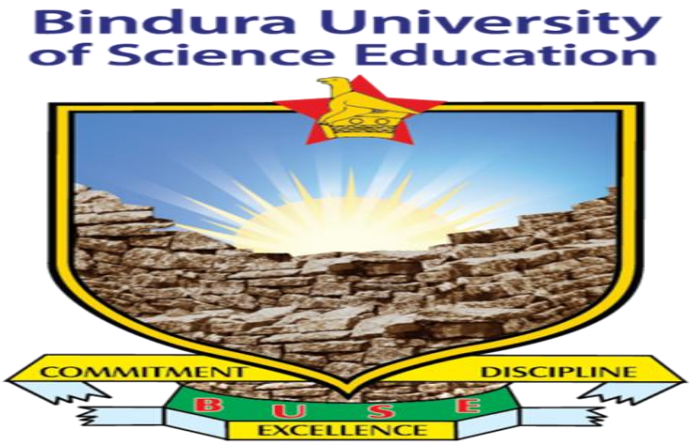

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF CURRICULUM STUDIES

AN ASSESSMENT ON THE TEACHING AND LEARNING OF O'LEVELPHYSICS USING ICT: A CASE STUDY OF TWO SCHOOLS IN GWERU DISTRICT OF ZIMBABWE.

BY

CHOFAMBA AGNES

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Education in physics.

Name of supervisor: DR ZEZEKWA

Signed……

Date…….

DEDICATION

This study is dedicated to my, family members and friends whose constant love, patience and dedication has propelled me this far and to Jairos, my caring husband and who inculcated a positive attitude towards my education, may God bless them.

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- Finally, I thank God for giving me wisdom and perseverance during my studies.

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ABBREVIATIONS AND ACRONYMS

The following abbreviations are used in this manuscript:

ICT Information and Communication Technology

PhET Physics Education Technology

ABSTRACT

The purpose of the research was to investigate the impact in the application of ICT in the teaching and learning of O Level Physics in Chinhoyi Urban, Makonde District. To carry out the study, the researcher adopted the Case Study Design. The researcher used a sample of three high schools. The sample was made up of eighteen students, six teachers, Three Heads of Departments, three Heads of Schools. The researcher used the purposive sampling techniques in sampling the students, teachers and Heads of Departments. Unstructured Interviews and Focus Group Interviews were used for data collection. The findings discussed and analysed using the thematic approach and linked with the related literature. It was found that ICT has a positive impact on teaching and learning of O Level Physics. Further, it was revealed that, despite the fact that the schools are partially equipped with ICT facilities and that teachers have positive attitudes towards the use of ICT as a pedagogical tool, they did not integrate ICT in teaching and learning effectively. The researcher concluded that availability, accessibility and user-ability of ICT resources significantly affect the integration of ICT in teaching and learning O Level Physics. Besides, ICT use as a pedagogical tool among teachers was found to be a problem that was attributed to lack of ICT integration skills and strategies in schools. Therefore, based on the above findings, the researcher recommends that the schools design an ICT strategy that aims at equipping teachers and students with knowledge and skills required for ICT integration. Secondly, there is need for the schools to invest more in ICT tools so that the access to ICT tools cannot be limited only in computer laboratories but expand through establishment of ICT resource centre's that should include Physics Laboratories. In addition, ICT training should aim at training teachers with the appropriate pedagogical skills to use ICT for their teaching. The study findings are thought to be of importance to teachers, students, school administrators and Ministry of Primary and Secondary Education (MoPSE) in Zimbabwe.

Contents

CHAPTER 1

INTRODUCTION

1.0 Introduction

Information Communication Technology (ICT) has evolved to become a natural part of people's lives in most urban communities in Zimbabwe. Increasing the quality of student learning is the main goal of the learning process; therefore, it become so important to use technology in schools to have good results especially in STEM based subjects, Physics in particular. Physics is the backbone of all engineering courses and with some universities, even medical courses. With ICT the teacher's role in the learning process becomes more and more important and critical. The function of ICT in teaching and learning is the most essential areas taken into consideration in the modern educational policy. Despite the fact that ICT is important in teaching and learning, there are complexities that hinder the effective implementation ICT policy in day to day teaching and learning activities in schools. Therefore, this research focuses on investigating the assessment of Information Communication Technology in the teaching and learning of O' Level Physics in Gweru District; Midlands Province; Zimbabwe. This chapter looks at the background to the study, statement of the problem, hypothesis, aims, objectives, research questions, significance of the study, delimitations of the study, and limitations of the study and definition of key terms.

1.2 Background of the study

Teaching and learning of physics has been found to assist learners in the accessing digital information efficiently and effectively as Brush, Elazewski and Hew (2008) have stated, ICT is used as a tool for learners to discover learning topics, problem solving and providing solutions to the in the learning process. ICT makes knowledge acquisition more accessible and concepts in the learning areas are understood while engaging learners in the application of ICT.

A Jones (2004) cited that ICT support learner –centered and self directed learning, learners should frequently engage in the meaningful of computers use of computers. Learners build knowledge through accessing, selecting, organizing and interpreting information and data. Based

on learning through ICT, students are more capable of using information and data from various sources and critically assessing the quality of learning materials.

M.M.Yunus Pp, 79-95(2007) stated that ICT develops and produces a creative learning environment. It develops learners' new understanding in the learning of physics. ICT provides more creative solutions to different types of learning inquiries, for example in a reading class, e-books are commonly in reading aloud activities, the use of overhead projectors in the teaching and learning, learners are able to view diagram illustrations and such that they can increase comprehension in their learning activities. Learners can access all types of texts through the use of computers, laptops personal digital assistants (PDAs), iPods more specifically, these e-books may come with some reading –aloud interface, relevant vocabulary building activities and services, games related to practical skills and knowledge acquisition. ICT involves purpose-designed application that provides innovative ways to meet a variety of learning needs

ICT promote collaborative learning in distance-learning environment. Koc (2015) mentioned that ICT enables learners to communicate, share work collaboratively anywhere, anytime, for instance in teleconferencing classroom could invite learners around the school to gather together simultaneously for a topic discussion.

ICT offers more opportunities to develop critical (higher-order) thinking skills. Thus schools are strongly advised to integrate technology in teaching and learning physics at ordinary level.ICT improves teaching and learning quality. A.S lowther et.al (2018) has stated that there are three important characteristics that are needed to develop good quality teaching and learning with ICT: Autonomy, Capability and creativity. Autonomy means that the learners take control of their learning through their use of ICT. Teachers can also authorize learners complete certain tasks with peers or in groups with regard to capability, students become more confident in the learning processes, they become capable to apply and transfer knowledge while using ICT with efficiency and effectiveness by using ICT, learners creativity can be optimized. They may discover multimedia tools and create devices in the styles readily available to draw and design circuit diagrams in the topic of electricity and practice how to connect the circuit wires using ICT and television with a combination of learners' autonomy, capability and creativity and the use of ICT can improve both teaching and learning.

ICT supports teachers which can act as catalyst for the integration of technology if the encouragement, equipment and necessary technological support is made available from institutions for the teachers, developing an ICT class will be made easier. The main responsibilities for teachers will be changing their course format, creating and explaining the new assignments and arranging for the learning of physics.

M.D.Mathevula, D E Uwizeyimana (2004) have shown several obstacles that teachers face in integration of ICT in their classrooms either in teaching and learning physics. The following are the barriers:

- lack of confidence among teachers during integration,
- lack of access of resources,
- lack of time for integration,
- lack of effective training,
- facing technical problems while the software is in use
- lack of personal access during lesson preparation
- The age of the teachers

M.D.Mathevula, D.E Uwizeyimana (2004) Major problems associated with ICT use in education is related to learners learning:

Over reliance in ICT limits learners' critical thinking and analytical skills

Learners often have only a superficial understanding of the information they download

Computer based learning has negative physical side effects such as vision problems

Learners may be easily distracted from their learning and may visit unwanted sites

Learners may tend to neglect learning resources other than the computer and the internet

Learners may tend to focus on superficial presentations and copy from the internet

Learners may have less opportunity to use oral skills and hand writing

Use of ICT may be difficult for weaker students, because they may have problems with working independently and may need more support from the teacher.

The solution to these problems is: teachers should be able to create effective digital presentations using common tools for preparing slide shows; videos and podcasts

Teachers should have the ability to differentiate instruction with digital media

Teachers should be able to capture and edit images, audio and video

Teachers should be able to produce digital multimedia educational experiences by employing new media devices for teaching and learning, create effective digital presentations using common tools for preparing slide shows, videos and podcasts, be able to communicate using digital tools, choose the appropriate research tools and data bases, and applies most search techniques, to produce useful and safe online resources in the classroom.

I therefore recommend that ICT laboratories should be established in all physics learning areas and fund be made available to purchase computers and other ICT equipment. Trained computer teachers should be employed and those who are not computer literate should be mandated to go for computer training. Government should make it mandatory for physics teachers to always attend seminar workshop, conference and refresher course seminar in computer and provide all physics teachers with laptop and to work hard to solve the power failure problem in the country

Table1.1Statistics for the pass rate school A in Gweru district for the past four years.

YEAR	Number of learners who sat for the exam	Number of learners who passed	Number of learners who failed	% pass rate using ICT	% fail rate without ICT	Number of female learners who sat for exam	Number of female learners who passed	Number of male learners who sat for the exam	Number of males who passed the exam	Total % pass rate
2019	48	38	10	79.2	20.8	22	16	26	22	84.6
2020	49	39	10	79.5	21.2	23	17	27	23	85.7
2021	51	39	12	84.1	24	27	17	25	24	85.8
2022	45	38	7	85.1	15	31	19	26	25	87.7

Source: school head

Table 1.2 statistics for the pass rate school B in Gweru District for the past four years

YEAR	Number of learners who sat for the exam	Number of learners who passed	Number of learners who failed	% pass rate using ICT	% fail rate without ICT	Number of female learners who sat for exam	Number of female learners who passed	Number of male learners who sat for the exam	Number of males who passed the exam	Total % pass rate
2019	36	6	30	20.8	79.6	22	16	26	22	16.6
2020	40	7	35	21.2	74.4	23	17	27	23	17.5
2021	39	12	29	16.4	84.4	27	17	25	24	31.7
2022	45	8	32	20.1	85.1	31	19	26	25	17.7

1.3 STATEMENT OF THE PROBLEM

Physics is an important subject for economic development of every nation. The subject should be taught in such a way that ensures an improvement in pass rate .One such method is to integrate ICT in the teaching and learning of physics. The shift from a wholly face to face learning due to covid-19 pandemic in 2019-2020 where school were closed entirely to control the spread of the deadly pandemic . ICT became the only way through to education. There was need for integration of ICT in the teaching and learning of physics despite the challenges that might be encountered. The aim of this study is therefore to access the extent to which ICT is integrated in the teaching and learning physics.

1.4 Main Research questions

1. Which are the ICT tools used in the teaching and learning of physics?
2. What are the benefits of the use of ICT tools in the Teaching and Learning Process?
3. What are the problems faced in integrating ICT tools in teaching and learning physics at ordinary level.
4. What could be done to increase teaching and learning physics using ICT?

1.5 ASSUMPTIONS

Participant's willingness to participate in the research and also the participants were honest in the responding to questions posed to them during the research and their participation is none biased. The researcher also assumes that in the area of interpretation was that the results of the study were meaningful and relevant to stakeholders.

1.6 Significance of the study.

The beneficiaries of the study will be all stake holders and the benefits they will achieve be as follows

Learners might be putting efforts in using ICT in learning physics and practicing by carrying out experiments and taking all relevant recommendations.

The government of Zimbabwe through the ministry of primary and secondary education (MOPSE) might benefit from the study by enhancing education development formulating of education syllabuses might benefit from the study by the use of ICT in writing books, designing programs and teaching materials which will help improve other learners' performance.

The examining body, Zimbabwe examinations council (ZIMSEC) might benefit by setting and administering standards and national examinations.

The schools might benefit by equipping their libraries with relevant ICT material for teaching physics and encouraging physics teachers to go for further ICT training for the to meet the required national standards.

The teachers might benefit by improving their teaching methods and setting internal examinations by the use of ICT thereby meeting the national standards.

Parents, guardians and sponsors would appreciate the value of their money if learners pass in their physics examinations.

1.7 **Delimitations**

The major aim of this research was to look into the assessment of Information Communication Technology in the teaching and learning of Ordinary level Physics in selected schools in Gweru District. This study was carried out in schools offering O Level Physics in Gweru Urban since most of the urban learners have access to ICT tools and can easily use them. Investigations focused on the assessment of teaching and learning of Ordinary Level Physics.

1.8 Limitations

One impediment regarding this investigation was the information and gathering process. Since to be sure the information gathering process was done through the schools administration, the researcher does not know whether the procedure of the information assortment referencing was pursued precisely. Another shortcoming of the study was this study was that the researcher was not in a position to control the honesty of the respondents as they reacted to questions.

1.9 **Definition of terms**

Cognition is the mental action or process of acquiring knowledge and computer machine that process data according to a set of instructions to a set of instructions

Hardware all equipment attached to computer understanding through thought, experience, and the senses. It encompasses process such as

Software the instructions that tell computer what to do

Technology: refers to any computer device or electronic device which is attached to a computer use in a classroom

Traditional learning chock and talk

Computer- Based:" mixed –media**"** it is multimedia work or digital work that is accessed through the computer even if parts were created in analog form and then digitalized tor integration on the computer.

E-Learning: it has been defined as providing courses on the internet for students so that they can study at home.

1.10 **Organization of the study**

There are the main five sections of this study. The foundation of the investigation is depicted in one section along with concern articulation, the key motivation behind this investigation and the study's significance along with some investigative question are included. This section also includes limitations and delimitations, key terms and their meanings and study organization. In the same way, the review of applicable and related writings was discussed in section two on various challenges of using ICT in teaching and learning.

1.11**Chapter summary**

Information Communication Technology (ICT) has evolved to become a natural part of people's lives in most urban communities in Zimbabwe. Increasing the quality of student learning is the main goal of the learning process; therefore, it become so important to use technology in schools to have good results especially in STEM based subjects, Physics in particular. Physics is the backbone of all engineering courses and with some universities, even medical courses. With ICT the teacher's role in the learning process becomes more and more important and critical. The function of ICT in teaching and learning is the most essential areas taken into consideration in the modern educational policy. Despite the fact that ICT is important in teaching and learning, there are complexities that hinder the effective implementation ICT policy in day to day teaching and learning activities in schools. Therefore, this research focuses on investigating the on the assessment of Information Communication Technology in the teaching and learning of O' Level Physics in Gweru District; Midlands Province; Zimbabwe. This chapter looks at the background to the study, statement of the problem, hypothesis, aims, objectives, research questions, significance of the study, delimitations of the study, and limitations of the study and definition of key terms.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

The chapter will focus on the theoretical framework and related literature on the complexities of integrating ICT in teaching and learning Ordinary level Physics. The chapter will show other similar studies which were done in Africa and other continents. This chapter will also reveal the views of different researchers and authorities about similar research problem. It wants to discover what different authorities and researchers found on the complexities faced in the application of ICT in the teaching and learning Physics at Ordinary level. The literature review will be carried out focusing on ICT tools available for teaching and learning, benefits of applying ICT tools in the teaching and learning and challenges teachers face in the application of ICT tools as well as the ways to mitigate those challenges.

2.1 THEORETICAL FRAMEWORK

Constructivist theory of learning is a set of prescriptions that challenge the transmission or behaviourist paradigms advocated in many education programs. Experiential learning, self-directed learning, discovery learning, inquiry training, problem-based learning, and reflective practice are examples of constructivist learning models (Gillani 2015; McLeod 2015; Slavin 2015). According to Fosnot (2010), constructivist teaching affords learners should construct their own questions, and structure their own models, concepts, and strategies. The classroom becomes a micro-society in which learners jointly engage in activity, discourse, and reflection. Teachers facilitate and guide rather than dictate autocratically. Autonomy, mutual reciprocity of social relations, and empowerment characterize a constructively conducted classroom (Fosnot 1996, pp. ix–x). Learners can develop in-depth understandings of the instructional materials, understand the nature of knowledge construction, and construct complex cognitive maps to connect bodies of knowledge and understandings (Richardson 2013). Because meaning, knowledge, and conceptual structures are constructed differently by each individual, teachers should be cognizant that students may view curricula, textbooks, didactic props, and micro worlds differently than they do. Accordingly, teachers should not attempt to transfer conceptual knowledge to students through words (Glasersfeld 1995); instead, they should be concerned with

how learners understand the process of knowing and how they justify their beliefs (McLeod 2003). Constructivist teachers challenge students to justify and defend their positions so that they can change their conceptual frameworks (e.g., beliefs, assumptions, and conceptions). In the constructivist classroom, learning emphasizes the process, not the product. The teacher also recognizes the pivotal importance of discourse. Richardson (2013) identifies several principles as the premises of the constructivist pedagogy. These principles suggest that the teacher first recognize and respect students' backgrounds, beliefs, assumptions, and prior knowledge; provide abundant opportunities for group dialogue aimed at fostering shared understanding of the topic under study; establish a learning environment that encourages students to examine, change, and even challenge their existing beliefs and understandings through meaningful, stimulating, interesting, and relevant instructional tasks; help students develop meta-awareness of their own understandings and learning processes; and introduce the formal domain of knowledge or subject matter into the conversation through a sort of loosely structured instruction and the use of technological tools such as Web sites.

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2.2 BENEFITS OF APPLYING ICT IN TEACHING AND LEARNING

The major issue is to improve the results of Ordinary level Physics results and to reduce the phobia of Physics since it is considered to be the most difficult subject by many pupils. According to Niran (2003), the learners have always rated physics with the three Ds (Dull, Dry and Difficult) but not anymore. He argues that with the advent of new technologies (CDs, Videos, computer simulations) and the big range of ideas offered on the Internet, physics teaching has changed for the better. The benefits of ICT in teaching and learning ordinary level Physics include the stimulating of interest is Physics, helps learners with learning challenges, source of information and as an administrative tool.

2.2.1 ICT STIMULATES INTEREST IN LEARNING

Sithole (2010) argues that, implementation of ICT tools in education will inspire and stimulate students' interests in learning. The learning processes of today can be enhanced through the use of modernized technology, which includes even the smart phone. Computers can be used for individual learning in secondary schools (Sithole, 2010). The differences in individual learning styles and pace, application of ICT tools will allow learners to develop their individual paces and

obtain constant assessment, response and corrections for errors made (Aduwa-Ogiegbaen and Lymn, 2015). This in return motivates the learner since he or she can get access to the information using different sensory mode. The application of Information Communication Technology tools generate greater eagerness for learning among the pupils, learning will also become exciting through games, puzzles and quiz (Patil 2012).

The other benefit mentioned by Aduwa-Ogiegbaen (2005) is that the use of ICT can change the teaching methods in schools. Aduwa-Ogiegbaen and Lymn (2005) mentioned that computers allow more of self-governing, searching more individually modified actions, more cooperation and little informative instruction. This changes the role of the teacher from information distributor to that of information manager (Aduwa-Ogiegbaen and Lymn, 2015). The learner will learn more by discovery and teacher will offer guidance and direction.

Aduwa- Ogiegbaen and Lymn (2015) mentioned that the application of information communication technology in teaching and learning processes enhance effectiveness. A motivated learner will get better results in the subject than a demotivated one.

2.2.2 ICT AS ADMINISTRATIVE TOOL

Aduwa-Ogiegbaen and Lymn (2005) further stresses that computers can serve administration by reducing paper work such as filling documents, writing correspondence and reports, assigning students to classes, reporting students' progress and testing students as well as giving marks. In this regard, the teacher can have notes which are in a soft copy, record of marks and schemes of work can also be in soft copy, thereby avoiding paper work, saving the school a lot of money.

2.2.3 ICT PROVIDES ACCESS TO LEARNING RESOURCES

Patil (2012) is of the view that ICT can develop individual access to learning thus; learners can use internet to research on topics such as Nuclear Physics, Waves Electricity and Magnetism and many other topics in Physics. According to Patil (2012), ICT allows distant learning nationwide by using online educational materials and with additional resources to assist resource based learning. Past Examination papers, Marking Schemes, Examiner's reports and Candidate's sample answers are also online for some examination boards, including ZIMSEC.

2.2.4 ICT HELPS LEARNERS WITH SPECIAL NEEDS

Due to use of the internet students, can study on their own at their spare time during the day or after school. Patil (2012), goes on to say that ICT help students with special educational needs to

learn at their own pace and may be able to accomplish the tasks working on their own. In his research Patil (2012) stresses that pupils can be able to revisit tasks with the help of ICT, to do revision on what had been done in the classroom. Some other educational software allows students to write some online tests or exercises and give feedback to the learners.
Patil (2012) mentioned that visual impaired pupils; due to use of the internet can have information along with their sighted peers through the use of Brail and Jaws software. The application of ICT may also help learners with deep and numerous learning problems for they can communicate easily using projected media and many other ICT tools (Patil, 2012).

2.2.5 ICT TOOLS AVAILABLE FOR TEACHING AND LEARNING

There is a wide range of ICT facilities that O level Physics teachers can use in the planning for a lesson and actual classroom instruction, such as computer-based laboratories, multimedia, simulations, interactive whiteboards and intelligent tutors. Furthermore, research has often been employed to direct educational software design and development to suit the challenges faced by learners. The ICT tools include: software, CD-ROMs, the internet, DVD players, television and radio, image capture devices that include still and video cameras, video recorders, among others (Steve and Keith, 2015).

2.2.6 MODELLING AND EXPERIMENTING USING VIRTUAL LABORATORIES

According to Cox (2017), learners should be introduced to the idea of modelling in science and at some stage in the curriculum so that they gradually learn to create their own models. Computer models are used to allow students to perform virtual experiments using virtual laboratories. Learners are able to investigate systems that are too fast, too slow, too remote, too dangerous or too expensive using virtual Laboratories; for example when studying radioactive materials and exploring the human body in 3-D. Software for virtual experiments are available on Internet and others on recorded CD-ROMs. These kind of software are available in all three science subjects; physics, chemistry and biology. In physics, learners can practice electric circuit connections using a virtual laboratory available at www.construction.kit.dc.virtual-lab-en.

2.2.7 MICROCOMPUTER BASED LABORATORY (MBL)

Microcomputer-based laboratory (MBL) involves use of a microcomputer as a laboratory tool to collect and analyse data. Students utilise a microcomputer and accompanying probes to collect, record and graph data to support the construction of their science concepts. Different probes

connected to transducers, interfacing boxes and software are needed in order to use the microcomputer as a laboratory to collect laboratory data that include temperature, motion, force, sound, light intensity and pressure.

Microcomputers used as laboratory tools may offer a fundamentally new way of aiding students' construction of science concepts (Linn et al., 2015). They also allow students to experience what it is like to do science (Tinker & Papert, 2017). Microcomputer-based laboratory provides opportunities for asking questions, making predictions, designing experiments, collecting and analysing data using graphs or pie charts, debating ideas, communicating ideas and findings with others, drawing conclusions. In addition, the use of the microcomputer may strengthen students' graphing and problem solving skills (Linn et al., 2015). For example, a temperature probe helps students construct an understanding about temperature and heat energy by allowing them to monitor the temperature of physical systems such as cooling of curtain substance.

According to Mokros and Tinker (2017), students using probeware "have unprecedented power to explore, measure, and learn from the environment." Another important outcome of using Microcomputer-based laboratory is that students spend less time gathering data, and more time interpreting and evaluating it, allowing for more activities central to critical thinking, problem solving, and self-monitoring skills. Hence, students are more willing to replicate, to evaluate, and improve the experiment. Microcomputer-based laboratory has instructional advantages that include: environmental simplicity, fast feedback, more direct experience, student control and interest, and ease of data transformation (Bentillo 2004).

2.2.8 WEB-BASED LEARNING

This approach makes use of Internet and web based resources. Internet is a rich resource where both the teacher and learners can get up to date information on Physics concepts. The teacher can assign students to visit certain websites, search for knowledge and answer some questions (Balbin, 2001). Learners and teachers can discuss through social media like WhatsApp, electronic mail, beyond the classroom with scientists or with other students from other schools or countries. To facilitate the use of web-based approach, the school should have the required infrastructure such as computers and Internet service provider such as Netone, Econet, Africa online and Telecel among others. In the absence of a computer, Physics teachers and students can still access Internet through mobile smart phones which are now cheap and affordable for many. Ekanayake (2009) argues that due to a wide range of attributes such as spontaneous,

personal, informal, contextual, portable, and pervasive and the functions such as talk, text, still camera, video, radio and the Internet, mobile phones could add a completely new dimension to the teaching and learning process.

Despite the potential benefits cell phones have in the teaching of science, their use in the Zimbabwean secondary schools for learning could be hampered due to the fact that students are not allowed to carry cell phones to school (MoE, Singapore, 2008). According to Yusuf (2005), web based learning creates a chance for personalised learning, visualisation of micro and macro world, creation of two dimensional and three dimensional mental images.

2.2.9 COMPUTER PRODUCTIVITY TOOLS

Yusuf (2005) noted that presentations can be made using Power point or other software applications and teachers can post their slides on the web so that learners may download them from wherever they are for the purpose of studying.

2.2.10 STORAGE OF INFORMATION

Smaldino, Simonson, Albright and Zvacek, (2008), further noted that the CDs can be used in teaching and learning as they store sound as digitalized bits of information. The information can be selected and taken back by learners or planned by the teacher. Many computers are capable of creating or burning audio and this makes it easy for instructors and learners to produce CD recordings (Smaldino et al, 2008). Smaldino et al (2008) indicated that auditory recordings can be used to demonstrate book reports, which learners may record during study time. Smaldino et al (2008) said that students can record information to bring into being from a field trip on portable devices. Pupils can record their selves giving a speech and presenting some of the topics in their syllabus. Auditory recordings adds an aspect to learning environments this improve pupils' education experiences. These days there are flash sticks which can be used to store information without the risk of being scratched.

2.3 FACTORS THAT INFLUENCE THE USE OF ICT IN TEACHING AND LEARNING

According to Maithya and Ndebu (2011), the factors that influence the use of ICT in teaching and learning are either institutional or teacher related.

2.3.1 TEACHER RELATED FACTORS

Teacher related factors determine to great extent the success of computer projects in education (Kavagi, 2010). Teachers play a very important role in the teaching-learning process, they must be able to prepare young people for the knowledge society in which the competence to use ICT to access information is very important (Samah, Afshari, Su Luan, and Fooi, 2009). According to literature reviewed, there are a number of teacher related factors that influence the use of ICT in teaching Physics. They include:

2.3.1.1 TEACHING EXPERIENCE

Some research findings show that teachers' adoption of new technology is influenced by age. Studies conducted by Roberts, Hutchinson, & Little, (2003),revealed that teachers who were educated 20 years ago were trained by people who themselves were trained before the arrival of computers in educational institutions and therefore such teachers were unlikely to use ICT in their classrooms. However, a study carried out by Albirini (2006) found that age did not significantly influence teachers' attitude towards the use of ICT. These two conflicting results need further research.

2.3.1.2 TEACHERS' ICT EXPERIENCE

Several studies show that teachers who are inexperienced or untrained in using ICT will most likely avoid using it in the classroom for fear of failure in front of their students. According to Balanskat, Blamire, and Kefala (2005) and Bingimlas (2009), limitations in teacher's ICT knowledge makes them feel anxious about using ICT in the classroom and thus not confident in using it in their teaching. This was echoed by Becta (2004) who found that many teachers who do not consider themselves to be well skilled in using ICT feel anxious about using it in front of a class of children who even know more than they do.

2.3.1.3 TEACHER COMPETENCE IN ICT USE

Teachers must be equipped with basic ICT skills to meet their individual administration and teaching requirements. They have to undergo ICT based pedagogical training so as to ensure effective use of technology in teaching and learning (MoE, Singapore, 2008).
Research studies in Australia found that teachers who lacked knowledge and skills to use computers were not enthusiastic about integrating ICT in teaching and learning (Newhouse, 2002). Research done in developing countries revealed that lack of technological knowhow is the

main obstacle to acceptance and adoption of new technology by teachers in classroom (Pelgrum, 2001). Further, studies conducted in Wanjala, Wamalwa & Egessa, (2014), confirmed that, to adopt any educational technology effectively, teachers must feel confident in its operation and their own ability to use it in classroom instruction.

2.3.1.4 TEACHERS' PERCEPTIONS

The role and importance of attitude and beliefs in education is a very well documented area in educational research. This is also true when it comes to studying the relationship between attitudes and the usage (or lack of usage) of ICT in education (Ertmer, 1999 and Jegede, 2008). Teachers' attitude determines the extent of ICT use in the teaching and learning as revealed by a number of studies. According to Gakuu, as cited in Maithya (2011), how people perceive and react to technologies is far more important than technical obstacles in influencing ICT implementation and use. Watson (1998) argues that integrating new technologies into educational system requires change and different teachers will handle the change differently. Drent and Meelissen (2007) conducted a study on the use of ICT by teachers in classroom instruction in Netherlands and found that positive ICT attitude has direct positive influence on the innovative use of ICT by the teacher. Educational theorists and researchers have alluded to the fact that teacher's attitude is an important factor in the adoption of new technologies in classroom instruction (Koohang, 1989). It has also been argued that attitudes towards ICT not only affect teachers' use of computers in the classroom but also their likelihood of benefiting from training (Kluever et al., 1994). In addition, Tay (2012:7) asserts that: Teachers have very often been identified as one of the most significant resources in the integration of technology into schools but they could also be one of the main barriers. However, a study conducted in Ghana revealed that teachers' perceptions with regards to the use of ICT were positive and low but not statistically significant (Buabeng, 2012). Also Eugene (2006) revealed that there was inconsistency between teachers' beliefs and their actual use of technology in classroom. Teachers' beliefs and teaching practices were found not to match. This revelation casts doubts on other findings which have reported that teachers' actual ICT use related to their perceptions (Keengwe& Onchwari, 2008; Lau & Sim, 2008).

The inconsistency between teachers' actual use of ICT and perception can be attributed to inadequate supply of ICT resources, lack of access to the right kinds of technology, inadequate ICT pedagogical training and insufficient administrative support.

2.3.2 INSTITUTIONAL FACTORS

2.3.2.1 TIME

Studies carried out by various scholars indicate that availability of time, determines the use of ICT in teaching and learning of Mathematics and Science (Becta, 2004). According to Kozma et al., (2004), lack of time available in classes, and in teachers' own schedules for planning is a major factor influencing ICT integration in teaching science subjects. Teachers have a syllabus to complete and help their learners to prepare for public examinations. A study carried out in Saudi Arabia shows that time is an important factor affecting the application of new technologies in science education and is attributed to busy school schedules since teachers work from about 7.00 am to 2.00 pm and have on average 18 lessons per week (Al-Alwani, 2005). Both teachers and students have little time to work on integrating ICT in Physics and science education in general.

2.3.2.2 ACCESS TO ICT FACILITIES

Access to ICT facilities as a whole science class is an important factor that could influence the teachers' use of ICT in conducting lessons. A study conducted in Europe found that lack of access is the largest barrier to using ICT. Teachers gave reasons such as: lack of computers and related hardware, lack of appropriate software, slow Internet,(Empirica as cited in Bingimlas, 2009). Further, a study carried out at the Kenya Technical Teachers College revealed that most lecturers (96%) had ICT skills but many (75%) had difficulties in integrating ICT into their subjects. The lecturers cited lack of sufficient Internet facilities for this scenario (Maithya and Ndebu, 2011). Keiyoro (2010:175) revealed that there is no point in spending any time and effort in equipping teachers with necessary skills to integrate ICT into their teaching if schools do not have computer laboratories accessible by the whole class and other ICT resources necessary to put those skills into practice with learners.

2.3.2.3 TECHNICAL SUPPORT

Good technical support both in the classroom and in the whole school resources will help the teachers to overcome the barriers preventing them from using ICT (Lewis, 2003 as cited in Bingimlas, 2009). According to Sicilia (2005), technical problems were found to be a major barrier for teachers. Such technical problems include: waiting for website to open due to slow Internet, failing to connect to Internet, malfunctioning computers and jamming printers as well as old and slow computers. These barriers affect the natural flow of classroom activities. Gomes

(2005) argues that ICT integration in science teaching needs a technician and if one is not available, lack of technical support can be an obstacle.

2.3.2.4 MANAGEMENT SUPPORT

Successful integration of ICT in the teaching and learning depends mainly on the support given by the school management to the teachers and learners. The school needs to adopt ICT as part of the school culture and which in turn influences people's perception. William et al., as cited in Maithya and Ndebu (2011) argues that culture developed within an institution can act as a barrier to change. This is supported by Gakuu (2006) who cites organizational culture as playing a key role in implementing change in an organization. According to Kara (2008), management of ICT should involve continuously reviewing and putting in place the most appropriate ways of exploiting ICT, acquisition and utilising new ICT required by an institution. The management should also ensure that the capacity of the staff is enhanced, monitor and ensure effectiveness of ICT usage in the organisation.

2.3.2.5 SCHOOL ICT POLICY

The ICT policy in Zimbabwe and MoPSE through its Updated Curriculum formulated a number of policies aimed at having coordinated approach to ICT integration in education. According to Dawson & Rakes (2003) school policies play a significant role in promoting ICT integration in teaching and learning. Schools are expected to make their ICT policies based on these policies. School policies are intended to guide the integration of ICT in teaching and learning by articulating the expected characteristics and experiences; and how they will be used to enhance the use of ICT in the teaching and learning process. The ICT policy further influences the school culture which is an important aspect in ICT integration. School ICT policy entails the development of a shared vision concerning how ICT is to be used for teaching and learning, and putting in place systems to support the school system.

I therefore recommend that ICT laboratories should be established in all physics learning areas and fund be made available to purchase computers and other ICT equipment. Trained computer teachers should be employed and those who are not computer literate should be mandated to go for computer training. Government should make it mandatory for physics teachers to always attend seminar workshop, conference and refresher course seminar in computer and provide all physics teachers with laptop and to work hard to solve the power failure problem in the country

2.4 SUMMARY

According to the literature reviewed, the studies show that there are a number of factors that influence the use of ICT in teaching and learning of ordinary level Physics. Most of the research findings revealed that teachers' adoption of new technology is influenced by teaching experience while some of the studies found otherwise. Further, most of the researches have been conducted in developed countries and not much has been done in Africa, Zimbabwe and Gweru Urban in particular. Moreover, most of the studies carried out on ICT integration in teaching and learning in a number of countries were general not O Level Physics. This study will help in filling the above gaps by focusing on use of ICT in teaching and learning of Ordinary Level Physics in Gweru Urban, Gweru District, and Midlands, Zimbabwe.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 INTRODUCTION

The purpose of this chapter is to present the philosophical assumptions underpinning this research, as well as to introduce the research strategy. It defines the scope and limitations of the research design, and situates the research amongst existing research traditions in information systems. It has focused on the theoretical framework and related literature on the complexities of integrating ICT in teaching O level Physics.

3.1 CONTEXT OF THE STUDY

The literature review focused on ICT tools available for teaching and learning, benefits of applying ICT tools in the teaching and learning and challenges teachers face in the application of ICT tools as well as the ways to mitigate those challenges. The chapter focuses on the research approach, its justification, and appropriateness, population, sampling and it portrays the population of the study and the sampling techniques used. It also shows the research instruments which were used to adequately address the research questions, in addition looks at the reasons why the research instruments to collect data where used. It also explains the data collection, presentation and analysis procedures followed. It also includes ways of ensuring trustworthiness of the data and the ethical considerations. The main data collection techniques used in this research study were semi-structured interviews, participant observation, group discussion, documentation analysis and questionnaires. This chapter is divided into three sections. In the first, the interpretive stance in the field of information systems is examined. The next section is about the research strategy. It describes the research approach followed in case study research. Finally, section three deals with the research design and covers the reasons for selecting organisations, data sources, research analysis sub-units, data collection and analysis, and a brief summary of the expectations from the theoretical framework adopted

3.2 RESEARCH APPROACH

Qualitative methods are supported by the interpretive paradigm, which describes a world in which reality is socially constructed, complex, and ever changing. Taylor and Francis (2015)

defined the paradigm as a set of interrelated assumptions about the social world which provides a philosophical and conceptual framework for the organized studies of that world. Maxwell (2015) pointed to the key criteria for qualitative research design as the activities of collecting and analyzing data, developing and modifying theory, elaborating or refocusing the research question, and identifying and dealing with validity threats are usually going on more or less simultaneously, each influencing all of the others. In addition, the researcher may need to reconsider or modify any design decision during the study in response to new developments or to changes in some other aspect of the design. Corbetta (2017) demonstrated that qualitative research is open and interactive and observation precedes theory whereas quantitative research is structured and theory precedes observation. Qualitative research is primarily exploratory research. Qualitative data collection methods vary using unstructured or semi-structured techniques. Some common methods include Focus Group discussions (FGDs), in-depth interviews, key informant interviews, and participation observation. The sample size is typically small, and participants are selected to fulfill a given quota.

The Researcher chose qualitative approach because it gains more detailed and rich data in the form of comprehensive written descriptions or visual evidence. It also looks at context and social meaning and how it affects individuals, which is advantageous particularly in the sciences.

3.3 RESEARCH DESIGN

The Research Design includes the overall plans of collecting data in order to answer research hypotheses (Cohen, Manion, and Morrison, 2017). Leedy (2017) states that Research Design involves analyzing, confirming data, sequence, the period and the methodology used in the study that is whether it used survey, historical or experimental. Mhembwe et al (2017) defines Research Design as a process in which the researcher tries to accomplish methodically with the help of data, solutions to the questions and way of addressing the problems. A design should involve issues such as who are the subject participants or participants, what is to be determined and from who? , what procedures are to be followed and what are instruments for capturing data to be used?

The researcher adopted case study design. The word ‘case’ means ‘an instance of’ and the central feature of case study research design is the investigation of the one or more specific ‘instances of’ something that comprise the cases in the study Yin (2015). A case can be something relatively concrete such as an organization, a group or an individual, or something

more abstract such as an event, a management decision or a change program. Yin (2015) defines the case study research method “as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.” Case studies are chosen because the research requires the “close examination of people, topics, issues, or programs” (Hays, 2015). A case study can give access to of the reasons for strategy use, and how the strategies are used in relation to other strategies. Each of the preceding items would constitute a case or what is termed a “bounded system.” The bounded unit for this study was the impact of ICT in teaching and learning O level Physics in Gweru District.

3.3.1 POPULATION OF THE STUDY

Fraenkel and Wallen (2019) define population as the group of interest to which the researcher would like to generalize the results of the study. This can also be defined as including all people or items with the similar characteristic one wants to study. Best and Khan (2017) defines research population as a huge collection of persons or items focused by the research. In this study, the population comprised of two high schools in Gweru with a total number of students of sixty eight students, four Physics teachers, the total number of targeted population adds up to 76.

3.3.2 POPULATION OF THE STUDY

Burns and Grove (2003:213) describe population as all the elements that meet the criteria for inclusion in a study. Burns and Grove (2003: 234) define eligibility criteria as “a list of

Characteristics that are required for the membership in the target population”. The criteria for inclusion in this study were as follows per each school:

• Physics learners 30 respondents

• Teachers who teach science classes 2 respondents

The total number of the targeted population adds up to 64.

3.3.3 SAMPLING TECHNIQUE

Burns and Grove (2003) refer to sampling as a process of selecting a group of people, events or behavior with which to conduct a study. Merriam (2002) defines sampling as the selection of a research site, time, people or events in field research. The number of participants in a sample depends on the questions being asked, the data being gathered, and the analysis and resources available to support the study (Merriam, 2002; Dawson, 2002:46) Polite et al (2001) confirm that in sampling a portion that represents the whole population is selected. Sampling is closely related to generalizing ability of the findings. The sample size can be determined using various techniques: probability sampling techniques of such as sample size tables, sampling formula and use of previous sample sizes among others; and use of non-probability sampling techniques especially for small population (Annum, 2015).Purposive sampling was used in this study, purpose sampling is a sampling method that

Involves selecting subjects with the required characteristics, being those that the researcher can get the most relevant information from (McMillan & Schumacher, 2010:326; Dawson, 2002:49). Parahoo (2017) describes purposive sampling as "a method of sampling where the researcher deliberately chooses who to include in the study based on their ability to provide necessary data". The rationale for choosing this approach was that the researcher was seeking knowledge about the students' opinion on challenges they are facing in the learning of physics using ICT, which the participants would provide by virtue of their experience. The advantage of purposeful sampling includes that participants who are relevant to the study are selected, therefore reducing costs and saving time. It also allows for the collection of reliable and robust data (Tongco, 2017).

The sample size was selected on considering the role of the respondents in teaching and learning of physics, age of the respondents, their experience in the field, their proximity to issues of ICT and their contribution towards the addressing challenges associated with ICT in learning of physics.

3.3.4 SAMPLING PROCEDURE

Sampling of the participants was done as follows:

• Using purposive sampling, the researcher sought the assistance of the qualified physics teacher to identify potential learners' participants.

• Possible participants were selected after the researcher pre-selected participants according to the criteria of gender balance and performance i.e:

a) Gender balance (equal number of boys and girls were selected)

b) Results of mid-year exams were used.

c) Physics teachers and science head of departments (HODs), first preference to physics teachers.

• The research project was explained to the prospective participants who were on the short- list and they were asked personally if they wanted to take part in the research.

3.3.5 SAMPLING SIZE

Sample size is the total number of people or elements included in a sample (Yount, 2016). The sample size for this study will consist of 76 respondents covering all the people who are directly and indirectly linked to O'level teaching and learning of physics in Gweru District. The researcher worked in conjunction with the qualified teacher in choosing participants, based on their knowledge of student performance. There were 10 potential participants. This was 15% of the population.

3.3.6QUESTIONNAIRES

A questionnaire is a tool for collecting information which is made up of a set of written questions or pictures that requires a response given in various options (McMillan &Schumacher, 2010:195; Kumar, 2002:72; Wellington, 2015:110; Opie, 2004:25).Questionnaires can consist of closed-ended, open-ended or both (Dawson, 2002:30). A questionnaire is an instrument through which respondents answer questions pertinent to the study in writing. Borg and Gall as cited in Chiota (2003) say questionnaires are documents that ask questions to all individuals in a sample. Maxwell (2013) describes the questionnaire as a data collection method in which respondents are asked to respond to the same set of questions in a pre-determined order .This instrument sought information on challenges faced by learners and teachers, internet access, online learning fees and app convenience level in teaching and learning using ICT. The instrument also collected data

on the extent of gender disparity in physics classes and opinions sought on resolving challenges faced in teaching and learning of physics using ICT. It has been noted that closed and open-ended questionnaires are useful to elicit both quantitative and qualitative data Best & Kahn (2005); Fraenkel et al. (2012). The researcher chose the mixed method of collecting data both qualitatively and quantitatively to increases the validity of results (Creswell 2018). Also, many people's opinions can be elicited through questionnaires and participants can respond in a place and time convenient to them Gray, (2009). One form of both closed and open-ended questionnaire was developed and used for data collection. The questionnaire for physics learners was adopted from the qualitative approach which allows questionnaires to collect data for the research.

The questionnaire was ideal for the current study as it has a number of advantages. The instrument allowed the researcher the opportunity to ask as many questions as possible to many respondents in the shortest time possible economically. The questionnaire also guarantees uniformity of questions put across to the respondents. Also, chances of honest and unaffected responses were enhanced as the questionnaires bore no identify of the respondent. The risk of contrived answers on the part of respondents to protect images or self-esteem was, therefore minimized. Responses remained anonymous. Open ended questions availed to respondents, room to give opinions and new issues to be dealt with. The questionnaire was used for the learners. The researcher delivered the questionnaires by hand to the identified schools. This is called 'face-to-face' delivery. This method was chosen because it allows for information in respect of the questionnaires to be clarified to the learners before they complete the questionnaire. The face-to-face delivery resulted in a high response

rate (Wallen & Fraenkel, 2011:81)

i) Physics students' Questionnaires

This instrument in **Appendix 1** whose structure is similar to the teachers' questionnaire was used to gather data from the students. The data covered areas such a: background information, student's perception on the use of ICT in learning Physics, extent to which ICT is used in classroom instruction, management and technical support

ii) Focus group question

This instrument in **Appendix 2** is a structured discussion with the purpose of stimulating conversation around a "the assessments of teaching and learning physics at ordinary level, and it focuses on the discussion that gives us the possibility to cross check ones individual's opinion with other opinions gathered.

iii) Teachers interview

The items in this questionnaire were adapted from those developed by wakhaya (2010). It is divided into five sections, A, B, C, D and E.A sort of information regarding biographical data relating to the teacher and his or her experience using computers. The interview aimed at gathering information on the physics teachers' know how in using various ICT software and hardware.

Section C comprised of questions that sought information on extent of ICT use in teaching Physics. The teachers, responses from an interview. Section D comprising questions focused on management and technical support. The last section E focused on the teachers' perception on the use of ICT in teaching physics.

3.3.7 STRUCTURED INTERVIEW SCHEDULE

An interview is an interaction between two or more people for purposes of exchanging information through a series of questions and answers (Bryant, 2011; Kumar, 2002:72). Interviews can be structured, semi-structured or unstructured (Dawson, 2002:26).Structured interviews: In this type of interview the researcher prepares questions beforehand, and they are arranged and asked in a particular order (Dawson 2002). Identical questions are asked for each individual, and the researcher does not probe the participants but only clarifies instructions (Taylor & Bogdan. 2015).his instrument collected information on internet access, online fees, app convenience level, to mention but a few. Semi-structured interviews: This is a type of interview where the researcher compares and contrasts specific information with information that was gained by means of other interviews.

The interview uses an interview schedule with topics or questions to be discussed. However, the order in which the questions are asked is not fixed but is determined by the conversation between

the researcher and the participant (Dawson, 2002; Woods, 2011). This type if interview makes use of flexible questions. The role of the researcher is to probe the participants for more information (Taylor & Bogdan, 2015).

In these interviews the participants are free to talk about their experiences without being given direction by the researcher. The only time where the researcher guides the participants is when they are talking about issues that are irrelevant to the topic (Dawson, 2002; Taylor & Bogdan, 2015). Structured interviews were selected for this research because they made it easier to replicate discussions and to get standardized views on the topic. It was easy to simplify the findings. The interviews were recorded rather than relying on written notes, as recorded information proved to be more reliable and allowed the researcher to properly analyse it at a later stage (Patton, 2015:348; Dawson, 2002:66).According to McNamara (2015), interviews are used to get the story behind a participant experience and to get in-depth information about the topic. Woods (2011) agrees with this by stating that a lot of relevant information about people's experiences are collected by directly questioning or talking to them. Only a small number of individuals were interviewed about the same topic so as to get more viewpoints about the questions that needed further explanation. The interviews were conducted simultaneously with the issuing of the questionnaires. The researcher conducted interviews with physics teachers.

3.3.8 INTERVIEW FOR PHYSICS TEACHERS

This instrument sought information on internet access, online learning fees, app convenience among other challenges faced in the teaching and learning of physics and their possible solutions when using ICT. The instrument also collected data on the extent of gender disparity in physics classes and an opinion sought on improving the same.

3.3.9 QUESTIONNAIRE FOR PHYSICS STUDENTS.

The students' questionnaire was administered to physics learners and was used to collect data on app convenience level, learners' attendance online lessons and their opinion on teacher characteristics and teaching methodology. This instrument also collected data on students' performance in the previous mid-year examination, challenges faced in the teaching and learning of physics and possible solutions using ICT...

3.3.10 DATA COLLECTION PROCEDURE

The researcher visited school A and B, arranged with the administration of the school on when it was most appropriate to collect data from the school. The researcher took the questionnaires and structured questions for interview to the school on the agreed date. The researcher sought assistance from the physics teachers to administer the questionnaires to the learners to help reduce the Hawthorne effect. The teacher introduced the researcher to the student to reduce impressionistic factor. The researcher then explained to the learners what was expected of them in filling the questionnaire. Teachers' interviews, the researcher conduct it face- face. Structured interviews were selected for this research because they made it easier to replicate discussions and to get standardized views on the topic. It was easy to simplify the findings.

3.3.11 DATA PRESENTATION AND ANALYSIS.

In the educational research there are various methods and procedures for data analysis. The findings will be presented by use of frequency tables and graphs. The collected data will be organized in line with the research questions and objectives of the research and analyzed using triangulation procedures. Data collected through interviews, document analysis and observation will be analyzed through thematic and discourse analysis. Self-reflectivity examination will also

3.4 DATA COLLECTION

3.4.1 Focus Group discussions

Focus Groups consist of small groups of informed people who are engaged in social processes premised upon the collection of conversations as data. The purpose of focus groups is to elicit participants' feelings, attitudes and perceptions about a particular topic through conversations (Stewart, &Sham Dasani, (2015).In education research focus groups can be used to stimulate conversations around carefully constructed questions that are initiated by the researcher for the specific purpose of obtaining data relevant to the specified research outcomes.

In focus groups the conversations are facilitated so that the discourse is oriented to the interpretative context established for the focus group. Focus groups use people's voices as part of a research methodology which affects the power relationships between the researcher and the participant: to listen to people is to empower them (Casey, 2015). The collection of this data

usually occurs through the use of recording devices: often with a tape recorder along with notes taken by an observer (Krueger, 2017). The tape-recorded conversations are then transcribed and coded, turning the conversations into texts. The written notes taken together with the transcripts of the focus group conversations become the data ready for analysis. Thus conversations in educational research can be captured through focus groups.

The researcher used the focus group interview for students because of its flexibility, which allows the researcher to explore unanticipated issues and encourages interaction among participants. Also discussions in the focus groups can enable clarification of issues and enable views to be both challenged as well as accepted.

3.4.2 Unstructured Interviews

Mhembwe sees an interview as a verbal representation of the set of questions that are set in advance. An interview can be exceptional tool that involve the collection of data through oral communication. There are two types of interview guides and these are structured and the unstructured questions. A structured interview guide is an interview which only allows questions on the list (Leedy, 2017). An unstructured interview guide is an interview which has room for adding more questions and responding to them (Leedy, 2000). The interviewer could probe for more information and opinions since the interview allows flexibility in terms of dialogue. Maddon (2000) supported the use of interviews because they give instant feedback and they also allow the researcher to have a conversation with the participants as well as adding more questions. Interviews were also used to find clear explanations on what people think. Best and Khan (2019), say that interviews allow the interviewer to gain clear explanations about what the participants think.

3.5 ENSURING TRUSTWORTHNESS

3.5.1 Credibility of the study

The external audit assesses the trustworthiness of a study. The audit corroborates to the dependability of the study by reviewing the data, analysis and interpretations and assessing whether or not the findings accurately represent the data (Lincoln and Guba 2000). According to Guba and Lincoln (2000) member checking is considered as the single most provision that can be made to bolster a study's trustworthiness. To ensure dependability in this research, member checking was used by conducting a small sample of the participants who attended the focus

group in order to ascertain whether the identified themes appropriately reflected their experiences of the research study. The concepts of generalization of findings from a case study are often debatable. The paucity of sample in a case study poses doubts on how much representative it is for the outcome to be applied to a larger population (Babbie and Rubin, 2008). In this study the researcher applied the member checking method for ensuring trustworthiness.

3.5.1.1 Triangulation

Triangulation is the process by which several methods are used in the study of one phenomenon (Burns and Grove, 2005).Triangulation is a powerful technique that facilitates validation of data through cross verification from two or more sources. An alternate perspective is used to validate, challenge or extend existing findings. Creswell and Plano (2007) say that one of the easiest strategies to ensure validity of a study is through triangulation of data which is gathering of data from various sources and examining these to see if they build coherent thermos. According to the scholars if themes constructed from these various sources then validity could be say to be in that particular study. In this study triangulation involved the use of different methods of data collection, focus groups and individual interviews.

3.5.1.2 Member checking

In qualitative research, a member check, also known as informant feedback or participant validation, is an integral part of creating trustworthiness in qualitative research (Creswell & Miller, 2000) Member checking can be done during the interview process, at the conclusion of the study, or both to increase the credibility of a qualitative study. The interviewer should strive to build rapport with the interviewee in order to obtain honest and open responses. During an interview, the researcher will restate or summarize information and then question the participant to determine accuracy. Member checks completed after a study are completed by sharing all of the findings with the participants involved. This allows participants to critically analyze the findings and comment on them. The participants either affirm that the summaries reflect their views, feelings, and experiences, or that they do not reflect these experiences. If the participants affirm the accuracy and completeness, then the study is said to have credibility. The researcher is going to apply member checking during interviews and after the research.

3.5.1.3 Peer de-briefing

Lincoln and Guba (2000) define peer debriefing (also called analytic triangulation) as a "process of exposing oneself to a disinterested peer in a manner paralleling an analytic session and for the purpose of exploring aspects of the inquiry that might otherwise re-main only implicit within the inquirer's mind".

They recognize that the process of moving in and out of data collection, striving to identify the salient patterns, captures the attention of the key investigators. The researcher is going to use the other teachers at the schools in question to be part of the focus group during the student's interviews.

3.5.2 Dependability

Dependability refers to the consistency and reliability of the research findings and the degree to which research procedures are documented, allowing someone outside the research to follow, audit, and critique the research process (Streubert, 2017). Dependability is important to trustworthiness because it establishes the research study's findings as consistent and repeatable. This means that if some other researchers were to look over the data, they would arrive at similar findings, interpretations, and conclusions about the data. While there are several techniques one could use to establish dependability, the researcher used an outside researcher who conducted an inquiry audit on the research study. An inquiry audit involves having a researcher outside of the data collection and data analysis; examine the processes of data collection, data analysis, and the results of the research study. This is done to confirm the accuracy of the findings and to ensure the findings are supported by the data collected. All interpretations and conclusions are examined to determine whether they are supported by the data itself.

3.5.3 Confirmability

Confirmability is the last criterion of Trustworthiness that a qualitative researcher must establish. This criterion has to do with the level of confidence that the research study's findings are based on the participants' narratives and words rather than potential researcher biases. Confirmability is there to verify that the findings are shaped by participants more so than they are shaped by a qualitative researcher (Leedy 2017). The researcher used the Audit Trail to establish the confirmability of the study. The researcher used this technique because it is useful when writing up the results chapter. An audit trail is when a qualitative researcher details the process of data

collection, data analysis, and interpretation of the data. The researcher recorded what topics were unique and interesting during the data collection, write down his thoughts about coding, provide a rationale for why he merged codes together, and explain what the themes mean.(Source required)

3.5.4 Transferability

Transferability is established by providing readers with evidence that the research study's findings could be applicable to other contexts, situations, times, and populations. (Lincoln and Guba, 2000). In order to determine transferability, the original context of the research must be adequately described so that judgements can be made (Koch, 2015). The responsibility of the researcher lies in providing detailed descriptions for the reader to make informed decisions about the transferability of the findings to their specific context (Lincoln and Guba, 2000). The emphasis must be on creating thick descriptions including accounts of the context, the research methods and examples of raw data so that the reader can consider their own interpretation (Dawson, 2009). Ultimately, the reader can decide whether or not the findings are transferable to another context (Graneheim and Lundman, 2014). However, a rich and vigorous presentation of the findings, together with appropriate quotations, also enhances transferability (Graneheim and Lundman, 2014).

3. 6 DATA COLLECTION AND ANALYSIS

The main data techniques used in this research study were semi-structured interviews, participant observation, group discussion, secondary source analysis and questionnaires. Personal interviews constituted one of the most important and valuable sources of information The social nature of information systems has led the researcher to adopt research approaches that focus primarily on human interpretations and meaning Walsham, (2017). Interpretive studies advocate a relativistic understanding of the phenomena being studied Orlikowski and Barbuda,(2002). Interpretive researchers see the pursuit of meaning and understanding as subjective and knowledge as a social construction (Walsham, 2017). They examine the social reality and subjective meanings held by people by eliciting and observing what is significant and important to them. They are not reporting facts, but their interpretations of other people's interpretations Walsham, (2017). There is no rigid separation between data collection and analysis, and the process is an iterative cycle of data collection and analysis, with the intention that the results of the analysis will help guide the subsequent collection of data. The cycle is repeated and theory is elaborated and checked as the process continues. When conducting interpretive research it is generally accepted that researchers should interact directly and intensively with the subjects of their research over a period of time

3.7 DATA PRESENTATION AND ANALYSIS

Data presentation and analysis entails the process of ordering and structuring of data to produce knowledge. This connotes that data interpretation includes explaining, presenting and deducing meaning from the collected data during research.

Creswell (2018) said that data presentation and analysis denotes how the gathered data or responses given in a study are treated, analyzed and presented in a research write up. Data analysis was also done through evaluating emerging patterns from the data and ideas linked together, a grounded theory was built. In so doing, the researcher was in a position to locate areas where the research was inadequate. This enabled the researcher to revisit the initial data and collected more information.

The researcher used thematic analysis approach to analyse the data. Braun and Clark, (2016) states that thematic analysis is a method used for identifying and reporting recurring patterns or

themes with the data. In this study the researcher collected data from Focus Group from students and Unstructured Interview guides for Physics teachers was analysed under the themes. This thematic approach is ideal because the ICT impact in this area to teaching and learning shows some common grounds like the competence of Physics teachers and student in using ICT, availability of ICT instruments and the support policies in using ICT tools in teaching and learning.

3.9 ETHICAL CONSIDERATIONS

Creswell (2018) says that ethics are the keystone of any research enterprise and therefore anyone purporting to undertaking research should treat ethical issues with uttermost deference. In undertaking this study, researcher will take cognizance of a number of ethical considerations.

3.9.1 Permission to conduct study

The Faculty of Science Education at Bindura State University (BUSE) offered the researcher a letter. The researcher went on to get permission from the Ministry of Primary and Secondary Education Provincial office for Midlands Province. The researcher got the permission from the Ministry of Primary and Secondary Education District office of Gweru. On each school the researcher sorts for permission from the School Heads . The consent of the physics teachers and the students to participate in this study was also sought before administering the instruments.

3.9.2 Informed consent a principle of research ethics

According to Yin (2015), all researchers intending to use human participants in their studies should ask for permission so that they do not cohere with these people without the participants' knowledge or permission. To use people in a study without their knowledge is highly unethical and renders the findings of the study void. People should participate in a study voluntarily. Wiles, Heath, Charles, Crow (2004) point out that "gaining informed voluntary consent from people involved in research is generally regarded as central to ethical research practice". Voluntary consent ideally means that a researcher does not pressure anyone into agreeing to participate in a research project, but rather seeks to obtain participants' voluntary consent (Creswell, 2018).

3.9.2.1 Informed consent for adults

Participants were informed fully about the purpose, methods and intended possible use of the research findings and what their participation in the research entails. Research participants participated in a voluntary way, free from any coercion. Informed consent for people participating in this study was done in this enquiry. Participants were clearly told of the study and its objectives.

3.9.2.2 Informed consent for students

Since the Form threes were participants in this research, they are below eighteen years of age. The informed consent was sorted through their School heads since they possess the loco parentis status to these students. (Wiles et al, 2014)

3.9.3 Confidentiality

Another ethical issue researcher should be worry of is the issue of privacy and confidentiality. Mhembwe 2017) says that any research taken for either academic or any other reasons should guarantee participants and their responses may result in them either being victimized, segregated against or labelled in the light of that the researcher in this study made an undertaking to the participants that their responses would be used only for this study and would not be used anywhere else as well as making sure that the participants would not mention in interviews their identities or anything that identified them. Given this, how can people who participate in research projects be protected? The confidentiality of information supplied by research subjects and the anonymity of participants was respected by giving the schools and participants codes.

3.9.4 Avoidance of harm to participants

In this study avoidance of harm was also done by the researcher through ensuring that the participants would not be identified by name or anything else that directly pointed to them. This was done to ensure that if the participants mentioned anything that contradicted either school or societal principles those participants would not be victimized at the close of the study Creswell,(2018)

3.9 SUMMARY

This chapter has focused on the research design, population, sample, ethical issues, reliability, validity, data collection procedures and data analysis procedures. The chapter explained the case study design, targeted population and the sample, sampling techniques during data collection as well as research instruments. A combination of non-statistical and statistical sampling procedures was used that lead to site and participant selection were highlighted. The two instruments for collecting data that is interviews and questionnaires were explained pointing out their advantages, disadvantages and the ways used to eliminate those disadvantages. The chapter also made attempts to justify the use of those data collection methods. The next chapter focuses on the presentation, analysis and discussion of the data collected.

CHAPTER FOUR: DATA PRESENTATION, DISCUSSION AND ANALYSIS

4.1 INTRODUCTION

In this chapter, the findings from the assessment on the teaching and learning at O' level physics in Gweru District faced by learners and teachers at school A and B are presented and discussed in relation to the research questions that were formulated to guide the study. The findings are discussed based on the qualitative data that compared the responses of participants, that is; physics teachers and students, who participated in the study. The qualitative data gathered are used to complement and substantiate case study findings. Below are the research questions that guided the study and this discussion:

- Which are the ICT tools used in the teaching and learning of physics?
- What are the benefits of the use of ICT tools in the teaching and learning process?
- What are the problems faced in integrating ICT tools in teaching and learning physics at ordinary level
- What could be done to increase teaching and learning physics using ICT?

4.2 GENERAL ICT TOOLS USED BY TEACHERS IN TEACHING AND LEARNING OF PHYSICS.

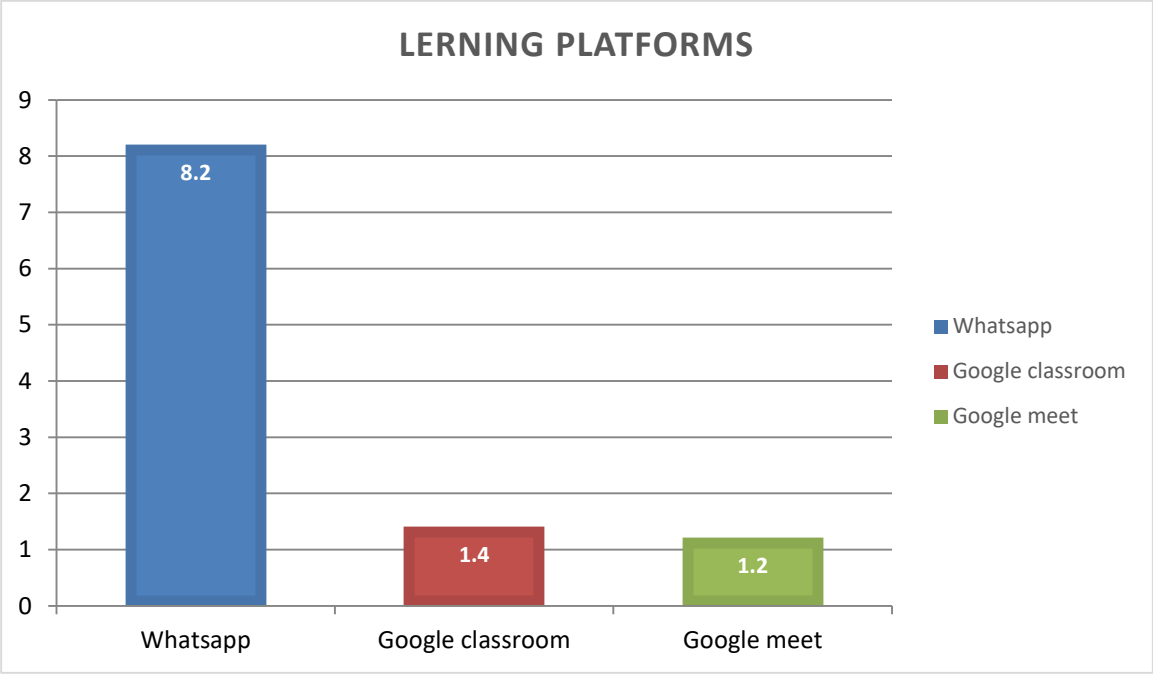
Based on the data obtained from the results of interviews and filling out the questionnaire, the following ICT tools are said to be commonly used in schools

Table 1. **Percentage of each aspect**

Indicator	**Used ICTtools**
More than half the learners	Computer, LCD projector
I have access to the internet for learning	Television, (e,g, for viewing physics related films, videos and programs)
A few number of learners	I have used internet (to source for information in physics, radio for listening to physics lessons

A significant number	I have used Mobile phone e,g sourcing for information from internet
Half the number of learners	Have digital cameras(e,g taking photographs and using them for learning during physics

Figure 1. **The platforms that is often used during the learning process**



4.2.1 BENEFITS FOR USING ICT TOOLS IN THE TEACHING AND LEARNING OF PHYSICS

A Jones (2004) cited that ICT support learner –centered and self directed learning, learners should frequently engage in the meaningful of computers use of computers. Learners build knowledge through accessing, selecting, organizing and interpreting information and data. Based on learning through ICT, students are more capable of using information and data from various sources and critically assessing the quality of learning materials.

M.M.Yunus Pp, 79-95(2007) stated that ICT develops and produces a creative learning environment. It develops learners' new understanding in the learning of physics. ICT provides more creative solutions to different types of learning inquiries, for example in a reading class, e-books are commonly in reading aloud activities, the use of overhead projectors in the teaching and learning, learners are able to view diagram illustrations and such that they can increase comprehension in their learning activities. Learners can access all types of texts through the use of computers, laptops personal digital assistants (PDAs), iPods more specifically, these e-books may come with some reading –aloud interface, relevant vocabulary building activities and services, games related to practical skills and knowledge acquisition. ICT involves purpose-designed application that provides innovative ways to meet a variety of learning needs

ICT promote collaborative learning in distance-learning environment. Koc (2015) mentioned that ICT enables learners to communicate, share work collaboratively anywhere, anytime, for instance in teleconferencing classroom could invite learners around the school to gather together simultaneously for a topic discussion.

ICT offers more opportunities to develop critical (higher-order) thinking skills. Thus schools are strongly advised to integrate technology in teaching and learning physics at ordinary level.ICT improves teaching and learning quality. A.S lowther et.al (2018) has stated that there are three important characteristics that are needed to develop good quality teaching and learning with ICT: Autonomy, Capability and creativity. Autonomy means that the learners take control of their learning through their use of ICT. Teachers can also authorize learners complete certain tasks with peers or in groups with regard to capability, students become more confident in the learning processes, they become capable to apply and transfer knowledge while using ICT with efficiency and effectiveness by using ICT, learners creativity can be optimized. They may discover multimedia tools and create devices in the styles readily available to draw and design circuit diagrams in the topic of electricity and practice how to connect the circuit wires using ICT and television with a combination of learners' autonomy, capability and creativity and the use of ICT can improve both teaching and learning.

ICT supports teachers which can act as catalyst for the integration of technology if the encouragement, equipment and necessary technological support is made available from institutions for the teachers, developing an ICT class will be made easier. The main

responsibilities for teachers will be changing their course format, creating and explaining the new assignments and arranging for the learning of physics.

4.2.2 PROBLEMS FACED IN INTERGRATING ICT IN TEACHING AND LEARNING PHYSICS

Respondents outlined challenges faced by learners ranging from lack of access to technological gadgets used to conduct online learning, lack of access to internet services, interrupted access to electricity and network services affecting learning and others failing to participate in online learning as a result of other commitments.

M.D.Mathevula, D E Uwizeyimana (2004) have shown several obstacles that teachers face in integration of ICT in their classrooms either in teaching and learning physics. The following are the barriers:

- lack of confidence among teachers during integration,
- lack of access of resources,
- lack of time for integration,
- lack of effective training,
- facing technical problems while the software is in use
- lack of personal access during lesson preparation
- The age of the teachers

M.D.Mathevula, D.E Uwizeyimana (2004) Major problems associated with ICT use in education is related to learners learning: Over reliance in ICT limits learners' critical thinking and analytical skill. Learners often have only a superficial understanding of the information they download Computer based learning has negative physical side effects such as vision problems Learners may be easily distracted from their learning and may visit unwanted sites .Learners may tend to neglect learning resources other than the computer and the internet. Learners may tend to focus on superficial presentations and copy from the internet. Learners may have less opportunity to use oral skills and hand writing .Use of ICT may be difficult for weaker students,

because they may have problems with working independently and may need more support from the teacher.

Teachers had the following comments about availability of gadgets for teaching.

Teacher 1: ***My phone is not compatible for some online learning platform due to low space and Out-dated hence it will be difficult for me to familiarized myself with the learning platforms like Google meet, Google classroom and Zoom.***

Teacher 2:***The school could not support the teaching stuff by provision of gadgets like laptops and cell phones to facilitate the learning process during online lessons .Myself I don't have a big phone to conduct online lessons even the idea how to use the learning platform to conduct lessons need someone to teach me I only use my Nokia phone (chimbudzi) which does not have all those applications.***

Teacher 3***: As a teacher who is also acting parental role yet conducting lessons online most of my learners have no gadgets to use during online lessons. My learners have inadequate resources as you can see hence not all of them a privileged to have a cell phones, hence during the lessons I might teach few learners and what will happen to the rest of the class who do not have the gadgets to use.***

Furthermore, the report of this study corroborated the findings of the earlier research by Education International at the global level. For instance, the earlier report indicated that in most places, teaching and learning moved to online platforms but there was no significant support from governments to teachers to help them to teach online effectively. Similarly, the digital divide created two worlds of the privileged learners on the one hand who continued learning via online modes, and on the other, vulnerable learners – those with disabilities, economically poor family backgrounds, and dwellers of rural areas – un empowered to adequately take part in digital and distance learning (EI, 2020b).

4.3.1. **Internet access**

Internet connection is important and the main thing for the creation of online learning, because learning must be accessed via the internet, without an internet connection, there will be no direct interaction between learners and teachers. Based on the interview with teachers of physics subjects and the results of filling out questionnaires by learners found internet access during the online learning process was ineffective.

Teachers had the following comments about internet access.

Teacher 4: ***Internet access is the most important factor in teaching and learning of physics without internet we cannot talk about teaching. Considering the location and set up of the are you can tell that there is a problem ,this is a rural set up were you don't find internet connection on your comfort zone sometimes you need to go to set positions to access internet.***

Teacher 5: ***It's very difficult to talk about online lessons in remote are like this, the school it's self does not have Wi-Fi for its staff members and I.C.T is one of the subject which supposed to be taught but lake of resources and internet access leaves a lot to be desired and worry to the outcome of results.***

The finding that online teaching and learning in Gweru District of Zimbabwe were ineffective is also not surprising because data from the literature (e.g., African Union Commission, 2020a, 2020b; African Union Commission & UNICEF, 2020; UNESCO, 2020a; UNESCO Institute for statistics, 2016; Teacher Task Force, 2020a, 2020b) reveal the numerous challenges in Africa which make the use of online approach difficulty and of limited impact. Some of the challenges are the dearth of digital infrastructure (absence of computers for individuals and homes, poor internet coverage .), lack of electricity, poor ICT skills and a huge number of teachers who did not attain the required minimum professional competences.

4.2.1 Online learning fees

Based on the results of interviews with teachers of physics subjects and filling out questionnaires by students, the cost of online learning during the online learning process is quite effective. This can be seen from the results of filling out the questionnaire; learners spend quite a lot of money to buy internet data. This also agrees with the HODs, who said that online learning requires more expensive costs to just buy data.

4.2.2 Level of student adaptation to online learning.

The Minister of Education and Culture called online learning as a process of adapting to technology. Adaptation to technology for children is much easier because children are in a generation that is very attached and familiar with digital devices or technology (Roni Hamdani &Priatna, 2020). Based on the results of interviews with teachers of physics subjects and filling out questionnaires by students, the researchers found that the level of adaptation of learners to online learning was quite effective. This can be seen from the results of filling out the questionnaire, some learners use the time to study at home to.

4.2.3 App convenience level

In an interview with physics teachers and learners questionnaires, revealed that the WhatsApp Group is the most used applications that helped in carrying out online learning. Teachers also believes that today's children are very close to technology so it is easy to operate the application as an intermediary during the learning process . From the results of filling out the questionnaire, it was found that the level of convenience of the application as an intermediary for online learning activities was quite effective. Most learners can operate the WhatsApp Group but Google class room and Google meet is not the same. In view of this situation it can be noted that there are several external factors that might affect the convenience of application used like those discussed above.

4.4 IMPACTS OF ICT ON PASS RATE OF LEARNERS IN PHYSICS DURING THE LAST FOUR YEARS.

Base on the data collected it can be viewed that the pass rate of physics has increased due to various factors. The advantage is that there is much material provided, so that it is not challenging to keep understanding the material, and the large number of assignments given by the teacher makes learners feel short of ample time. Respondents also assumed that they did not easily forget material and only learn if there is a test. Napsawati's research (2020) states thatlearners who find it difficult to understand material related to calculations and learners find it challenging to express difficulties to the teacher through messages. But with the integration of ICT In addition to the simplified of understanding the material, respondents also did not experience problems with the internet network and unlimited data.

Table 2. **Challenges that affected student learning process using ICT.**

Challenge	**Learning effect**
Adjustment to online format	Making learning physics concepts difficult
Remote nature of instruction	No hands-on experience or immediate feedback
Human-human interaction	Learners felt isolated and lost motivation to learn
Learning environment	Distracting family members, lack of focus or interest
Connectivity and technical difficulties	Missed classes, quizzes, added layer of learning difficulty
Lack of peer-to-peer interaction	Lack of exchange of ideas and support
Feedback from distance Student-Teacher engagement	Limited questions, expressing ideas, getting extra help, and showing worked out problem solving by hand.
Lock Down Browsers for exams	Added stress, connectivity uncertainty, anxiety

The use of ICT resulted in many improvements and effects which results in high pass rate following the above information on the table 2. The provision of e-books and other learning resource considered as development which results in high pass rate.

4.3 POSSIBLE SOLUTIONS AS SUGGESTED BY TEACHERS, AND LEARNERS.

More in-service courses and use of I.C.T tools should be organized for teachers to improve the quality of their teaching ,

Teacher 1 state: ***The school administration should create a society of learners where learners are constantly challenged by teachers as well as their peers to keep improving and use of learning management system at school . The administration should motivate the learners to enable them to become facilitators of learning rather than dispensers of content through provision of enough resources. Parents to support their children through provision of gadgets, data and giving them enough time for study when using ICT.***

Teacher 2: added that, ***it is crucial to asses students' performance first and to set appropriate prerequisite to understand the level of the students' capabilities through on time feedback.***

Failing to adequately assess performance and prior knowledge may be detrimental to the learners and result to teachers' failure to achieve the goals and objectives set for physics

Table 3. **Suggested strategies that can be impacted in teaching and learning.**

Instructor implemented strategies	**Impact on student learning**
Pre-lesson recordings	Familiarized with material before class time
Live recorded lectures	Allowed replaying lessons at their own pace on concepts and problem solving
Education videos/animations	Clarification of difficult concepts and an additional source of learning
All content available on Google classroom	Helped to access and review material at own pace, and stay on track with

	assignments/due dates
Reading quizzes	Allowed to constantly review concepts
Graded feedbacks on quizzes, class work, labs and homework	Helped them to have a better understanding of content and be prepared for exams
Use of special Bb collaborate features (Break-Out Sessions)	Peer-to-peer interaction and exchange of ideas
Use of Bb whiteboard feature for problem solving	Enabled to follow steps used in solving problems in real time
Effective Instructor Communication	Helpful on keeping class informed on important due dates, announcements, reminders, assignment directives, etc
Flexibility in turning in assignment	Lessened anxiety, stress level, provided support, motivated
Weekly help session	Provided a platform for extended discussion with instructor
Installation of network boosters	To improve connectivity and internet access

4.4 DISCUSSION

The data gathered by the researcher shows that to a greater extent use of ICT has positively affected education sector in Zimbabwe. The case study of Gweru district used in this research reflect the trajectory in which the majority of urban schools in Zimbabwe found themselves in. The research established that both learners and teacher faced almost similar challenges that in some cases were as a result of the spillover effect of the weak adaptation strategies that were

employed by the schools. The employment of online learning was the major strategy employed by schools to keep the learning process afloat. The strategy had positive outcomes not withstanding some of the ubiquitous challenges that it posed to learners and teachers in teaching and learning of physics. The research established that learners faced challenges largely emanating from adapting to the new form of learning that was done online. These challenges include lack access to essential gadgets for use such as laptops and smart phones. In the same fashion a rise in the national inflation as it was influenced by the economic sunctions subsequently resulted in the rise in prices of internet data packages which made it difficult for learners to also access learning physics. The research established that teachers equally faced challenges that were driven by the advent of the use of ICT. Some of the major challenges that faced teachers include following up on learners who did not submit their work timeously. Respondents mentioned that due to various adaptation challenges to online learning by students, submission of work on time became a huge task and teachers were left with a mammoth task of following up on those who did not submit their work. To counter these challenges teachers mentioned that they had to give a chance to submit their work physically when they physically attended school for examinations. Just like learners, teachers faced connectivity challenges emanating from poor network connections, lack of internet data packages and lack of essential equipment such as laptops and smart phones. This challenge affected the ability of teachers to deliver online lectures. In order to deal with such challenges, the research established that teachers had to borrow laptops from family and friends of lobby the institution to provide them with the necessary infrastructure required for conducting online learning perhaps due to power cuts. The research also established that learning of physics using ICT has offered learning institutions with an opportunity to innovate and adapt to the new conditions. ICT has seen these institutions venturing into partnerships with other entities and the government in coming up with innovative ways of using ICT. The use of ICT result in vicissitudes in many aspects of life hence learning institutions should facilitate the entrenchment of other forms of learning and begin to migrate from the traditional face to face learning. Schools should equip both learners and teachers with the essential infrastructure to conduct virtual learning. The teachers hold the key to quality education. Perhaps, they are the single most important factor for the achievement of desirable pass rate which advocates ‘inclusive and equitable quality education’ for all. In other words, the achievement of pass rate is largely predicated on the competences, perception,

motivation, and aspirations of the teachers and education support personnel. Therefore, their views must count as the world explores the best ways to address the unprecedented disruptions wrecked on the education system. This is the reason why this and other studies exploring the situation, views and proposals of the teachers and education support personnel are critical. This study has, therefore, filled important gaps in information regarding the use of ICT on education in Zimbabwe and what the teachers and education support personnel are experiencing and expecting from the government and international stake holders. The data gathered by the researcher shows that to a greater extent the use of ICT has positively affected teaching and learning of physics. The case study of Gweru District used in this research reflects the trajectory in which the majority of urban schools in Zimbabwe found themselves in. The research established that both learners and teachers faced almost similar challenges that in some cases were as a result of the spillover effect of the weak adaptation strategies that were employed by the institutions. The employment of online learning was the major strategy employed by institution to keep the learning process afloat during the pandemic. The strategy had positive outcomes notwithstanding some of the ubiquitous challenges that it posed to learners and teachers. The research established that learners devised a plethora of interventions to increase the use of ICT on teaching and learning of physics. Some of the teachers who responded to this research mentioned that they arranged with learners to shift to Google classroom platform which demanded expensive internet packages to learning through Whats App groups. The teacher also mentioned that learners would arrange with their colleagues to hand deliver assignment write up to teacher as the process was coordinated by colleagues who stayed close to physics teacher. The research established that teachers equally faced challenges that were driven by the advent of the use of ICT. Some of the major challenges that faced teachers include following upon learners who did not submit their work timeously. Respondents mentioned that due to various adaptation challenges to online learning by students, submission of work on time became a huge task and teachers were left with a mammoth task of following up on those who did not submit their work. To counter this challenge teachers mentioned that they had to give a chance to submit their work physically. Just like learners, teachers faced connectivity challenges emanating from poor network connections, lack of internet data packages and lack of essential equipment such as laptops and smart phones. This challenge affected the ability of teachers to deliver online lessons. In order to deal with such challenges, the research established that teachers had to

borrow laptops from family and friends of lobby the institution to provide them with the necessary infrastructure required for conducting physics online learning. Prior to the use of ICT, UNESCO (2015) had described the teaching profession as facing a process of 'deprofessionalization' denoted by the 'influx of unqualified teachers, casualization of teachers, reduction in professional autonomy, erosion of quality of the teaching profession, poor remuneration of teachers and the encroachment within educational institutions of private management techniques' (UNESCO, 2015, p. 54). d. UNESCO (2017) further pointed to the growing number of out-of-school children and adolescents in countries affected by conflicts and natural disaster. Based on this, it called for "emergency preparedness and recovery and the development of international standards and legal mechanisms" (UNESCO, 2017, p. 15) and planning for disaster risk reduction and strategies for overcoming post-conflict challenges. It is obvious that the economic sanctions has worsened these challenges and caused a decline in the 'quantity and quality' of teaching and learning of physics in Zimbabwe, as this study had revealed. The finding that online teaching and learning of physics in Gweru District of Zimbabwe were ineffective is also not surprising because data from the literature (e.g., African Union Commission, 2020a, 2020b; African Union Commission & UNICEF, 2020; UNESCO, 2020a; UNESCO Institute for statistics, 2016; Teacher Task Force, 2020a, 2020b) reveal the numerous challenges in Africa which make the use of online approach difficulty and of limited impact. Some of the challenges are the dearth of digital infrastructure (absence of computers for individuals and homes, poor internet coverage especially for the rural areas), lack of electricity, poor ICT skills and a huge number of teachers who did not attain the required minimum professional competences. According to UNESCO Institute for Statistics (2016), even for teachers with the minimum teaching qualification, they have not been sufficiently trained in ICT or prepared for a total shift to online education at the scale warranted by the use of ICT. Indeed, the respondents gave the same reasons highlighted in the literature as the reasons why the online approach has not worked effectively.

4.5 SUMMARY

This chapter presented the data, and the analysis of responses from teachers and the learner's questionnaires and the interviews were presented. Only those factors that were regarded as the assessment on the use of ICT in teaching and learning of physics in were discussed in detail. The

findings in this chapter were also compared with research done previously. The research findings in this study produced similar results as research done previously by other researchers but in a different context. However, the findings of this study are related to teaching and learning of physics in Gweru District. In the next chapter a summary of the findings will be presented. Recommendations from the study and for future research will be suggested.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This study sought to investigate the impact of integrating ICT in teaching and learning of O Level Physics in Gweru District. A number of issues were investigated. The issues included: extent of ICT use in teaching and learning of O Level Physics and the factors influencing the use of ICT in teaching and learning of O Level Physics. This chapter summarises the findings. In addition, the conclusions and recommendations are outlined.

5.1 Summary of the project including constraints

A number of factors that influence use of ICT in teaching O Level Physics were considered in this study. They are: teachers' and students' ICT competence, teaching experience, school policy and access to ICT facilities.

Physics teachers in the sample schools were found to be competent in ICT especially use of hardware such as computer and projector and software such as Microsoft word processing, Internet and Microsoft excel. However, the teachers in the sample schools were less skilled in the use of digital and video cameras which could be useful in preparation of ICT integrated lessons.

The study revealed that all the teachers have at least three years teaching experience. This means that the teachers has enough experience to try to implement ICT tools with being hesitant to lose track of the syllabus.

The study showed that technical support to teachers and students in their effort to use ICT in teaching and learning was moderate. This support is through acquisition of resources, formulation of rules and regulations at Advanced level for all the schools in the study, but only one school support the use of ICT at O level. One school has made an effort to buy laptops, interactive boards and projectors and WIFI for its Science department. However, there was minimal support in facilitating teachers to acquire more skills in use of ICT in teaching and learning O Level Physics.

The attitudes of students towards the use of ICT in teaching and learning of physics were found to be very positive. They agreed that indeed ICT not only makes learning more enjoyable but also enhances understanding of concepts that are abstract.

The results of this study revealed that teachers were in a good position to use ICT in teaching and learning of O Level Physics. The teachers were professionally qualified, experienced, fairly competent in ICT, had positive attitude towards use of ICT in teaching and learning of O Level Physics. However, ICT use in teaching and learning of Physics was found to be moderate within the sample schools Gweru District. ICT, especially computers, were mainly used for typing lesson plans and analysing students' test scores. It was noted that there was little integration of ICT in lesson delivery. The implication is that the real benefits of using ICT in teaching and learning of O Level Physics may not be felt by the learners.

5.2 Conclusions

This study investigated the impact of ICT integration in the teaching and learning of O Level Physics. In addition, the study established a number of factors that influence the integration of ICT in teaching and learning of O Level Physics in the sample schools in Gweru District. This study adopted Technology Acceptance Model (TAM); there are two factors relevant in computer use behaviors, perceived usefulness and perceived ease of use. Ghaviferkr, S. & Rosdy (2015) defines perceived usefulness as the prospective user's subjective probability that using a specific application system will enhance his or her job or life performance. Perceive ease of use ICT can be defined as the degree to which the prospective user expects the target system to be free of effort. According to TAM, ease of use and perceived usefulness are the most important

determinants of actual system use. In this research, the focus was on the Physics teachers, since they are the one who are supposed to integrate ICT in teaching Physics.

On the extent of ICT on the assessment of teaching and learning of O Level Physics, this study revealed that ICT was mainly used at the planning stage of the lessons especially typing of lesson plans and schemes of work. Teachers also use computers to analyse students' test scores. Teachers also used computer as a source of text books or to search for information not found in the text book. However, ICT use during lesson delivery was minimal despite the fact that most of the O Level Physics teachers in the sample schools had been trained in use of computers.

The following factors were identified to influence ICT in the assessment teaching and learning of O level Physics in Gweru District.

First, the possession of the necessary skills and knowledge in use of ICT is an important consideration that determines the extent of ICT integration in teaching and learning of O Level Physics. Although all of the Physics teachers in the sample schools are good in the use of ICT tools, they moderately employed ICT in the teaching and learning process; mainly at the planning stage of a lesson. This could mean that Physics teachers lack the skills to integrate ICT in actual lesson delivery, especially using the Video cameras and other physics related software, so the ease of use is lost. The pedagogical and didactic competences are more significant factors if effective and efficient educational ICT interventions are likely to be implemented.

Secondly, the attitudes of both teachers and students towards use of ICT in teaching and learning of Physics influence ICT use in teaching and learning physics. Physics teachers and students were found to have positive attitudes towards use of ICT in teaching and learning of Physics although this was not reflected in actual use. The mismatch between the actual use of ICT by Physics teachers and students positive attitudes could be due to other barriers such as lack of inadequate ICT facilities and inadequate skills among others.

Thirdly, administrative support encourages teachers to successfully use ICT in classrooms. Yamamoto (2019) believes that a leader who implements technology plans and also shares a common vision with the teachers stimulate them to use technology in their lessons. This study revealed that management support to Physics teachers in sample schools is only by one school in

the sample. The other school only support the A level student, due to the perceived misuse of the ICT gadget by O Level pupils. This support is expected to motivate teachers and students to utilise ICT. More support by the management by facilitating training for teachers could enhance ICT uptake in the schools.

Lastly, the study revealed inverse relationship between teaching experience and ICT use. This implies that the older the teacher, the less they are likely to integrate ICT in their lessons. This could be due to the fact that when the older teachers were being trained in colleges, use of computers had not picked up in educational institutions and therefore they did not get an opportunity to interact with computers as the younger teachers.

5.3 Recommendations

A number of recommendations were made in this study. Some of the recommendations are for action by stakeholders in education while others are for further research.

5.4.1. Physics teachers in the sample schools were found to be experienced and fairly competent in use of ICT. Both the teachers and students had positive attitudes towards ICT use in teaching and learning of physics. As such, it is recommended that teachers should capitalize on the favorable attitude the learners have towards ICT use in the teaching and learning of Physics. This could enhance learners understanding of concepts in the subject and this will motivate them to pursue Physics related courses to higher levels.

5.4.2. The changing landscape of communications and information exchange in the 21st century requires teachers to be at the cutting edge of knowledge production, modification and application rather than consumption. They need to be prepared for this by being educated to use ICT effectively and creatively in teaching and learning. This study revealed that most of the Physics teachers were fairly competent in computer literacy. However, integration of ICT in lesson delivery was low and this could be attributed to inadequate skills to integrate. It is therefore recommended that pre-service training and in-service training of teachers should include a component on how to integrate ICT in lesson delivery. These are the two most important supports for ICT integration into teaching and learning.

5.4.3. The government through the MoPSE and SDA committees as school managers are charged with the responsibility of provision of teaching/learning facilities. This study revealed that

schools in the study sample had inadequate ICT facilities. In view of this finding, it is recommended that the school managers look into ways and means of sourcing for more facilities especially computers, LCD projectors, Internet connection, digital and video cameras and fuel to always run backup generators in times of power cuts.

5.4.4. Most of the sample schools did not have well documented policies on ICT integration in teaching and learning for their teacher and O level pupils. It is recommended that school principals be sensitized on the importance of having well documented ICT policies which should dove-tail into the MoPSE ICT policy in education.

5.4.5 Given the importance of technical support and maintenance in ensuring the continued operation of their ICT system, schools should endeavor to allocate a separate budget annually for the maintenance and development of their ICT systems.

5.4.6 Schools need to manage their computer systems more effectively. Heads of Schools should help in formulation of the school's ICT policy and strategic plan to enable easier access and effective utilization of ICT recourses

5.4.7 As resources permit, schools should work towards providing all teaching and learning spaces with ICT facilities. This should include general classrooms and not be confined to specialized rooms, as it is at present.

5.4.8 Schools with computer rooms should ensure that they are as fully accessible as possible. This could be achieved by a combination of effective timetabling and the adoption of a system that allows teachers to book the room as necessary.

5.4.9 Schools should also explore ways of facilitating students with access to ICT facilities outside lesson times. The setting up of a computer club, for example, could contribute to making computer facilities more accessible to students. For the able schools they can acquire two computer centre one for teaching computer as a subject and the other to be used as a resource centre (Computer Library) by the rest of the school fraternity.

5.4.10 Schools should provide staff members with adequate access to ICT facilities for the purpose of planning and preparing for their teaching. This can be done by providing such facilities in their staff rooms. Consideration could also be given to acquiring laptops and software (see Appendix F), which could be used by members of the staff at school or at home, as necessary.

REFERENCES:

Aina K.K, "Effective Teaching and learning science Education through information and communication 10SR journal of Research and Method in Education, vol2, issues pp. 43-47 2013

Adeyemo .S.A,"The impact of information and communication and technology (ICT) on teaching and learning of physics" International journal of Education Research and technology, VOL 1, Issue2, pp48-59, 2010.

Aduwa- Ogiebaen, S.E. and Lymn, E. O. S (2015), Using information Communication Technology in secondary schools in Nigeria: Problems and Prospects, *Educational Technology and Society, 24, 32-35.*

Agyei.D, D. Voogt.J, "ICT use in the teaching of Mathematics: Implications for proffessional development of pre-service Teachers in Ghana" Educ Inf Technol, Vol.16.Pp423-439, 2011

Albirini, A. (2016), Teachers' attitudes towards information and communication technology: The case of Syrian EFL, Teachers. *Computers and education*, 47,373-398.

Al-Alwani, A. (2015). Barriers to Integrating Information Technology in Saudi Arabia Science Education. *Doctoral dissertation, the University of Kansas, Kansas*.

Balanskat, A. Blamire, R., and Kefala, S. (2015), A Review of Studies of ICT impact on schools on Schools in Europe: *European schoolnet* (Retrieved 25/09/15 12:00).

Balbin, C. (2018). *ICT integration examples*. Unpublished manuscript, University of the Philippines, Diliman-Quezon City.

Bentillo, E. (2014). Microcomputer Based Laboratory Teaching and learning of physics .*Unpublished manuscript, University of the Philippines*, Diliman-Quezon City

Best, J.W.B.and Khan, J.V. (2015), *Research in education* (7th Ed), Boston:Allyn and Bacon ltd

Bingimlas (2019). Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature. *Eurasia Journal of Mathematics, Science and Technology Education*, (235-245).

Brush, T, Glazewski,K.D and Hew,K.F(2018) Development of an instrument to measure preservice Teachers technology skills, technology beliefs, and technology barriers, computer in the schools, vol, 25, pp, 112-125.

Buabeng-Andoh (2012), Development using information and communication Technology *International Journal of Education:* vol. 8, Issue 1, pp136-155. (Retrieved 22/09/2015 9:38).

Creswell, J.W. (2018) *Qualitative Inquiry and Research Design: Choosing among Five Approaches.* 3rd Edition, Sage, Thousand Oaks.

Creswell, J.W (2018), *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. New Jersey, Upper Saddle River.

Creswell, J.W. and Miller, D.L. (2018) Determining Validity in Qualitative Inquiry. Theory into Practice, 39, 124-130. http://dx.doi.org/10.1207/s15430421tip3903_2

Creswell, J. W, & Plano-Clark, V. L. (2018). *Designing and conducting mixed methods research*. Thousand Oaks, Calif: SAGE Publications.

Davis, F. (2015) *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.*MIS Quarterly, 13, 319-340. https://doi.org/10.2307/249008

Drent, M., and Meelissen, M. (2017). Which factors obstruct or stimulate teacher educators to use ICT innovatively?*Journal of computers and Education*.17, 57-59

Dube, A. Nkunda, D and Guj, C. Conducting Research, blogspot.com (archive2010-11-01). Ltml. Research Methods: *Surveys and Questionnaires*. (date accessed 25/09/15 at 18:00 pm).

Ertmer, P. A., Ottenbreit-Leftwich, A., & York, C. (2006). Exemplary technology-using teachers: perceptions of factors influencing success. *Journal of Computing in Teacher Education*, 23(2), 55–61.

Fraenkel, J.R. and Wallen,N.E. (2003): *How to Design and Evaluate Research in Education*, 5th edition. New York: McGraw-Hill.

Gakuu, C.M. (2006). Analysis of the Factors and Attitudes that Influence Lecturers' Readiness to Adopt Distance Education and the Use of ICT in Teaching: the Case of the University of Nairobi. *Unpublished PhD Thesis University of Nairobi.*

Gorder, L.M. (2018). A Study of Teacher Perceptions of Instructional Technology Integration in the Classroom.*Delta Pi Epsilon Journ*al, *50*(2), 63-76. Retrieved November 3, 2019 from https://www.learntechlib.org/p/68467/.

Graneheim, U.H. and Lundman, B. (2014) Qualitative Content Analysis in Nursing Research: Concepts, Procedures and Measures to Achieve Trustworthiness.*Nurse Education Today*, 24, 105-112. https://doi.org/10.1016/j.nedt.2003.10.001

Gomes, C. (2015). Integration of ICT in Science Teaching: A study performed on Azores, Portugal.*Recent Research Development in Learning Technologies.* 10(2), 99-110.

Gunter, B.(2018) Ethnicity and involvement in violence on television: nature and content of on-screen portrayals. *Journal of Black Studies*, 28(6), 683-703

Ghavifekr, S & Rosdey. W.A.W.(2015) Teaching and learning with technology: Effectiveness of ICT integration in schools. *International journal of research in education and science(IJRES),I(2)175-191.*

Jones.A, "A review of the research Literature on barriers to the uptake of ICT by teachers" UK: Becta, 2004

Kara, A.M. (2018). The use of Information and Communication Technologies (ICTs) in enhancing teaching and learning in public primary teacher training colleges in Kenya.*Unpublished, Master's Research Thesis*, University of Nairobi.

Kavagi, L. (2010). *Computers in Schools*. Jomo Kenyatta Foundation. Nairobi.

Keengwe, J. & Onchwari, G. (2018). Computer technology integration and student learning: Barriers and promise, *Journal of Science Education and Technology*, 17, 560–565.

Keiyoro, P., Verlag, V., and Mullar, A. (2015). Factors influencing integration of ICT in teaching science curriculum: A case of Cyber and NEPAD e-schools in Kenya. *Doctorate Desertation*. VDM publishing House Limited, Meldrum Court 17, Beau Bassin, Mauritius.

Kluever, R. C., Lam T.C., Hoffman, E.R., Green, K. E., and Searinges, D. L. (1994). The computer attitude scale: assessing teacher's attitude towards computers.*Journal of Educational Computing Research*, 11(3), 251-261.

Koohang, A. (1989). A Study of Attitudes Toward Computers: Anxiety, Confidence,
Linking, and Perception of Usefulness, *Journal of research on computing in education*, 22, 137-150.

Kozma, R., McGhee, R., Quellmalz, E., and Zalles, D. (2004). Closing the digital divide: evaluation of the World Links Program.*International Journal of Educational Development*, 25(4), 361-381.

Koc, M (2005) Implications of learning theories for effective technology integration and preservice teacher training: A critical literature view, journal of Turkish science Education, vol 2, pp.2-18.

Lowther, D.L.Inan.F.A.Strahi.J.D and Ross.S.M. (2008). Does technology integration work when key barriers are removed? Educational Media International, vol45.pp 97-108.

Mathevula.M.D, Uwiziyimana D.E" The challenges Facing the integration of ICT in the teaching and learning Activities in south African Rural Secondary schools" Mediterranean Journal of social sciences,Vol 5, Issue 20 , 2014

Miller.J.W.MartineauL.P.Clark .R.C, "Technology infusion and Higher Education, vol, 24, Issue3, spring 2000.

Patil, S. V. (2017), The role of ICT in Education sector, LokavishkarInternatioanl E. *Journal ISSN 2277-727X*, Vol-1, Issue- IV, October - December 2012.

Plomp, T., Anderson, R.E., Law, N. & Quale, A. (2019). Preface. In T. Plomp, R. E. Anderson, N. Law, and A. Quale. Cross-national Information and Communication Technology: Policies and Practices in Education.*A volume in Research in Educational Policy: Local, and Global Perspectives*. Charlotte, NC, USA: Information Age Publishing.

Pfaffenberger and Daley (2014) *Computers in Your Future 2004: Introductory Version*, Prentice Hall PTR, 2003

Pelgrum, W. J. (2015), Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computer and Education*, 37, 163-178.

Petrogiannis, K. (2015). The relationship between perceived preparedness for computer use and other psychological constructs among kindergarten teachers with and without computer experience in Greece.*Journal of Information Technology Impact*, 10(2), 99-110.

Rathus J. H., Miller, A. L., & Linehan, M. (2017). *Dialectical behavior therapy with suicidal adolescents*. New York, Guilford Press.

Roberts, S. K., Hutchinson, C. J. & Little, M. (2013*).* Making the Invisible Visible and Back Again: Highlighting technology in an integrated curriculum for pre-service teachers.*Journal of Computing in Teacher Education*, 19, 73-81.

Roblyer, M. D. and Edwards, A. H. (2018), *Integrating Education Technology into Teaching*, 6th edition. Tokyo: Pearson.

Rosen, L. and Well M. (2015), Computer availability, Computer Experiences and Technofobia among Public School Teachers, *Computers in Human Behaviour*, 11, 9-31.

Rosenfeld, B. & Martinez-Pons, M. (2015). Promoting classroom technology use. *The Quarterly Review of Distance Education*, 6(2), 145–153.

Salahi.H, Salehi. Z, “the challenges for using ICT in Education: Teachers’ Insights” International journal of e- Education, e-Business, e-Management and e-Learning.Vol 2 Issue 1 Pp 40-43

Sithole G. Smith JL, Strever AE (2010)- Vine signal extraction–an application of remote sensing in precision viticulture;*South African Journal of Enology and Viticulture*;1 (11), 582-593

Wanjala, D. N., Wamalwa, R. W. & Egessa, R. (2014). Effect of selected human resource practices on teachers’ performance in public primary schools: A case of Bungoma West Sub-county. *International Journal of Social Sciences and Entrepreneurship*, 1 (11), 582-593.

Yusuf Ahmad Yunusa, Zainab Yusu Lambisa, Fatima Umar Yarima, Vol 7, issue, 1, pp.09-11, October (2019). World academics Journal of management. ICT, in teaching and learning physics: prospects and challenges in Nigerian Educational sector.

Yunus.M.M, “Malaysian ESLTeachers” use of ICT in their classrooms: expectations and realities “The journal of EUROCALL, Vol 9 Issue .1.Pp.79-95.2017

APPENDIX 1

Physics students ‘

The purpose of this questionnaire is to solicit information concerning use of communication and technology in teaching and learning of physics. The information provided will be treated with uttermost confidentiality and used ONLY for the purpose of this research.

Section A: back ground information

1. What is your gender?

…….
…….
…….

2. For how long have you been using computers?

……
……
……

3. Ever since you have been trained to use a computer, how often do you have access to it?

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……
……
……

4. For how long have you been using internet?

……
……
……

5. How do you feel when using ICT when teaching and learning physics?

……
……
……

6. Besides internet which other learning ICT tool would you prefer and explain why?

……
……
…….

Section B: What Competence do you have in use of ICT

	ICT Tools
6	Microsoft office word(word processing)
	……
	……
	……
7	Microsoft office excel(Spreadsheets)
	……
	……

……

8 Microsoft office(PowerPoint)

9 Internet

……

……

……

10 Computer Printers

……

……

……

11 Scanner

……

……

……

12 Mobile Phone

……

……

……

13 Digital Camera

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……

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14 Video Camera.

……..

……..

……..

15 LCD projector

……..

……..

……...

Section C: Extent of use of the ICT tools in teaching and learning of physics

How often do you use the following ICT tools and facilities in learning physics and state where and when do you use the tools listed below?

	ICT tool
16	Computer ....
17	LCD projector ....
18	Television(e.g. for viewing physics related films , videos and programmes .....

.....
.....

19 Internet (to source for information in physics)

.....
.....
.....

20 Radio(e.g. listening to physics lesson

.....
.....
.....

21 Mobile phone e.g. sourcing for information from internet

.....
.....
.....

22 Digital camera (e.g. taking photographs and using them for learning during a Physics

.....
.....
.....

Section D: Management and technical support

23 . How many hours per week are computers accessible to you?

.....
.....
.....

24. What challenges do you face when using ICT tools?.(e.g. computers TV, Radio among others) in learning .

.....
.....
.....

25. Do you use a computer as part of your learning, if not explains why?

.....
.....
.....

26.Do your teachers use computers during classes, if not explain why?

.....
.....
.....

27.Explain why your teachers expect you to use a computer during classes when learning physics?

.....
.....
.....

29. How often are virtual environments used in the teaching and learning of physics?

.....
.....
.....

30. Explain how ICT instruments create a better atmosphere in the learning of physics?
.....
.....
.....
31. Explain why and how information is much more easily available by using ICT tools than visiting the library.
.....
.....
.....
32.Explain why one cannot learn effectively without using ICT tools?
.....
.....
.....
33. Explain why learning physics using ICT in the class room is more interesting than without?
.....
.....
.....
34. Give a valid reason as to why ICT tools should be included in the learning of physics always?
.....
.....
.....
35. In your opinion do you think the use of ICT when learning of physics should be mentained?
.....
.....
.....

APPENDIX 2

FOCUS GROUP DISCUSSION QUESTIONS FOR STUDENTS

1 What do you already know about ICT and what do you want to learn more?

…….

…….

…….

2 How familiar are you with using ICT?

…….

…….

…….

3 What thoughts, feelings and associations do have when using ICT?

…….

…….

…….

4 Do you prefer using ICT and why?

……..

……

…….

5 Tell me about a time you experienced a mishap when using ICT?.

……

……

……

APPENDIX 3

TEACHERS STRUCTURED INTERVIEW SCHEDULE

Dear Physics Teacher,

This interview seeks your opinions and concerns about teaching and learning of physics at your School and the education of physics teachers. The interview is part of Honors Degree research Project being completed at Bindura University of Science Education. Your responses will be treated confidentially and will be used for research purposes only. No person or school will be identified in any reports. Thank you for participating in the interview. Your cooperation is greatly appreciated.

1. What is the general performance in physics at your school?

2. What are the challenges you face in teaching and learning of physics?

3. What might be the causes of poor performance in physics?

4. Comment on the app convenient level for effective teaching and learning of physics?

5. Which learning platform do learners understand most during the teaching and learning of physics?

6. Comment on the internet access during the teaching and learning of physics lesson?

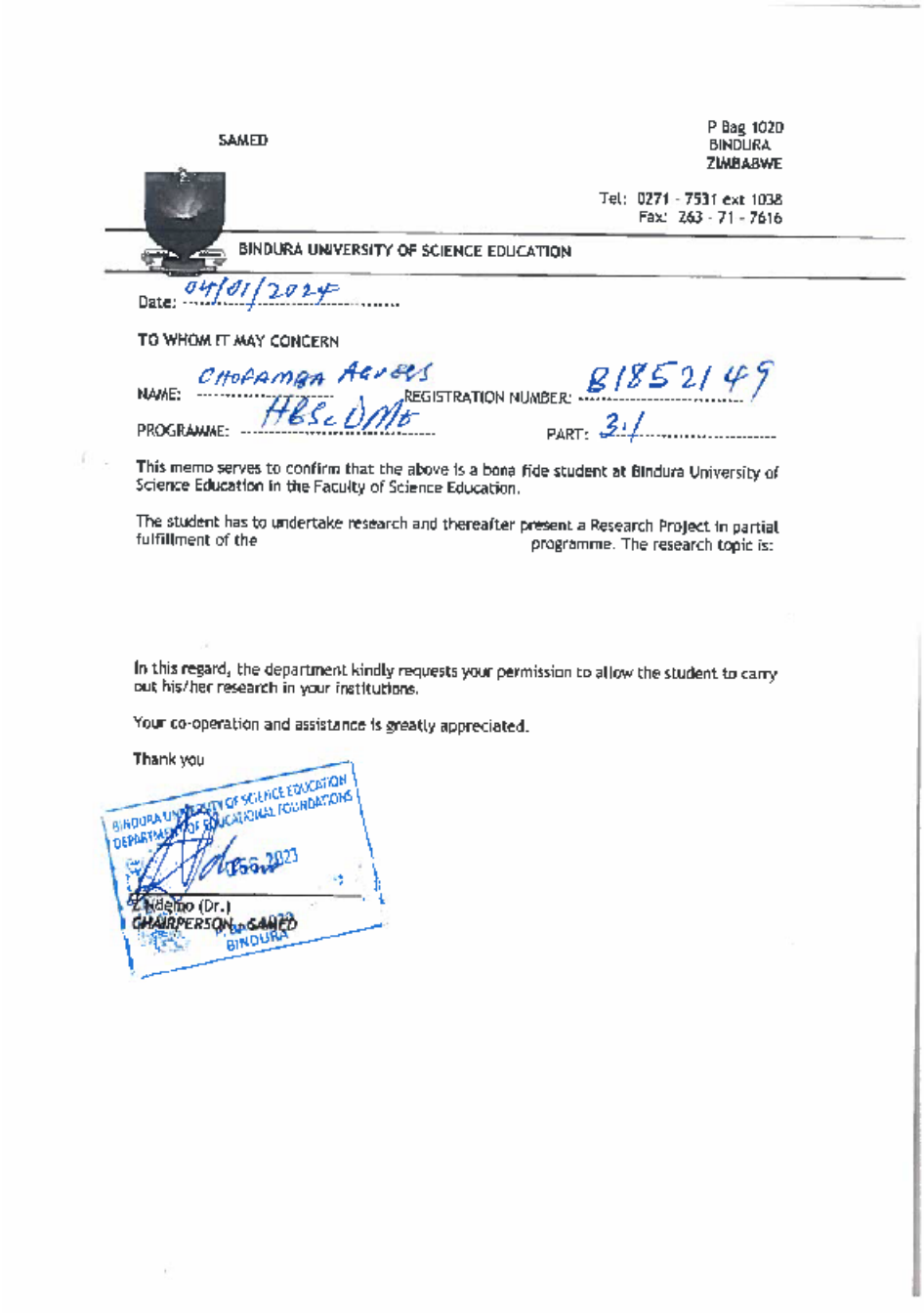
7. Comment on gargets availability at school for online lessons?

8. Comment online learning fees?

9. Suggest measures that can be done to improve performance in physics.

APPENDIX 4

LETTER OF INTRODUCTION TO THE SCHOOL HEAD



SAMED

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ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 04/01/2024

TO WHOM IT MAY CONCERN

NAME: CHIPAMBA Agnes REGISTRATION NUMBER: B1852149

PROGRAMME: BSc (Hons) PART: 3.1

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

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

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

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
2023

Z Ndemo (Dr.)
CHAIRPERSON, SAMED
P Bag 1020
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