability make it a powerful tool in various fields, including social sciences, health, and education. However, researchers must remain aware of its limitations and complement quantitative methods with qualitative approaches to gain a holistic understanding of the research topic.

3.4 Research design

The research design refers to the overall strategy that a researcher can choose to integrate the different components of the study in a coherent and logical way, thereby, ensuring you will effectively address the research problem, it constitutes the blueprint for the collection, measurement, and analysis of data (Stake, 2015). It is important to note that your research problem

determines the type of design that can be used. The research design is the glue that ties together the research process, providing direction of the research study (Yin 2015). Thus, for this study the researcher used a case study because he wanted to carry out an assessment of the teachers experiences on the use of ICT in the teaching and learning of Biology in secondary schools under study.

According to Jamna (2018), a case study is an in-depth study of a particular research problem rather than a sweeping statistical survey. It is often used to narrow down a very broad field of research into one or a few easily researchable examples. The case study research design is useful for testing whether a specific theory and model actually applies to a phenomenon in the real world (Hlomain 2020). It is a useful design when not much is known about a phenomenon and it's an approach that excels at bringing us to an understanding of a complex issue through detailed contextual analysis of a limited number of events or conditions and their relationships (Dube, 2020). To answer the research questions of this study, the researcher used the case study on three selected secondary schools in Zvimba district.

The design can extend experience or add strength to what is already known through previous research. Social scientists, in particular, make wide use of this research design to examine contemporary real-life situations and provide the basis for the application of concepts and theories and extension of methods (Chidakwa, 2021). For this study the researcher used a case study design which makes it simple to narrow down a very broad field of research into one or a few easily researchable examples. In the study the mixed research was designed with the objective of establishing the factors affecting effective teaching and learning of Biology with Zvimba secondary schools as a reference. The study involved designing of teachers, head of departments and school heads questionnaires which were answered by them in the selected secondary schools. Interviews were conducted with the heads of science departments and school heads of the sample schools.

3.5 Target Population

According to Lavrakas, (2018) target population for a survey is the entire set of units for which the survey data are to be used to make inferences. Thus, the target population defines those units for which the findings of the survey are meant to generalize. The Participants were drawn from

three schools; Mururi secondary school, Matoranhembe High School and Kawondera secondary school. The schools were selected through purposive sampling taking into consideration the distance from which the researcher resides and the fact that all the three schools offer Biology at Ordinary level. The population included secondary Biology teachers, science head of department as well as school heads. The sample comprised of ten Biology teachers, three heads of department and three school heads.

3.6 Sample Size And Sampling Procedure

In research terms a sample is a group of people, objects, or items that are taken from a larger population for measurement (Cohen, 2016). The sample should be representative of the population to ensure that the findings from the research sample can be generalised to the population as a whole. According to Lunga (2021) in most cases it is impossible or costly and time-consuming to research the whole population. Hence, examining the sample provides insights that the researcher can apply to the entire population. Making an enumeration of the whole population is practically impossible. The sample usually represents a manageable size from this population. Researchers then collect data from these samples in the form of surveys, polls, and questionnaires and interviews and use this data analysis to the broader community (Lohr, 2019). There are different types of techniques which help us to gather a sample depending upon the need and situation. Cluster sampling techniques were used in the study, which is a method where the respondent population is divided into equal clusters. Thompson (2017) defined cluster sampling is where the whole population is divided into clusters or groups. Subsequently, a random sample is taken from these clusters, all of which are used in the final sample (Chipato, 2021). The stages of cluster sampling were followed, with the first stage being choosing cluster grouping for sampling frame, then the numbering of each of the clusters and lastly the selection of a cluster using random sampling was conducted. Clusters were identified and included in a sample based on defining demographic parameters such as subject of study, location, sex, among others. This makes it extremely easy for a survey creator to derive practical inferences from the feedback. Research studies were then administered to participants in these clusters. Ten teachers were involved in this research through answering a questionnaire. Three head of department sciences and the Biology teachers from selected schools answered questionnaires and school heads of schools were interviewed. Three Biology teachers from two secondary school and four from the high school,

heads of science department from each school and school heads gives a total of sixteen participants for the research.

3.7Data collection methods

Data is a collection of facts, figures, objects, symbols, and events gathered from different sources (Turner and Houle,2019). Organizations collect data to make better decisions .Without data, it would be difficult for organizations to make appropriate decisions, and so data is collected at various points in time from different audiences. Data collection is a methodical process of gathering and analyzing specific information to proffer solutions to relevant questions and evaluate the results (Saunders, Lewis & Thornhill, 2018). It focuses on finding out all there is to a particular subject matter. Data is collected to be further subjected to hypothesis testing which seeks to explain a phenomenon. Hypothesis testing eliminates assumptions while making a proposition from the basis of reason. The study employed two major methods for the collection of relevant data, questionnaires were used on Biology teachers and heads of science departments. Interviews were used on school heads and science head of departments for the sampled schools. The next section will cover the data collection tools used in the study.

3.7.1Data collection tools

Data collection tools refer to the devices/instruments used to collect data, such as a paper questionnaire or computer-assisted interviewing system (Turner & Houle, 2019). In a Case Study, interviews, surveys and questionnaires are the tools commonly employed to collect data (Maboni, 2021). The objective behind data collection was to capture quality evidence that allows analysis to lead to the formulation of convincing and credible answers to the posed questions.

3.7.2 Structured interviews

According to Turner and Houle (2019) an interview is a face-to-face conversation between two individuals with the sole purpose of collecting relevant information to satisfy a research purpose. Interviews are of different types namely; [structured](#), [semi-structured](#), and [unstructured](#) with each having a slight variation from the other. In this method, the interviewer asks questions on face-to-face basis with the participants, asking a series of questions to the interviewee in person and notes down responses (Londima, 2018). The interview was employed as a form of data collection

suitable to the few participants in this case on head of science departments and principals. The main advantage of interviews was to gain an in-depth understanding of perceptions or opinions on a topic (Yin 2015). However, they are rather time-consuming hence the need to manage time jealously. In order to save on time, the structured interviews were employed on head of science department and school principals of the sampled schools.

A structured interview is essentially a questionnaire which is mediated or administered by the researcher (Turner & Houle, 2019). In this study, structured interview was used to increase response rates and to help the researcher get an in-depth understanding of the participants' responses in the questionnaires (Hallele, 2020). Interview schedules were conducted with the participants of the sample group. Several advantages of these interviews were that they enabled the researcher to obtain useful information about the teachers experiences in the use of ICT during teaching and learning of Biology, they also gave room for more detailed questions to be asked, they enhanced a high respond rate, the participants' own words were also recorded, and it was easy to clarify ambiguities and follow the incomplete answers (Turner & Houle 2019).

3.7.3 Questionnaires

Kazomuka (2020), asserts that a questionnaire is a printed set of questions, either open-ended or closed-ended, where the participants are required to answer based on their knowledge and experience with the issue concerned. The questionnaire used was a part of the survey, whereas the questionnaire's end-goal may or may not be a survey in some instances. The study employed the use of paper questionnaires as data collection tools consisting of a series of questions for the purpose of gathering information from participants (Tarisayi, 2022). The questionnaires were designed for statistical analysis of the responses and also used as a form of data collection tool (Trochim 2015). There are three kinds of questions used which include fixed-alternative, scale, and open-ended. They also simplified the task of categorising, tabulating and summarizing reactions or responses from the participants (Chiromo, 2021). The questionnaires used contained both open ended items and closed ended ones. The next section will cover the reliability and validity of data.

3.8 Reliability and validity of data

3.8.1 Reliability of data

According to Mureza (2021), reliability refers to the extent to which the same answers can be obtained using the same instruments more than one time. In simple terms, if your research is associated with high levels of reliability, then other researchers need to be able to generate the same results, using the same research methods under similar conditions. Reliability is a concern every time a single observer is with the source of data, because we have not certain to guard against the impact of that observer's subjectivity" (Wakura, 2020:9). In the study, reliability is the degree to which an assessment tool produces stable and constant results. The idea behind reliability is that any significant results must be more than a one off finding and can be repeatable and reliability was enhanced by the inclusion of similar items on a measure, by testing a diverse sample of individuals and also using uniform testing procedures (Yin 2015).

3.8.2 Validity of data

Validity of research can be explained as an extent at which requirements of scientific research method have been followed during the process of generating research findings (Oliver, 2016). According to Trochim (2015) validity is the accuracy and meaningfulness of inferences drawn from the researcher findings. It is the degree to which results obtained from the analysis of the data actually represent the phenomena under study Mugenda and Mugenda, (2017). Kumar (2015) defined validity as the quality of data gathering instrument or procedures that enable the instrument to measure what it is supposed to measure. In this study, validity refers to the extent to which the instruments cover the objectives. In the study, the researcher ensured validity of the findings by conducting pilot testing with the form three Biology learners of the sampled schools.

3.9 Ethical considerations

Bryman and Bell (2017) defined ethical considerations in research as a set of principles that guide your research designs and practices. The study ensured that the participation of participants in the research was on voluntary basis and they have the right to withdrew from the study at any given stage if the wish to do so (Muchopa et al, 2019). In addition, the study observed the principle of informed consent, whereby the researcher provided sufficient information and assurance about

taking part to fully understand the implications of participation and freely decide on their own (Manibi, 2020). The study seeks to ensure the privacy and anonymity of participants as of a paramount importance. Moreover, the study ensured the acknowledgement of works done by other authors which was used in any part of the study. The next section will cover the processing and analysis of data.

3.10 Data processing and analysis

Data processing is a series of actions or steps performed on data to verify, organize, transform, integrate, and extract data in an appropriate output form for subsequent use (Cohen, Manion, Morrison & Morrison, 2017). Methods of data processing must be rigorously documented to ensure the utility and integrity of the data. Data Analysis involves actions and methods performed on data that help describe facts, detect patterns, develop explanations and test hypotheses (Chiremba, 2018). This includes data quality assurance, statistical data analysis, modeling, and interpretation of results.

Saunders, Lewis and Thornhill (2017) pointed out that the data processing starts with data in its raw form and converts it into a more readable format, giving it the form and context necessary to be interpreted by computers and utilized by other participants. There are several stages of data processing with data collection as the first stage, in this stage data is pulled from available sources, including data lakes and data warehouses (Wakura, 2020). It is important that the data sources available are trustworthy and well-built so the data collected which can later be used as information, should be of the highest possible quality.

Secondly there is the data preparation, once the data is collected, it undergoes preparation stage which is often referred to as the pre-processing stage, at which stage raw data is cleaned up and organized for the next stage of data processing (Dube, 2020). During preparation stage, raw data is diligently checked for errors; however, the purpose of this step is to eliminate redundant, incomplete and incorrect data in order to create high-quality data (Mureri, 2018).

In addition there is the data input, where clean data is then entered into the computer and translated into a language that it can be easily understood.

Furthermore, the data inputs in the computer are actually processed for interpretation and thereafter we have the data output and interpretation, at this stage data is finally usable to non-data scientists

(Saunders, Lewis & Thornhill, 2017). The data is then translated, readable, and in the form of graphs and plain text. Data storage and reporting is the final stage in data processing. After all of the data is processed, it is then stored for future use. While some of the information may be put to use immediately, much of it will serve a purpose later on. In addition, properly stored data is a necessity for compliance with data protection legislation. The data would be properly stored, so that it can be quickly and easily accessed by members of the organization when needed.

Data analysis as the systematic application of statistical and logical techniques to describe the data scope, modularize the data structure, condense the data representation, illustrate via images, tables, and graphs, and evaluate statistical inclinations, probability data, and derive meaningful conclusions (Ndoni, 2019). These analytical procedures enable us to induce the underlying inference from data by eliminating the unnecessary chaos created by its rest. Data generation is a continual process; this makes data analysis a continuous, iterative process where the collection and performing data analysis simultaneously (Chikosi, 2020). Ensuring data integrity is one of the essential components of data analysis.

Data analysis is a process used by researchers for reducing data to a story and interpreting it to derive insights. The data analysis process helps in reducing a large chunk of data into smaller fragments, which makes sense.

The quantitative analysis is used for the quantification of data which allows the generalization of the results obtained from a sample to a population of interest (Saunders, Lewis & Thornhill, 2019). In simple terms, statistical methods of data analysis are used to collect raw data and transform it into numerical data. In this study the mean which is also the average is the most basic method of analyzing data where the sum of a numbers list is divided by the number of items on that list.

3.11 Summary

Once the data is collected the data should be processed or organized for analysis. During the analysis phase, data analysis tools and software can be used which will help you to understand, interpret, and derive conclusions based on the requirements. The data interpretation is the

interpretation of results through charts and tables as appropriate. Data visualisation was used to discover unknown facts. The next chapter covered data presentation, analysis and discussion of the findings of data.

CHAPTER 4 Data Presentation, Interpretation and Analysis

4.1 Introduction

The study sought to establish if there was ongoing support of teachers to enable and motivate them utilize ICT in their teaching and learning of Biology in schools in Zvimba District. Data analysis and presentation. The first step was that of transcription, that was getting the material from questionnaires, interviews and observation. Data was codified according to similar responses. Questions were asked and presentation was done using Excel. Tables were used to summarize and present collected data. The data was fully analyzed by means of descriptive statistics. Chapter 4

4.1 .1 Introduction

A quantitative survey was used to collect the data. The first step was that of transcription, that was getting the material from questionnaires and interviews. Data was codified according to similar responses. Collected data was presented using Microsoft excel. Tables were used to summarize and present collected data. The data was fully analysed by means of descriptive summary.

4.2 Teachers experiences regarding the integration of ICT in the teaching and learning of Biology.

The analysis on the teacher's questionnaire

4.1 How familiar are you with the use of ICT tools in teaching and learning of Biology?

Table 2: How familiar are teachers with the use of ICT tools

	Good	Very good	Not sure	Poor	Very poor
Frequency	4	4		8	
Percentage	25	25	0	50	0

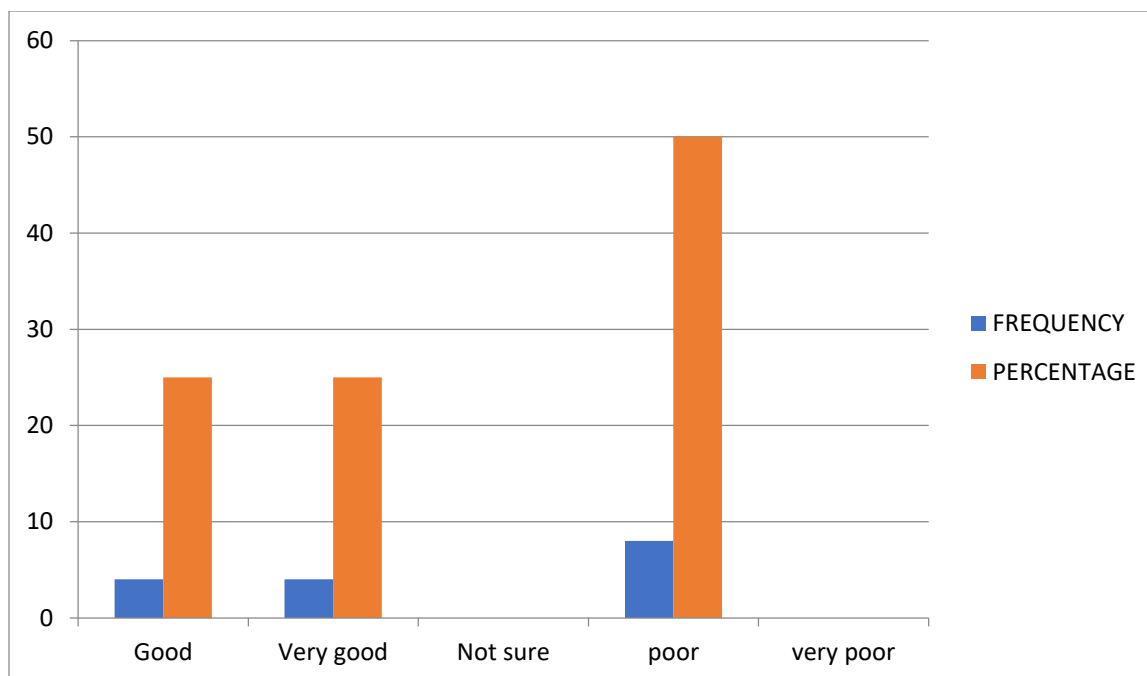


Fig 4.1 How familiar are teachers with the use of ICT tools

As presented on table 2, 4 (25) of the teacher responded very good, 4 (25%) responded good and 8 (50%) responded poor

4.2 How often do you use ICT tools in your lessons?

Table 2 summary of usage of ICT tools in lessons.

How often	Frequency	Percentage
Daily	0	
Weekly	4	25
Monthly	8	50
Not at all	4	25

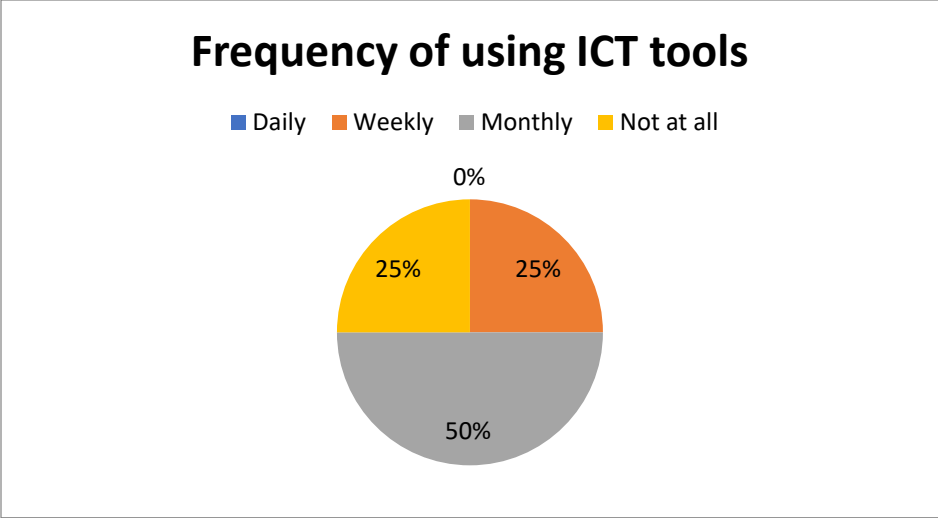


Fig 4.2 Frequency of using ICT tools

As presented by the table above 4 (25%) use them weekly, 8(50%) monthly, 4 (25%),4 (25%) and none of the teachers use ICT tools daily.

4.3 Section C

4.3 Do you have power supply at your school?

Yes	No
Number 16	Number 0
Percentage 100	Percentage 0

Table 3: power supply at school

All of the teachers (100%) responded of having power supply at their schools a shown by the table

4.4 Internet accessibility at school

Table 4 Internet accessibility at school

		Very good	Good	Poor	Very poor
(a)internet connectivity at your school	<i>Frequency</i>	0	4	4	8
	<i>Percentage</i>	0	25	25	50
(b) internet connectivity stable and reliable	<i>Frequency</i>	0	4	8	4
	<i>Percentage</i>	0	25	50	25
(c) internet speed enough to support use of digital technology during teaching	<i>Frequency</i>	0	4	8	4
	<i>Percentage</i>	0	25	50	25

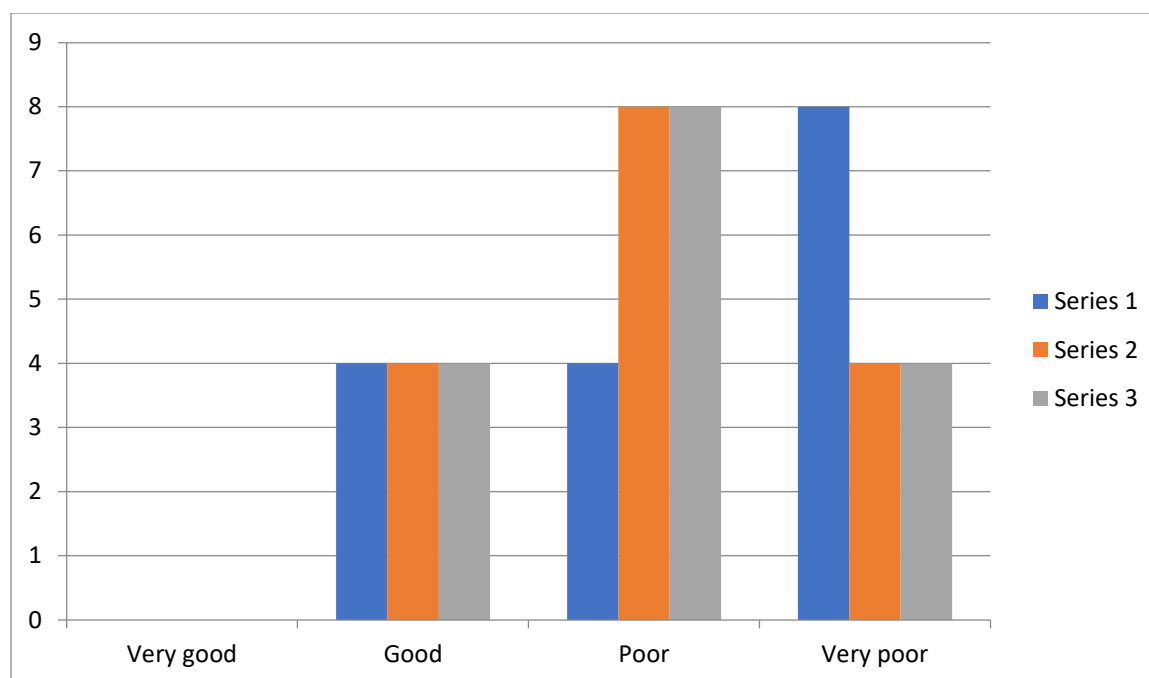


Fig 4.3: Internet accessibility at school.

Table 4 provides results on the accessibility of internet at schools .4(25%) responded that the internet connectivity is good , 4 (25%) responded that internet connectivity is poor and 8 (50%) responded that the internet connectivity at the school is very poor

4.5 Benefits of using ICT tools in teaching and learning of Biology

Table 5 acronyms and description of changes observed since the use of ICT tools

Acronym	Description
LKRCE	Level of knowledge retention of science concepts and experiments
LUC	Level of learners understanding concepts
LPL	Level of personalised learning
LCT	Level of collaboration learning and teamwork

Given below is an analysis on the changes observed since the teacher started ICT tools when teaching Biology based on fig 4.

The survey results have shown that on LKRCE 8(50%) very good, 4(25%) good, 4(25%) fair. LUC 8(50%) very good, 4 (25%) good, 4 (25%) fair, LPL 12(75%) very good, 4 (25%) fair, LCT 8(50%) very good, 4 (25%) good, 4(25%) fair.

4.6 Are ICT tools beneficial in teaching and learning of Biology?

Table 6 Benefits of ICT tools

Response	Frequency	Percentage
ICT tools are beneficial	12	75
ICT tools not beneficial	4	25

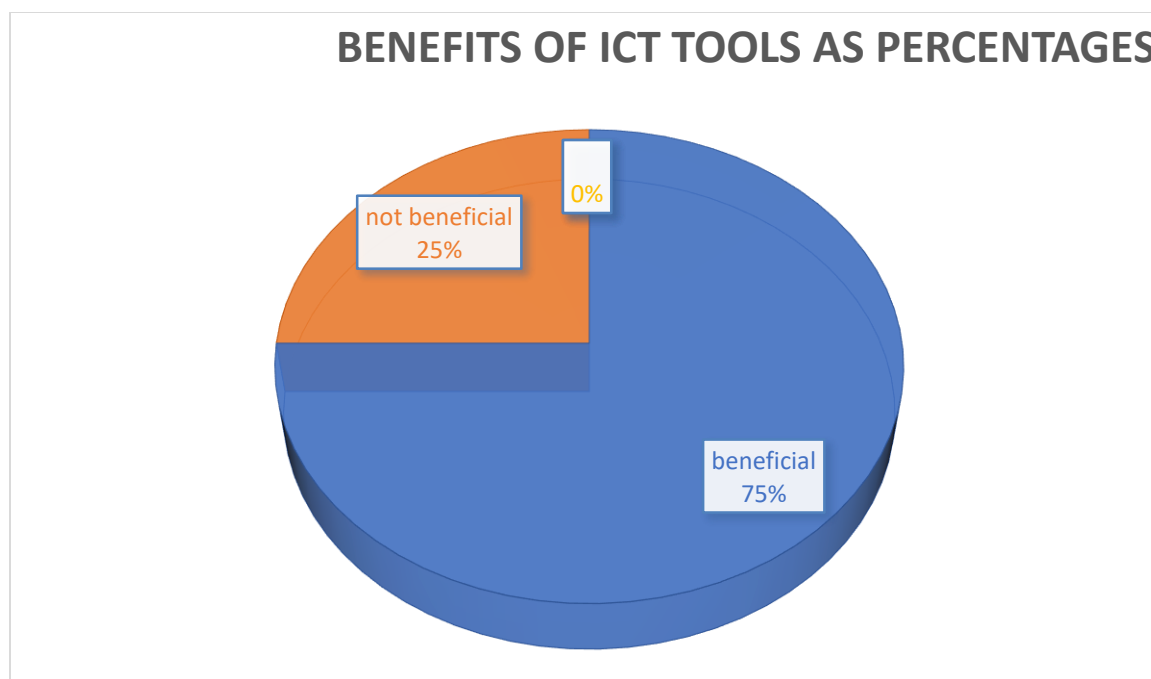


Fig 4.4 Benefits of ICT tools

Based on fig 5 on the analysis of benefits of using ICTtools in teaching Biology ,12 (75%) responded that it was beneficial and 4 (25) responded not beneficial.

4.3 Challenges faced when teaching using ICT tools in teaching and learning of Biology and ways of addressing them.

4.7 Technical challenges faced when using ICT tools

Table 7. Technical challenges

Challenge	Frequency	Percentage
Limited access to devices and internet	8	50
Technical issues and glitches	4	25
Compatibility issues	4	25

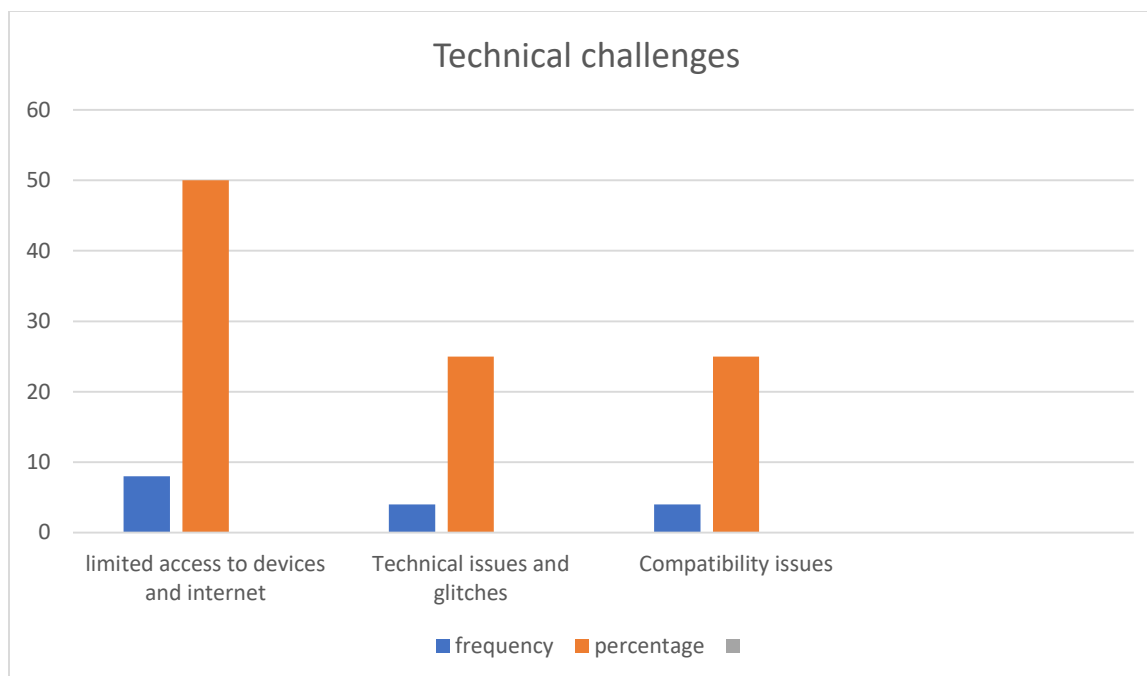


Fig 4.5. Technical challenges

From the table above 8 (50%) of the participants responded that they have limited access to devices and internet some teachers and learners may not have access to devices or internet outside of school limiting their ability to engage with ICT –enhanced Biology lessons, 4 (25%) responded that they experience technical issues and glitches which can disrupt lessons and cause frustration for teachers and students and the remaining 4 (25%) responded that they experience compatibility issues as different devices and software may not be compatible causing difficulties in sharing and accessing resources.

4.8 Pedagogical challenges when using ICT tools

Table 8 Pedagogical challenges

Challenge	frequency	Percentage
Lack of teacher training and support	9	56,25
Difficulty in balancing ICT use with hands-on activities	3	18,75

Ensuring ICT use enhances learning outcomes	4	25
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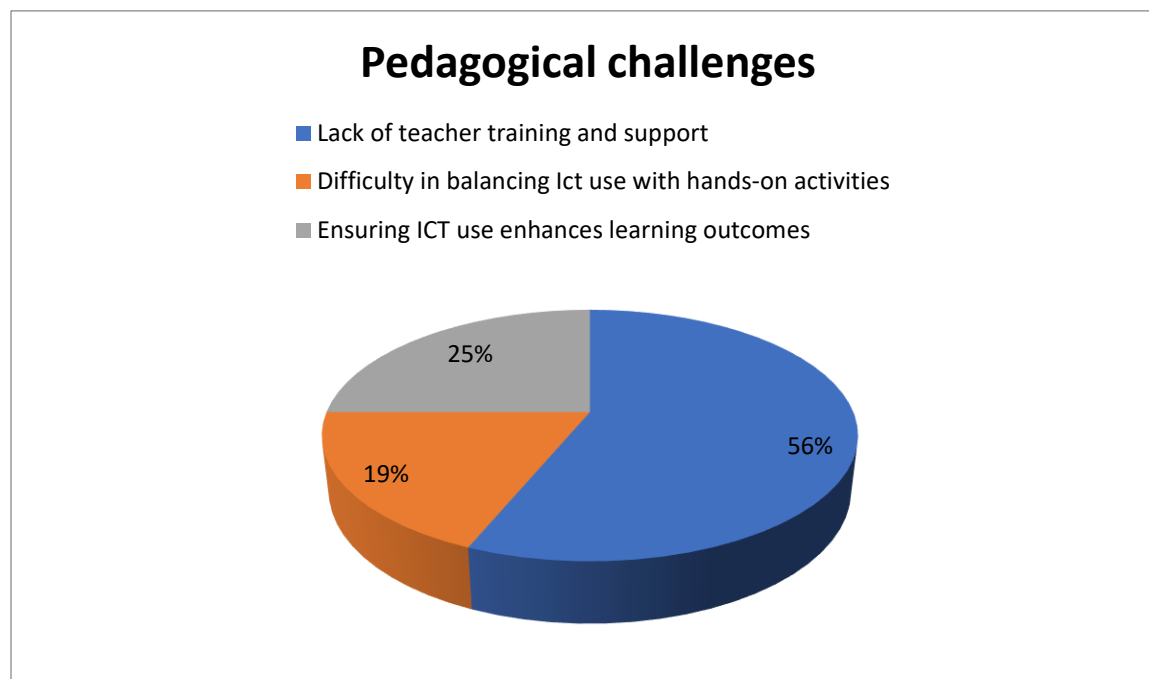


Fig 4.6 Pedagogical challenges

Table 7 above shows that 9(56,25%) indicated that they lack training and support and need training and support to effectively integrated ICT tools into their Biology lessons,3 (18,75%) indicated that teachers face difficulties in balancing ICT use with hands-on activities since Biology requires hands-on experimentation and investigation which can be challenging to balance with ICT-enhances lessons and 4 (25%) indicated that they face challenges in ensuring ICT use enhances learning outcomes because teachers must ensure that ICT use is aligned with learning objectives and enhances learner understanding of Biology concepts.

4.9 INTERVIEWS FOR TEACHERS AND HEADS OF DEPARTMENT

4.9.1 Presentation of open ended interview questionnaires

The data obtained through face to face interview with respondents are presented according to the order of the objective of the study.

Question 1: What are the teachers experiences regarding the integration of ICT in teaching and learning of Biology in the classroom?

In an interview conducted by the researcher respondents gave their views on what are the factors determining the use of ICT to facilitate teaching in secondary school here under are their views.

In responding to the interview T11 said:

“I don’t use ICT to facilitate teaching and learning of Biology because I don’t know how to use ICT the knowledge I have regarding using ICT is very basic to the extent that I lack confidence to use it in front of the students, but I do believe that through ICT my job as a Biology teacher will be simplified and entertaining to my class, I think the school owners should organize Biology practical seminars, workshops and short courses on how to integrate ICT in teaching processes, it is very important to introduce teachers and other education stakeholders to seminars and workshops on technology based teaching and learning”. Moreover, the following is a comment from another

respondent T12:

“One of the barriers that hinder us to use ICT in teaching and learning of Combined Science at advanced level is lack of access to ICT facilities and infrastructures, most of schools especially government school either have inadequate ICT infrastructures or do not have at all, Ministry Primary and Secondary Education (MOPSE) should ensure that these infrastructures are available and train Biology teachers to use them in classrooms.

A comment from a T13:

“Not only computer and internet the school could purchase a TV set and a DVD player and Multimedia CDs which are recorded with different subject topics this can be used as supplementary materials for both teachers and students, CD’s like world encyclopedia can also be used in classrooms.”

A response from H1

“Accessibility is one issue and usage is another issue, I think if there could be enough accessibility and awareness of the ICT infrastructures, Biology

teachers are ready to use ICT in their classes in our schools all Chemistry teachers have laptops all science laboratory are equipped with multipurpose whiteboard and some have Smart boards, most of teachers here use ICT and we have a policy of giving loans for purchasing laptops where a teacher pays the loan from minor deductions from their salaries.”

A response from H2:

“Integrating ICT in teaching and learning Biology in government secondary schools is a myth most of the government schools do not have ICT infrastructures at all, even if a teacher wants to use his/her own laptops there is no projectors, some classes have no powers I think the government should put more emphasis establishing ICT infrastructures in its schools,”

Another T14 form said:

“Most of us learnt to use ICT especially computers by our own, we search on the internet for references that matches our lesson and correlate with our lessons, this consumes lots of times since I have to find free time to do so, I would advise provision of seminars and workshops on how to use ICT in classrooms”. More suggestions from another respondent to the interview question on which way to improve use of ICT to facilitate teaching and learning;

A comment from a T15:

“Biology teachers need to be introduced to ICT education earlier and the only time that they can get enough time to learn how to integrate ICT with their respective subjects is during their training course, my opinion is ICT integration in education should be taught in teachers training colleges”

The respondent continued

“The curriculum is silent about the use of ICT I think curriculum developers should revisit the curriculum and introduce usage of ICT in teaching, we are in the 21st century and to achieve the Millennium Development Goals (MDG) I think use of ICT in education should be a number one priority. Allocate more funds on ICT projects, train teachers in uses and integration of ICT in teaching and learning and provide in-service trainings, seminars and workshops on the use of ICT in education”

One H3 of school gave the following comments regarding attitudes towards use of ICT to facilitate teaching and learning of Biology:

“Biology teachers in this school like using ICT in implementing the competence based curriculum. Some even use their own money to buy CDs with relevant information in their subjects and bring them to school with an aim of using them to teach Chemistry students.”

Question 2: What are the benefits of using ICT in the teaching and learning of Biology in the classroom ?

In the interviews held between the respondents and the interviewer, majority of respondents revealed that most respondents replied this question by enlisting the possible benefits that ICTs has when it is used in classroom environment, the list included the following observations identified as the benefits of using ICTs in classroom:- facilitates and makes the teaching process easier, ICTs widens access to education resources, ICTs arouses learners enthusiasm towards the subject matter, through use of ICTs learning becomes autonomous, using ICT enhances students understanding of the subject matter, through use of ICTs in classroom students can work collaboratively, the use of ICT in classroom makes learners more engaged and attached to the lesson,

A comment from a Biology T7 is presented:

“ICT has the ability to make learning to occur anytime at any place, through the use of ICT access to education has been widened and limitless, students can learn and get access to educational resources anywhere and at any time, there are varieties of educational materials on the internet such as virtual classes, virtual forums, audio books, electronic books, electronic libraries that are accessible 24 hours everywhere ICT have made education resources to easily be available, easily accessible, you just need a computer connected to the internet, I use ICT occasionally when I face difficulties explaining a concept I would Google search the concept such as genetics, biotechnology and cell division models are there on the list of short videos I watch and choose one

that is suitable for my Biology class and I will use it to teach. I find it easier and entertaining to use ICT in teaching Biology "

Another respondent T8 had the following to say on the benefit of using ICT to facilitate teaching:

"Through the use of ICT learners take control of the lesson and a teacher is there as a facilitator; use of ICT in classrooms is more of learner centered type of teaching"

Moreover, another respondent T9 said this with reference to the benefits of using ICT to facilitate teaching and learning in secondary schools:

"The use of ICT to facilitate teaching has great potential to enhance student achievement and teacher learning. There are a bunch of ICT tools which when well used in classroom they can turn a class into a place where students want to be, mobile phones, tablets and mobile applications such as Edmodo, My homework Student, Biology terminology book, Combined Science trick etc., which are available in Google Play for free for android users, they can be downloaded and installed by the students in their phones and use while away from school". Another respondent said:

"New technologies can be used to enable students to collect information and interact with resources, such as images and videos, and to encourage communication and collaboration."

Another respondent T10 sharing her views on the benefits of using ICT in to facilitate teaching process she said:

"By using ICT in a Biology classroom learning becomes autonomous and interesting where learners are fully engaged within the lesson, with ICT learning of abstract Biology concepts such as Meiosis and mitosis becomes simplified and interesting when a Biology teacher employ a simulation software or short video clips to demonstrate a difficult concept to students, through the help of internet. I have been able to research on different topics that I teach such polymerization, organic compounds, DNA replication, plant anatomy and physiology and all these materials are available online for free and they simplified my work and arouses students' morale and interest towards topic of discussion. In addition to that, ICT also can be used for preparation and planning, keeping students' records and attendance monitoring. ICT is a potential tool for modern teaching and learning though it seems to be a service of few teachers."

Question 3: What are the challenges faced by teachers when using ICT in the teaching and learning of Biology in the classroom?

Majority of the respondents responded verbally by listing the common barriers that hinders the use of ICT to facilitate teaching and learning of Biology Ordinary Level here and the researchers have identified the most listed challenges which includes, inaccessibility and unavailability of ICTs resources, inadequacy of ICTs resources in schools, lack of training on the use of ICT hinders its effective use in teaching, teachers have negative attitude towards the use of ICTs in teaching, the unavailability of technical support staff. When asked to give their views on the barriers of integrating ICT in facilitating teaching and learning of Biology at Ordinary Level here are their views:

“Lack of ICT competence and knowledge is my problem”, I have no enough skills to incorporate ICT tools in my lesson”

T1 respondent said that:

“The use of ICT in teaching and learning is essential to both the teacher and the learner. As a teacher I can use website such as You Tube and Google to search for relevant materials for my lesson and use them to teach the students, everyone would like to integrated ICT in his/her lesson, the main challenge we face at our school is that we have only one classroom with computers and a media room that is having a smart board and computer facility and the rooms are always booked, if all classes could be facilitated with at least a projector we could use our own laptops”

T2 respondent said that:

“Integrating ICT in my lesson becomes hard because I am not knowledgeable on working with a computer I find it hard to use it in class. In occasions with the help of my students who are knowledgeable with ICT we have used videos and simulations from www.yteach.com and www.youtube.com to explain concepts like alimentary canal, respiratory system, cardiovascular system and nutrition, among others.”

Other respondent from a government school commenting on the barrier of ICT he said

“I think there should be a program of providing basic ICT education to teachers not only on how to use them but also on how to integrate ICT in their teaching subjects. I really need to know how

to use ICT to teach Biology and I believe if I have proper training on how to use internet and computer I will be able to search relevant materials for my students”

Responding to the interview question T3 alleged:

“Not all teachers are capable of using ICT some of us don’t know how to use one and they are not available at our working environment, I have never thought that ICT can be used in classrooms also”

A comment from another T4:

“I would love every teacher at my school to at least have a personal computer that is connected to the internet so they can use for lesson preparation and teaching, but we are a government school we depend everything from the Ministry of Education budget, teachers as educators are supposed to be ahead with the changing technology and adopt innovative teaching through using ICT in classrooms”

Responding to the interview a T5 Biology teacher in one of the secondary schools said:

“ I feel like I am too old to learn to use a computer and not to mention integrating ICT in my classes, our generation is over but I advise junior teachers to include ICTs knowledge into their teaching, the world is changing fast and I believe technology enhanced teaching caters well in the world we are into, occasionally I have been using CDs and Audio Books in reading English I have seen kids more involved and proactive than when I use the traditional talk chalk methods”

Another T6 described:

“I am too old to adapt to the new teaching styles and I am happy with my own teaching period”, “I believe in traditional method which let the students touch, feel and learn. I could make interactive lesson without using the ICT tools”

4.10 Discussion of the findings

This area presents discussion of the findings of the study. The research questions lead the discussion to be organized under the following broad themes:

- i) The teachers' experiences regarding the integration of ICT in teaching and learning of Biology in the classroom?
- ii) The benefits of using ICT to facilitate teaching and learning of Biology in secondary schools.
- iii) The challenges faced by teachers in using ICT tools in teaching and learning of Biology. .

4.11 The challenges faced by teachers when using ICT tools in the teaching of Biology in the classroom at O Level.

This section discusses the barriers that have been identified as the barrier to the use of ICT in teaching processes in secondary schools.

4.11.1 Teacher Competence and Confidence

In the study around 83% of the respondents agreed that lack of training on the use of ICT in teaching is a barrier in integrating ICT in teaching. This study matches with the study done by Newhouse (2019), which reveals that many teachers lack the knowledge and skills to use computers and are not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices. Another study by Pelgrum (2017), found that teachers' lack of technological competence is a main barrier to their acceptance and adoption of ICT. Mukama & Anderson (2018) in their study reports that, using ICT to train teachers is most necessary as it leads teachers to change attitudes, be more technologically skilled, motivated to use the same technologies after training and enhance collaboration.

Moreover, the study concludes little or lack of professional training on how to use ICT in teaching is a major barrier, for successful integration of ICT in teaching an emphasis should be put in providing pedagogical training on using ICT as across the curriculum is important. Therefore, teachers need knowledge of appropriate ICT integration approaches and ICT skills to successfully incorporate the ICT tools into their lessons. Training teachers on ICT related skills within the

context of classroom objectives and activities ensures development of skills in integrated use of ICT in teaching.

4.11.2 Teachers Attitude towards the Use of ICT to Facilitate Teaching

A lot of research on the attitude of both students and teachers towards the use of ICT in teaching and learning had been done with outcome being either positive or negative. For instance, BECTA (2014) reported that negative attitude was a barrier towards integration of ICT in teaching and learning while, Rhoda and Gerald (2016) found that positive attitudes towards ICT use are widely recognized as a necessary condition for effective ICT use in teaching and learning. Similarly, Kubiato et al., (2019) in their study identified that attitude towards ICT determines its adoption in teaching. According to Jones (2015), the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching.

The study shows that teachers prefer to use the traditional method for teaching in their classroom because of their lack of motivation, acceptance and readiness towards the ICT integration and adoption in teaching. From the results, this study found that 88% of the respondents agreed that their negative attitude towards the use of ICT to facilitate teaching hinders them to use ICT in classroom teaching. According to Gomes (2015), much research into the barriers to the integration of ICTs into education found that teacher attitudes and an inherent resistance to change was a significant barrier. To successfully initiate and implement educational technology in schools depends strongly on the teachers' support and attitudes. It is believed that if teachers perceived technology programs as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching. In the study by Selewyn (2017), integration of ICT in education environment depends, to a great extent, on teachers and student attitude towards their use. If teachers' attitudes are positive toward the use of educational technology, then they can easily provide useful insight about the adoption and integration of ICTs into teaching processes.

From interviews some teachers who resist to use ICT in teaching believe that ICT have no benefits for themselves and their learners they give excuses such as they feel shy to learn use ICT, they are too old to learn how to use ICT and some don't see the logic of learning while they know they won't use because facilities are not available. An interview results with teachers both who are

computer literate and other with limited computer skills revealed that teachers are more sensitive about their ability to use computer and intention to use computer than their perceptions of the usefulness of computer. It therefore appears that teachers' attitude may influence adoption of ICT in teaching process.

The study reveals that positive attitude towards computers, computer experience, and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher. The study is in line with another study by Schiller (2015) which reveals that personal characteristics such as educational level, age, gender, educational experience, and experience with the computer for educational purpose and attitude towards computers can influence the adoption of a technology in teaching.

It is undeniable that teacher attitude is one of the most critical factors that enhance or inhibit the integration of ICT into classroom instruction. Teacher attitude and competence ensure ICT implementation and guarantee further ICT innovation. The attitudes of teachers towards technology greatly influence their adoption and integration ICT into their teaching process, therefore an understanding of personal characteristics that influence teachers' adoption and integration of ICT into teaching is relevant. To successfully integrate ICT in teaching processes teachers are argued to change their attitude towards ICT especially to develop a positive attitude. It is advisable to adopt more appropriate measures to help both teachers and students further improve on their attitude towards ICT use in teaching and learning.

4.11.3 Limited Access to ICT Facilities

The study results show that 100% of the respondents agreed that unavailability and inaccessibility of ICT facilities and resources hinders the use of ICT to facilitate teaching. The study results indicate that accessibility and availability of ICT resources plays a huge role in determining the use ICT to facilitate teaching. To supplement these results an interview was conducted to the selected sample and the respondents gave their views regarding the barriers that hinders the use of ICT to facilitate teaching and learning most respondents argued that they do not use ICT because they do not have access to ICT resources and some schools don't have fs such as power, computer laboratory, internet access, and electronic projectors.

The study by Eze and Olusola (2013) revealed that in Botswana, lack of electricity in rural schools and high cost of computers is a stumbling block to the integration of ICT in teaching, internet is impossible where there are telephones and electricity. Effective application of ICT into classroom heavily relies on the availability of technological resources, qualified and confident teacher and other internal and external factors that directly or indirectly affect teachers' welfare and morale.

The study further show that teachers have a positive perception on the use of ICT, but the availability and accessibility of ICT resources such as hardware, software and communication infrastructure are limited. If there are some ICT resources in a school, they are only limited to office use. Integrating ICT to teaching learning is not an option to the government and school owners, efforts should be made to ensure ICT infrastructures are available in all schools and are used as we are preparing children to live in a 21st century.

4.11.4 Lack of Technical Support

The study shows that 80% of the respondents indicated that they lack technical support on ICT issues hence they are intimidated to use ICT in teaching. The study by Pelgrum (2014) found that in the view of primary and, secondary teachers, one of the top barriers to ICT use in education was lack of technical assistance. Lewis (2017) asserted that without both good technical support in the classroom and whole school resources, teachers cannot be expected to overcome the barriers preventing them from using ICT. The findings show that one of the challenges facing the use of ICT in teaching and learning is the availability of support staff.

The interview conducted revealed that breakdown of a computer causes interruptions and if there is lack of technical assistance, then it is likely that the regular repairs of the computer will not be carried out resulting in teachers not using computers in teaching. The effect is that teachers will be discouraged from using computers because of fear of equipment failure since no one would give them technical support in case there is technical problem. BECTA (2014) agrees that 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. Therefore, if there is no technical support for teachers, they become frustrated resulting in their unwillingness to use ICT, ICT support in schools influence teachers to apply ICTs in classrooms without wasting time troubleshooting hardware and software problems.

4.11.5 Teaching Experience

The study result shows that there is a digital divide (generation gap) between the teachers. Younger teachers have emerged to be positive about using ICT to facilitate teaching than older teachers, the study indicates that for most of younger teachers apart from owning computers and tablets or smartphones they occasionally engage in using software and mobile application and educational website in teaching as compared to senior teachers. The study reveals that senior teachers indicated that their age and teaching experiences were the barriers to adapt to the ICT integration into their lessons. The older teachers with more experience in teaching did not prefer to use ICT tools in their classes.

4.11.6 Professional Development

Insufficient amount of in-service training programs for teachers is another barrier that hinders the use of ICT in teaching, during the interview session respondents reported that there were not enough in-service training opportunities for teachers in the use of ICTs in teaching. A study by Newhouse (2017) states that “teachers need to not only be ICT literate; but they also need to develop skills in integrating ICT use into their teaching”. According to Newhouse (2015), teachers need training in technology education (focusing on the study of technologies themselves) and educational technology (support for teaching in the classroom). It can be concluded that there are barriers which hinder the use of ICT to facilitate teaching and learning which are teachers’ attitudes toward use of ICT, lack of teacher training on the use of ICT to facilitate teaching and learning, unavailability of technical support staff, availability and accessibility of ICTs resources and facilities. These factors have been mentioned repeatedly as the barriers to the use of ICT to facilitate teaching process.

4.12 The Benefits of Using ICT to Facilitate Teaching and Learning of Combined Science in Secondary Schools

This section discusses the benefits of the use of ICTs in teaching processes in secondary schools.

4.12.1 ICT Facilitate and Make Teaching Process Easier

From the finding the study shows that the use of ICT in teaching makes the teaching easier and hence teaching is simplified. The study agrees with study by Bransford, (2020) several studies

have reviewed the literature on ICT and learning and have concluded that ICT has great potential to enhance teacher performance. Another study by Dawes (2017) views that, new technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before.

Using ICT in teaching is also perceived as having the advantage of heightening motivation for the learner; helping recall previous learning; providing new instructional stimuli; activating the learner's response; providing systematic and steady feedback; facilitating appropriate practice; sequencing learning appropriately; and providing a viable source of information for enhanced learning.

Consider teaching cell division by using you tube with moving picture and traditional explanation usually the Biology teacher does in the classroom. A teacher's job is simplified, and the role becomes that of a facilitator. Research and active projects, such as those run by Equal, a Research Consortium of educational institutions in the UK and Africa (Zimbabwe, Rwanda, South Africa, Tanzania) on Educational Quality, typically indicate two main reasons why teachers use ICT: teachers feel that their own use of computers benefits their learners, teachers feel learners benefit from using computers themselves, they gain confidence, self-esteem and renewed motivation.

INTERVIEW FOR THE ADMINISTRATION

(a)Do you allow personal electronic gadgets for the learners in the school?

RESPONSE:

(H1)No, personal electronic gadgets for the learners are not allowed at the school to curb the problem of virus infection.On the other hand,(H2)agreed that they allow learners to bring their personal smart phones and laptops in the school but have noted that only a few learners have them.

The above response suggests that, the smuggling of foreign electronic gadgets in to the school laboratory results in the infection of school computers by the virus. What it means is that, things such as flush discs, memory cards and data cables which do not belong to the school should not be used on the school electronic gadgets .The second response suggest that there is low use of ICT

tools in that particular school therefore teacher and learners have low experiences with ICT during teaching and learning of Biology.

(b) Is ICT included in the school curriculum?

RESPONSE:

(H3) Yes, it is included in the school curriculum

ICT has several benefits to the learners which include;

(i) being computer conversant /literate.

(ii) enhance their learning through researching on internet.

(iii) typing their projects other documents.

(e) At what ratio do the learners share the computers?

RESPONSE:

(H1) The learners share the computers at a ratio of 1:15.

T(H2) Explained that the school has only two computers used only for administrative purposes, meaning to say that learners and teachers have limited access or no access to computers to use during teaching and learning.

(f) Are the computers enough for the learners?

(H2) The computers are not enough since some other learners can hardly see what is on the screen /monitor.

The above response suggests that, more electronic gadgets should be purchased at the school so as to reduce the learner to computer ratio.

4.13 Summary

In this chapter, the researcher interpreted and analyzed the gathered data. To make the presentation clear tables were used to summarize the information collected. The findings showed positive

perceptions on teachers on the use of ICT in teaching and learning of Biology in secondary schools of Zvimba District Mashonaland West Province. The findings showed that more than fifty percent of the teachers support the ongoing use of ICT, and teachers' perception on the use of ICT in teaching and learning of Biology as ICT promote effective learning, and also the use of ICT enables teachers to plan Biology effectively. In the next chapter, the researcher will present the summary, conclusion and recommendations.

CHAPTER 5 Summary, Conclusion and Recommendations

5.1 Introduction

This chapter gives a summary of the entire research from the first chapter to the final chapter. It presents the conclusion reached on the topic after data collection, analysis and interpretation. Lastly, a list of some recommendations deemed relevant to the research problem is made.

5.2 Findings

From the study findings, it is evident that positive attitude toward technology enables teachers to adapt to new technologies, embrace the different changes in technology and also deal more aptly with emerging challenges (Hutchison & Reinking 2011). The findings revealed that teachers think that technology-supported teaching makes learning more effective. The findings therefore concur with the views of Drent and Meelissen in their study of the factors that influence the innovative use of ICT by teacher educators in Netherland. They posits that positive attitude towards computers and computer experience has a direct positive influence on the innovative use of ICT use of ICT by teachers.

The research findings on the usage of ICT are also in agreement with what Huang and Lu (2010) say, the teachers' attitudes towards technology influences their acceptance of the usefulness of technology and its integration into teaching. Teachers also think that the use of instructional technologies increase the quality of courses and productivity of teacher. This is in agreement with the observations of EU School survey on teachers' use of Acer net books were it was revealed that large number of participants believed that the use of net book had positive impact on their learning and lengthened study beyond school day. On the contrary, the minority of the teachers believed that the use of ICT in teaching did not benefit their students' learning and not all teachers are convinced that ICT should be an integral part of their teaching strategies as a result of resisting change to effective ICT integration and also the fact that some openly mentioned that they are not computer literacy, they cannot make use of the ICT tools. The research find out that most teacher, HODs and the administrators are not even interested in incooperating ICT fully into their curriculum as they think it requires a lot of funding which is not adequate in most rural schools.

5.3 Recommendations

From the study results, it is clear that teachers' experiences has a momentous effect on the teaching and learning of Biology. The findings show that positive attitude of teachers towards technology makes them more interested in adopting new technology and innovative use of ICT by the teachers which improves the learning process of students. Finally, teachers' experiences have a significant effect on the teaching and learning of Biology as evidenced from the study. It is recommended that, school administrations should encourage teachers to use technology, e.g. computers as much as other resources such as books and make teachers aware of the opportunities and importance that technology offers. The school administrators are also encouraged to procure ICT tools to encourage its use during teaching and learning. More so, teachers must be afforded ICT training programs offered by various government and nongovernmental organization as a way of equipping them with the necessary skills. Workshops must organized from organized at school ,cluster and district level to stress on the importance of adapting to changes in technology especially in the teaching and learning of Biology in Secondary schools which will ease the burden of making drawings, illustrations and simulations to mention a few when teaching since it is a subjected loaded with anatomy and physiology of living organisms

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APPENDICES

Appendix A

BINDURA UNIVERSITY OF SCIENCE EDUCATION



FACULTY OF SCIENCE EDUCATION AND TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND SCIENCE

QUESTIONNAIRE GUIDE FOR TEACHERS AND HEAD OF DEPARTMENT SCIENCES.

Both qualitative and quantitative methods were employed in this research

SECTION A

Research questionnaires for teachers and head of department sciences

I am a student at Bindura University of Science Education carrying out a project on teacher's experiences on the use of ICT in teaching and learning of Biology. I kindly ask you to provide me with information on the following questions. The information you would have provided will only be used for academic purposes and will remain confidential. Indicate with a tick in the appropriate box. For privacy, do not write your name and be honest with your answers.

Section A. Ongoing support on the integration of ICT in schools

(a) Government provides quality, relevant and affordable educational and training programs for biology teaching

Strongly Disagreed (SD) Neutral (N) Strongly Agreed (SA)

☐☐☐

(b) School develop and assess Human ICT Resources through National Examination for Biology integration in all levels of learning

Strongly Disagreed (SD) Neutral (N)

Strongly Agreed (SA)

(c) Government recruit qualified Biology ICT teachers

Strongly Disagreed (SD)

Neutral (N)

☐☐☐

Strongly Agreed (SA)

☐☐☐

(d) Government design and develop ICT curriculum for Biology for all levels of education and training

Strongly Disagreed (SD)

Neutral (N)

Strongly Agreed (SA)

☐☐☐

(e) Schools develop learning ICT resources for Biology e.g. books, multi-media resources, conducting in-service training of teachers and trainers in new curriculum trends in education and training

Strongly Disagreed (SD)

Neutral (N)

Strongly Agreed (SA)

SECTION B

Experiences of ICT use in schools

1. I use computers but not as much as other resources (books, overhead projectors) for instructional purposes

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

2. I know what to do when using computers in instructional environments

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

3. I am aware of the opportunity/important that computers offer

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

4. I think that tools like E-mail will make communication with my colleagues and students easier

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

5. I think that I can use ICT in class activities more effectively day by day

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

6. I think that ICT supported teaching makes learning more effective

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

7. I think the use of ICT quality of courses and productivity of teacher

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

8. I think that usage of ICT makes it easier to prepare course material

Generally Disagreed (GD)
(GA)

Neutral (N)

Generally Agreed

9. It is hard for me to explain the use of computer application to my learners

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

10. I think ICT makes effective use of class time

Generally Disagreed (GD)

Neutral (N)

Generally Agreed (GA)

BINDURA UNIVERSITY OF SCIENCE EDUCATION



FACULTY OF SCIENCE EDUCATION AND TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND SCIENCE

APPENDIX B

PART 1

INTERVIEWS GUIDE FOR TEACHERS

Greetings colleagues , my name is Gundani Ephraim. I am currently studying degree at Bindura University Of Science Education .My research has to do with: An assessment on the teachers experiences on the use of ICT in the teaching and learning of Biology at Ordinary Level.

For the purpose of this research I will be asking questions and I want you to be as open as you can and be honesty when responding to the questions. You are also free to tell us what you like and dislike during the interview.

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

Interview guide

PART 1

Interview for teachers

- a) Do you have any kind of electronic gadgets?
- b) If yes what do you use your electronic for?
- c) Do you own a computer?
- e) How do you prepare lessons content?
- f) Is it included on your school curriculum?
- g) Are the computers enough for pupils?

PART 2

Interviews for the administration

- a) Do you allow personal electronic gadgets for the learners in the school?
- b) If no why do you avoid personal electronic gadgets for the learners in the school?
- c) Did you include it in your school curriculum?
- d) If yes what benefits do you think ICT has on learners?
- e) On what ratio do the pupils share the computers?
- f) Are the computers enough for the learners?

APPENDIX C

P Bag 1020
BINGURA
ZIMBABWE
Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

SAMED

 BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 04-12-2021

TO WHOM IT MAY CONCERN

NAME: GUNDANI LINDANI REGISTRATION NUMBER: B.225822A
PROGRAMME: H.BSCBZ BIOLOGY PART: 2.2

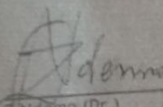
This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

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

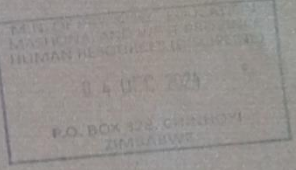
In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you


Zindemo (Dr.)
CHAIRPERSON - SAMED

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
OCT 2021
P. BAG 1020
BINGURA


MINISTRY OF HIGHER AND TERTIARY EDUCATION
MASHONA AND VICE-CHANCELLOR'S OFFICE
HUMAN RESOURCES DEVELOPMENT
04 DEC 2021
P.O. BOX 128, CHIRICHIRI
ZIMBABWE



All Communications should be addressed to: "The District Education Officer"
 Telephone: 0678 2021
 Fax :067- 28208
 Email: districtschools@zimba@gmail.com



ZIMBABWE



Ministry of Primary & Secondary Education
 Mashonaland West Province
 Zvimba District
 P Bag 2062
MUROMBEDZI

06 December 2024

The Head

MURURI SECONDARY

AUTHORITY TO CARRY OUT EDUCATIONAL RESEARCH: MURURI SECONDARY ZVIMBA DISTRICT: MR. EPHRAIM GUNDANI

EC NOID 0951403H

STATION MURURI PRIMARY DISTRICT ZVIMBA

INSTITUTION BUSE REG NUMBER 6225822A

PROGRAMME H.B.S.C.B.Z. BIOLOGY

The above referred has been granted authority to by the District Office to carry out research at MURURI SECONDARY. The student has been advised to seek permission from your office before conducting the research.

Research Topic An assessment of teacher experience use of ICT in the teaching of Bio at O level
 Period of Research September to December 2024
 Targeted Schools Mururi Secondary
 Method of Research Questionnaires, Interviews & Obser

Please ensure that teaching and learning at the targeted schools is not interrupted and the researcher adheres to the specified topic and given timelines.

You are advised to ensure that a copy of the research is findings is submitted to the District Schools Inspector once the research is completed.

Yours faithfully

Matsikiti A

District Schools Inspector

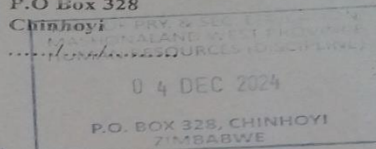


APPENDIX D

All communications should be addressed to
"The Provincial Education Director"
Telephone: 067-23043/25655
Tele Fax: 067-23320
Email: edumashwest@gmail.com



Ministry of Primary & Secondary
Education
Mashonaland West Province
P.O. Box 328
Chinhoyi



The District Schools Inspector
ZVIMBA District

AUTHORITY TO CARRY OUT EDUCATIONAL RESEARCH: SCHOOLS IN
ZVIMBA DISTRICT: MR/MRS/MS. EMMAIM GUNDANI
EC.NO/IDNO. 09514234 STATION MURRAY PRIMARY SCHOOL
DISTRICT ZVIMBA INSTITUTION BASE
REG.NO. 82258221 PROGRAMME H88CBZ BIOLOGY

The above named student has been granted authority by the Provincial Education Director to carry out a research in ZVIMBA District. The student has been advised to visit your office before entering the schools.

Research Topic: An analysis of teacher experience on the use of ICT in teaching & learning of Biology & Kjet at

Period of research: September to December 2024

Targeted school/s: Murumbi Secondary

Method of research: Questionnaires, Interviews & Observations

Please ensure that the learning and teaching programmes at the targeted schools are not interrupted in any way; the student strictly adheres to the activities and topics specified in his/her letter of request and that the research should be conducted according to the given time frame.

The District Schools Inspector is requested to liaise with the researcher on the specific schools where the research will be conducted and advise the Provincial Office of the chosen schools. Furthermore, the District Schools Inspector should ensure that a copy of the research findings is submitted to the Provincial Education Director once the research is completed.

T. MAKONI
FOR ACTING PROVINCIAL EDUCATION DIRECTOR
MASHONALAND WEST PROVINCE