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FACULTY OF SCIENCE EDUCATION

BACHELOR OF SCIENCE EDUCATION HONORS DEGREE IN BIOLOGY

CHALLENGES FACED IN USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN TEACHING AND LEARNING OF BIOLOGY AT KOTWA HIGH SCHOOL IN MUDZI DISTRICT

BY

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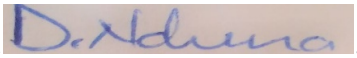
……  …… ……10/07/2024……

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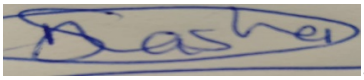 … …12/07/2024……

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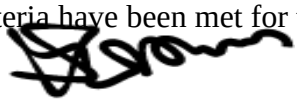

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DEDICATION

This research is dedicated to my husband, Robert Mzezewa, who encouraged me to make education the foundation of my life and my aunt Saneliso Dube who supported me during the tough times of my years of study. This work is also dedicated to my sons, Andile, Robin and Munashe, for their unconditional love, understanding and patience

ABSTRACT

In this digital era, ICT use in the classroom is important for giving students opportunities to learn and apply the required 21st century skills. Hence studying the issues and challenges related to ICT used in teaching and learning can assist teachers in overcoming the obstacles and become successful technology users. A qualitative research design will be used to collect the data randomly from a sample of 5 teachers and 20 learners in Kotwa high school. Evidence will be collected through distribution of a modified- adopted survey questionnaire. The research is going to look at the challenges faced by the teachers and learners and ways to enhance the use of ICT in the teaching and learning of Biology at Kotwa high school in Mudzi District. The chapter focuses on the background of the study and its context, the research problem and discussing the problem that the researcher wants to address. The chapter proceeded with the significance of the study, limitations, delimitations and assumptions of the study. The key terms will be defined as well as the summary.

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CHAPTER 1

1.1. Introduction

In recent years, the integration of Information and Communication Technology (ICT) has revolutionized various aspects of education, including the teaching and learning of biology. ICT tools such as computers, smartphones, interactive whiteboards, and online resources have the potential to enhance students' engagement, foster interactive learning environments, and provide access to vast amounts of information. However, despite the numerous advantages ICT offers, implementing these technologies in biology education is not without its challenges (Maxwell, 2016).

This venture ambitions to discover the challenges confronted in utilizing ICT for instructing and learning biology. By gaining a deeper understanding of these challenges, educators, policymakers, and stakeholders can make informed decisions to maximize the benefits of ICT integration in biology education.

One of the predominant challenges is the availability and reliability of infrastructure and connectivity. Many educational institutions, specifically in faraway or underprivileged areas, lack sufficient technological sources and web access. Insufficient infrastructure and unreliable connectivity can avert the fine implementation of ICT tools and restriction students' get entry to online resources and interactive mastering platforms (Cohen, 2017).

Also the profitable integration of ICT in biology training requires teachers to possess the integral digital literacy competencies and pedagogical knowledge. However, many educators can also face challenges in adapting to new technologies, navigating digital tools, and incorporating them into their educating practices. The lack of ample coaching programs and expert improvement opportunities can in addition hinder teachers' ability to correctly make use of ICT tools in the classroom.

While the internet provides a tremendous array of educational resources, making sure the high-quality and accuracy of accessible content material can be challenging. Not all online materials are reliable or aligned with the curriculum standards. Teachers ought to cautiously consider and pick out fabulous digital resources that are scientifically accurate, up-to-date, and relevant to the biology curriculum (Patton, 2015). The integration of ICT equipment in biology schooling have to prioritize fairness and accessibility

for all students. However, socioeconomic disparities and varying levels of get right of entry to science can create inequalities in students' getting to know experiences. Limited get entry to devices, net connectivity, or assistive technologies can avoid some students' ability to totally engage with ICT-based getting to know materials, ensuing in a workable digital divide.

Lastly, the speedy tempo of technological advancements poses an undertaking in retaining up-to-date ICT infrastructure and software. Outdated hardware, software, or digital sources may additionally end up incompatible with more modern technologies, limiting the effectiveness of ICT integration in biology education. Schools and establishments want to allocate resources for ordinary updates and upgrades to ensure technological sustainability (Bell, 2015).

1.2. Background of the study.

The research explores the challenges of using Information and Communication Technology (ICT) tools in the teaching and learning of biology at ordinary level. ICT has become one of the main pillars of modern society, and therefore teachers' attitudes, proficiency and understanding of basic ICT skills and concepts are essential in the learning and teaching process. Considering the rapid development of ICT and its spread around the world, especially in the field of education, we can predict what education will look like. Because society is so intertwined with technology, it has become easier to find technological solutions to problems rather than finding just one technological solution. ICT has undeniable advantages over traditional communication systems. As a result, ICT development is widely recognized as a powerful tool for sustainable development (Becta, 2015).

ICT have gradually become a pattern of human life, there are calls for children to use ICT in developing learning materials which can elevate students learning experience beyond textbooks and whiteboard (Todo Sibuea, 2015). It opens room for teachers to innovate with existing learning materials and provide their students with tailor made lessons which should be more in tune to students needs and capabilities. This could hold true for biology teachers who need to adjust to teaching biology with aid of resources such as ICT in a changing society. The teacher s role keeps on changing because of the ever changing amount of resources available to students available via the internet.

The integration of ICT in teaching and learning process was found to help in creating a conductive learning environment in which students participate actively and constructively (Volman and Van, 2001). It is therefore used in developing the abilities of students in terms of communication, problem solving, cooperation and lifelong learning (Plomp, Brummelhis and Rapmund, 1996). The innovative use of ICT in teaching and learning, enhances learner-centered method which is an important approach for effective teaching and learning process (Drent and Meelissen,2008). Therefore, the adoption of this technology is necessary for enhancing the students learning in every subject (Mwanda; Mwanda; Midigo Rwandan

Journal of Education, Vol.6, No 1(2022) 60 and Maundu, 2017). This will engage students in developing decision making, critical thinking and problem solving behaviours (Grabe and Grabe, 2001). In teaching biology, ICT (especially when using visuals and animations) makes the learning environment more enjoyable, motivating and attractive by increasing learner's attention to the subject content thus promoting the effective teaching and learning process (Tomljenovi and Zovko, 2016).

A phenomenal growth within communication technology, computer network and information technology, development of new broad band communication services and convergence of telecommunication with computers have created numerous possibilities to use a variety of new technology tools for the learning system. Thus integration of computers and communications offers unprecedented opportunities to the education systems with its capacity to integrate enhance and interact with each other over a wide geographic distance in a meaningful way to achieve the learning objectives.

South African learners particularly in schools with limited resources have continuously not performed well in subjects like Mathematics and Science. The government has turned to modern technology and ICT to strengthen teaching and learning and to redress past inequalities in its schools. This intervention has made little or no progress despite the availability of Information and Communication Technologies (ICTs) in these institutions. The teachers and learners in these schools are still facing challenges in the use of ICT to enhance teaching and learning (Maxwell 2016).

The South African ICT Education policy, advocates the pedagogical integration of ICT that promotes the development of higher-order thinking skills. Teachers attitude, competence and innovativeness maximize the potential of ICT in teaching and learning biology was critical if their use was improved thinking skills that were a significant component in enhancing performance. Teachers in most South African public schools have attended ICT training workshops and generally these sessions constitute basic computer skills. These acquired abilities have proved inadequate to equip teachers with the skills they need to infuse ICTs into the subject teaching. A research carried on ten South African schools by Pan African Research Agenda (2008-2011) showed that the majority of teachers cannot go beyond using ICTs to type lesson plans, tasks and tests for their learners. Internal factors were to do with their computer literacy, their attitudes and abilities to adopt new educational technologies into the teaching-learning programmes (Johnson, Jacovina, Rusell and Soto, 2016). They are not maximizing the potential of computers especially for enhancing the actual learning of their subjects.

In the United Kingdom, the official view of ICT as potentially transformative of education has placed it at the centre of the national agenda for school reform. The more recent PISA data study also found a positive relationship between the use of computers and better results in literacy were it is evident that digital technology is being used by learners to increase study time and practice (OECD, 2015).

As a result, the promotion of ICT in education has been a significant part of the UK government policy in education since the 1980s with various programmes being implemented over the years has yielded positive results on teaching and learning. In United States of America schools generally showed a positive trend in the achievement of students when ICT was employed. Computers are more effective when used in simulation or tutorial modes. There is clear evidence from the findings that ICT has a positive impact on learning and teaching, although on small effect.

The Zimbabwean government has put into place the ICT Strategic Plan and created the Ministry of Information and Communication Technology which requires everyone to be computer literate. To bring the potential and benefits of ICT into schools and encourage computer literacy, President Robert Mugabe donated computers and laptops, data projectors, interactive whiteboards and other ICT tools to schools for students and teachers. Donations were not utilized properly as they were given to incompetent personnel. Students and teachers were unable to use available biology tools.

The education sector plays a key role in information and knowledge production hence the need to ensure that teachers and pupils are not left behind. As a developing nation, Zimbabwe needs to be part of this new dispensation which entails integrating new ICT. In Mudzi District, some schools have computer laboratories but they are not connected to the internet. The teachers were not embracing ICT in teaching and learning, they continue to favour the traditional methods of teaching which make the lessons more teacher-centered rather than the effective ICT learner centered approach in spite of the availability of ICT tools in schools. It is against this background that the research looked at challenges faced by learners towards ICT use in teaching and learning of biology at Kotwa high school. The learners are experiencing problems by having limited ICT tools and the exposure on how to use the smart phones, computers as well as the internet facilities which also needs some data bundles for one to use it.

1.3. Statement of the Problem

Students who have difficulty using technology must make every effort to find ways to be successful in using ICT. Education is a tool that ensures a successful transition from childhood to adulthood. Teachers must impart knowledge to students as the transfer of knowledge and skills promotes independent living. The new curriculum places greater emphasis on computer literacy to better adapt to the technological world (Department of Primary and Secondary Education, 2015). Today, ICT is considered a basic requirement, so every child must be computer literate.

The expansion in the capabilities of information and technologies and emergence of information driven company underpin the need for the development of new skill sets that enable citizens to live and work competitively in the global village (Ministry of Primary and Secondary Education, 2015). Teachers were using textbooks frequently and did not make use of other instruction and technologically oriented resources in their teaching and learning. This is so because ICTs in education are not considered central to the teaching in the classroom in Zimbabwean methods which made the lessons more teacher-centered than the learner-centered. This study will help both teachers and learners to analyse the importance and challenges of using ICT in teaching and learning of biology.

1.4. Research questions for teachers

1. What are the attitudes of biology teachers in the use of ICT tools in the teaching of biology?

2. Are the biology teachers using ICT in the teaching of biology?

3.What are the challenges faced when integrating ICT into biology lessons?

4.What are the benefits of using ICT in teaching of biology?

5.What ICT tools are currently used in biology lessons?

6.What obstacles do you encounter when using ICT in teaching biology?

1.5. Research questions for learners

1. What are the attitudes of learners in the use of ICT tools in learning of biology?

2.Are the biology learners using ICT in the learning of biology?

3.What are the challenges of using ICT in learning of biology?

4.What are the benefits of using ICT in learning of biology?

1.6. Objectives of the Study

1. What are the attitudes of biology learners on the use of ICT tools in their learning?
2. Establish the factors faced by teachers in the teaching of biology using ICT.
3. Analyse the challenges faced by teachers and learners in learning of biology using ICT.
4. What are the benefits of teaching and learning biology using technology?
5. Find out the solutions to the challenges faced by teachers and learners in the use of ICT.

1.7. Assumptions of the study

It was assumed that:

1. ICT tools like computers and smart phones were available in Mudzi district and were accessible to learners for use in the teaching and learning process.
2. It was also assumed that the biology teachers are aware of the benefits of ICT in teaching and learning.
3. The study also assumes that ICT is used in teaching and learning of biology in Mudzi District though there were no proper implementation strategies that were employed

1.8. Significance of the study

It is hoped that school authorities would know if they are meeting the needs of students as well as teachers effectively in fulfilling their mission statement of providing quality education. They will be forced to review the school policies on the use of ICT in teaching and learning of biology.

The study will also provide a deeper understanding on the challenges faced by learners and teachers in the use of ICT in teaching. The study would improve the use of ICT in teaching and learning of biology in the Zimbabwean schools. It is also hoped that the study would form the basis for further research in related areas. The study is also of benefit to the Ministry of Primary and Secondary Education since it will produce a guide for the implementation of ICT in teaching and learning of biology. Finally, the study would contribute to the existing theory and practice relating to ICT technology use in teaching and learning.

The research was intended to benefit the researcher, learners, parents, teachers, school administrators, community, other researchers, ministry of education and policy makers.

1.8.1 Learners

The study is going to help the learners in the sense that the findings may be used by teachers to help and intervene to accept and tolerate the differences in them as learners. By accepting the change of environment since we are living in the world of technology, the learners may identify their challenges in the use of technology and ways to minimize them.

1.8.2 Parents

The parents would benefit in that, their children would adapt to the change of environment, they would also be able to be taught technology through their children. They were able to get news update through technology and they are kept informed.

1.8.3 Community

The community would also benefit in that they have a clear understanding of the importance of the use of technology in the learning process of their children. They would work together for the betterment of their children's lifestyle in the near future.

1.8.4 Teachers

This study will also help the teachers as they gain more insight of using technology and educate other students so that those with challenges in the use of technology cannot be stigmatized and encourage those who are able to use ICT to work together. The teachers as role models would demonstrate to the community and pupils that all learners can learn and be able to use technology well if these barriers are dealt with correctly. The teacher would design the curriculum so that technology becomes the backbone of education. That is differentiated learning styles were adopted.

1.8.5 School Administrators

The results of this study will be important to school administrators as they will help them conduct workshops with teachers on how to use technology in teaching biology. They will also host parent-teacher conferences and educate the community about the benefits of using technology in biology education.

1.8.6 Researcher

The researcher benefited a lot from the research through reading and researching materials written by other researchers.

It helped researcher to extend her knowledge about the use of technology in the teaching and learning of biology.

1.8.7 Other Researchers

The study was significant to other researchers in that findings of this research would enable potential researchers to use knowledge gained in the research as a guide for future use. The research would also give them insight of new developments in the world of technology and problematic areas that may require attention.

1.8.8 Ministry of Education

The study will also be important to the ministry at large in that findings may help schools to use more systematic interventions considering the use of technology in the learning process when scheduling class activities to improve academic achievements in the near future.

1.8.9 Policy makers

The study will also be of importance to police makers. Findings may be used by curriculum developers to modify the teacher training programs to include the aspect of using ICT in learning of biology. We will also be adjusting our existing policies.

1.9. Limitations of the study

The researcher had financial difficulties purchasing office supplies and data kits to access information on the internet. Time was limited because the researcher had to write time-limited assignments and participate in the researcher's social life. Due to the country's economic crisis, researcher was trying to make ends meet. The researcher had to sell cookies to raise money to buy supplies needed for the study. Data received from participants must be kept confidential.

1.10. Delimitations of the study

In terms of time, the researcher did her best to manage her time wisely by utilizing nights and weekends for research.

This study was conducted in Mashonaland East Province in Mudzi district at Kotwa High School. This study was conducted on third and fourth grade biology students and school biology teachers.

1.11. Definitions of Terms

1.11.1 ICT

ICT is defined as manipulation and communication of information by using electronic resources and tools such as computers, internet and broadcasting technologies (Kaware and Sain, 2015). ICT stands for Information and Communication Technology. It is defined as a diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include computers, the internet live broadcasting technologies, recorded broadcasting technologies and telephony (UNESCO 2017). These information handling tools include the computers, laptops, handheld devices such as mobile phones, iPods, pads, and tablets among others which are now able to work together and combine to form a networked world which reaches every corner of the globe using the internet.

1.11.2. Challenges

A challenge is defined as "any condition that makes it difficult to make progress or to achieve an objective" (WordNet, 1997, as cited in Schoepp, 2005, p. 2). It also refers to something that by its nature or character serves as a call to make a special effort a demand to explain, justify or difficulty in an undertaking that is stimulating to one engaged in it (Baporikar, 2020).

1.11.3 Learning

It is a process of acquiring new knowledge or improves and develops on an existing knowledge through teaching study and experience which one can apply from memory to face to face. Therefore, effective teaching can take place when a learner performs what the teacher had expected during lesson planning.

1.11.4 Teaching

Teaching is a process which involves imparting of knowledge, skills and behaviour from a knowledgeable resource person to learners in a well-designed system and environment for

such an activity. (Lincoln and Guba, 1985). In short teaching is the provision of an environment for effective learning.

1.12. Summary

This chapter provides some background on this study. It also allowed me to focus on my research area and define the problem I wanted to solve. To achieve the objectives of this study,

the objectives of the study were outlined and formulated. The significance, limitations and boundaries of the study were also discussed.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Literature review is very important to collect appropriate and necessary information to realize the research objectives. The review summarizes, evaluates, refines, and presents the theoretical foundations of the study. The key topic covered in this chapter is the theoretical framework. This chapter examines teacher and student attitudes towards the use of ICT in teaching and learning biology around the world, particularly in Zimbabwe. Students and teachers had different views on the use of ICT in teaching and learning. In this study, literature review was also conducted to explore the challenges, solutions and benefits of using ICT in the teaching and learning of biology. Literature review was also used in this study to explain different concepts that were used build this research. The following section presents theoretical framework.

2.2 Location of the study in literature

A number of literatures were revealed to show that this study was not isolated. This reveal also helped to identify the knowledge gap that the study sought to cover.

2.2.1 Information and Communication Technology (ICT)

It has been observed that, the current situation is characterized by an extraordinary and a rampant increase in major areas of knowledge and ambitions along with fast increasing population. (Sahu and Pradhan. 2016). The two posits that, this has resulted in the Earth shrinking into a global village with indistinct geographical' social, economic and political boarders. This development is due to a swift technological expansion, scientific progression

as well as the development of communication and transportation system. This then shows that, the development of fast technological systems is enabling and allowing rapid communication throughout the globe via the use of the internet. Speedy transmission of information is entailed by the use of modern ICT gadgets and devices such as televisions, radio, computers, satellite dishes and mobile phones. The current era has seen these ICT devices frequently being developed into smaller, useful and fast gadgets. Through the advancement of knowledge, skills and mechanization, there is a massive increase in the manufacture and production of ICT gadgets thereby resulting in the tools becoming readily available, cheaper and affordable.

Sahu and Pradhan (2016) further alluded that, during learning, ICT was of late restricted only to textual mode of transmission of information yet presently information can be transmitted in the form of audios, videos or any other media. The two authors went on to say teaching and learning can be transformed into a multicultural approach due to the use of ICT tools. It has been noted that, traditional methods of teaching make it difficult to achieve all the learning objectives hence the need to opt to multiple methods or integration of different methods. To achieve the several objectives, ICT is of much use. It is a known fact that not a single teacher can be able to give up to date and complete information in his/her subject area. Therefore, ICT can bridge this gap as it has been seen that it can provide access to several sources of information via the internet. More so, ICT diversify the way information or content is presented. It also helps in learner concentration resulting in a better understanding and long-term retention of the concepts learnt.

The internet provides a lot of websites which may be used by teachers and learners to achieve their objectives. In addition to that, Mingaine (2013) highlighted that, there are some experiments which pose much danger when carried out in the school science laboratories. He went on to say that the use of ICTs can actually help learners to see what happens in such experiments via videos or any other media in class. This becomes less costly to schools as they will not have to buy the materials required for experiments in school laboratories. However, all the outlined studies have highlighted the impact of ICT in general but lacked emphasis on the impact of ICT in the teaching and learning of gene technology. It is in light of that status quo that this research seeks to establish the impact of ICT in the teaching and learning of recombinant gene technology.

2.2.2 Attitude of teachers towards the use of ICT in the teaching of biology.

Teachers are expected to adopt and use ICTs appropriately in their teaching hence implement the changes expected in pedagogy. This is to say successful implementation of ICT depends mostly upon teachers' attitudes, perception and competence in the integration of ICT into the teaching process. Research reveals different attitudes of teachers toward ICT integration. Studies by Korte and Husing (2007) and Oldfield (2010) as cited in Oboegbulem and Ugwu, (2012), Blanknskat et al (2006) and Becta (2008) have revealed that despite the benefits of ICTs in teaching and learning, there is still a small group of teachers who do not see any. significant advantage to the teaching process while using ICTs. Kearsley, (2004), however reported that a good number of teachers in high school have positive attitudes towards the use of ICT in their educative activities. Lauman (2000) in Kearsley, (2004) also reported that most teachers believe that ICT helps them to develop cognitive skills in their daily teaching process, to be professionals in organizing subject content and in enabling a creative learning atmosphere.

2.2.3 Attitude of Learners towards the use of ICT in the learning of biology.

The researches carried out in the world especially in the developed countries have revealed that the learner attitudes towards the use ICT in learning varies with teacher competence, access to ICT hardware and software and understanding of benefits brought about by ICT. Pre-service teachers have the opportunity to share, develop and critique learning resources to help integrate technology into their lessons and it can help them see the utility, value and potential of using a particular technology and teaching strategy (Dorner, 2016). Some learners believe that ICTs have the potential to improve the teaching and learning, but almost equal numbers of them still find it difficult to understand the specific benefits of ICTs or how it can be used to achieve maximum results.

ICT is a tool that supports the learning process and holds the promise of new solutions to all the challenges that education is facing. It has been proposed that the development of ICT has become a vital issue to meet the needs of the education system (Chao, 2015). It is believed that

if teachers perceived technology programs as neither their teaching nor their learners' needs it is likely that they will not use technologies in their teaching. If the teacher has already shown an attitude it is also passed on to the learner, they might not show interest in it. On the other hand, if the teacher attitudes are positive towards the use of ICT then the learners quickly adopt and use ICT in their learning process. Some teachers prefer to stick with tried and tested methods which they believed would enable them to predict and control outcomes easily (Ndibalema, 2014).

ICT in the classroom especially in the incorporation of a positive outcome depend on the following factors: teachers' attitudes to the contribution of ICT for teaching biology towards the role of ICT, biology education of learners and teacher's attitudes towards the use ICT in the classroom sense that presence of ICT in the classroom biology teachers' self-esteem and classroom administration ability to integrate ICT in education in teachers and attractions. Most students have technophobia, the fear of technology, which contributes to developing negative attitudes towards the use of ICT in education. At the heart of this justification is the scepticism that students cannot become classroom learning revolutionaries even if they use ICT tools to change their learning philosophies. Using ICT in 2D and 3D provides students with visual representations. Thanks to the Internet, students always have access to new information and data. Self-regulated students are aware of their academic strengths and weaknesses and have a good understanding of the strategies they use to cope with everyday academic challenges (Das and Chowdhury, 2019).

If students have a positive attitude toward learning biology, it will be very easy for these students to adopt it because they now live in a world of technology where they can learn using other people's devices.

2.2.4 Challenges on the use of ICT in the teaching and learning of biology.

In Zimbabwe the 2010-2014 strategic plans for the Ministry of Information and Communication technology with regards to education are to have one computer per class by 2014. Looking at most Zimbabwean secondary school classes have an average of 40 pupils per class and this means that there will be one per 40 which is not workable. Arthur-Nyarko (2019), posit that in Ghana and many other African countries are lagging behind in terms of the use of

ICT in education with the ratio of one computer to 150 learners against a ratio of 1 to 15 learners in the developed countries. This is mainly due to the lack of access to ICT facilities and knowledge in the use of the ICT tools. The successful integration of ICT in education depends largely on the availability of the tools and this is also enhanced by the inability of the parents to purchase the required gadgets. The researches have shown that Zimbabwean teachers fear change, lacks qualifications in ICT skills and develops negative attitudes towards the use of ICT in learning. The education system of teacher training is lagging behind on the requisite ICT training of teachers.

Pupils of today are now computer literate meaning that some of them have the knowledge of computers but due to poverty in the country schools usually those in rural areas they cannot purchase them. However, we have issues of logistics and infrastructural deficit, improving accessibility and bridging the gap between theory and practice that need to be addressed (Peprah, 2016). The gap in knowledge acquisition and lack of skills in ICT, there is the unavailability of computers and other modern technologies especially in rural schools where there is poor internet connectivity and unreliable power supply. These challenges are negatively affecting the use of ICT in teaching and learning of biology. Moreover, some do not have electricity and it is meaningless to acquire them. Some schools have computers but due to power cuts and lack of internet access or are bedevilled with erratic power supply. The lack or inadequate access to ICT resources by both teachers and learners are among the numerous issues challenging the schools in ensuring effective implementation of use of ICT in education (BECTA,2004 cited in Aikins and Nyarko, 2019). Because of the above mentioned points learning of biology with the use of ICT become a challenge hence teachers continue to use the old methods.

The introduction of computers has done a great harm to education, pointing to the fact that, because of the availability of technology students have lost their thinking routine and problem solving skills as they rely heavily on already done work available on computers and online sources that they copy blindly instead of thinking to create something original (Iskrenovic-Momcilovic, 2018).Teachers and pupils were becoming lazy in thinking and gradually they are losing their memories and thinking abilities to technologies. Pupils do not take their time

to get answers to the most complex biology problems within some seconds they produce answers through the use of computers.

2.2.5 Benefits of using ICT in the teaching of biology.

Integrating ICT in teaching and learning biology, provides teachers with opportunities to bring nature into classroom activities (Demkanin et al., 2008). The Edmodo platform, an e-learning model, has been successful in teaching biology (Végh and Elbert, 2017). ICT has been recognized to increase student motivation by facilitating information exchange between groups of students (Senthilkumar, Sivapragasam, and Senthamaraikannan, 2014). Karim (2018) explained that multimedia strategies are the best way to make biology education meaningful.

Virtual labs may also find virtual frog dissection useful for improving biology education. Interactive Frog Dissection provides both realistic images and opportunities for students to practice frog dissection and anatomical identification (Kinsey, Birch, and Bocker, 1996). In addition to the above, various applets (small programs) have been developed for educational purposes. These include: Experimental simulations and animated images (Demkanin, Kibble, Lavonen, Guitart, and Turley, 2008). Data logging has also been developed to help teachers conduct hands-on science experiments. Biology education focuses on living organisms and life processes, but some organisms live in remote areas that are not accessible to all students. Digital cameras allow us to bring images of a variety of living things into the classroom (University of York, 2002).

2.2.6 Benefits of using ICT in the learning of biology.

The use of ICT in the teaching and learning environment had brought a number of advantages to school going pupils. There are numerous benefits of computer technology when it is integrated deliberately comprehensively into teaching and learning. Computer technology support student achievement. When integrated into situation appropriately computer, computer technology has significant positive efforts on student achievement in reading, literacy and biology.

Specific ICT tools and applications (software) were developed for teaching and learning Biology as well as other science subjects. Among this software we may include the SimBio software for DNA replication (The SimBio Consortium, 2001), the NeuroBytes for improving the teaching and learning of nerve transmission across the synapses (Isabel, Vignesh and Rogers 2018) that was difficult to be grasped through the traditional didactic methods (Šorgo, Verčkovnik, and Kocijančič, 2010). Meanwhile, virtual laboratories also play a big role in biology teaching and learning. Through these scenarios, students learn to understand analogies of natural phenomena through visual representations and realistic simulations based on real phenomena (Sommer and Sommer, 2003). Virtual laboratories leverage the power of computer models and simulations, as well as a variety of other teaching technologies, to replace face-to-face laboratory instruction (Scheckler, 2003). This type of learning experience gives students access to hands-on activities that are not possible in a physics laboratory (Muhamad, Zaman, Ahmad, 2012).

In the past twenty years there had been a significant increase in Information Communication and Technology investment in education so that students and teachers now had a much wider access to ICT than before (OECD, 2015). The reason for investment is the belief that introducing ICT in education improved the teacher productivity student’s outcomes and prepare them for a world were technology is an important part of life.

Recent research has shown that teacher integration of ICT into biology teaching in the classroom had an impact on student outcomes (Hegedus and Tapper and Dalton, 2016). The availability of technology in classrooms alone does not improve student outcomes. If the teacher who is the facilitator of the classroom should be the one is able to use technology for him or her to pass on the knowledge to the learners. They can help most students because they have the necessary knowledge and computer skills. Teachers' decisions about how to integrate ICT into biology classes can either improve or decrease student performance. Considering the important role of teachers in integrating ICT in the classroom, the educational literature has developed various theoretical frameworks to understand ICT integration in biology.

The use of ICT can improve students' information reliability, accuracy and motivation, create high-quality multimedia products, and change teacher practice planning tools. This improves the quality of teaching, learning and management in schools as well as teachers' professional development (Ojugo et al., 2015).

ICT supported changes to the way students were learning as they move from one content centered to curricula to contemporary based curricula. It improved the quality of learning and collaborative learning. One major advantage of using of using ICT in the education system was to prepare the present and next generation of students for a workplace where ICT particularly computers, internet and other related technologies were ever present.

2.2.7 Solutions in the use of ICT in the teaching and learning of biology.

With the emergence of new technologies, more time is needed to learn and gain experience and confidence to use it in the presence of learners who in most cases know better than them. ICT cannot replace normal classroom teaching but can be a positive force in biology classrooms for deep understanding of concept and could be used to provide new authentic, interesting, motivating and successful learning activities. Training on the use of ICT tools might be a solution to the learning of biology. Learners need to have the background knowledge on how to use the internet, how to operate the tools, how to select relevant information from the internet. Providing pedagogical training for teachers rather than simply training them to use ICT tools as an important tool.

The teacher training colleges need to be prepared for current and future changes that may occur. The teachers' module was seen to be lagging behind regarding the ICT training before they were deployed in schools to enhance the use of ICT in the teaching and learning. It is now taken into consideration since all teacher training institutions are taking ICT as a compulsory subject to make sure that every teacher is computer literate. Students at universities and colleges are even given assignments and projects that need to be submitted typed and as soft copies hence they are computer literate.

2.3 Summary

This chapter looked at what different scholars thought about the attitude of teachers and learners on the use of ICT in teaching and learning of biology. The chapter discussed the use of ICT in teaching and learning in Zimbabwe and the world at large. The chapter also discussed the challenges and solution of using ICT in teaching and learning. Finally, the benefits of ICT use in teaching and learning were discussed. The following chapter is going to discuss the methods that are going to be used to meet the objectives of this study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

Research methodology refers to the developmental logic of the process used to generate theory, that is, the procedural framework within which research is conducted [Remenyi et al., 1998]. Data were collected to obtain results consistent with the purpose and scope of this study. In this study, secondary data is used to strengthen the article. To collect secondary data, we used both published and unpublished data sources. In this chapter, the researcher reviewed the description of the research design adopted based on its perceived strengths in the research context. The factors that determine design selection and the research methodology that will be used for data collection and analysis are explained. Qualitative and quantitative research has been used to explore and understand complex phenomena, experiences, and social interactions. This involves collecting and analysing non-numerical data, such as interviews, questionnaires, observations, and focus groups, to gain insight into the subjective experiences and meanings given by individuals. This chapter also includes observations, questionnaires and interviews and how they were used to collect data. The population, sample, and sampling method were determined. Data collection tools, data analysis and organization, validity, reliability, and ethical considerations were described. A summary of the chapter is also provided. The next section will use qualitative research for this study.

3.2 Research Design

This study used a case study design. This study also used mixed methods research. Creswell (2015) states that mixed methods research is research that integrates multiple methods to address a research problem in an appropriate and principled manner, including the collection, analysis, interpretation, and presentation of qualitative and quantitative data. Using mixed methods allows researchers to answer research questions in depth. Mixed methods designs offer several advantages when approaching complex research problems because they integrate the philosophical frameworks of post positivism and interpretive approaches.

Qualitative research does not involve statistical analysis and empirical calculations [Brink, 1993]. Qualitative research has roots in social and cultural anthropology, philosophy, psychology, history, and sociology. The goal of the qualitative tradition is “a deep understanding of something specific” [Domholdt, 1993]. The purpose of qualitative research is to systematically describe and interpret problems or phenomena from the perspective of the

individual or group being studied and to create new concepts and theories. The choice of methodology is determined by the questions posed [Viswambharan, Priya, 2016]. It also provides logically sound methodological flexibility and deep insights into small-scale cases (Maxwell, 2016). Qualitative approaches provide a deeper understanding of the issues under study by considering the voices of participants. This can be useful when previous research yields expected results. Mixed research methods can help generalize, to degree, qualitative data. It is also helpful in designing and validating research instruments. A mixed method design can integrate and synergize multiple data sources which can assist to study complex problems (Poth and Munce, 2020). The application of mixed methods means purposeful data consolidation which allows researchers to seek a whole view of their study by enabling them to view their study by enabling them to view a phenomenon from different perspectives and research lenses (Shorten and Smith, 2017).

Qualitative data such as interviews and focus groups can provide depth in the research inquiry as the research can gain a deeper insight into the phenomenon from narratives. Among the six types of mixed methods research, parallel triangulation was selected and used. A study is characterized by two or more methods used to validate, cross-validate, or confirm within a study. Data collection occurs simultaneously. By design, both methods are commonly used to overcome the disadvantages of using one method and take advantage of the advantages of the other. Research on modern, non-quantifiable data such as emotions, thoughts, behaviours, and beliefs is effective. It also uses different evidence from interviews and observations.

Quantitative research is defined as a proper, objective and deductive approach to problem solving. (Lincoln and Guba 1985). This study also uses quantitative research because of the need to produce quantifiable results, involving numbers and the process of counting. The researcher takes advantage of the aspect of quantitative research which is context free which means that it is free of context and random sampling is typically employed since the concept can handle large numbers of participants. Large numbers of participants are involved during the lesson and the analysis of ordinary level learners' Biology exercise books. The study also takes advantage of the quantitative research as it is useful in obtaining the data that allow quantitative deductions to be made. Data analysis is fairly less time consuming and data collection using some quantitative methods is relatively quick like for example through use of

questionnaire. Quantitative research paradigm therefore is rationale because the researcher employs questionnaires as data collection instruments.

3.3. Instruments used to collect data

In this study, researcher used interviews, questionnaires, visits, document analysis and observations as research instruments in gathering the relevant data. Qualitative methods are typically more flexible – that is, they allow greater spontaneity and adaptation of the interaction between the researcher and the study participant. With open-ended questions, participants are free to respond in their own words, and these responses tend to be more complex than simply "yes" or "no." Participants have the opportunity to respond more elaborately and in greater detail. In turn, researchers have the opportunity to respond immediately to what participants say by tailoring subsequent questions to information the participant has provided. Quantitative methods such as questionnaires are quick and less time consuming.

3.3.1 Semi-structured Interviews

The interview is one of the data collection techniques for qualitative researchers. Semi-structured interviews are organized around a set of predetermined open –ended with other question emerging from the dialogue between interviewer and interviewee. Qualitative research interviews are attempts to understand the world from the subjects' point of view, to unfold the meaning of people' experiences and to uncover their world prior to scientific explanations (Schoenborn, Lee, Pollack et al, 2017).

The semi-structured interviews allow the researcher to collect open –ended data, to explore participant thoughts, feelings and beliefs about a particular and developed to direct the researcher during an interview. Essentially, interviews have become a common means of collecting qualitative data. They allow the researcher to enter into the other person's inner world and they help to understand the other person's perspective and meaning he or she give to perspectives (DeJonckheere, Robinson, Evans et al, 2018). Interviews were conducted with

five biology teachers and twenty learners who are randomly selected. The researcher used these face to face semi-structured interviews as they allow the researcher to probe for more information from participants (Malterud, Siersma, Guassora, 2016). The researcher used semi-structured interviews to obtain primary data from teachers and learners with technical challenges in its original form. In this research original or primary data refers to information that was collected from teachers and learners. These interviews tend to be used to gather qualitative data, usually last a little longer and allow the interviews to explore questions in greater depth (Corona, 2017). It is important to note that all the interviews were prepared in order to obtain detailed qualitative information.

The researcher will take notes, modify the data collection procedures and write reflective memos throughout the data collection process (Babchuk, 2019). Interviews were carried out face to face with the school biology teachers with a purpose to obtain more information on the attitudes of the teachers in using ICT in their teaching of biology using ICT. They gave room for probing more information for further clarification. The interviewer gains more insight into the attitudes of learners through gestures and facial expressions from the interviewee. Researchers must be mindful of limitations of interview tools that may make respondents feel uncomfortable. However, it is only in the past decade that interest in testing applicants for cheating during interviews has increased (Bourdage, Roulin, and Levashina, 2017). The next section is about observations.

3.3.2 Observations

This involves observing objects, processes, relationships, events, etc. and formally recording the information. The observation method may be structured or expert observation. Through observation, the researcher was able to investigate the ICT components and social environment of the MUJI research area using non-participant observation. The biggest advantage is that actions are recorded as they occur. Researchers can use observation guides to focus on what they need to know (Pascual, 2017). This is highly recommended when more than one researcher is involved in data collection to ensure that everyone follows the same procedures. The required information was recorded in an observation checklist. Observations improve reporting of research results.

Singh (2015) points out that observation helps us understand verbal responses more effectively. By using good and modern gadgets, observation can be made continuously for a larger duration of time period. Observation was less demanding in nature which makes it less biased in working abilities. However, its main shortfall is that problem of the past cannot be studied by means of observation hence the researcher will cushion this problem by employing interviews to solicit for information about pat problems.

3.3.3 Questionnaire

The researcher is aware that questionnaires are mostly used in quantitative research and uses them to get responses from learners who may be too busy to spare time for interviews. For the sake of consistency and clarity concerning the investigation of the use of the attitudes of teachers and learners in the integration of ICT tools in the teaching and learning of biology, questionnaires are of great importance and most ideal in the quantitative paradigm which is also used in this research. Questionnaires are widely used in research study to provide an efficient way of collecting results in both quantitative and qualitative data collections for all the respondents answer the same set of questions. The study selected this data collection instrument as it provides physical verification that the researcher is carrying out properly.

Closed and open ended questionnaires are used to collect data from teachers. Respondents provide confidential information which increases chances of correct findings and accurate in terms of space and time. Answers are standard and comparable from person to person. Respondents are required to mark by deleting the applicable. Spaces are provided for respondents to give their own suggestions on issues the feel to be of much help.

A descriptive research design has been used by the researcher where open ended questionnaires were used. This helped the researcher to classify and describe the inconsistency in different phenomenon. In addition, closed ended questions are easy to compare and contrast. The inclusion of open ended questions is meant to enable the collection of detailed qualitative data. The questionnaires employed by the researcher are self-administered by personally providing them to the learners in each case.

3.3.4 Document Analysis

According to Creswell, (2003), document analysis focuses on interpreting recorded material in order to understand more about human behaviour or the phenomenon under investigation. Pursuing the above thought, Buttler (2013) states that document analysis helps when looking for patterns in order to build up a picture of the phenomenon that is being observed. In this case, it is the learners' biology exercise books, biology teachers' evaluation.

In this study, the documents are valuable basis of verification of other forms of unrecorded data since they assist in exploring the actual content by comparing performances when learners are taught and learn without aid of ICT tools. The form 3 and form 4 biology exercise books and their biology teachers' evaluation books are intended to help rebuild events and give evidence about proceedings as well as substantiate interviews and thus will assist in making conclusions which are trustworthy and reliable.

3.3.5 Classroom observations and Laboratory Visits

The researcher will do at least one class visit observing ICT tools used as well as their benefits in the teaching and learning biology. For the sake of this study, the researcher visits the laboratory in order to collect data. During the visits., the researcher will be noting the type ICT tools available at the school. This gives a true record of what exactly is on the ground.

3.4. Population

Population is a group of people which the researcher is intended to use. Target population is the specific conceptually bounded group of potential participants to whom the researcher may have access that represents the nature of the population. In this study, the population is made up of teachers and learners doing biology. The study involved twenty learners and five teachers who would be purposively selected.

To determine the target population, one must operationalize the units' characteristics of interest based upon the study variables or the qualitative experience so that the results of the study may be accurately inferred back to the population of interest (Ackerman et al, 2019). The target population must also be exclusive enough to avoid having participants who do not represent the study needs which will misrepresent the population of interest.

3.5 Sample and Sampling procedures

According to Tuckman (1994), sampling is a means of selecting a given number of objects from a defined population as a representation of that population. It is a sub group of members drawn from the population to participate in the study. A sample is used to make generalizations about the population.

The sample must be representative of the population of interest, and this requirement is achieved by identifying an appropriate sampling frame and using appropriate sampling techniques. The two main factors to consider when choosing a sample are how many units should be in the sample (sample size) and how to select those units (sampling method). Moreover, sampling allows generalization to larger populations. A sample is a small number of elements from a large group of elements. Information obtained from small groups of elements reflects the true views and accurate judgments of the larger group. In this study, a purposive extraction method was used based on the researcher's judgment and the purpose of the study.

3.6 Purposive Sampling

Purposive sampling is the international selection of a participant because of the characteristics and qualities of the individual processes (Etikan et al, 2016). Purposive sampling enables the selection of information-rich individuals whose experiences amply the questions being studied. In this study the researcher interviewed biology teachers and biology learners in the third and fourth grade all from Kotwa High School. Patton (2015) posits the view that the information that rich informants produce insights and in-depth understanding and not empirical generalizations. Cohen (2017) emphasized that purposive sampling doesn’t aim to achieve population validity but a deep understanding of selected individuals.

These were respected, expert teachers who were willing to participate in lengthy interviews and to allow the data to be published in a research project. All biology teachers were competent

enough to answer the questions asked in this study. The sample is large enough if the researcher is satisfied that the data are broad enough to encompass the dimensions of interest. This view is also supported by Patton (2012) who confirmed that qualitative research typically uses small samples and single cases are also acceptable. He said sample size depends on the purpose of the study and the time available to the researcher. However, he warns that insufficient depth of data collection and insufficient sample breadth can cause problems in research. What mattered was not the size but the careful selection of the samples. Considering the above, the researcher was confident that the sample size was sufficient for the purpose of this study. Purposive sampling was used to select participants.

Students were purposively selected between 15 and 20 years of age. The students were selected because they were experiencing technical issues and because the teachers in their classrooms were aware of these students' problems and were knowledgeable about factors affecting academic achievement. Due to the nature of the sampling method, purposive sampling has been most commonly used in qualitative and quantitative research (Patton, 2015).

It bears repeating that purposive sampling methods do not contribute generalising results to the population of interest. The researcher involved those who were dealing with these learners, purposeful sampling methods extensively used in qualitative research for the identification and selection of information rich participants. Thus the selection of participants was done purposively on the merits of their position and their ability to explain the challenges which teachers and learners faced and how to overcome them.

3.7 Data collection procedures

A letter from Bindura University that requested for being allowed to conduct a research was sought. Then the researcher asked permission from the Permanent Secretary of Education, Provincial and District Education Ministry of Primary and Secondary Education offices. Permission was sought from School Head to carry out the research at Kotwa secondary school. When permission was granted data collection began. The researcher interviewed the biology teachers during their free periods so as to avoid disturbance of lessons. They dedicated their

spare time to have the interviews. The researcher also interviewed selected learners and their responses were captured. Observation and visits was also done and recorded.

3.8 Analysis and Organisation of Data.

Content analysis is a systematic procedure designed to examine and analyse recorded information. Researchers should protect participants' anonymity by assigning numbers or letters to be used during data analysis and presentation. Dudovsky (2018) lists the steps of data analysis and presentation. The first step means that the researcher must read the entire interview to better understand the text. Second, the researcher identifies possible themes from the data and meanings that emerged from the interviews. Researchers then analysed each document. The researcher used an in-depth interpretation of each text provided or written to the participants. Additionally, the researchers continued to interpret the data that emerged from additional discussions and treated them as new data. The researcher then identified themes through review and re-examination of data interpretations and discussions with participants. Then, the investigator will prepare the final report using information from interviews which allows readers to participate in validation of the findings.

Qualitative data is analysed using descriptive statements based on relevant thematic areas given in prose (Alvi, 2016). The technique is advantageous in the sense that it is objective and it prevents any bias of the researcher from being included in the findings. The study uses tables, charts and thematic approach in analysing collected data. Conclusions can be drawn from the data collected by the researcher from document analysis, interviews and questionnaires. Data obtained are analysed, evaluated and interpreted through the use of words and figures.

3.8.1 Reliability

Reliability refers to 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. “Trustworthiness issues come in many forms. Whenever the data source is a single observer, reliability becomes an issue because there is no reliable protection from the influence of that observer's subjectivity (Bell, 2015). In most cases, reliability issues are closely related to subjectivity, and when researchers adopt a subjective approach to research, the level of trustworthiness of their work decreases. In this study, respondents are first informed of the purpose of the interview and the need to answer truthfully.

3.8.2 Validity

Validity is the extent to which an instrument measures what it is intended to measure. (Mugenga, 2003). Validation involves collecting and analysing data to assess the accuracy of an instrument. To ensure the validity of this research, appropriate research instruments were employed to collect data.

Following the above views, Buttler (2013), discusses triangulation which means using more than one method to collect data on the same topic. It is a way of assuming the validity of research through the use of different methods to collect data on the same topic, which involves different types of methods of data collection. However, the purpose of triangulation is not to cross validate data but rather to capture different dimensions of the same phenomenon. In this regard, the study uses more than one method which includes interviews, questionnaires and document analysis to get a deep understanding in an attempt to interrogate the effectiveness of ICT tools in the learning of Biology at ordinary level.

Overall, validity was a measure of how valid the study was. More specifically, validity refers to both the design and methods of the study. Gathering valid data means that the findings truly reflect the phenomenon they are intended to measure (Drew, 2018). Validity is the extent to which an instrument measures what it is intended to measure. The research instruments that will be used in this study will provide accurate measurements or a realistic picture of what will actually happen. i.e. research tools.

In other words, the research instruments provided fair and correct data that would not mislead any users of the outcomes of this research.

3.8.3 Ethical Considerations

According to Dudovskiy (2018) ethics in research are standards governing human behaviour, thus they are values that distinguish right and wrong, good and bad. The ethical considerations were mentioned. As a student at Bindura University focusing on the challenges faced in using ICT in teaching and learning of biology, all responses will be kept confidential. This means that responses will be used for purposes of this research only.

3.8.4 Integrity

The researcher was able to keep her promises and agreements; act with sincerity; and strive for consistency of thought and action.

3.8.5 Consent

Participants were informed on the purpose of the investigation. Consent was sought before commencing of the study was done. The researcher asked for permission to carry out the research in Mudzi District from the Ministry of Primary and Secondary.

3.8.6 Openness

The researcher was open to criticism and accepted new ideas.

3.8.7 Confidentiality

The researcher tried by all means to protect confidential information. She was able to keep respondents' responses private and confidential. She also encouraged participants not to divulge information pertaining to the research.

3.8.8 Legality

The researcher tried by all means to obey relevant laws and institutional and governmental policies. The researcher sought authority from Mudzi District Education Offices and was granted authority to carry out the research.

3.9 Summary

The mixed methods approach was used to conduct the research. This chapter outlined the methodology that was used in investigating the problem. The qualitative and quantitative design was used and its justification was also given. The purposive and stratified random sampling techniques were used to select the specified sample. The researcher used observation to collect data and interviewed teachers and the learners. The interview guides and questionnaires were administered to biology teachers and learners as well as the learners' books were used to collect data. The chapter detailed how the data collected was going to be analysed to draw conclusions and meanings.

CHAPTER 4: DATA PRESENTATION

4.1. Introduction

This chapter is going to present collected data that was obtained using the instruments discussed in the previous chapter regarding the effectiveness of ICT tools in the teaching and learning of Biology at Kotwa High school. The study has found out that the effectiveness of ICT in relation to the teaching and learning of biology depends on quite a number of factors. These factors include the usage of ICT by teachers, usage of ICT by learners and the availability as well as adequacy of ICT tools in schools. The findings from this research are proof towards the positive impact of ICT tools in the teaching and learning of biology. Themes and diagrams were actually used in laying out and analysing data which was gathered through the data gathering instruments (interviews, questionnaire, document analysis and observations) discussed in the previous chapter. Tables are used in this chapter to summarize the data presented and some other illustrations were also done using a pie charts.

4.2. Structure of the Sample

The core participants were five (5) biology teachers from Kotwa high school, and twenty (20) 'O' level Biology learners. Therefore, in total the number of informants was twenty-five (25). The school teachers were then labelled A, B, C, D and E respectively for confidentiality sake. Detailed descriptions in the form of narrations were used to present the facts and findings of this study. Obtained data was presented in tables and the numbers show the responses that came from the respondents. The following table gives the structure of the sample as regards to gender for both teachers and learners.

Table 4.2.1: Biological Data for the Sample Data

	Females	Males
Teachers	3	2
Learners	9	11

The sample consisted of three female teachers and two male teachers from Kotwa high school science department to make a total of five teacher participants. The sample also included twenty learners of which nine were girls and eleven boys from 'O' Level science classes at Kotwa high school. The teachers that made the sample were all with teaching qualifications ranging from diploma in education to masters in their areas of specialization.

4.3. Questionnaire Response Rate

Questionnaires were not administered to learners as it was observed that some may not know which ones are ICT tools and which ones are not. However, teachers were given questionnaires to complete as their schedule was tight. A 100% response rate was achieved. The table below shows the response rate.

Table 4.3.1: Questionnaire Response Rate

	Teachers	Percentage
Questionnaires given out	5	100
Questionnaires returned	5	100

Five questionnaires were issued out and all of them were returned completed with responses. Open ended questions were not satisfactorily answered but all close ended questions were answered satisfactorily.

4.4. ICT tools and the teaching and learning of biology.

In this section, responses from teachers in an attempt to interrogate the effectiveness of ICT tools in the teaching and learning of biology at ordinary level are laid out. Both interviews and questionnaires were done to teachers and classroom observations were done and even laboratory observations were successfully done. The researcher had formulated close ended questions which requires a yes or no as an answer. At the beginning of the questions were the interrogations whether ICT tools are being used or are readily available in schools as well as the type of ICT tools that are available and used. The researcher's questions suggested possible advantages of using ICT tools in the teaching and learning of biology. The table below illustrates the responses from teachers on the availability, the type of, the use of and the effectiveness of ICT tools in the teaching and learning of biology.

4.5. Teacher Responses

Table 4.3 below represents the responses from teachers during interviews. The researcher had a chance to interview all the selected teachers at appointed times.

Table 4.5.1. Teacher Responses

Questions	TEACHER										TOTAL
	A		B		C			D		E	
Are teachers using ICT tools when teaching Biology?	Yes	No	Yes	No	Yes	No	YES	NO	YES	NO	
	1	0	1	0	1	0	0	1	1	0	5
Does the use of ICT tools enhance the teaching and learning of biology?	1	0	1	0	1	0	0	2	1	0	5
Do ICT tools makes illustration of some biology concept easier?	1	0	0	1	1	0	1	0	1	0	5

Table 4.5.1 above illustrates that ICT tools are being used by teachers during teaching even though in other circumstances teachers do not use ICT tools. Four teachers which makes up 80% of teacher participants for this research shows that there is availability of ICT tools in the school and they are often used during the teaching and learning of biology.

Teacher responses show that one teacher, that is 20 percent of the Biology teachers who took part during this study do not use ICT tools during the period of teaching and learning of biology. This shows that the greater percentage of teachers (60%) which is constituted by three teachers admit that ICT tools enhance the teaching and learning of biology. On the other hand, 40% which is made up of two teachers do not agree that ICT tools enhance the teaching and learning of biology, of which this is a smaller percentage of the sample. From the findings presented in

the above table, it can be highly noted that ICT tools has a greater potential in enhancing the teaching and learning of biology. One teacher out of five strongly believe that making illustrations of some biology concepts is not made easier when one is using ICT tools. On the contrary, four teachers out of five agreed that illustrations are made easier through the use of ICT tools in teaching of some biology concepts.

Teachers explained that the use of ICT tools enhance the learning of biology by making presentation of diagrams on the projector using PowerPoint is much easier and clearer than drawing diagrams and illustrations on the chalkboard. Explanations by the teacher can be made as many times as necessary referring to the presentations beamed by the projector or notes displayed used PowerPoint presentations. This enhances the teaching process. The use of ICT tools makes learning fast and saves time due to the fact that there will be no need to draw the diagrams, videos can be used to make learners understand some concepts in biology for example, mitosis and meiosis.

The participating teachers who were of the opinion that illustrations of biology concepts are made easier by the use of ICT tools gave their reasons for this view. They pinpointed that illustrations on the internet come in different forms giving the teacher more choices to choose an illustration which suits his/her group of learners for them to grasp the concept. They also added that, PowerPoint illustrations are colourful therefore attracts learner's attention thereby making illustrations easy.

4.6. Learners' responses

The following table shows responses by learners from Kotwa high school pertaining the use, availability and effectiveness of ICT tools in learning of biology. Questions were formulated in such a way that they started with finding out the availability of ICT tools in the school, whether they are used or not and the benefits of using such tools. The questions led to the assessment of the effectiveness of ICT tools in learning of biology.

Table: 4.6.1 Learners' responses

QUESTIONS	YES	NO	TOTAL
Are ICT tools such as computers available at your school?	20	0	20
Do teachers use ICT tools like projectors and computers during biology lessons?	12	8	20
Do learners use smart phones, computers or notepads during lessons?	0	20	20
Do ICT tools help learners grasp biology concepts?	18	2	20

From the results shown in the table above, it emerged that the school have ICT tools like computers available at their schools but they are rarely used during the teaching and learning of biology as they are few, they are mostly reserved for computer science students. When asked whether teachers use ICT tools when teaching some biology concepts twelve out of twenty learners, revealed that ICT tools are actually used in school. However, 8 out of 20 revealed that teachers in the school do not use any ICT tool when conducting lessons.

Learners indicated that all learners are not allowed to use ICT tools such as smart phones during lessons as they misuse these gadgets. Eighteen out of twenty learners agreed that the use of ICT tools by teachers help learners to grasp the biology concepts. Two learners did not find ICT tools being effective in enhancing learning of biology since they are not allowed to use ICT tools like cell phones when there are in school premises and learner's performance is likely to increase this year since the school has bought an interactive board for the science department.

The learners explained that ICT tools helped them to easily grasp concepts in biology by watching and listening to tutorials given to them by their teachers who will have downloaded

them from internet. Its more advantageous as the learners can watch and listen to tutorials over and over again at their spare time until they understood the concepts. They also highlighted the fact that, using ICT tools was so enticing that one would often end up enjoying learning thereby enhancing learner's understanding and grasping of concepts.

From the above results, it emerges that a greater percentage of learners are of the opinion that ICT tools enhance the learning process because they make it easier for learners to grasp the difficult concepts in biology. However, a lesser percentage of learners do not agree that ICT tools can enhance the learning process.

4.7. Effectiveness of ICT tools in the teaching and learning of biology.

The effectiveness of ICT tools in the teaching and learning of gene technology was determined by the performance of learners who were exposed to such tools. The performance of the learners was established by document analysis. The documents analysed are the test and daily exercise books of all the biology students for term one (before the use of interactive board) and term two (interactive board in use). After analysing the Biology exercise books of all Biology learners in the school, it was discovered that the use of interactive board (ICT tool) performed better than before the use of the interactive board. Learners who does not use ICT tools because of unavailability of computers, projectors and electricity performed poorly than those who use ICT tools as evidenced by their Biology exercise books. A total number of learners who did well in biology was computed by the researcher from Biology daily exercises and weekly tests. The researcher then calculated the percentage of learners who passed and used ICT tools and those who passed without using ICT tools. The table below represents the results.

4.7.1. Learners' Performance in biology

	Learners using ICT	Learners not using ICT
Percentage	73	27

The presentation in the table above indicates that 73% of all the learners who performed well in their daily exercises and weekly tests in biology used ICT tools. Only 27% of them did not use ICT tools in their learning of biology. This reveals a positive relationship between the use of ICT tools and pass rate. It therefore, means that ICT tools have the potential for improving the teaching and learning of biology and thereby improving the performance of learners.

4.8. Teacher's views on the use of ICT gadgets during lessons

A question was directed to teachers in an effort to find out their views towards the use of ICT tools or gadgets during the teaching and learning process. The following table shows their views towards the use of smart phones during lesson times.

4.8.1. Teacher's views on the use of ICT gadgets during lessons

Question	TEACHER										TOTAL
	A		B		C			D		E	
Do you think ICT tools like smart phones should be used during biology lessons?	Yes	No	Yes	No	Yes	No	YES	NO	YES	NO	
	1	0	1	0	1	0	0	1	1	0	5

Four teachers' views are that smart phones or note pads can be used during lesson times whilst one disagreed. The teacher highlighted that learners may be enticed by other activities on the phone such that they possibly end up not following lesson procedures. Another reason is that, learners may be disrupted by other activities on the phone such as calls and other social network platforms. A greater percentage of the participants showed that smart phones must be used during lesson time but teachers has to check and monitor disruptions that may be faced due to the use of smart phones in lessons. 80% of teachers were in agreement that the use of ICT gadgets during lessons was a positive and welcome move.

4.9. Teachers' views on challenges of using ICT tools when teaching biology.

A question was directed to teachers in an effort to find out their views on challenges of using ICT tools or gadgets during the teaching of biology. The following table shows their views on challenges of using ICT tools when teaching biology.

4. 9.1. Teachers' views on challenges of using ICT tools when teaching biology.

QUESTION	LIMITED RESOURCES	NETWORK CONNECTION	NO TECHNICAL SUPPORT	LIMITED TIME	ELECTRICITY ISSUES	NO TRAINING
What challenges do you face as teachers in using ICT tools when teaching biology	5	3	2	5	5	2

All teachers stated that the challenge they face is of limited resources as the department has only one laptop and one interactive board to be used by eight teachers in the department. Three teachers out of five teachers interviewed pointed another challenge of poor network connectivity, the internet is weak as there are many users and it becomes difficulty to download simulations to be watched by learners.

Forty percent of the teachers stated that the school has no technical support to look into faulty gadgets. Another challenge is on limited time, all teachers stated that there is limited time to use ICT gadgets as teachers are over loaded and they want to cover the syllabus which is too broad so if they divert some time to incorporate ICT tools in their teaching there will be minimum syllabus coverage.

Two teachers pointed out that there is no training done on use of ICT tools to those teachers who were trained long back hence they find it difficult to use ICT gadgets when teaching some biology concepts. There is also issue of electricity, the school rely on ZESA, there is no other alternative source of electricity. This makes it difficult to use ICT tools because of load shading.

4.10. Summary

This chapter presented, analysed and interpreted the data gathered from 25 respondents that included 5 teachers and 20 learners from Kotwa high school in Mudzi district. Included in the chapter was the introduction, demographic composition of the participants and data presentation analysis.

There is a general agreement that the use of ICT tools enhances learning and teaching amongst participants. They showed that the use of ICT tools in the teaching and learning of biology improved learner performance as well as mastery of the biology concepts. This effect of the use of ICT tools in schools can be of paramount importance to learners and this may result in intrinsic motivation amongst learners and the teachers. However, some of the learners and teachers were against use of ICT tools like smart phones as they can disturb learners during lessons.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter's main aim is to present the summary of the findings of this study, conclusion as well as recommendations. The chapter also looks on the summary of the study in relation to the challenges of using ICT tools in the teaching and learning of Biology. The main focus was on the views of teachers and learners on the challenges of using ICT tools on academic performance. The main thrust was also given to the conclusions drawn from the literature reviewed, methodology and the discussed and presented data. The chapter also highlights recommendations for further studies on the challenges of the use of ICT tools when teaching biology at ordinary level. The recommendations seek to help stakeholders in the education fraternity, the government, school heads, teachers, parents and learners to make informed decisions on the here said challenges of using ICT tools and how best can they be rectified to improve teaching and learning of biology.

5.2. Summary of findings

The study discusses the findings in relation to the research questions.

5.2.1. Benefits of using ICT tools during biology lessons.

This stage analysed data on the availability of academic software, the availability of internet connections as well as learners' access to these facilities as a way of finding out if lesson delivery is enhanced by ICT. According to Benzion (1994), the use of academic software during lesson delivery by teachers cultivates a culture of critical thinking among learners. Software like multimedia which comprises of hearing, seeing and motion skills promote lesson delivery. A spreadsheet package is an example which can actually be used to simulation or modelling. Subjects like physics, biology, chemistry and geography have software which is available and can leave learners with an in-depth understanding of the issues they cannot see or touch in the school laboratory. On a larger scale, the software is also appealing to learners.

The school confirmed the availability of internet connections and learners at that school also confirmed the use of internet for academic research. Teachers with academic software and internet connections highlighted that lesson delivery on the teacher's side and mastery of concepts on the part of the learner was better and easy. Bourdieu in Haralambos and Holborn (2008) alluded on cultural capital theory when he puts the idea that cultural capital includes verbal skills, knowledge base as well as ways of thinking that gives the learner room to understand concepts better and easier. The availability of academic software promotes teaching and learning to those using them.

5.2.2. The common ICT tools used during the teaching and learning of biology.

The study found out that the school have ICT tools. All teachers confirmed that laptops, overhead projectors, interactive board and smartphones are the ICT facilities in the school and these proved to make the learning process more interesting.

Findings from the participants showed that learners got interested in learning when they watch videos from their devices like laptops, interactive board and smartphones. They said it makes clear elaborations of the things they cannot see. They went on to say following lessons beamed by the projector had turned out to be interesting and eye catching. It motivates learners and enhance learning as compared to the chalk and talk traditional method which was said to be boring and some learners may fall asleep at some point in lessons, a situation almost not possible when using ICT tools.

Learners pointed out that they are not allowed to use their personal smartphones at the school and during lesson delivery time. If learners want to research they are allowed to use smartphones in the library where they will be monitored not to misuse the gadgets.

5.2.3. Views of teachers towards the use of ICT tools in the learning of biology.

Findings from the participants that is four teachers who participated making it eighty percent feel that the use of smartphones by learners at school is a welcome idea. However, participants' views differed on whether these gadgets can be used during lessons or not. Twenty percent where of the opinion that learners should not use smartphones during lessons. The respondents

cited reasons such as disruptions. They pinpointed that learner may divert their concentration from learning to social networking like Facebook and WhatsApp as well as other sites such as YouTube rather than strictly following lesson proceedings.

5.3. Conclusion

The study came up with various conclusions as far as the challenges of using ICT tools on learners' performance is concerned in the teaching and learning of biology. Response from participants indicated that the use of ICT tools as a pedagogical tool promotes quick mastery of concepts in biology. There is easy planning of lessons as well as recording of progress reports due to the availability of ICT tools at schools. This then went on to leave sufficient time for educators to focus more on the task of teaching. In other words, ICT tools shaped a conducive environment for teaching and learning of biology. Basing on the study results, it can be concluded that, teaching and learning is enhanced when ICT tools are used in schools as a pedagogical tool. Challenges such as shortage of ICT gadgets, electricity, time and qualified personnel should be addressed at schools for effective use ICT tools in teaching and learning of biology. This is in line with the Zimbabwe's latest curriculum which places much emphasis on the implementation of the usage of ICT tools in schools. The new curriculum is advocating for hands on approach through inquiry by research and experimenting in all possible areas of teaching and learning.

5.4. Recommendations of the study

The government of Zimbabwe through its line ministry that is the Ministry of Primary and Secondary Education should make sure that all secondary schools in the country as a whole have access to ICT tools because this advances the teaching and learning process. State funding should continue like STEM and reach all the corners even secondary schools at the grassroots level. The state should avail loans for schools to acquire the basic ICTs such as computers and Internet linking. Solar powering of schools without electricity is also a matter of urgency which the government is recommended to look into and consider.

Through government intervention, teachers should be taught how to use ICTs as pedagogical tools. This kind of staff development will help some teachers who have joined the service a

long time ago and are reluctant to use ICT tools. These teachers may ignore these good changes because they are not aware of the benefits of using ICTs in the teaching and learning process.

Government together with non-governmental organizations should also organize and sponsor training and workshops on how to use ICTs especially these days where there is high need for the online teaching and the virtual laboratory.

Responsible authority such as the School Development Committee, heads and administrators should make efforts to make sure that schools are linked to the internet for the rich and diverse information it offers for effective teaching and learning of biology. This is of great importance nowadays as learners can research more easily from the internet and learning can take place anywhere, anytime even during the national holidays. Strictness and good guidance and counselling should be put in place by parents and teachers to keep an eye on learners so that they do not visit malicious sites. Having internet connections reduces the costs of buying text books as they are replaced with e-books. This to a greater extent enhances learning a lot as teaching and learning can take place anywhere and anytime. Also it saves the burden of carrying textbooks which might become cumbersome especially with the large volumes of Biology textbooks. E-books are portable. This is in line with the trending technology of going paperless.

Parents need to support their children by purchasing and providing ICT gadgets like laptops and smartphones. Also teachers and parents should work together to monitor the learners on the use of ICT devices and the internet so that learners stay guided towards being morally upright people.

5.5. Recommendations for the study

The researcher suggests that there are some areas which need further studies. The challenges of using ICT tools on teaching and learning to be investigated on other specific topics and subjects. Another concept which requires further studies is; are there subjects that are better suited for the use of ICT tools than others. Other researchers can also research on; does the exposure and use of ICT tools in schools have a bearing on the future employment.

5.6. Summary

Incorporated in this chapter is the summary of findings, recommendations and conclusion of the study. Stakeholders targeted for the recommendations were the state, Ministry of Primary and Secondary Education, heads of schools, school administrators, educators, parents and learners. The major reason is to make sure that ICT tools are embraced and used in the teaching and learning of biology in schools to bring a positive change in the learners' academic performance.

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APPENDICES

Appendix 1. Questionnaire for teachers and learners.

Dear Respondent

I am a degree student at Bindura University of Science Education collecting information on teachers and learners' perception on challenges of using ICT tools in teaching and learning of biology at Kotwa high school. The information collected is strictly for academic purposes and will be helpful to the Ministry of Primary and Secondary Education, in assessing how best can challenges encountered when using ICT tools in teaching and learning of biology can be addressed.

Kindly answer all questions in this questionnaire freely, correctly and honestly. All the answers you give will be treated confidentially.

Thank you in advance

Nduna Dalubuhle.

Section A: (Demographic information): Please tick or cross your choice.

1. What is your gender?

a) Male [ ] b) female [ ]

2. Age

a) 15-20 [ ] b) 21-30 [ ] c) 31-40 ( ) d) 41-50 ( )

3. What is your role?

a) Student [ ] b) Teacher [ ]

4. What is your level of education?

a) High school ( ) b) Diploma ( ) c) Degree ( ) d) Masters ( )

Section B: ICT Experience.

5. Do you have access to computers for teaching/ learning biology?

a) Yes ( ) b) NO ( )

6. How often do you use ICT for biology teaching/ learning?

a) Daily [ ] b) Weekly [ ] c) Rarely [ ] d) Never [ ]

7. Are learners allowed to bring to school ICT gadgets like smartphones?

a) Allowed ( ) b) Not allowed ( )

8. What ICT tools/ platforms have you used for biology teaching/ learning? (Select all that apply)

a) Virtual labs [ ]b) Simulations [ ] c) Educational apps [ ] d) Videos [ ]e) Other (specify) [ ]

9. Do you think ICT enhances student engagement and motivation in biology lessons?

a) YES ( ) b) NO ( )

Section C: Challenges faced.

10. What challenges do you face in using ICT for biology teaching/ learning? (Select all that apply)

a) Time [ ] b) High cost of ICT tools [ ] c) Lack of training [ ] d) Lack of skills [ ] e) Limited computers [ ] f) Other (specify)

11. How do these challenges affect your teaching/ learning of biology? (Select all that apply)
    a) Reduced interest in biology ( ) b) Failure to access relevant resources ( ) c) Reduced effectiveness of lessons ( ) d) Limited student engagement ( ) e) Other (specify) ( )
12. How do you find experimenting in class?

a) Very interesting [ ] b) interesting [ ] c) boring [ ] d) very boring [ ]

Section D: Suggestions

13. What support or resources would you need to overcome the challenges faced in using ICT for biology teaching/ learning?

    ……
    ……
    ……
    ……
    ……
    ……
    ……
    ……
    ……

Thank you for finding time to answer this questionnaire.

APPENDIX 2: Interview questions for teachers.

1. What are some of the challenges you face while using ICT in teaching biology?

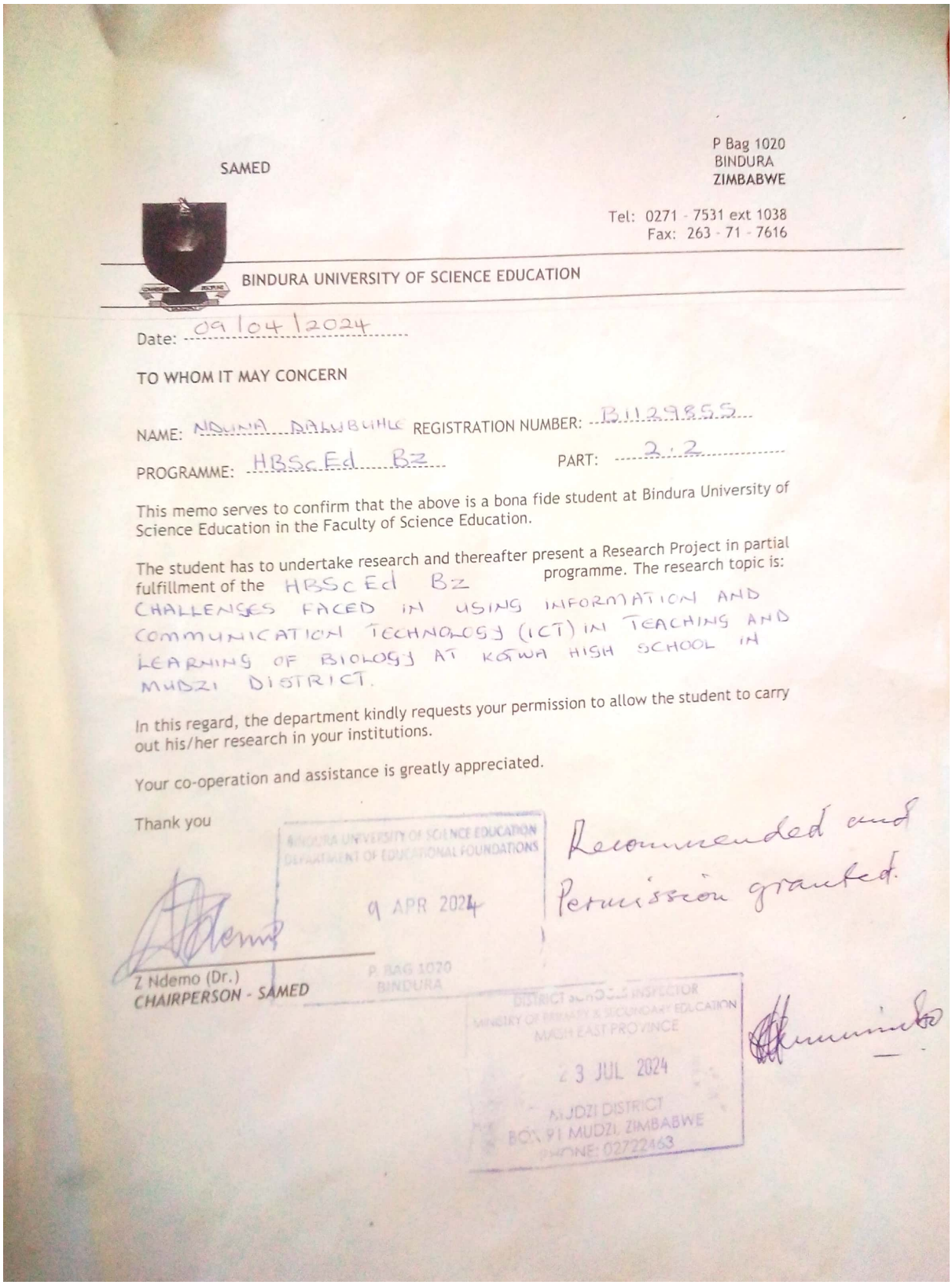
2. How do you think ICT can enhance the teaching and learning of biology, despite the challenges?

3. What kind of support or training do you need to overcome the challenges you face in using ICT in biology teaching?

4. How do you think the government or education authorities can support the effective integration of ICT in biology education?

5. Are there any potential solutions or strategies you think could address the challenges faced in using ICT for biology teaching and learning?

APPENDIX 3: CONSENT FORM



SAMED

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BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 09/04/2024

TO WHOM IT MAY CONCERN

NAME: NDUNA DANIBUHLE REGISTRATION NUMBER: B1129855

PROGRAMME: HBSc Ed Bz 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 HBSc Ed Bz programme. The research topic is:
CHALLENGES FACED IN USING INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN TEACHING AND LEARNING OF BIOLOGY AT KOTWA HIGH SCHOOL IN MUDZI DISTRICT.

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

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
9 APR 2024

Recommended and Permission granted.

Z Ndemo (Dr.)
CHAIRPERSON - SAMED

P. BAG 1020
BINDURA

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