

# **BINDURA UNIVERSITY OF SCIENCE EDUCATION**

## **FACULTY OF SCIENCE EDUCATION**



### **EXPLORING THE CHALLENGES FACED BY RURAL TEACHERS AND LEARNERS IN THE USE OF ICT TOOLS FOR THE TEACHING AND LEARNING OF 'O'LEVEL CHEMISTRY**

**BY**

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***A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF SCIENCE AND  
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EDUCATION IN PARTIAL FULFILLMENT TO THE REQUIREMENTS OF THE  
DEGREE IN SCIENCE EDUCATION.***

## **ABSTRACT**

The research project was about challenges faced by the teachers and students in using ICT tools and software to teach and learn Chemistry at Ordinary level. A case study approach was used. A population of six (6) Ordinary level Science teachers and one hundred and sixty (160) ordinary level Chemistry students. The researcher used a sample size of four (4) teachers and sixty (60) students. The research participants were selected so as to provide information regarding their experience on the use of ICT tools and its use so as to facilitate teaching and learning at their school. Teachers' were interviewed so as to get information about the level of ICT tools and software knowledge and skills they held and if they understood their usage. Questionnaires were for the students and it was meant to get information about the students' competency level and to find out if they had the knowledge and skills to use these tools and integrate them in their studies. Observation checklist was also used so as to gather information about how and when the teachers and students used ICT tools and software in teaching and learning process. The research project's major findings were that some teachers lacked the knowledge and skills to use ICT tools to teach. Some teachers' had the knowhow but lacked the confidence and the technological expertise of using it in the Chemistry class. The students were ICT competent. The school under study had the appropriate ICT tools but they were not adequate to teach and learn Chemistry. The researcher concluded that Chemistry teachers at the school under study were not well equipped to incorporate the use of ICT into their Chemistry lessons. The students took great care of their studies hence they knew and used ICT tools to learn. Findings showed that the barriers to lack of technology were due to lack of access to the technology, adequate and appropriate resources. The academic and professional recommendations were that since the teachers had limited skills in the use of ICT, staff development for teachers had to be mounted. Teachers' Colleges and Universities should also train teachers' in using ICT tools and make it compulsory to all. Recommendations for further research were that more similar research study needs to be conducted at a wider range so as to reveal the experience of the teachers and students on the challenges they face in the use of ICT tools and software in the teaching and learning of Chemistry at Ordinary level.

## DECLARATION

I Senzen Mabhera declare that; **what challenges are faced by teachers and students in the use of ICT tools for the teaching and learning of ‘O’ Level Chemistry at a rural High School in Karoi?** Is my original work that has not been submitted for any degree or examination in any other University and that all the sources I have used or quoted here have been indicated and acknowledged?

*Signature:*

*Date:*

## **APPROVAL FORM**

The undersigned certify that they have supervised, have read and recommend to the University for Acceptance and examination a research project entitled;

**What challenges are faced by teachers and students in the use of ICT tools for the teaching and learning of ‘O’ Level Chemistry at rural High School in Karoi?**

Submitted by Senzen Mabhera in partial fulfilment of the requirements for the award of the Degree in Science Education in Chemistry.

*Supervisor:    Name:*

*Signature:*

*Date:*

## **ACKNOWLEDGEMENTS**

I would like to acknowledge the support I got from my supervisor Dr Chidarikire. Thank you for the support and guidance throughout the project. It would have not been a success without your guidance. I also acknowledge the support rendered from the research participants and my friends Gally and Irene during the time of the study. I would also like to thank my family for the financial and moral support. Lastly but not least we give honour to the Almighty our God for the strength to complete this project and the opportunity to interact with other researchers

## **DEDICATION**

This research is dedicated to Mr and Mrs Mabhera

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## **CHAPTER 1**

### **THE PROBLEM AND ITS SETTINGS**

#### **1.1 Introduction**

This chapter takes a look at some critical issues related to the background of the problem. It also highlights the statement of the problem, purpose and objectives of the study, research questions, and significance of the study and definition of key terms.

#### **1.2 The contextual background of the problem**

The importance of ICT tools in the education sector is quite evidenced in many aspects. Over the years, the textbook and the chalkboard had been the two principal teaching instruments for the teacher (Visser, Wild, & Newton, 2015). With time, radios, televisions and film projectors became the gadgets but they were huge, immovable and lacked portable power sources. With time much smaller and portable information sources like the compact discs (CDs) and digital video discs (DVDs) were introduced. These offered flexibility for the teacher, since one could play them when required, could replay for emphasis and stop when one needed to comment. This is different from the radio and TV programs that offered no such controlled usage. Despite their usefulness, the impact of these tools in teaching remained low because they offer a limited range of experiences to the learner, that is, only visual and audio experiences. The advent of the computer impacted the educational system in a very massive way than the rest. This is because while the textbook, radio and television impacted only on either visual, audio and touch of users, the computer provided all experiences at once.

Since the inception of computers into the educational system, educational policies around the world have endorsed their use as teaching aids. Most experts now agree that when properly used, the computer and other ICT tools can improve both teaching and learning experiences thus leading to improved educational experiences (Visser, Wild, & Newton, 2015). This means if properly used in the Chemistry classroom, ICT tools and the internet can be powerful tools towards motivating learners and improving their grades.

The Zimbabwean educational sector introduced a new curriculum in 2015. The curriculum places a lot of emphasis in the teaching and learning of science subjects like Chemistry, Biology, and Mathematics. An aspect of this curriculum called the Science, Technology, Engineering and Mathematics (STEM) emphasises more on using teaching methods that increase student motivation to take science subjects, as well as enrol in science programmes in tertiary education. The implementation and success of both the new curriculum and the STEM depends on the teacher, who is expected to use a variety of teaching methods and concepts to motivate students as well as enhance their understanding of science concepts. One such method that is advocated for in the new curriculum is the use of Information, Technology and Communication (ICT) tools. The internet would also widen both learners' and teachers' research as well participation and understanding of concepts.

### **1.3 Statement of the research problem**

The use of ICT tools in science teaching in Zimbabwe is increasing. However, since the inception of the new curriculum and the science, Technology, Engineering and Mathematics (STEM), many schools in Zimbabwe still do not use any of these tools in Chemistry classroom today. So far, there are few published researchers that deal with teacher related factors that are delaying or awaiting the use of ICT tool in Chemistry classes today, (Masunungure 2016). This research seeks to fill this gap, by investigating the problems that the teachers are facing in implementing the use of ICT tools.

### **1.4 Research questions**

This research seeks to answer the following questions:

**1.4.1** What level of knowledge and skills of ICT tools and their use are held by teachers for the teaching of Chemistry?

**1.4.2** What ICT competencies do students have to help them learn Chemistry?

**1.4.3** Are there adequate and appropriate ICT tools in the school to teach Chemistry?

### **1.5 Objectives of the research**

This study is guided by the following objectives:

**1.5.1** To identify the level of knowledge and skills of ICT tools and their use held by teachers in the Chemistry classroom at Ordinary level.

**1.5.2** To identify the ICT competencies the students have to help them learn in the Chemistry classroom.

**1.5.3** To find whether there are adequate and appropriate ICT tools available in the teaching and learning of Chemistry.

## **1.6 Assumptions of the study**

The research study took the following for granted:

**1.6.1** It is the assumption that, computers are available in the school are used for ICT integration in the teaching and learning process,

## **1.7 Limitations of the study**

The research is based on the following weaknesses:

**1.7.1** Because of financial restrictions that made it difficult for the researcher to use a larger sample. This is compounded by the fact that the student has financial challenges and relies on hand-outs to carry out the study.

**1.7.2** The study restricts the participants to the Chemistry teachers, Chemistry students and school Heads who some of them were dishonest and unwilling to avail information on their ICT competencies. To lessen this, the researcher tried by promising the participants on the discretion of their identities.

## **1.8 Delimitations of the study**

The research is confined to the following physical and conceptual boundaries:

**1.8.1** The study targeted only 1 school in Karoi Province, Zimbabwe which had ICT tools for teaching and learning of Chemistry. It also dealt with Chemistry teachers, their students and the Headmaster. These participants were suitable to the study since they could provide first-hand information.

## **1.9 Significance of the study**

Most studies conclude that political and economic problems are to blame for the failure of teachers to implement the use of ICT tools in teaching Chemistry. The government as well as international organisations such as UNICEF has made enormous donations with science kits as well as financial donations to try and alleviate these problems. However, teachers are still using the traditional methods, despite both government interventions and economic support. This shows that the problems must be inherent within the teachers. This research is a complementary effort to the government's efforts to promote STEM. This study will provide necessary information for decision makers in educational field as well as teacher educators on how well to prepare Chemistry teachers for their profession. If teachers can be helped to overcome identified problems, then more learners will take Chemistry as a major at A' level, and then can enrol in Chemistry related fields such as medicine, radiography and engineering. This study is of scholarly importance because it will provide information to fellow researchers regarding a gap in knowledge on why low usage of ICT tools still persists. If these problems can be identified, it will be easy to address them at school and national level, thus improving the whole educational system of the country.

**1.9.1** The findings seek to create awareness among teachers on the importance of using ICT tools to teach and change their attitudes.

**1.9.2** Findings may also help educational stakeholders in the improvement of provisions of educational materials to secondary school teachers

## **1.10 Definitions of key terms**

**1.10.1** Chemistry – The branch of science concerned with the study of properties of space, time, matter and energy. In Chemistry it is talked about things which are experienced in everyday life.

**1.10.2** Teacher – Professionally trained person to formally interpret and implement curriculum requirements in the transmission of knowledge in schools.

**1.10.3** ICT Knowledge – Understanding of facts of Information Communication Technologies.

**1.10.4** ICT Competencies – ICT knowledge and skills possessed by an individual.

**1.10.5** ICT tools – Information Communication Technologies. The technology and tools used to transfer information and speed up the communication processes.

**1.10.6** Adequate and appropriate ICT tools – Equal to some requirement and suitable Information Communication Technology tools used to transfer information and speed up the communication process.

**1.10.7** Challenges in ICT use - Difficulties faced in applying of Information Communication Technologies.

## **1.11 Acronyms and abbreviations used in the study**

ICT – Information and Communication Technologies

STEM – Science Technology Engineering and Mathematics

## **1.12 Organisation of the research project**

**1.12.1** Chapter 1- An overview on challenges faced in the use of ICT tools. This chapter will look at the contextual background of the problem, statement of the research problem also the research questions, objectives of the research, assumptions, limitations and delimitations of the study. It will also look at the significance of the study, definitions of key terms and organisation of the research study.

**1.12.2** Chapter 2 – Related Literature Review, in this chapter the researcher will look at the challenges, prospects and theoretical framework on the use of ICT tools in the teaching and learning of Chemistry at ordinary level.

**1.12.3** Chapter 3 – Research Design and Methodology, this chapter will deal with methodological issues where the researcher will discuss and justify the method of data gathering, analysis, study population, sampling techniques, sample size and the research design that will be used in answering the problem under study.

**1.12.4** Chapter 4 – Data Analysis, Presentation and Discussion, in this chapter data collected using research instruments will be analysed and the summary presented. The analysed data will be interpreted and discussions of the same will be presented in this chapter.

**1.12.5** Chapter 5 – Summary, conclusions and Recommendations, a number of issues are to be investigated. The issues will include: the extent of ICT tools used in teaching and learning of Chemistry and the factors influencing the use of ICT tools in teaching and learning of Chemistry. This chapter will also summarise the findings. The conclusions and recommendations will be outlined.

### **1.13. Conclusion**

This chapter focused on assessing the extent to which ICT tools are being used in the teaching and learning of Chemistry. After outlining the research findings, possible strategies that will help in encouraging teachers and learners in using ICT tools to learn and teach Chemistry.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter takes a look at literature review on the importance of the teachers' knowledge and skills of ICT tools, students' ICT competency and the appropriate and adequate ICT tools available in schools in the teaching and learning of Chemistry at Chikangwe high school, Karoi.

#### **2.2 Importance of teachers' knowledge and skills of ICT tools**

Teachers are key in the success of ICT incorporation in education and they should incorporate ICT in science teaching. Research studies in Australia found that teachers who lacked knowledge and skills to use computers were not willing to incorporate ICT tools in teaching and learning (Newhouse, 2015). The lack of technological know-how is the main problem to acceptance and adoption of new technology by teachers in classroom instruction (Pelgrum, 2017).

Teachers must feel confident in order to adopt any educational technology successfully. Also they must have the ability to use it in the classroom. Teachers who are inexperienced in using ICT tools will most likely avoid using it in the classroom for the fear of failure. According to Balanskat, Blamire, Kefala., (2018) and Bingimalas, (2016), limitations in teacher's ICT knowledge makes them feel anxious about using ICT tools in the classroom and thus not confident in using it in their teaching. This is in line with the findings of a study carried out in the United Kingdom by Becta (2016) who found that many teachers who do not consider them to be well trained in using ICT feel fearful about using it in front of a class of students who perhaps know more than they do.

Teachers believe that ICT could be used as a pedagogical tool in improving their teaching if there are sufficient resources and infrastructure to support it.

Incorporating ICT in teaching of science embraces the functions of planning and preparation of suitable learning activities and their implementation in the classroom (Newton, 2019). Science teachers can use a wide range of ICT tools in planning for their lessons and the actual classroom instruction. These include software, the Internet, projectors etc. computers should be used to help the teacher and for individual lessons. Planning for a lesson involves preparation of schemes of work, lesson plans, teaching notes, and learning activities, amongst

others. Science teachers could use the Internet when planning for a lesson to identify and develop learning activities and search for up to date information on the concept or skills they want to teach about. Moreover, teachers could use the computer to type schemes of work, lesson notes, lesson plans and test assessments which will save on planning time as compared to using pen and paper.

### **2.3 Importance of students' ICT competency**

While there are different definitions of competency, as Clark (2015) explains, most of them have two common components: first they are observable or measurable skills, knowledge and abilities, and second they must distinguish between superior and other performers.

Therefore, competency is an individual characteristic that can be measured reliably and that can be used to make differentiation between superior and average performers, or between effective performers (Bartram, Robertson, & Callinan, 2018). As far as ICT competency is concerned, it can be regarded as the ability “to use ICT to retrieve, store, create, present, sort and exchange information” (European Commission, 2016, p.13). Students who possess ICT skills will be able to apply the basics in authentic, integrated ways to solve problems, complete projects and creatively enhance their abilities.

As a result of new technologies which are introduced continually, new ICT competencies appear. Therefore, students need to acquire these competencies. There are different interpretations on adequate ICT competencies.

### **2.4 Importance of appropriate and adequate ICT tools**

Access to ICT infrastructure and resources in schools is an essential condition to the incorporation of ICT in education (Plomp, Anderson, Law, & Quale, 2015). Effective embracing and incorporation of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Obviously, if teachers and learners cannot access ICT resources, then they will not use them. Consequently, access to computers, updated software and hardware are key elements to successful adoption and incorporation of technology.

Considerable resources have been invested to justify the place of ICT in education since it provides many benefits and gains that can be achieved by students (Jhurree, 2019). For example, Papert (2015) identified the several positive effects of ICT on students and stated

that it improves students' motivation creativity when they are faced with the new learning environments, and provides a greater disposition to research and problem-solving. Furthermore, students become able to produce knowledge, increase their capability to deal with rapidly changing world and gain new skills fostered through technological literacy (cited in OECD, 2016, p.26).

## **2.5 CONCLUSION**

The literature review covered the significance and challenges faced in the teaching and learning of Chemistry using the different types of ICT tools. It is an account of already published information on the extent of ICT use and it serves to acknowledge the works of other researchers which helped the researcher to be aware of the information gap thus the need and importance of this study.

## **CHAPTER 3**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Introduction**

This chapter explains how the research was carried out and how the data was gathered. It covers the research design, the target population, sample and the research instruments that were employed in order to gather the data. An explanation is offered on the rationale behind the decision to use the research design employed in the study as opposed to the others.

#### **3.2 Research Design Used**

According to Moore (2018), research design is the strategy, the plan or the structure of conducting a research project. The research design used in this study was a case study. A case study is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real life context. Bryman (2017, p. 52) describes a case study as one which "... entails the detailed and intensive analysis of a single case". On the outset, the term "case" is synonymous with a particular location e.g. an organization. A case study design is concerned with the complexity, characteristics, particular nature and implications of the case in question, in my research, the challenges faced by teachers and learners of Chemistry in using ICT at a rural school in Karoi.

It was chosen because it keeps the research focused and manageable especially when the researcher does not have time and resources to do large scale research.

#### **3.3 Population, Sample and Sampling**

##### **3.3.1 Population**

Target population refers to the grouping from which the researcher intends to gather information related to the stated problem. The target population included the Headmaster of the school under study, 6 'O' Level Science teachers including the Head of department and 160 'O' Level Chemistry students.

##### **3.3.2 Sample**

A sample can be defined as, "...a smaller group or subset of a total population in such a way that knowledge gained is representative of the total population under study"

(Cohen, Manion, and Morrison, p... 2019). The researcher came up with a sample size comprised of 60 Chemistry students and 4 teachers.

### **3.3.3 Sampling**

The researcher used purposive sampling in the research. Purposive sampling is a sampling technique which the researcher relies heavily on his or her own judgment when choosing members of population to participate in the study (Black, 2016). Purposive sampling is when researchers thoroughly think through how they will establish a sample population, even if it is not statistically representative of the greater population at hand. In this type of sampling, the researcher goes to a community (a high school Chemistry Department) on purpose because they think that these individuals fit the profile of the people that they need to reach.

## **3.4 Research Instruments**

The researcher employed the interview schedule, the questionnaire and observation as the research instruments for this study.

### **3.4.1 The interview schedule**

An interview schedule is a list containing a set of structured questions that have been prepared, to serve as a guide for interviewers, researchers and investigators in collecting information or data about a specific topic or issue (Luenendonk, 2019). The interviewer, who will fill in the questions with the answers received during the actual interview, will use the schedule. Barbour and Schostak (2018) argue, “Implicit in our images of interviews are a number of key concepts listed below that fundamentally impact on their utility as methods to be employed by researchers and these may introduce aspects of bias”: The interview was meant for teachers. The role of the interview schedule is to provide a protocol for interviewers to ask and record answers in a consistent way across all participants and to facilitate the process of getting through the interview smoothly and efficiently. The researcher used the interview because they wanted to have a better understanding of the research participants’ level of knowledge and skills in the use of ICT tools and software and also their competence level.

### **3.4.2 The questionnaire**

A questionnaire is a research instrument consisting of a series of questions or other types of prompts that aims to collect information from participants (James, 2015).

There are many methods in which to obtain questionnaire data, the researcher used email. The questionnaire was sent via email to all participants for them to respond it at their convenience. A questionnaire allows a large amount of information to be collected from a large number of people in short period and in a relatively cost effective way.

The questionnaire was meant for Chemistry students. It was used to establish the number of students with computers and those who felt comfortable in integrating ICT in their lessons, the ICT knowledge held and competencies which the students had.

### **3.4.3 Observation checklist**

Observation research is a qualitative research technique where researchers observe participants' on-going behaviour in a natural situation. Observation data collection method is classified as a participatory study, because the researcher has to immerse herself in the setting where her participants are (in the classroom), while taking notes and/ or recording. The researcher observed an on-going class in trying to find out how the teachers and students used ICT tools and software in teaching and learning.

## **3.5 Data Collection Procedures**

These are steps, procedures and strategies for gathering data in this study (Bhandari, 2020). Data collection refers to gathering specific information aimed at providing or reputing some facts. (CIromp, 2019), in this study, the following methods were used in collecting the required information, interviews, focus groups, observation and questionnaires.

After validation of the instruments, the researcher secured a written permit to the Headmaster of the school under study.

### **3.5.1 Interviews**

A structured interview was used in order to determine the different perceptions of the participants as to the challenges faced in integrating ICT with teaching of Chemistry. The interviews were conducted with the teachers only. Many of the interviewers gave emphasis on the shortage of ICT equipment at the school

### **3.5.2 Observations**

After being given permission to be in a lesson, the researcher observed how the teacher undertook the lesson from start to end. There was a teacher who used a personal computer/laptop; this is where he stored all the notes for the pupils. The personal computer was also used to enhance the learning process by allowing students to watch simulation videos. The screen was very small and students were so many which posed a challenge. The other teachers did not use a laptop. There were also students who brought their own laptops and used them to watch a simulation video which was provided by the teacher.

### **3.5.4 Administering questionnaires**

The questionnaire was the main tool used in data gathering. A questionnaire is a research instrument consisting of items and a prompt for the purpose of gathering information from the participants it includes the use of multiple choices and scaled questions. It generates quantitative information, which can be analysed statistically, and endeavours to reduce any bias potentially originating from the researcher or participants. Copies of the approved questionnaires were distributed in order to gather relevant data. The instruments were retrieved after the students and teachers finished answering. There were a set of two different questionnaires, the one for the students and the other for the teachers. This really helped in trying to cover both the student-specific questions and teacher-specific to reduce biased results.

## **3.6 Data Analysis Techniques Used**

The following data analysis techniques were used.

### **3.6.1 Transcription**

Data transcribing process was done using data collected from the interview. The data collected in this study was of a qualitative nature. “In qualitative research, the interview is usually audio-recorded and transcribed whenever possible” Bryman 2016:482). Each hour of speech was given 2 hours on average during the transcription process. To avoid a huge backlog, it was deemed necessary to make the transcription process an on-going activity as advised by a number of writers on qualitative research like Lofland and Lofland (2017), Kvale & Brinkmann (2018) and Bryman (2019). Transcribed interviews were then categorized in themes for ease of analysis. Each research question formed the basis for which

these themes were established. These themes were, “How and the extent of ICT use”, “Perceived role of ICT in education”, “Impediments to ICT use in teaching and learning”. This thematic approach of data analysis helped in sorting out which responses from the interview related to which research question. In addition to this, the handwritten notes made during the interviewing process were used alongside the recorded responses.

So the steps in the transcribing process followed are:

Firstly, the researcher took the interview recorded and gave listened to it for a time deducing themes and noting them down, recurring themes were “insufficient ICT infrastructure at the school” and “teacher’s incompetence towards ICT integration”.

Secondly, the researcher used the notes which were taken down during interviews to note important points given by participants.

Thirdly, the researcher came up with final theme, documented them in the results document.

### **3.6.2 Test Scores**

During observations, the researcher was given access to go over student test scores. The researcher noticed that some teachers used a personal computer (laptop) to show students videos, online tutorials and simulations to enhance teaching. The researcher then compared the test scores of that class and the classes which used no ICT at all. The results showed that the class which used ICT had more improved test scores.

### **3.7 Ethical Considerations**

The researcher considered the confidentiality of the participants. This means that any identifying information was not made available to, or accessed by anyone but the researcher. Given that there are often small numbers of participants in the research, it is very important to consider how reports are worded to ensure that there is no opportunity for students or teachers to be identified even though the names are not used. Voluntary participation was another factor, which was considered; people participate in the evaluation free from coercion and were free to withdraw from participation at any time.

The researcher obtained a research permit from the school under study. A verbal permission was also granted from the Head of the school to administer the questionnaire to the teachers and to interview them. Prior to the data collection

process participants were informed about the purpose of the study and were ensured that confidentiality would be maintained for any inform they volunteered during data collection.

### **3.8 Conclusion**

In this chapter the reasons for adopting a case study research design have been discussed. The chapter outlines the procedures adopted for sample selection and research instruments used for the study.

## CHAPTER 4

### DATA PRESENTATION, ANALYSIS AND DISCUSSION

#### 4.1 Introduction

This chapter deals with the presentation and analysis of data collected and the discussion of the research results.

#### 4.2 Data presentation and analysis

This section describes the information obtained from the research participants.

##### 4.2.1 What level of knowledge and skills of ICT tools and their use are held by teachers for the teaching of Chemistry?

Responding to an interview question on their level of knowledge and skills in the use of different ICT tools, the teachers revealed the information on the following table.

***Table 4.1: Level of Knowledge and skill of ICT tools and their use held by teachers.***

| ICT Tools and their uses  | Knowledge & Skills Level |        |        |
|---------------------------|--------------------------|--------|--------|
|                           | Excellent %              | Good % | Poor % |
| Laptops                   | 50                       | 25     | 25     |
| Projectors                | 50                       | 0      | 50     |
| Videos                    | 75                       | 25     | 0      |
| Simulations               | 50                       | 25     | 25     |
| Smart boards              | 50                       | 0      | 50     |
| Internet                  | 50                       | 25     | 25     |
| Smart Phones              | 75                       | 25     | 0      |
| Microsoft Office Software | 50                       | 25     | 25     |

Table 4.1 above shows that some teachers said they know a lot of ICT tools including videos, simulations, laptops and smart boards. Through observation it was noticed that some of the teachers only used a laptop in teaching Chemistry. On further probing, the teachers explained that they are able to use ICT tools but they don't have the knowledge of integrating it in the classroom. They said it is difficult for them to identify the exact tool to use to teach a specific concept i.e. match the ICT tool with the lesson/concept. Of the 4 teachers interviewed 2 did basic computer lessons at private colleges during their spare time and hold certificates. 2 elderly teachers agreed that they had no skills in ICT tools and the other one responded: -

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

One teacher said that they used WhatsApp in conducting online lessons especially during the COVID 19 pandemic lockdown. The findings from the interview question showed that some teachers had ICT skills whilst others did not. Elderly teachers had no interest in implementing ICT in their lessons.

One teacher who knew and had the skill of using ICT tools had this to say:-

*“Technological advancement is a part and parcel of the educative process especially now with the COVID-19, as teachers we must just embrace ICT,” “ It makes you as a teacher to take a fresh look at the way you teach.”*

Findings also showed that the teachers had access to ICT tools at school and none had access at home whereas at school there was no time for some teachers to learn how to use these ICT tools. Teachers' competence also showed that most teachers lacked confidence to use ICT in the classroom. Despite efforts made towards the use of ICT in teaching, it was evident from the findings that majority of the teachers were unaware of how to use ICT pedagogically. The researcher also observed that the use of ICT tools provided the teachers an opportunity to be innovative in lesson delivery because they were now using computers to scheme and plan lessons instead of writing in books with a pen.

The level of knowledge and skills of ICT tools held by teachers was average.

#### 4.2.2 What ICT competencies do students have to help them learn Chemistry?

Responding to the interview and questionnaire questions on their ICT competencies, the students revealed the information on the following table.

**Table 4.2: Students' ICT Competency**

| ICT Tools, Knowledge and Skills | Students Competence Level in % |        |        |
|---------------------------------|--------------------------------|--------|--------|
|                                 | Excellent %                    | Good % | Poor % |
| Laptops                         | 49.18                          | 16.39  | 34.43  |
| Tablets                         | 57.38                          | 11.48  | 31.15  |
| Smart boards                    | 49.18                          | 19.67  | 31.15  |
| Projector                       | 42.62                          | 24.59  | 32.79  |
| Internet                        | 91.80                          | 8.2    | 0      |
| Word processing                 | 73.77                          | 16.39  | 9.84   |
| Spread sheet                    | 11.48                          | 27.87  | 60.66  |
| Smart Phones                    | 100                            | 0      | 0      |

**4.2.2.1** The questionnaire showed that students knew a lot of ICT tools including projectors, smart boards, tablets, internet, word processing, mobile phones etc. Most students believed that through using ICT tools in the classroom it motivated and stimulated their interest to scientific ideas and they will get connected to many information sources.

**4.2.2.2** Through observation, the researcher noticed that students knew and also used laptops, smart phones and tablets at school in reading and taking notes in the classroom. As shown by table 4.2 above, most of the students claimed they are most able to use and implement ICT into their studies. The use of ICT tools helped improve the students understanding of Chemistry as a subject and it provided them with access to more sources of information and data. None showed any ability at all and a few of students were at ability below average. Therefore, the findings showed that students were ICT competent. Through implementation of ICT in class it helped the students to think critically and independently and learn how to operate in an information and technology age.

Data showed that the students were ICT competent and that though some ICT tools were not readily available the students used their own tools and were eager to learn more about Chemistry.

#### 4.2.3 Are there adequate and appropriate ICT tools in the school to teach Chemistry?

Observations at the school under study are revealed in the information on the following table.

**Table 4.3: Adequacy of ICT tools**

| ICT Tools         | No. of Students per ICT Tool Ratio | Functionality of the ICT Tool % |
|-------------------|------------------------------------|---------------------------------|
| Laptop            | 0                                  | 21.15                           |
| Desktop Computers | 2:1                                | 81.81                           |
| Projector         | 1:61                               | 16.67                           |
| Smart Boards      | 1:61                               | 37.5                            |

Observation showed that the school had various ICT tools including projectors, smart boards, and desktop computers, Microsoft Office software, pastel, spread sheet, etc. However, through observing classroom sessions, the researcher noticed that the equipment was not enough for all departments and classes at the school. The school had 2 'O' level classes and only one projector for the department. The projector was shared among the classes throughout the day. Some teachers ended up not bothering to look for the projector and they would just teach without it. The computers were in the computer laboratory and most times the laboratory was always occupied by other Computer Science students. This left no room for teachers or other Chemistry students who wanted to use the computers to research and or type their assignments. The internet was mostly for the staff and it was at the administration block and the staffroom.

Some time ago the school installed smart boards in every classroom but they were now damaged and the school was not providing any technical maintenance and repairs to fix the boards. The school had also purchased a laptop for the department of Chemistry but the laptop was only used by the head of department and it was not helping any teaching in the classroom. Teachers wanted their own personal computers so that they will be able to

research online. The school computers were so few; there were 44 desktops to support a school of almost a thousand students.

Therefore, the researcher found out that there are no adequate ICT tools at the school to support ICT integration with Chemistry lessons.

The school under study had appropriate ICT tools but they were not adequate to teach and learn Chemistry.

### **4.3 Data Discussion**

This section discusses the data presented and analysed in section 4.2 above.

#### ***4.3.1 Teachers' level of knowledge and skills of ICT tools***

The teachers had mixed feelings towards the knowledge and skills on the use of ICT tools and software. Some said they wanted to stick to their old fashioned way of teaching. While some welcomed ICT and had the knowledge in using laptops, Internet, projectors, videos, smart phones. The latter group was doing online lessons on WhatsApp but they all lacked the skills on how to use it pedagogically because they did not know which applications or software to use so it was difficult for them. The results showed that the teachers' level of knowledge and skills was average because the teachers had limited ICT tools and software knowledge and skills and lacked pedagogical training on using ICT in the classroom and also lack of confidence. Gomes (2018) relating to a variety of subjects concluded that the lack of training regarding technology use in particular subject areas were an obstacle to using new technologies in the classroom. Also since some teachers wanted to stick to their old ways of teaching, they lacked knowledge and skills to use ICT tools and software in teaching.

Research studies in Australia found that teachers who lacked knowledge and skills to use computers were not willing to incorporate ICT tools in teaching and learning (Newhouse, 2015). The lack of technological know-how is the main problem to acceptance and adoption of new technology by teachers in classroom instruction (Pelgrum, 2017). According to Balanskat, Blamire, Kefala., (2019) and Bingimalas, (2015), limitations in teacher's ICT knowledge makes them feel anxious about using ICT tools in the classroom and thus not confident in using it in their teaching. The reviewed literature mirrors the researcher's findings where some teachers did not want to implement or change their way of teaching because they lacked ICT tools knowledge and skills.

#### ***4.3.2 ICT competency of students***

Students knew a lot of ICT tools for example smart boards, tablets, internet, projectors, word processing, mobile phones etc. the students claimed that they are able to use and implement ICT into their studies. The students' competence level on laptops was 49.18% on excellent, good was 16.39% and Poor was 34.43%. The level on tablets 57.38% on excellent, good was 11.48% and poor was 31.15%. These figures are shown on table 4.2 above. They showed that most students were ICT competent because they took great responsibility for their own learning and worked self-sufficiently in using ICT tools to help them learn.

Empirica (2018) states that students are more encouraged and they take part more actively when ICT based approaches are being used in the classroom. Students who possess ICT skills will be able to apply the basics in authentic, integrated ways to solve problems, complete projects and creatively enhance their abilities. This mirrors the researcher's findings that students were ICT competent.

#### ***4.3.3 Adequate and appropriate ICT tools in the school***

The school under study had various ICT tools and software for example smart boards, desktop computers, Microsoft Office software, spread sheet, projectors etc. though the school had these ICT tools and software they were not adequate for everyone at the school because majority of the equipment was used at the administration's office and the computer laboratory. As shown by table 4.3 above number of students per ICT tool ratio on laptops was 0 and the functionality of the laptops was also 21.15%, desktop computers its ratio was 2:1 and their functionality was 81.81%, projectors' ratio was 1:61 and their functionality was 16.67% and smart boards ratio was 1:61 and their functionality was 37.5%. The results showed that the school had the appropriate ICT tools but they were not adequate to teach and learn Chemistry because all the other relevant ICT tools were there at the school under study but since desktop computers were based at the computer lab and the projectors were few most teachers forego using them and hid behind the unavailability of these to use ICT tools and software.

Access to ICT infrastructure and resources in schools is an essential condition to the incorporation of ICT in education (Plomp, Anderson, Law, & Quale, 2015). Considerable resources have been invested to justify the place of ICT in education since it provides many benefits and gains that can be achieved by students (Jhurree, 2019). Effective embracing and incorporation of ICT into teaching in schools depends mainly on the availability and accessibility of ICT resources such as hardware, software, etc. Obviously, if teachers and learners cannot access ICT resources, then they will not use them. Consequently, access to computers, updated software and hardware are key elements to successful adoption and incorporation of technology. The literature review is in line with the findings of the researcher where the resources were there at the school under study but the teachers and learners could not access these ICT tools and software.

#### **4.4 Conclusion**

In conclusion this chapter outlined data presentation, analysed data and also discussed data based on the findings. Data was presented in form of tables.

## **CHAPTER 5**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter covers summary, conclusion, and recommendations for the professional and academic development of teachers' and students' knowledge and skills as well as competency level on the use of ICT tools and software and for further research.

#### **5.2 Summary**

This study intended to examine the challenges faced by teachers and students in the use of ICT tools in the teaching and learning of 'O' Level Chemistry at a rural high school in Karoi.

The researcher sought to determine the knowledge and skills of ICT tools and software held by Chemistry teachers and students and their competency level, and whether the school had appropriate resources to teach and learn Chemistry.

The researcher used a case study research design. According to Smith, Thorpe, and Lowe (2018) the main purpose of a case study design is to obtain information from a defined set of people so as to generalize the sample results to the population. Four (4) 'O' level Chemistry teachers and sixty (60) Chemistry students were the research participants chosen. The research participants were purposely selected so as to provide information regarding their experience on the use of ICT tools and its use so as to facilitate teaching and learning within their school. The researcher interviewed teachers to get information about the level of ICT tools and software knowledge and skills the teachers held and if they understood the usage and find out their competency level and the challenges they faced in using ICT to teach. The questionnaire for the students was meant to get information about the student's competency level and if they had any knowledge and skills on the use of ICT tools and software and whether they integrated it in their learning. The researcher observed Chemistry lessons in order to gather information about how and when the teachers and students used ICT tools and software in teaching and learning process.

### 5.3 Conclusions

The research study came up with the following research findings and conclusions:

- Data obtained showed that the teachers' level of knowledge and skills on the use of ICT tools and software was average. Some teachers welcomed the use of ICT tools to teach, while some preferred the old teaching ways this was due to their limited knowledge and skills in ICT use, lack of pedagogical training and lack of confidence. It can be concluded that Chemistry teachers at the school under study were not well equipped to incorporate the use of ICT into their Chemistry lessons.
- The students were ICT competent and they took great responsibility for their own learning and worked self-sufficiently to help them learn. They knew a lot ICT tools and software and they implemented their knowledge of technology into their studies. It can be concluded that the students took great care of their studies and were very much interested in the use of ICT tools to learn hence they used their own gadgets.
- The school under study had the appropriate ICT tools but they were not adequate to teach and learn Chemistry, since the students and teachers had no easy access to these ICT tools. From the research's findings it can be concluded that most barriers in the working of ICT in schools is due to lack of access to the technology and adequate and appropriate resources.

### 5.4 Recommendations

This section discusses the academic and professional recommendations and the recommendations for further research.

#### 5.4.1 Academic and professional recommendations

The study found that the teachers had limited skills in ICT usage. It is recommended that staff development workshop on ICT usage be mounted for the teachers. More investment should be directed to moving ICT tools to classrooms instead of just in the computer laboratory. Teachers' colleges and Universities which train teachers' should make the use of ICT tools and software training compulsory for all teachers.

The research findings showed that the school under study had appropriate but no adequate ICT tools and software to help facilitate the teaching and learning process. It is therefore, recommended that more funds are needed from the relevant Ministry to establish at least

minimum ICT facilities to enable the school to have these infrastructures for teaching and learning.

#### ***5.4.2 Recommendations for Further Research***

This study was only carried out at one rural high school, therefore the researcher recommends that a similar study can be done at District or Province level to widely disclose the experience of teachers and students on the challenges they face in using ICT tools and software in teaching and learning Chemistry at Ordinary level.

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## APPENDICES

### Interview Guide for Teachers

My name is Senzen Mabhera I am a student at the Bindura University of Science Education taking a Degree in Science Education. I am doing a research on challenges faced by 'O' level Chemistry teachers and learners in integrating ICT with their work.

- i. On a scale of 1 (least) to 5 (most) how do you rate your ability to use ICT tools and software to teach Chemistry at ordinary level?

|                                     | Least | Much | Average | More | Most |
|-------------------------------------|-------|------|---------|------|------|
| Projectors                          |       |      |         |      |      |
| Laptops                             |       |      |         |      |      |
| Word processing software            |       |      |         |      |      |
| Simulation boards                   |       |      |         |      |      |
| Mobile phones                       |       |      |         |      |      |
| Internet                            |       |      |         |      |      |
| Smart note pads & tablets           |       |      |         |      |      |
| Spreadsheet & Presentation software |       |      |         |      |      |

- ii. On a scale of 1 (least extent) to 5 very high extent) to what extent do you use each of the following ICT tools and software in your Chemistry lessons?

|                            | Least extent | Much Extent | Average | High extent | Very high extent |
|----------------------------|--------------|-------------|---------|-------------|------------------|
| Projectors                 |              |             |         |             |                  |
| Laptops                    |              |             |         |             |                  |
| Word processing software   |              |             |         |             |                  |
| Simulation boards          |              |             |         |             |                  |
| Mobile phones              |              |             |         |             |                  |
| Internet                   |              |             |         |             |                  |
| Smart note pads & tablets  |              |             |         |             |                  |
| Spreadsheet & Presentation |              |             |         |             |                  |

|          |  |  |  |  |  |
|----------|--|--|--|--|--|
| software |  |  |  |  |  |
|----------|--|--|--|--|--|

iii. What are the challenges of using ICT in teaching 'O' Level Chemistry?

.....

.....

.....

iv. Are you comfortable integrating ICT with your Chemistry lessons?

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.....

.....

v. Do you have any knowledge and use of computer application and software?

.....

.....

.....

## Questionnaire Questions for the students

My name is Senzen Mabhera. I am a student at Bindura University of Science Education taking a Degree in Science Education. I am doing a research on challenges faced by 'O' level Chemistry teachers and learners in integrating ICT with their work.

*All answers in this questionnaire remain confidential.*

i. On a scale of 1 (least) to 5 (most) how do you rate your ability to use the following ICT tools and software to learn Chemistry at Ordinary level?

|                          | Least | Much | Average | More | Most |
|--------------------------|-------|------|---------|------|------|
| Projectors               |       |      |         |      |      |
| Laptops                  |       |      |         |      |      |
| Word processing software |       |      |         |      |      |
| Simulation boards        |       |      |         |      |      |
| Mobile phones            |       |      |         |      |      |
| Internet                 |       |      |         |      |      |

|                                        |  |  |  |  |  |
|----------------------------------------|--|--|--|--|--|
| Smart note pads & tablets              |  |  |  |  |  |
| Spreadsheet &<br>Presentation software |  |  |  |  |  |

- ii. Do you think the following suggested challenges hinder the use of ICT in classroom teaching?

|                                                                            | Strongly Agree | Agree | Not Sure | Disagree | Strongly Disagree |
|----------------------------------------------------------------------------|----------------|-------|----------|----------|-------------------|
| The unavailability of and access to ICT facilities and resources           |                |       |          |          |                   |
| Teachers negative attitude towards the use of ICT                          |                |       |          |          |                   |
| Lack of or inadequate teachers' competence in using ICT tools and software |                |       |          |          |                   |
| Lack of or inadequate students' competence in using ICT tools and software |                |       |          |          |                   |

- iii. How do you mostly use ICT tools?

Studying [     ], Gaming [     ], Shopping [     ], Networking [     ]

- iv. List at least 5 ICT tools you know:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

## Observation Checklist

| ICT Tools                   | Usage monitor |   |   |   |   |   |   |   |   |    |    |    |
|-----------------------------|---------------|---|---|---|---|---|---|---|---|----|----|----|
|                             | 1             | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Laptops                     |               |   |   |   |   |   |   |   |   |    |    |    |
| Desktop computers           |               |   |   |   |   |   |   |   |   |    |    |    |
| Projectors                  |               |   |   |   |   |   |   |   |   |    |    |    |
| Simulation software         |               |   |   |   |   |   |   |   |   |    |    |    |
| Smart boards                |               |   |   |   |   |   |   |   |   |    |    |    |
| Internet                    |               |   |   |   |   |   |   |   |   |    |    |    |
| Smart note pens and tablets |               |   |   |   |   |   |   |   |   |    |    |    |
| Presentation software       |               |   |   |   |   |   |   |   |   |    |    |    |
| Word processing software    |               |   |   |   |   |   |   |   |   |    |    |    |
| Spreadsheet                 |               |   |   |   |   |   |   |   |   |    |    |    |
| Mobile Phones               |               |   |   |   |   |   |   |   |   |    |    |    |