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DEARTMENT OF SCIENCE AND MATHEMATICS

AN INVESTIGATION INTO THE USE OF VISUAL AIDS IN THE TEACHING AND LEARNING OF ORDINARY LEVEL PHYSICS

BY NHIWATIWA LORIETTE

B1438022

SUPERVISED BY DR. ZEZEKWA

A Research Project submitted to the Department of Science and Mathematics Education in partial fulfilment of the requirements for the Bachelor of Science Education in Physics Degree

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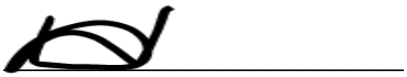

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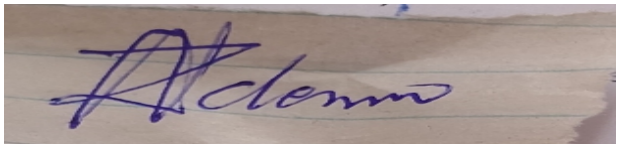

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I, Loriette Nhiwatiwa, Registration Number BU1438022, do hereby declare that this dissertation is the result of my own research and investigation, except to the extent indicated in the acknowledgements, references and by comments included in the body of the report, and that it has not been previously submitted by me in part or in full for any other degree to any other college.

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DEDICATION

The outcome of this research project has been made possible by my resolute and unwavering supervisor Dr. Zezekwa without whom I could never have imagined succeeding in this path. His immeasurable and tremendous support and guidance has been second to none in my coursework. Secondly, I dedicate this project to my daughters Rumbidzai and Stacy who were always on my side, encouraging me to soldier on despite the hardships. I salute you my daughters for being there for me when i need you the most especially during my absence at school. My mother has ever been the mother she is to me. Her love for me has never subsided despite my being a grown up woman. I will forever cherish her love, support, encouragement, comfort and the never say die attitude she ingrained in me when growing up.

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To my fellow classmates and schoolmates, I thank you so much for leaning on each other during study time. It was quite heart-warming to know that you were there for all of us. We collectively achieved this degree, and I look forward to further collaborations even after school.

My loving daughters, Rumbidzai and Stacy, take this degree as your own because I did for you. Carry the torch from where I left and finish the race for I have laid the foundation for you.

Lastly, I thank the almighty God for his everlasting love and patience with me. When the road seemed bleak, you were there for me.

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ABSTRACT

The attitudes displayed by learners towards learning Physics has been a major concern especially for learners in the rural areas. One of the major impediment has been lack of exposure to the benefits derived from learning physics given that they are not exposed to opportunities abound in having passed sciences. Inadequate practical Ordinary Level Physics interactive teaching methods such as Visual Aids inhibits the efficiency and efficacy in the cognitive development of the learner. Resultantly, this led researchers to investigate the effectiveness of utilising of Visual Aids in the teaching and learning of Ordinary Level Physics as outlined in this research.

In conducting this research, the researcher employed the qualitative research method to investigate the findings inherent in the utilization of Visual Aids, particularly the adequacy and availability of teaching materials to physics teachers, the attitudes displayed by the students towards learning of physics and those of the teachers towards teaching the subject. Questionnaires were employed to collect information from the students in the process of learning Physics. Classroom observations to learners were conducted by the teachers during physical and practical work in the use of Visual Aids so as to determine their attitude, aptitude, behavior and performance. Student engagement, flexibility, control, time management, efficacy and cognitive development were recorded. Teachers were interviewed to find out their feelings, opinions and recommendations towards the study. Visual aids have been a game changer in the delivery of Physics lessons because learners can visualise and make their own deductions about the concepts and themes available.

Policymakers, teachers, learners and the communities in which the study was conducted are expected to immensely benefit in the provision of new findings. The Government, in its quest to produce well-meaning and socially contributory individuals will benefit the more by availing the teaching materials timeously to teachers and school administrators. Teachers must be professionally developed to keep the abreast with trending technological changes. There should be policies to systematically force teachers to regularly improve themselves for as long as they are in the profession. Redundancy must never be an option in the teaching profession.

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ABBREVIATIONS

CALA – Continuous Assessment Learning Activity

LCP – Learner Centered Program

GoZ ：Government of Zimbabwe

MoPSE – Ministry of Primary and Secondary Education

OECD

STEM – Science, Technology, Engineering, Mathematics

TCP – Teacher Centered Program

UNICEF – United Nations Children Education Fund

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CHAPTER 1: INTRODUCTION

1.1 Introduction to the study

This study investigated the use visual aids in the teaching and learning of Ordinary Level Physics and their effects on the students' acquisition of scientific processes, attitudes, skills and academic achievement. The structure of this study contains the background to the study, which outlines the reasons for conducting the study to investigate the utilisation of visual aids in the teaching and learning of ordinary level physics, the statement of the problem, the main research question and the sub research question, the research assumptions, purpose of the study, significance of the study, delimitations, limitations of the study, definition of terms, organisation of the study and chapter summary.

1.2 Background of the study

Continuous breath taking technological advancements anchored on disruptive innovations, inventions and unparalleled creativity have become the order of the day for global economies, Africa included. The utilisation of visual aids in schools, colleges, industries, research centres and institutions of higher learning is imperative especially for rapid development on a global scale. Science subjects such as physics and mathematics, are the most difficult subjects to comprehend especially to the non-intellectually gifted students. The Government of Zimbabwe (GoZ), through the Ministry of Primary and Secondary Education (MoPSE), introduced STEM in partnership with UNICEF as a global education goal. Regardless of the intervention strategy, teachers were found wanting in the acquisition of knowledge, management and outcome of implementing STEM education framework (Geng and Chai, 2019). The Government of Zimbabwe (GoZ) continues to conduct researches vital to the development of the educational curriculum since it forms the basis of economic, industrial and scientific development of the nation. In pursuit of this seemingly elusive trajectory, visual aids as interactive pedagogical teaching tools are now an intrinsic component of the teaching and learning curriculum. They enhance the learners' cognitive intelligence and development (Agwu and Ogochi, 2019). Cognitive intelligence is achieved where

it is defined as " the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Deary,et al (2010). It is imperative that policy makers formulate educational policies that accommodate all learners from primary to secondary schools especially in the utilisation of visual aids. Most teachers and leaners are found wanting when it comes to the teaching and learning of physics (Agwu and Ogochi, 2019). Physics has always been a difficult subject to teach especially in the utilisation of the traditional teaching method where the teacher is the centre of knowledge while the student is the non-participatory participant.

However, in developing continents such as Africa, little is known on the application of visual aids when teaching ordinary level physics (OECD, 2020). Teachers still employ traditional teaching methods in the teaching and learning of ordinary level physics (Mollel, 2022). For effective lesson delivery, teachers need be knowledgeable in the delivery of physics teaching content to secondary school students or leaners, including the availability of teaching materials to teaches and the students alike. In Zimbabwe, physics teaching materials are in short supply, leading to diminished pass rates at ordinary level.

It is against this background that the Government of Zimbabwe (GoZ) sought to plug the gap by providing teacher capacitation programmes such as the professional development courses undertaken by the Ministry of Primary and Secondary Education (MOPSE) through various teacher education capacitation institutions like Belvedere Teaches College, Gweru Teachers' College and other such teacher training institutions across the country. When rightly and correctly capacitated with the current teacher intervention strategies like visual aids, the delivery of the lesson to learners becomes inevitable (UNESC0, 2019). Through these teacher capacitation programmes, school are provided with laboratory equipment for the provision of effective teaching and learning process.

According to MoPSE (2022), there has been a decline in the pass rates of ordinary level physics from 2015 to 2022, largely due to the insufficient teaching and learning material brought about by the financial constraints affecting the nation. The CALA system introduced by MoPSE in 2018 as in intervention teaching and learning strategy was shelved citing management and implementation strategies. Most students and parents alike could not afford sourcing teaching and learning

materials due to economic and financial constraints. The teachers and parents had difficulty in understanding the requirements of the intervention strategy, hence the proposal to discontinue it. Upon further analysis of the concern by teachers and parents, the challenge is centred on colonial teaching methods of theory and examination driven than practical. Visual aids therefore become the bedrock upon which simulations in research are conducted before the final product is availed to the market, especially in the developed nations (Munna and Khalam, 2022). In this context, the pedagogy is further expounded into its categories, each providing input to the wholesome development of the learner (Munna and Khalam, 2022). Behaviour and attitude during lesson delivery of both the teacher and the learner alike when utilising visual aids are discussed. Successful, effective, efficient and progressive teaching and learning of ordinary level physics largely attributable to behaviour and attitude of the teacher and the learner, albeit with a good curriculum (Karaku, 2021); (Nevenglosky, 2014).

Epistemology, as a teaching paradigm posits that beliefs are not an inborn or unchangeable, but are rather developed over time and being characterised by personal psychological beliefs (Taskin, T. 2021). Stating further this epistemological phenomena, the construct asserts there are basically two paradigm approaches which define the phenomena. The first being that the learner possesses knowledge derived from the parents or society which nurtures them and the second being that the learner acquires and constructs meaning derived from availed learning material, usually by doing it by themselves. Against this background, educational policymakers now include learners in policy formulation and implementation.

1.3 Statement of the problem

This study sought to investigate the importance, impact, management and effects of utilising visual aids in the teaching and learning of Ordinary Level Physics primarily, and particularly at School A in Mutoko District. Poor performance of the teacher and student at ordinary level physics gave rise to this research about investigating the usage of visual aids in the teaching and learning of ordinary level physics in Zimbabwe and beyond, especially at School A in Mutoko District.

1.4 Main research Question

The main research objectives of the study are as indicated below.

What can be done to dispel the perceived challenges and promote the utilisation of visual aids in the teaching and learning of Ordinary Level Physics?

1.5 Research Sub Objectives

The sub objectives of the study are as follows:

1.) How well do learners receive, articulate and decipher instructions from utilizing Visual Aids?
2.) What could be the challenges associated with the teachers' failure to prepare and employ visual aids in the delivery of teaching instructions to Ordinary Level Physics learners?
3.) What can be done to ensure that teachers can adequately prepare and employ visual aids in the delivery of teaching instructions to ordinary level physics learners?

1.6 Research Assumptions

The following assumptions were

- What abilities should the teacher possess to effectively and successfully convey teaching instructions to Ordinary Level Physics learners during lesson time?
- To what extent should teachers be equipped to pique learners' interest in Physics at Ordinary Level and enhance their learning when utilising visual aids?
- How do learners' perceptions of Physics at Ordinary Level affect their cognitive development in the teaching and learning of the subject when utilising visual aids?

1.7 Purpose of the study

This study seeks to investigate how teachers or facilitators employ visual aids instructional media in teaching Ordinary Level Physics in Zimbabwe and the world at large. Discussion of benefits accruing to teachers, learners, the nation at large, the communities in which the research in undertaken and the policy makers is undertaken in detail. Teachers and leaners are discussed as administrators given that leaners ae now an inherent input component in the composition of the educational curriculum. Leaners are now the major drivers of the teaching and learning paradigm in that they can plan how they want to conduct their lessons especially with the utilisation of visual aids. The Government would also find it necessary to utilise these results to steer the national economy ahead, for without education, nations fail. Further, the results obtained from the research seek to further the research and development in bridging the gap between advanced studies in physics post Ordinary level and improvements in grades below.

1.8 Limitations

The leaners lacked the scientific mind to correctly visualize the mathematical concept associated in the learning of physics (Irawat, and Sofianto, 2019). Financial constraints were some of the limitations inhibiting fluency of the study compound by the small geographical area in which this study was conducted. There is no common dictionary to describe and define physical terms in this location. There was therefore need to develop some common understanding of finding terms to define physical terms in the English language. Local vernacular languages were inadequate to fully define physical terms in internationally accepted language terms. The small sample size was a limitation in that it was confined to a small geographical area. The findings could be compromised since the whole province could not be accessed at the time of conducting the research. Teachers had difficulty in seeking to dispel the misconceptions associated with utilising visual aids in the teaching and learning of ordinary level physics (Bozzi et al, 2019) Policy guidelines in conducting the research was one of the limitations. This means that there was no clear and defined terms and conditions of conducting this research. Congested timetable when dealing with learners was another impediment in conducting the research. The researcher undertook as much time as possible to engage learners for research purposes while conducting regular teaching sessions. Learners could not be deprived of their

learning time during the course of conducting this research. acquiring visual aids materials were a further impediment to the researcher.

1.9 Delimitations

The case study focused on two teachers and Fifty Ordinary Level students studying Physics at School A in Mutoko District, Zimbabwe. There was special delimitation in that the school chosen for conducting this study in the rural district of Mutoko and is far from other schools in the same district. Further to the special delimitation was that of the method employed in conducting the research. The researcher, as school teacher, had to conduct the research in the midst of conducting regular lessons for the benefit of learners. The chosen instruments to collect data were another impediment to the research. For better outcome of the research, the researcher employed purposive sampling since it was solely meant to obtain results specifically at School A given the limitations enshrined in the study. Structured and unstructured questionnaires comprising of open ended and close ended questions were employed. Class observations were conducted as part of data collection instruments in that the teacher could easily observe the attitude and behavior of the learners at close range while in the class. This was done to allay fears in the leaners since the researcher is known to them. Transportation to and from the school is very difficult hence the researcher sought to conduct the research within the vicinity of the school.

1.10 Organisation of the Study

The study is divided into five chapters as indicated below.

1.10.1. Chapter One: Introduction to the study

This chapter introduces the study to investigate the usage of visual aids in the teaching and learning of ordinary level physics and explores the background to the study, the purpose of the study, including the statement of the problem in utilising visual aids. In addition to the above, the main research questioned its objectives are covered and so is the hypothesis to determine the correctness of utilising visual aids, the significance of the study including delimitations, limitations, definition of terms incorporated in the study, how the study is organised throughout the study and finally summarises the chapter.

1.10.2. Chapter 2: Literature Review

This chapter reviews the theoretical and empirical literature on the usage of visual aids in teaching and learning ordinary level physics and thus provides the basis for the discussion of results in chapter four.

1.10.3. Chapter 3: Research Methodology

Research methods and procedures utilised in data collection, the research tools employed to collect data and the data analysis methods are covered in this chapter.

1.10/4. Chapter 4: Data Presentation and Analysis

Presents an in-depth research analysis and interpretation of the research findings.

1.10.5. Chapter 5: Summary, Conclusions and Recommendations

Concludes the research study and provides appropriate recommendations.

1.11.0. DEFINITION OF TERMS

1.11.1. Visual Aids

Hamad (2023), in citing Ashever and Igyuve (2013) defines visual aids as instruments utilised to convey information in the form of real objects, models, pictures, videos, charts, maps and slides. Okeke (2013), postulates that visual aids are the equipment utilised by the teacher to pique students' interest in the subject including the sense of sight in the process of learning.

1.11.2. Teaching

Ordu (2021) defines teaching as an essential, interactive, progressive and developmental process to students through guidance.

Munna and Khalam (2022) define teaching as the process of transferring knowledge from the teacher tot the learner.

1.11.3. Learning

The OECD Learning Framework 2030 defines learning as the outcome of inter-related, intricate and interweaving competency arising from a concept of attitudes, values, knowledge and skills processed through reflection, anticipation and action to engage with the world (Mollel et al, 2022).

According to Haugen (2010), Learning is defined as new experiences gained, gradually leading to behaviour change by acquiring new knowledge and abilities. The implication is that in a classroom setup, comprehensive learning is achieved when the teacher fully engages the learner, providing the learner the opportunity to discover himself while observing and guiding accordingly.

1.12. Chapter Summary

This chapter discussed the usage of visual aids in the teaching and learning of ordinary level physics, commencing with the introduction to the study background to the study, the purpose of the study, statement of the problem, the main research question, research objectives, hypothesis, significance of the problem, delimitations, limitations, definition of terms, organisation of the study and chapter summary.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter reviews literature on the utilisation of visual aids in the teaching and learning of Ordinary Level Physics, their effects on the learners' cognitive development, and the teacher's delivery of the lesson. Definition of phenomenon with sub headings relative to research questions is also discussed. The underpinning theory relating to the utilisation of visual aids is discussed, including the existing models, frameworks, their variables or dimensions and the conceptual frameworks. Identification of research gaps in models and frameworks is achieved and discussed from the conceptual frameworks. The above concurs with Ramdhani et al (2014)'s definition of literature review, postulating that "literature review is a surveys scholarly articles, books and other sources relevant to a particular issue, area of research, or theory, and by so doing, providing a description, summary, and critical evaluation of these works."

2.2.0. Constructivism Theoretical Framework.

According to Creswell and Creswell (2018) constructivism relates to how people derive subjective meaning from their environment, or their habitat. It implies that learners develop construct meaning by performing experiments and action to decipher and deduct meaning on their own, instead of receiving everything from the teacher standing or teaching in front of them in a class set up. Liu and Mathews (2005) argue and diverge from this view postulating that there has not been a constructivist paradigm shift from the traditional approach of teaching and acquiring knowledge, but that there is need for deep correction of this paradigm to that of deep dualism, the humanistic and the world which incorporates the learner as an inherent component of the jigsaw. This gives rise to Social constructivism.

2.2.1. Social Constructivism

Social constructivism is defined by Vygotsky (1896-1934) as the process through which an individual derives meaning from his or her own understanding learnt from cultural knowledge. Social constructivism is a theory developed by psychologist Lev Vygotsky (1896-1934). It is called 'social constructivism' because he emphasized the critical importance of culture as well as language development and the importance of the social context for

socio-cultural development. Vygotsky's view had a socio-historical dimension that knowledge of a person living in a human community will be a large extent derives from social interaction, through which aspects of the culture are acquired. Social constructivism argues that all meaningful learning is a process of personal meaning-making through the individual's cultural knowledge and understanding. However, Moskal et al (2016) critiques Vygotsky theory of social constructivism stating that the theory does not differ from didactic traditional method of teaching and learning and thus presents no new dimension in the presentation of practical teaching to learners in the real world (Davis & Sumara, 2002; Karagiorgi & Symeou, 2005), (Terhart (2003)

Although successful in practical teaching recommendations in some educational areas, constructivism does not introduce a shift from the traditional dualist framework of thinking. A paradigm shift requires a deeper level of correction.

For example, Mukandi, et al (2020) affirms that visual aids as part of the teaching material, can be referred to as medium of instruction, and is never unitary. Several gadgets can be employed to convey information to the learner through projectors amongst others. The teacher has to be adequately prepared and be provided with relevant material to manage the dissemination of information to the learners in a conducive classroom environment. Hamad (2023) converges with Dalali and Mwila (2023) on the utilisation of visual aids stating that they are tools in the form of real objects, models, pictures, videos, charts, maps and slides which are utilised to enhance teaching and learning of ordinary level physics to learners. The authors further contend that learners utilising visual aids pass their examinations more than those without. It implies that visual aids must be an integral part of the teaching and learning process which must be enshrined in the school curriculum instead of depending on the Teacher Centred Pedagogy teaching formats.

2.3. Discussion of Existing Models/Frameworks

The researcher sought to make a comparison of existing theoretical frameworks in the teaching and learning of Ordinary Level Physics, with a view of conceptualising them to find the most appropriate learning framework. Literature synthesis section discusses strengths and weaknesses of frameworks to determine applicable areas of improvement or research gaps (OECD, 2020). Pedagogy as a teaching intervention approach is discussed detailing its importance in the

classroom set up where Brenner (2022) outlines the differences in pedagogical approaches such as leaner centered and teacher centered.

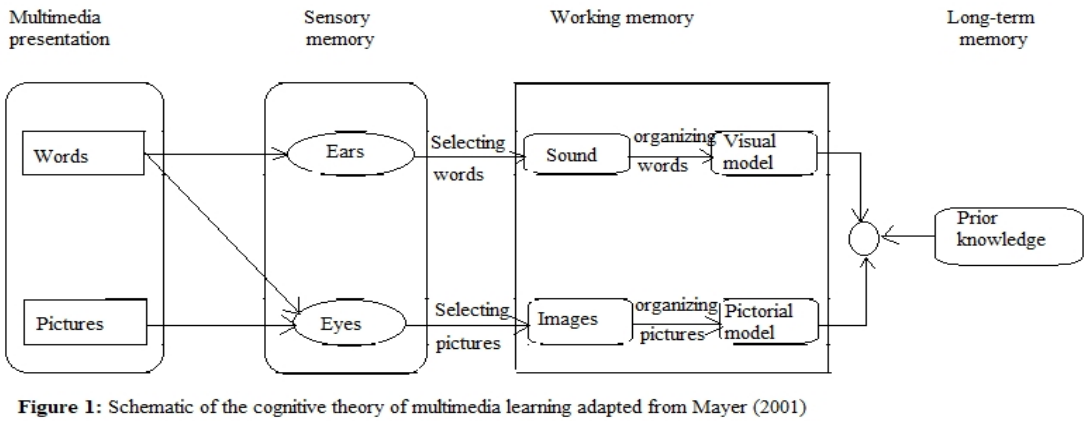


Figure 1: Schematic of the cognitive theory of multimedia learning adapted from Mayer (2001)

Fig 2.1: Cognitive theory of multimedia learning adapted from Mayer (2001). Source: Tugirinshuti (2021).

In discussing figure 1 above on the cognitive theory of learning methods, it follows that cognitive theory is achieved when there is multimedia presentation, which stimulates the sensory memory, the working memory and finally the long term memory of the learner.

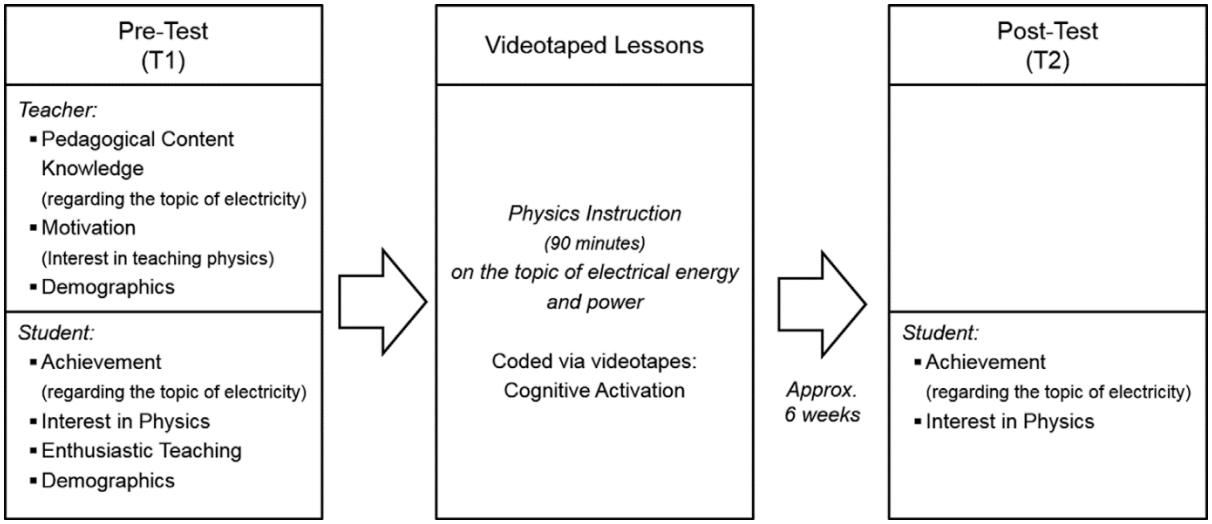


Fig 2.2: The Physics study design diagram. Source: Keller, et al (2016).

Figure 2 represents the physics study design as defined by Keller (2016) and posits that at the Pre-Test stage, the teacher and the learner alike must manage their tasks before engaging in the teaching and learning such that when the teacher delivers instruction through visual aids format, the student or learner's interest is piqued by the pedagogical approach of the teacher. The content of the lesson is easily understood, making management of the lesson easier for the teacher and the student or learner alike. According to Shah (2021) and Juta (2021), efficacy is easily and effectively achieved when visual aids are utilised in the teaching and learning of ordinary level Physics. Comparatively, Japan and the Philippines have different teaching and learning approaches to that of Zimbabwe in that Japanese teachers are extensively trained and provided with all they need to make the lesson successful, and therefore are autonomous in the design of their lessons for delivery to their students. Similarly, in the Philippines, teachers are extensively trained but provided with curriculum with which to follow in lesson delivery and management. In Zimbabwe, according to Chimbi and Juta (2021), MOPSSE converges on the narrative that pedagogy is for generating knowledge and not for information delivery. It therefore implies that the student is critical in the daily planning of the lesson instead of the teacher being the "sage on the stage".

2.4.0. Definition of phenomenon

2.4.1 Visual Aids/Intervention strategies

Visual Aids as part of intervention strategies utilised in the teaching and learning are defined as progressive elements utilised to enhance effective and efficient teaching and learning process (Dalali, B.G. and Mwila, P.M. 2022).Hamad (2023), in citing Ashever and Igyuve (2013) defines visual aids as instruments utilised to convey information in the form of real objects, models, pictures, videos, charts, maps and slides. Okeke (2013), postulates that visual aids are the equipment utilised by the teacher to pique students' interest in the subject including the sense of sight in the process of learning.

However, scholars such as Bukaliya and Jura(2021) in citing Kadzera (2006) and Smith and Nigel (2009) posit a divergent view stating that visual aids alone are not effective tools, but are dependent upon the learners and the teachers' attitude, their creativity and the situation upon which the lesson is delivered. The implication therefore is that visual aids as teaching and learning tools are comprehensive and effective when rightly and correctly applied in a classroom set up. The teacher should be adequately trained to know, understand and fully explain physics concepts to pique learners' interests and enhance their study.

2.4.2. Pedagogy

Recent studies have divided pedagogy into two classes of thought namely, Learner Centred Pedagogy (LCP) and Teacher Centred Pedagogy (TCP). Bremer (2022) define Learner Centred Pedagogy as the approach to teaching in which the student or learner is at the centre of teaching and encompasses attributes such as the learner's active participation, which relates to the learner's hands on experience; adapting to needs such as planning for the lesson in advance; autonomy, where the learner is responsible for his or her own study program. Relevant skills, power sharing, formative assessment are also part of the attributes. This same author defines TCP as the teaching approach where the teacher is the focus centre of teaching in which the learner does not necessarily participate, but receives instruction from the teacher. Shah (2021) converges with this view and posits that pedagogy is the science and art of teaching children, as derived from the two Greek terms *pais*, for a boy, usually, and *agogus* meaning leader of children. Loosely translated, it means leader of children.

Chimbi and Juta (2021) converge with this narrative in explaining its shortcomings and cite MOPSSE 2015 policy that “The focus will be on knowledge generation not just information delivery and treating learners as empty vessels ready to be filled with information” (MOPSE, 2015, p. 41). The implication is that, this one-way approach to teaching demotivates learners, makes them lose interest in the subject, drop the subject in some cases, or fail.

2.4.3. Behaviour

Behaviour is defined as the elaborate environmental forces that change or shape the person or product of design (Zulhanafi88. (2012). According to Budiman (2017) and in citing Skinnner (1976) defines behaviour as the “theory of learning that emphasizes human behaviour as a result of the interaction between stimulus and response.” For example, in the teaching and learning of physics at ordinary level, behaviour is critical in deriving motivation to learn when the learner fully understands the subject under study, especially when conducted in their language, or through the use of visual aids, practical work, individually or collectively.

2.4.4. Attitude

Hanel et al (2021) defines attitude as those changes towards an individual or something people either like or dislike. Ibrahim (2029) concurs with this view and postulate that attitudes are those negative feelings people have towards a subject, event or occasion. For example, in the study of ordinary level physics, students tend to fail because they have a negative attitude towards it, presumably because they consider it difficult to comprehend. Conversely, positive study attitudes towards physics enhance understanding and leads higher pass marks to learners. For example, in Malaysia and Zimbabwe, learners tend to learn about physics at secondary schools compared to other developed nations or first world nations where learners are Introduced to physics from tender ages. It implies that in a classroom setup, those significant negative attitude towards learning of physics are contributory in the attainment of low pass marks at ordinary level.

2.4.5. Curriculum

OECD (2020) in citing Fuller (2015) defines curriculum as the means by which desired objectives are achieved. In our study context, these desired objectives are those of imparting knowledge to learners in a classroom setup. Karaku(2021), in citing Mkandawire (2010), Mojkowski (2000) and Cobbold (1999) posits that educational curriculum are learning activities planned purposefully designed to create a progressive learner enhanced with relevant skills, attitudes, knowledge, experiences, materials and tools for relevance to the industry, his or her future and economic development. Yasar (2021) postulates that curriculum is that educational constitution which defines the society and the individuals it raises through an education system. However, Nevenglosky (2014) opines that teachers need be adequately equipped to achieve efficacy consistently and effectively. The implication here is that a good curriculum to forms the basis upon which learners and teachers alike strive to achieve success from collaborative cooperation between and amongst them. For example, in a classroom setup, the teacher lightens up the learning environment by engaging their learners through visual aids, requesting feedback, observing the learners' individual and group performances and preparing for improvements in lesson delivery.

2.5.0. Conceptual Framework

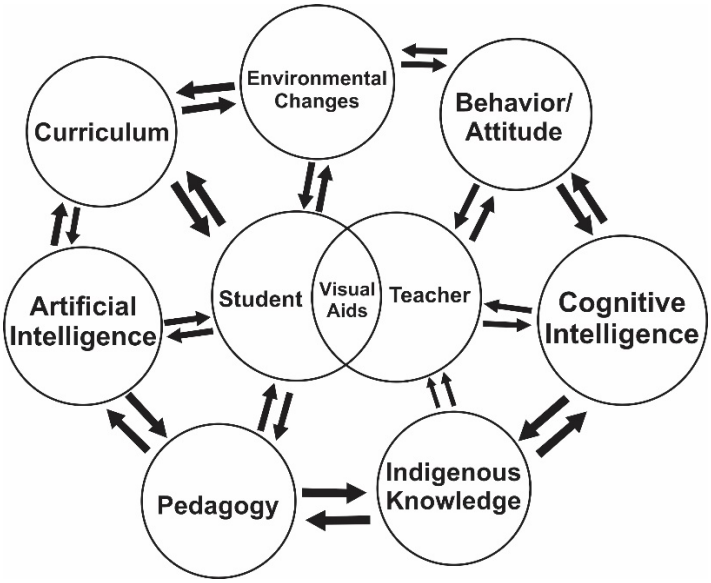


Fig 2.3: Researcher' conceptual framework diagram. March 2024

The researcher proposed the conceptual framework which sought to be wholesome in its approach to the teaching and learning of Ordinary Level Physics by utilising Visual Aids. The researcher further proposed the inclusion of artificial intelligence in school curriculum from primary level despite current challenges in its management. The Learner Centred Pedagogy intervention teaching and learning strategy encompassing the above proposal is extensive in that it seeks to develop the learner as a productive member of the community and country at large. Some of the in the conceptual framework attributes have been defined in the literature review. However, the following shall be defined as indicated below.

2.5.1. Discussion of key variables/ dimensions

2.5.1.1 Indigenous Knowledge

This is defined as the unique attributable knowledge enshrined in the local culture and wisdom and is hugely influenced by internal and external creativity systems of that culture (Ratnasari et al, 2020). According to Mashoko(2021) in citing Shizha (20026) postulates that "is a social construct that evolves out of the peoples' social world and cultural experiences" (2006, p. 23). It implies that indigenous knowledge is an important pedagogical attribute in the teaching and learning of Physics. In Zimbabwe, for example, indigenous knowledge has been trodden down as

superstitious due to colonisation and therefore learners and teacher alike disregard the importance of this attribute. Communities which embrace indigenous knowledge to their young ones from childhood tend to perform in their learning of physics as they progress with their studies.

2.5.1.2. Artficial Intelligence

According to Miguel (2023) artificial intelligence is defined as “automation based on associations.” This implies that artificial intelligence relates to cascading system employed to perform tasks simultaneously with the aid of machines. Individually, the machine cannot function correctly, but needs other machines in the system to communicate effectively. Some employ bidirectional communications systems such as computers, whereas others are multi scatter as in robotic systems. Communication of mechanical and electro mechanical sub units is utilised to complete a given task. Similarly, in the teaching and learning of Physics , interactions between the teacher and the student in paramount. Ogebo and Ramnarian (2022) concur and postulate that integration of education systems enhances visualisation, simulation and modelling of profound classroom learning experiences and should therefore be extensively utilised in the learning and teaching of physics, especially. Practical and hands on experience makes all the difference, coupled with individual, autonomous and group work systems to enhance collaboration amongst learners. From the literature above, it shows that Learner Centred Pedagogy is currently trending and should be maintained with a view to further research on the subject.

2.6. RESEARCH GAPS

2.6.1. Indigenous Language

Research gaps were inherent in the study and these included but not limited to the following.

Indigenous Knowledge

There exist gaps in the knowledge of the indigenous language when teaching and learning Ordinary Level Physics. Learners appreciate physics concepts more when they are taught in their mother language. There are concepts which cannot be freely explained and understood in the second language such as English when the learner's first language is say Shona or Ndebele. Learners have difficulty in assimilating the concepts in English or another second language. First they have to try and translate the concepts into their own language before they can understand the gist of the Philosophy

2.6.2. Attitude

Attitude in the context of this study is defined as the feelings the learner has toward s the subject, topic under discussion or the teacher. This leads to behaviour change toward the subject. Attitude and behaviour are intertwined that they cannot be easily separated.

2.7. Chapter summary

This chapter reviewed literature relating to the utilisation of visual aids in the teaching and learning of Ordinary Level Physics at School A in Mutoko district, Zimbabwe. The chapter covered topics such as Introduction to the study in which a preview of the chapter was given, the definition of terms, the underpinning theory relating to the study was discussed. Existing models of physics intervention strategies were also discussed and so was the definition of phenomena. Literature synthesis from the research conducted was discussed. Literature gaps and their respective discussions arising from the research were identified and put in perspective.

CHAPTER 3: RESEARCH METHODOLOGY

3.0. Introduction

This chapter presents how research assumptions in the teaching and learning of ordinary level physics were achieved through data collection, presentation, analysis, discussion and interpretation. The chapter contains the research design, philosophy, strategy, population and sampling techniques, data collection, research procedure and limitations. Relevant literature derived from the research was utilised to guide the research methodology.

3.1. **Research design**

Research design is defined as a method or procedure outlining how the research is to be conducted, methodically, in a blueprint (Creswell, 2014). Accordingly, (Kasonde-Ng'andu, 2013) concur with Creswell (2014) and posit that research design is an outline, a plan or scheme employed by the researcher in generating answers to research questions. It is a set of methodological guidelines indicating how the research is to be conducted. Scholars such as Hudgikar (2021) postulate that research design forms the basis, the backbone upon which the whole research is conducted. According to Creswell (2018), research design ensures the definition of all the linking parts to the study being conducted. It follows that effective and efficient research design is characterised by four attributes which are neutrality, reliability, validity and generalisation. Neutrality relates to the research being neutral and free from bias, reliability relates to obtaining consistent results arising from properly structured research questions, validity assures that the objectives of the study are gauged in line with the dictates of the research, and the outcome of the results should be accurate for application to the population. Research design can be conducted in several paradigms such as indicated below.

3.2.0. Types of research design

Research design is made up of the following modes of research**.**

3.2.1. Descriptive research

Descriptive research is defined as the presentation of findings in a describing manner about events, situations and conditions occurring in the present (Creswell, 2014). Researchers Mancebo et al (2023) posit that descriptive research design is an attempt to systematically describe the problem, phenomenon, situation, programme or service of an occurring event while observing the behaviours of the Participating subjects, be it learners, teachers the community, but without interfering with the specific variables concerning the cause and effect of the occurring event. Kothari (1988) postulates that research design is about answering the five basic research inquiry questions which are WHAT?, WHERE?, WHEN?, HOW MUCH?, by WHAT? Means. Descriptive research design methods can be conducted in paradigms such as case studies, focus groups, observational or archival. Particular attention is paid to the characteristics such as control, manipulation, observation and replication (Antwi, et al, 2021). The control characteristic entails that the researcher such as the teacher in classroom setup, discards non important variables to his study by randomly assigning the research subjects to groups and changing the set up at will.

According to Mancebo et al (2023 manipulation is the observation of the experiment on the subject by deliberate operation of independent variables. For example, in this study, the researcher sought to observe the effect of utilising visual aids, as a teaching intervention teaching approach when conducting Ordinary Level Physics lessons in a classroom set up. Attributes such as the gender of the student, their age, cognitive intelligence were observed as independent variables. These enhanced the researcher's quest to determine the effect of visual aids in the teaching and learning of Ordinary Level Physics.

3.2.3. CASE STUDY

Creswell (2018) defines case study as qualitative research method which examines practical, actual real life phenomenon. Mancebo et al, (2023), in citing Yin (2009), defines case study as an "empirical strategy of inquiry that investigates a contemporary phenomenon within its real-life context" The case is completely potrayed by a descriptive phenomenal construct of events for possible action. Case studies enhances deeper understanding of complex situations needing resolute answers in that through interactions enshrined in the case study, new paradigms are exposed, together with the establishment of possible solutions to it. Case studies can be classified and conducted in multiple or single paradigms and they are inherent in the provocation of further investigations to a phenomenon, prompting even quantitative study of the same phenomenon in the pursuit of establishing a generalised theory about that phenomena. For example, School A in Mutoko District of Zimbabwe was the subject of study. Two Ordinary Level physics teachers and fifty learners were selected as the sample for the study to investigate the use of visual aids in the teaching and learning of ordinary level physics. The mixed research method was employed to collect, analyse and interpret the results, determine research gaps and provide recommendations when availed.

3.3. Research paradigm/philosophy

The positivist ontology philosophy is an assumption that assumes that there exists a single measurable tangible reality which can be identified and understood. The outcome of this measurement is of a temporal precedence, associative and has no previous identified factors (Park et al, 2020). For example, for this research, no previous studies were conducted to investigate the importance of utilising visual aids in the teaching and learning of ordinary level physics at School A in Mutoko district, Zimbabwe except that conducted by this researcher. It implies that this research set the precedent for further researches in the teaching and learning of Ordinary Level Physics utilising visual aids in the future. The critical thinking philosophy is defined as the ability to choose criteria, solve problems, make decisions, evaluate arguments and interpret infinite information through interpretations, evaluations, analysis, explanations, inferences and self-regulation (Trusikova and Velmovska, 2020). Realistically in this research, the researcher chose the criteria in which to conduct the research of utilising visual aids in the teaching and learning of ordinary level physics at school A in Mutoko district of Zimbabwe. The findings

obtained during the research period were employed to analyse the effects and performance of visual aids on both teachers and learners in the teaching and learning of ordinary level physics.

3.4. Research Methodology

Research methodology is defined as the ability to systematically solve a problem or challenge (Rajasaker, 2013). Scientifically, research methodology studies how research is conducted (Creswell, 2018). Typically, the means by which researchers predict phenomena, explaining and describing it is defined as research methodology (Bhagwari, 2019). According to Sinha et al (2021), research methodology is defined as the study of acquiring knowledge, the aim of which is to outline the research work plan. The work plan can be conducted in the quantitative or qualitative paradigms.

3.4.1. Qualitative Research Methodology

Qualitative research is defined as "the study of the nature of phenomena", including "their quality, different manifestations, the context in which they appear or the perspectives from which they can be perceived", but excluding "their range, frequency and place in an objectively determined chain of cause and effect" (Philipsen, 2007). According to Houten (2013), qualitative research is defined as words converted into data, and not numbers.

Researchers Sinha et al (2021) define qualitative research as the study of phenomena utilising research instruments such as observation, interviews, questionnaires, documents, the researcher's perception and impressions. Ugwu and Eze (2023) postulate that qualitative research can be utilised to better understand opinions, experiences and ideas by the collection and analysis of non-numerical data such as visual aids. For this study, the researcher employed the qualitative techniques in that it is flexible, open and responsive to context and the steps of data collection and analysis. They are interrelated and follow each other in cyclical manner (Creswell 2014). The process allows the researcher to make informed decisions when conducting the research with respect to the research questions. In some instances, the research questions are changed as a result of the outcomes arising from findings undertaken by the employ of research questions (Ugwu and Eze, 2023).

The phenomena referred to in this research was that of interpretive epistemology and objective ontology methodologies which had qualitative variables such as foreknowledge in the teaching and learning of physics, indigenous knowledge, the attitude of both the teacher and the learner and adequacy of teaching materials (Fuyane, 2021); (Hudgikar, 2021); (Kumatongo and Kuzata, 2021).

3.5.0. Population and sampling

3.5.1. Population

Population is defined as the "set or group of all the units on which the findings of the research are to be applied." (Shukla, 2021). For this study, the population comprised of the two teachers and sixty students conducting the teaching and learning of ordinary level physics by utilising visual aids at School A in Mutoko District.

3.5.2. Sampling

Bhardwaj (2019) defines a sample as a group of objects, items or people taken for measurement from a large population. Sampling can either be probability or non-probability. Probability sampling is where each member of the population is accorded a known probability for selection as a sample. For example, a highly homogenous population has high chances of selection for each member as a sample, and this sampling technique is further sub divided into simple random, stratified, systematic, cluster and multistage sampling methods (Bhardwaj, 2019). Non-Probability sampling is where each member of the population does not have a known probability for sample collection. For this study, the researcher employed the simple random sampling technique and the purposive sampling technique. The two sampling techniques are as defined below The researcher undertook sampling of thirty students and two teachers at school A in Mutoko as the sample for conducting the utilisation of visual aids in the teaching and learning of ordinary level physics.

3.5.2.1. Definition of simple random sampling

Simple random sampling technique is one where each element of the population is accorded an equal chance of selection or of having a known probability (Bhardwaj,2019). For example in this research, the research was confined to ordinary level learners at School A in Mutoko District, and each ordinary level physics learner was accorded an equal chance of selection for the study. The learners possessed the same learner characteristics, which augured well with the requirements of the research assumptions.

3.5.2.2. Reason for utilising the simple random sampling technique

The major reason for employing the simple random sampling technique is the liberty from human judgement and bias. The participants are given an equal chance of selection and therefore cannot be subjected to bias by the researcher or researchers.

3.5.2.3. Advantages of utilising simple random sampling technique

Simple random sampling technique is flexible and cheap to employ for the researcher in that the same questionnaires apply to all participants thereby reducing coding time. Usually the trend or pattern of events is determined by the first few respondents and therefore becomes repetitive. Outliers are usually few.

3.5.2.4. Disadvantages of utilising Simple Random Sampling technique

It carries a large respondent or participants base where all the sample need be taken into account when coding.

3.5.3. PURPOSIVE SAMPLING TECHNIQUE

Purposive sampling technique relates to the selection of the sample from the population specifically for answering questions relation g to the phenomena. The researcher seeks to answer pertinent questions related to the new or desired study such as the effects of utilising visual aids in the teaching and learning of ordinary level physics in a rural settlement were there is a shortage of relevant materials to pique learners' interests.

3.5.3.1. Advantages of utilising Purposive sampling technique

Purposive sampling is cheap and convenient to the researcher. It implies that the participants are known to the researcher and are within reach for further studies or changes to the study when required. For the purpose of this research, sixty form three and form four learners were selected to participate in the study. The participant complement was such that boys were more than girls in both classes. The reason for such a disparity were some of the outcomes the researcher sought to investigate and determine the effects on the teaching and learning of ordinary level physics at school A in Mutoko District.

3.5.3.2. Disadvantages of Purposive Sampling Technique

Purposive sampling technique is subjective, it opines the researcher own interpretations of the observations made or research findings conducted.

The sampling technique is prone to rebuttal by the participants due to personal preferences or inferences as expressed by the researcher (Hendlin, et al, 2019); (Engel and Carlson, 2002)

For example, this researcher selected learners for interviewing to investigate the importance of visual aids in the teaching of ordinary level physics from the learners' attending lessons at School A in Mutoko District of Zimbabwe.

3.5.4.0. DATA COLLECTION INSTRUMENTS

3.5.4.1. Structured interview guide

Structured interviews relates to the predetermined order in which questions are availed to each respondent or interviewee, whereas unstructured questionnaires are more like a free flawing conversation with the respondent. (King et al. 2019). These interviews can be in the form of questionnaires which are defined below. Structured interviews were employed to collect raw empirical primary data by the researcher in order to answer the following research assumption.

To what extent should teachers be equipped to pique learners' interest in Physics at Ordinary Level and enhance their learning when utilising visual aids?

3.5.4.2. Definition of Questionnaires

Questionnaires relate to research instruments employed to collect people´s opinions or thoughts about a certain product, process or method (King et al. 2019). Questionnaires can be structured or unstructured. Structured interviews relates to the predetermined order in which questions are availed to each respondent or interviewee, whereas unstructured questionnaires are more like a free flawing conversation with the respondent. (King et al. 2019). These instruments can be open ended in which re respondents are given the chance to freely express themselves without fear over the subject under study. For example, learners at School A in Mutoko were availed with both open ended and closed ended questions to collect freely their opinion on the utilisation of visual aids in learning ordinary level physics. These questions were employed to answer the following research assumption.

What abilities should the teacher possess to effectively and successfully convey teaching instructions to Ordinary Level Physics learners during lesson time?

According to Antwi (2021), practical teaching of ordinary level physics must be continuous throughout the length of study for the subject and in conjunction with theory to enhance learners' cognitive intelligence.

3.5.4.3. Class Observation Schedule

This relate to the teacher observing the learners perform assigned tasks in a classroom setup and closely identifying attributes such as emotional intelligence, cognitive intelligence, attitude and body language to mention a few, when the learner is performing tasks on their own as compared to the teacher being the centre of focus. The approach forms the basis of the new teaching and learning method of learner centred teaching method. At School A in Mutoko learners were availed with open ended questionnaires attuned to answer the following research assumption (Vysoká, J., & Smetanová, D. (2016, 2-4 February)).

How do learners' perceptions of Physics at Ordinary Level affect their cognitive development in the teaching and learning of the subject when utilising visual aids?

The justification of employing this technique is that it gives the learners the sense of being when left to conduct experiments on their own , thus allowing for efficacy efficiency and effectiveness of visual aids in the teaching and learning of ordinary level physics(Vilia, P., & Candeias, A. A. (2020).

3.5.4.4. Data Analysis Instrument

According to Zezekwa (2020), in citing (Jupp 2006, p.161), defines data analysis as "the conversion of raw data into useful information that will provide the most value to researchers" Emergent categorization is defined by Powell and Marcus (2003) as a process of categorising data from recurring themes and issues. Categories arose from this data leading to data coding which was conducted through a narrative approach so as to capture the real views of the participants in the teaching and learning of ordinary level physics at School A in Mutoko District of Zimbabwe.

This raw data was utilised in answering and analysing the following research assumptions from a narrative approach:

(i) What abilities should the teacher possess to effectively and successfully convey teaching instructions to Ordinary Level Physics learners during lesson time?

(ii) To what extent should teachers be equipped to pique learners' interest in Physics at Ordinary Level and enhance their learning when utilising visual aids?

(iii) How do learners' perceptions of Physics at Ordinary Level affect their cognitive development in the teaching and learning of the subject when utilising visual aids?

3.6. RELIABILITY AND VALIDITY

Validity is defined as “the extent to which the assessment instrument measures what it is intended to measure, and reliability is the consistency of results obtained over time” (Petra and Aziz, 2020). According to Drost (2011), reliability is the repeatability of measurements conducted and obtained by people on different conditions and occasions which measure construct or skill. To ensure instrument validity, my Headmaster, Physics subject expert, collegues and students were provided with the questionnaire for moderation. These stakeholders assisted in ensuring that the questionnaire contained the required items.

For example, when a student measures the internal resistance value of a silicon diode utilizing a cathode ray oscilloscope and obtains five different values of say 1.75 Ohms, 1.8 Ohms, 1.6 Ohms, 1.9 Ohms and 2.0Ohms respectively, the results can be classified as reliable given their consistency in relation to the internal resistance of silicon diodes. The measurements may be repeated by other learners who may obtain slightly different measurements depending on well the student or learner calibrates the oscilloscope. Higher internal resistance values depict a good and well-functioning silicon diode, while lower values depict malfunctioning of the component when the load is added to it. It implies that the results obtained are reliable and valid.

3.7. DATA COLLECTION, PRESENTATION AND ANALYSIS

It is imperative to define data before we delve deep into its interpretation and analysis. According to Alem (2020) and in citing The Webster new Collegiate Dictionary of 1973 defines data as the “factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation.”. The Merriam Webster Online Dictionary concurs and defines data as measurement or statistical information employed to discuss, reason, calculate useful, relevant or redundant, irrelevant information presented by a sensing device for processing or transmission in meaningful or numerical form.

Given the above data definitions, it implies that data are the determination or specific action taken after assessing images, characters, numbers, or any recorded information, which is raw data. It follows then that data analysis is the process of drawing conclusions arising from analyzing raw data (Bhatia, 2017). In Physics, data can be processed in four basic formats which are the accounting method, the formula method, the listing and the graphic method. The accounting method employs the average value of several or multiple experimental results as the

final measurement result. For example, in a simple pendulum experiment, the average value of multiple oscillating time constants is taken as the final result of that experiment.

The formula experimental method obtains results derived from applying data from two or more groups from which the average of the obtained results can be utilized as the final experimental result. For example, in linear regression, results obtained from two or more groups can be applied to the regression analysis formula to obtain the average, which is the utilized as final experimental result.

The listing method relates to tabling the information obtained from the experiment or observation of physical quantities, their relationship, measurement accuracy and calculations, discovery of new patterns, behavior or characteristic and analyzing problems.

The graphical method relates to drawing conclusions from independent variables, their parameters, their functional relationship and representation in graphical form (Alem, 2020). The pedagogy of collecting. presenting and analyzing data is as discussed below.

3.7.1. Data Collection Procedure

The researcher utilized traditional qualitative research methods such as class observations, document analysis, structured and non-structured interviews, face to face interviews, closed and open ended questionnaires. Class observations enabled the researcher to closely monitor and control the students as they undertook the utilisation of visual aids in conducting class experiments.

3.7.2. Data Presentation Procedure

Data was presented in tabular format for observations the researcher undertook in the class and on practical experiments conducted outside the class setup.

3.7.3. Data Analysis Procedure

Data analysis was conducted by a qualitative descriptive narrative method, transcribing the coded information obtained from the teachers and the students. Class observations were employed to establish the students' attitudes and behaviours towards receiving instruction in the traditional methods compared to the utilization of visual aids. One group of learners was exposed to the utilization of visual aids such as projectors in some instances and simulations from

computers when conducting experiments to determine the electrical properties of materials in a classroom set up.

3.8. Trustworthiness and Dependability

3.8.1. Trustworthiness

In the context of this research, trustworthy is defined as the ability to ensure reliability and traceability by conducting rigours during the research study (Bacus and Alda, 2022). It ensures that the researcher undertakes to conduct rigorous data collection by recording interviews from respondents for purposes of transcription since all information may not be captured at the time of conducting face to face interviews.

3.8.2. Dependability

Depandability relates to the reliability of information sought and the trust entrusted into one individual over the other in securing intact the availed information or task. It also provides for collecting reliable and trustworthy information from the respondents or participants such that the collected data does not compromise its usage for future reference (Ogwu and Eze, 2021). Other scholars might want to retrieve the information at some other time for application in some other research areas. For example, data collected in the investigation of employing visual aids in the teaching and learning of ordinary level physics should be dependable to the researcher as secondary source of information.

3.9. ETHICAL CONSIDERATION

Ethics is derived from the ancient Greek word *ethos,* which word expressed the existential relationship between humans and other beings in accordance with their values, rules, norms, and principles (Cevizci, 2012, pp. 2-3). In philosophy ethics is concerned about questions relating to what should be and not be, what is wrong and what is right and what should be and not be and how to distinguish between good and evil. Baysan and Cetin (2021). Dissemination of information through media such as visual aids, computers for demonstration of various informatics, audio or printed tools which enhance the formation of information and suseqent processing is contained in the informatics branch of ethics (TBD, 2010), (Leymum, 2018), TDK-BT, 2020). Ethics in research relate to how appropriate the researcher conducts himself or herself during research with

respect to upholding the rights of the subjects or respondents (Saunders et al, 2009; Royle, (2011). For this research, the researcher collected data for research purposes only and data will not be processed or forwarded to third parties.

3.9.0. CONFIDENTIALITY

Confidentiality is defined as the ability to protect publications or communications such personal records, grants, trade or military secrets and patient records (Kabir, 2016). It implies that the researcher has the obligation to keep confidential all the information gathered during the research period and should not be published for financial gain at the expense of the participant or respondent.

3.9.1. Anonimity

Anonimity is concerned with the researcher upholding his or her integrity in keeping the identity of the participant secret. When collecting data, participants are differentiated by codes and not their names. This ensures that the respondents or participants' identification are not revealed to third parties, and therefore are not prone to victimisation.

3.9.2. Informed Consent

Informed consent is where the respondent or participant undertakes to conduct the study after being informed by the researcher of why they need that information from them (Baysan and Cetin, 2021). Participants' consent to partake in the research without fear of prejudice is sought before the research commences. In some instances, the researcher is known to the participant and therefore releasing information may not be difficult. In the case of this study, teachers, students and neighbourhood. Respondents' consent was sought before they were tap recorded. Respondents signed consent forms approving their consent to willingly conduct and provide the required data. They were assured that only the researcher knew them and their information was not shared with third parties. Identification of respondents was by way of coded ID and after validating the mutually agreed fundamental structure was the audio recordings destroyed. The participants were enlightened to their right of withdrawal from the research at moment should they wish before engaging in the research.

3.10. CHAPTER SUMMARY

The chapter discussed about the research methodology, the research design, research strategy, data collection and analysis, validity and reliability of the research on the utilisation of visual aids in the teaching and learning of ordinary level physics, particularly at School A in Mutoko district, Zimbabwe.

CHAPTER 4: DATA PRESENTATION AND ANALYSIS

4.1. Introduction

This chapter presents, analyses and discusses the results obtained by the researcher from conducting the research on the effects of utilizing visual aids in the teaching and learning of ordinary level physics. Key findings deduced from the main research questions are analysed and discussed in detail, and in tandem with literature outlined in the research.

4.2. OUTLINE OF PARTICIPANTS' BIOGRAPHIC DATA

This section presents the teachers' and students biographic data to this study. The participants were assigned unique identification code for anonymity as indicated in the biographic data indicated below.

Table 4.1. Composition of Teachers' biographic data

Teachers' Code	Gender	Age	Highest Level of Professional Qualification	Years in Teaching Profession	Teachers Response Rate
M1	M	45	HBscEd Physics	15	
F1	F	35	Dip Sci Ed	12	
					100%

Source: Researcher's field work, 2024.

The biographical data above is indicative of what the researcher expected given that all two teachers responded to the study. One male and one female teachers partook in this study to investigate the usage of visual aids in teaching and learning Ordinary level physics at school A in Mutoko. The results indicate that the male teacher had a degree in education for Physics while the female teacher had a diploma in teaching. This implies that teachers with degrees are better qualified to teach Physics compared to their diploma holders in teaching science. Further analysis indicate that the female teacher was undertaking professional development course in

Physics. The male teacher had fifteen years of experience in teaching physics compared to twelve years for the female teacher.

4.2.2. Demographics of participating teachers

Under this section, the researcher outlines the participants' demographics in respect of their gender, age and educational qualifications.

Learners' Code	Gender	Age	Form being Studied	Vernacular Language spoken	Response Rate
S1	F	17	F4	Shona	
S2	M	16	F4	Shona	
S3	F	18	F4	Shona/Ndebele	
S4	M	14	F4	Shona	
S5	M			Shona/Vemba	
S6	M			Lozi/Shona	
S7	M			Sena/Shona	
S8	M	18	F4	Shona/Portuguese	
S9	M	16	F3	Shangaan/Shona	
S10	M	18	F3	Shona	
S11	F	17	F4	Shona/Portuguese	
S12	M	16	F4	Shona	
S13	F	17	F3	Korekore/Shona	
S14	M	16	F4	Korekore/Shona	
S15	F	14	F3	Korekore/Shona	
S16	M	18	F4	Shona/Sena	
S17	F	18	F4	Buja/Korekore	
S18	M	18	F4	Shona	

Table 4.1. : Composition of the students' biographical Information

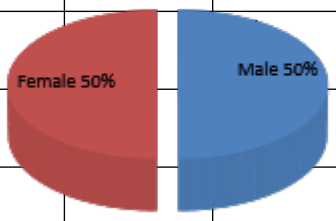


Fig 4.1. Respondents' Gender Demographics. Source: Researcher's Analysis, 2024.

Figure 4.1 above is indicative of the teachers' gender composition in that one of the two teachers at the school is male while one is female. The response rate was high enough to discredit the notion of there being bias in the research. This blends well with Bhatia (2017) view that the validity of an analysis lies in its ability to measure what it was created to measure, accurately producing profitable inferences about a particular attribute, trait or characteristic, intrinsically. The research was impartial, implying that it was fair to the point and was not biased.

Twenty-two students partook in the study and they were accorded coding numbers for validation of the research as indicated in the table below.

S19	M	17	F3	Shona	
TOTAL	**19**				**86.36%**

The biographical information contained in the table above outlines the students' information in relation to the study conducted, that of utilising visual aids to learn ordinary level physics. Twenty-two students partook in the study, and only nineteen responded, giving a response rate of 86.3%, a figure high enough to nullify bias in the research.

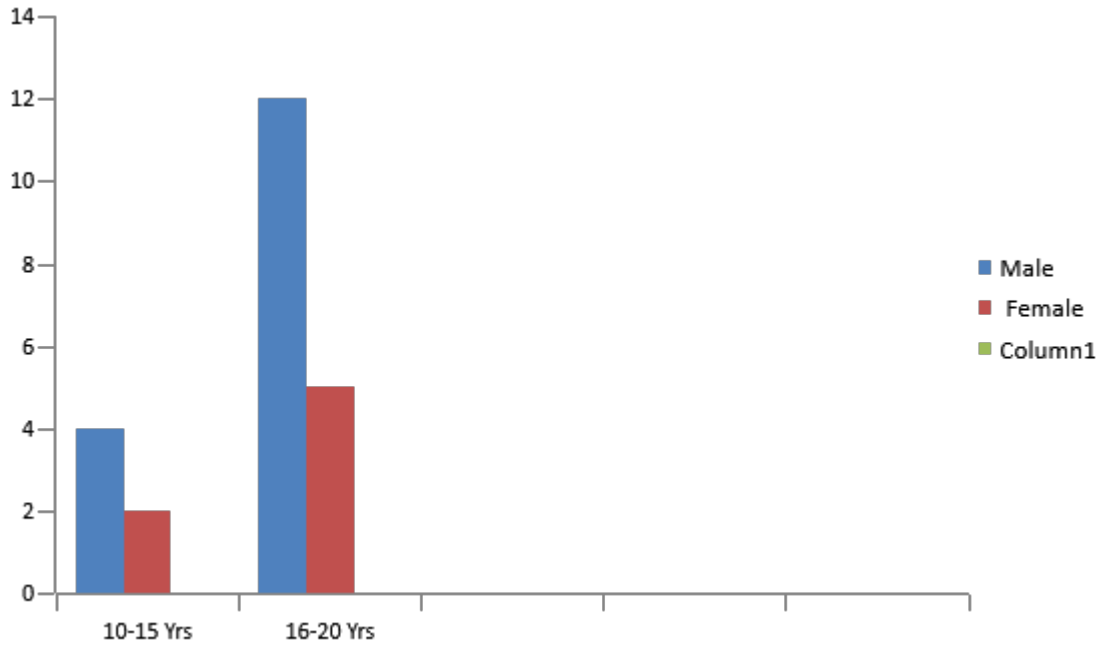


Fig 4.2: Biographical representation of participating students' age groups

Soucre: Researcher's Field work, 2024.

The distribution of the students' age groups as indicated above demonstrates that that there were more male students compared to female students. This could be attributed to lack of interest in the Physics subject, or difficulty in understanding the concepts, hence lack of interest in the subject. The distribution tallies with the Ghafar (2020) assertion that bias towards research is not constituted by either large or small number of respondents, which typically invalidates bias in this research.

4.2.5. Discussion of the Response rate

Response rate is defined as the number of returned questionnaires from those distributed to participants while conducting research (Chipangura and Kaseke, 2012). Under this study, the teacher' response rate is 100% which came from the two physics teachers partaking on the study, while that of the students is 86,3%. The response rate percentages are high enogh to authenticate the research. It gives credence to Hudgikar(2023)' assertion that the returned questionnaires are effective tools of data collection from the participants.

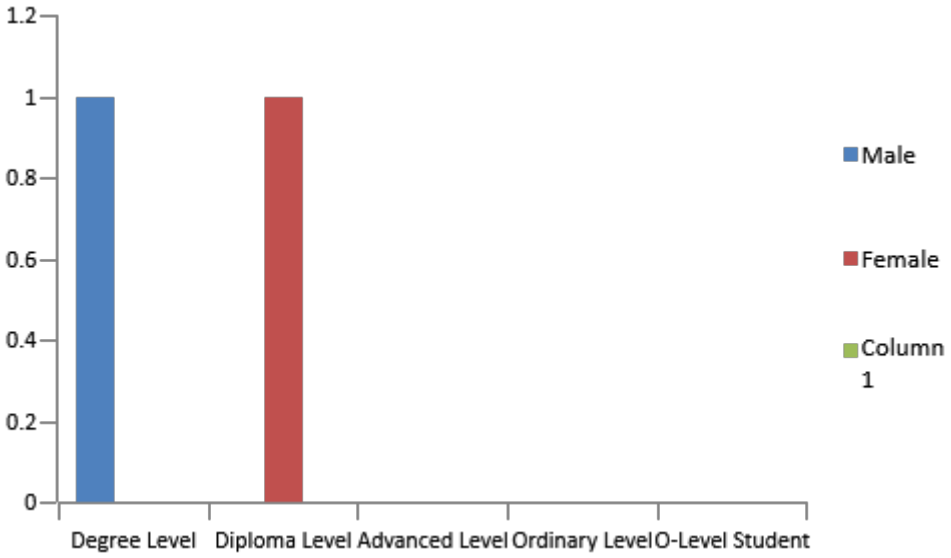


Figure 4.3: Distribution of Respondents' Level of Education
Source: Researcher's tabulated respondents' education level, 2024.

Figure 4.3 above graph further indicates that there were only two teachers at school A in Mutoko, a male degreed teacher and a female teacher with a diploma in teaching physic at Ordinary level.

4.3. DATA PRESENTATION AND ANALYSIS

The researcher presents and analyses the findings obtained from the research through active participants such as teachers and students at school a in Mutoko District. The presentation outlined in this section is in accordance with the research themes outlined in chapter three, and literature review contained in chapter two. This was conducted by utilising data collection tools such as closed and open ended questionnaires, structured and unstructured interviews including face to face interviews, focus groups and existing literature. Observations found out during this process were recorded for analysis. The researcher employed participating observations techniques to inspire students in constructing their own meaning from the experiments and observations availed to them in the classroom setup by utilising visual aids through problem based learning approach designed to enthuse and enhance leaners construct and interpret physics concepts as they were attempting to answer given tasks.

4.3.1. How students perceive research results of utilising visual aids

Several research findings emerged from the teachers and students while the researcher was conducting the study on the utilisation of visual aids in the teaching and learning of Ordinary Level Physics.

4.3.1.1. Results obtained from Learners' questionnaires

The following are the results obtained from learners through questionnaires in respect of questions pertaining to the usage of visual aids in the reaching and learning of ordinary level physics. The learners' expectations, challenges, benefits and solutions are all captured below. The results are indicative of the answers to the research question as outlined in the appendices.

4.3.1.1.1. Understanding of Physics Concepts

Understanding Physics concepts emerged as the major impediment amongst learners to the teaching and learning of physics in the traditional method. Introducing the same topic through utilising visual aids boosted the understanding of the concepts to learners. This tallies with the research objective outlined in chapter one about

How well do learners receive, articulate and decipher instructions from utilizing Visual Aids?

The perception is emblematically expressed by the learner's statement***: ''I hardly could understand Archimedes Principle until after it was articulately explained to us and physically demonstrated in our language'' F4***

The experiment was conducted by the use of visual aids in the class to make learners understand clearly what the principle says. Class observations indicated that learners could positively contribute to learning and articulating Physics concepts more when they understand what is they are learning and how it benefits them I the future, especially when utilising visual aids.

4.3.1.1.2. Attitude towards learning Physics

Learners displayed a significant shift in positive attitude towards Physics when taught utilising visual aids. Learners excitedly enthused when the topic of electricity was introduced through visual aids as they could clearly understand what the subject was all about, and how applicable it was to their lives. Explaining to them the generation and transmission of energy from the power generating plant to their homes was phenomenal. Their attitude played a major role in determining the ultimate performance of the student especially in the teaching and learning od ordinary level physics. According to Chala (2020), as derived in literature above, attitude refers to the positive or negative mentality the student possesses while conducting studies of that particular subject. The resultant outcome is intrinsically connected the cognitive development of the student, and the behaviour of the student or teacher. Observations made indicated poor academic performance in Ordinary Level Physics and pass rate amongst those students taught without utilising visual aids compared to those receiving instruction utilising visual aids. Learners The following sections of this analysis outline the observations made on tabular and chart format.

4.3.1.1.3. Cognitive development

Intrinsically linked to attitude in the learning process is cognitive development of the learner. Leaners who received instruction through utilising visual aids demonstrated an enhanced interest in Physics and they could conduct experiments and researches on their own. This is the object of teaching. Their self-efficacy and confidence was boosted such that they could then study ahead other topics on their own.

4.3.1.1.4. Connectedness

Leaners demonstrated that with visual aids, they can teach their peers to understand more.

4.3.2. Challenges to utilising visual aids

Research findings indicated that benefits derived from utilising visual aids are inherently associated with challenges. The learners asked for more access to such teaching materials and equipment as it only comes for lesser periods during the course of their study. Learners implored the need to have lessons conducted I their indigenous language so as to have assistance from their parents or guardians when tasked to conduct research on their own at home. The Physics traditional teaching concepts are at variance with their traditional beliefs and therefore dissuade many students from pursuing studies in Physics.

4.3.2.1. Learners attitude, beliefs and behaviour

Leaners indicated in increased desire to learn and understand Ordinary Level physics, an attribute needed to further whet their appetite. It is imperative that the school authorities, the parents and the community engage in awareness initiatives to enlighten parents about the importance of sending even the girl child to school. Much of the belief in learners emanates fir the beliefs held in the communities that it is not very important to send the girl child to school, that physics is difficult to comprehend and interpret.

4.3.3. Solutions to Research Findings

Research findings indicated that some students travel long distances to come to school and therefore are tired before they even begin lessons especially girls. The findings are in tandem with UNESCO 1950 goal that children need not travel more than 500metre stot go to school. This has not been achieved yet especially in Southern Africa. Teachers need materials to increase their frequency of utilising visual aids.

"I wish the teacher could employ visual aids more frequently and repeat the process regularly to make me understand more" F4

Following the responses obtained from the questionnaires sent to the students and teachers alike, the interviews conducted in the process and the observations made while undertaking research in the class, some solutions were recommended for adoption and application in pursuit of enhancing the delivery of physics instruction.

4.3.3.1. Access to Internet services

Given the fact that the school from which the research was conducted is in the remote areas of Mutoko District, it implies that access to internet services for current technological developments meant to assist students in understanding physics was and is not available.

4.3.3.2. Lack of career guidance

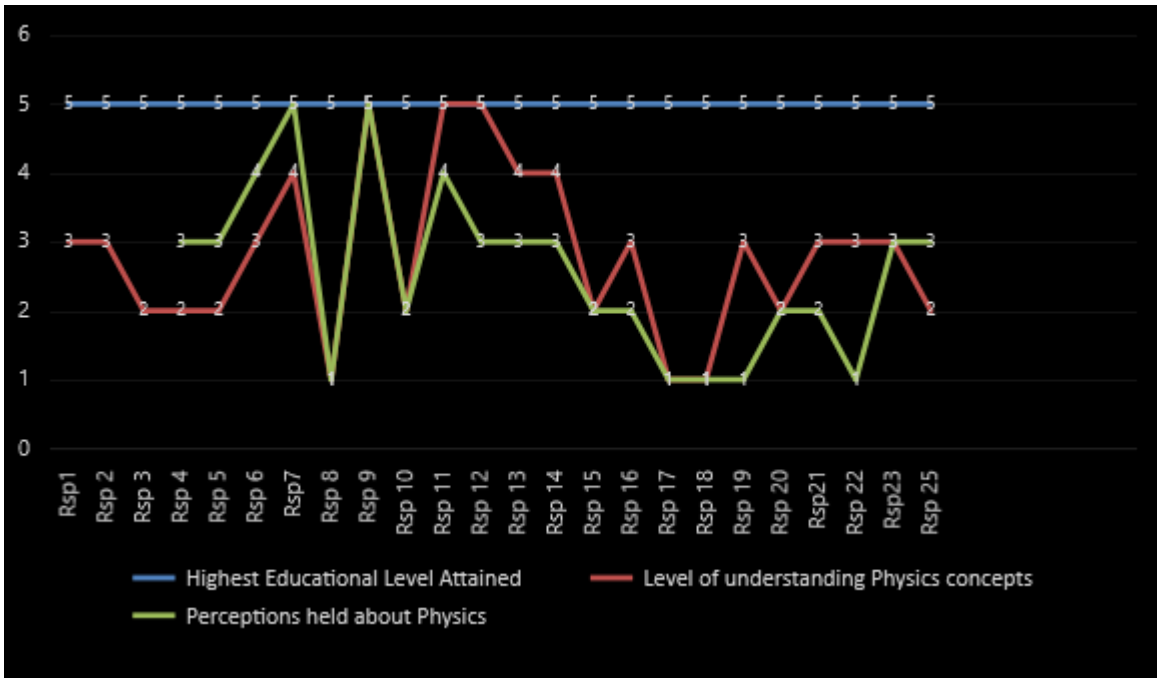
There is need for regular career guidance to infuse the importance of physics in learners so that they increase their interest in physics (Antwi, 2021, Zoker et al.2022).

The following tables, figures and charts serve to consolidate what the researcher established when conducting the research through learners.

4.4: REASON FOR STUDENTS' PERCEPTIONS IN LEARNING ORDINARY

LEVEL PHYSICS

Table 4.3: How students perceive Ordinary Level Physics



Source: Researcher Field work, 2024.

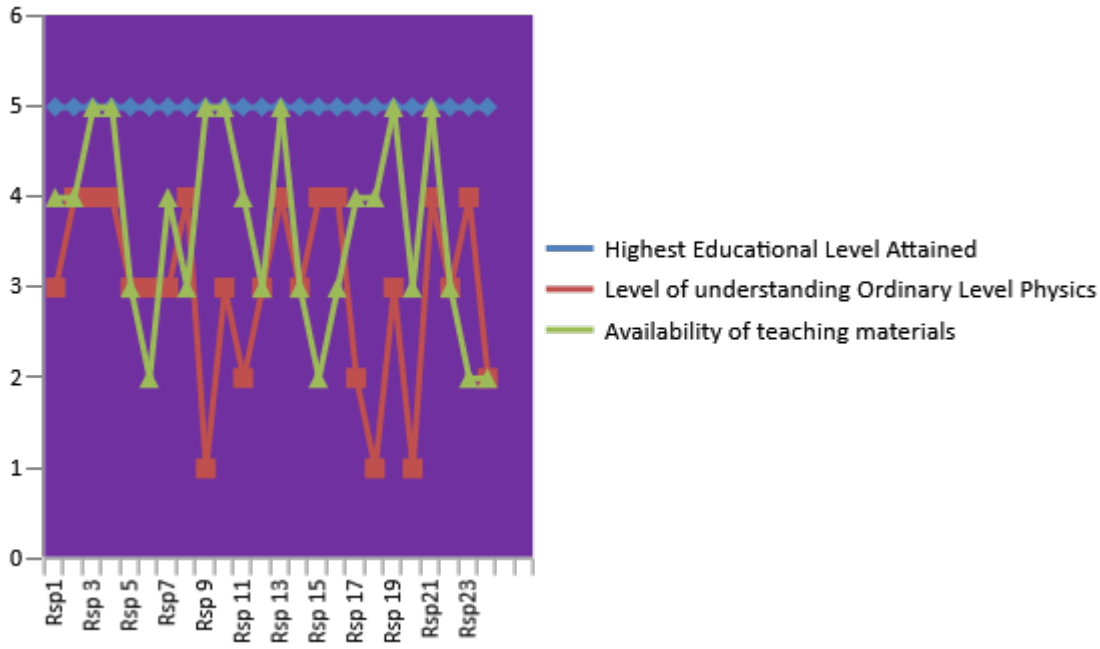
The table above narrates the perceptions held by learners in respect of ordinary level physics. The blue continouis line denotes the educational level of the leaners in that they are still undergoing ordinary level study and therefore do not quite undestand the physics concepts despite their piqued interest. The orange line represents the level of understanding physics concepts. Students opined that they understood more when taught utilisinfg visual aids as compared to tradtonal methods of instruction (Zoker. et al, 2022). It implies that meaningful physics concepts enable students to grasp more when tuaght using visual aids than without.

Learners cogntive intell ingence is equally enhanced and so is theor memory. Instruction in indegenous language tended to enhance the students undestabding of the subject especially where the concepts were difficult to comprehend as a result of the phhsical constatns employed to make scientific calculations.

4.4.1. REASON FOR STUDENTS' CHALLENGES IN UNDERSTAND ORDINARY

LEVEL PHYSICS

Table 4.4: Rate of learners' level of understanding Ordinary Level Physics



Source: Researcher's Field work, 2024.

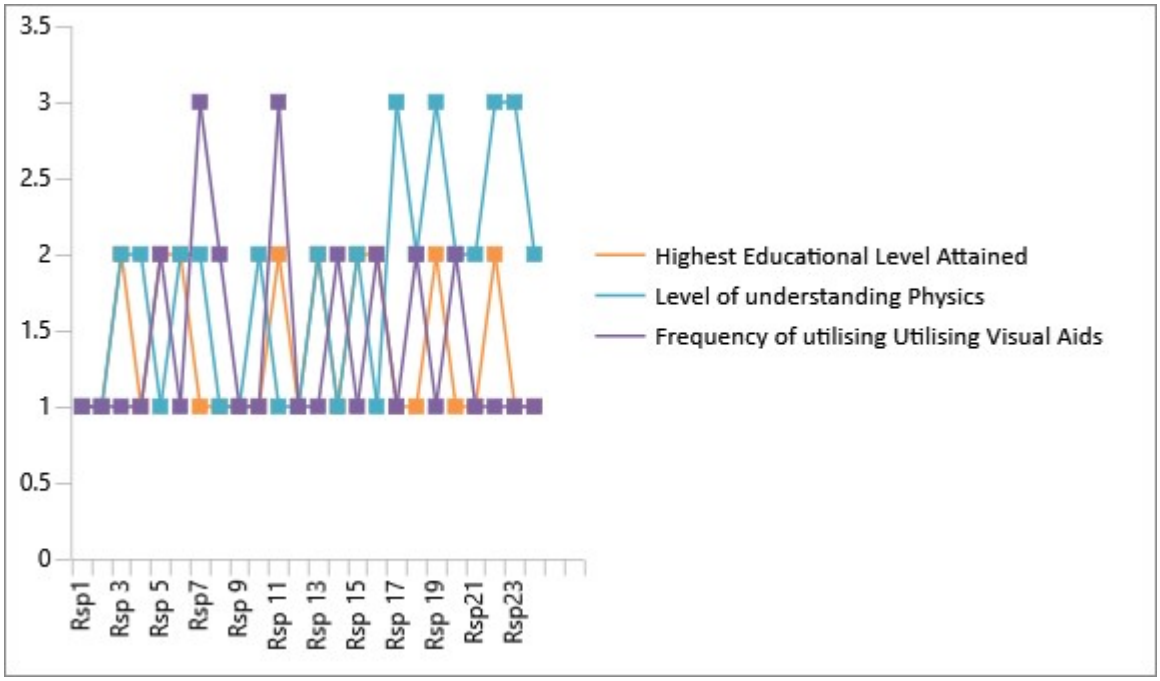
Table 4.5 above indicates the level at which learners are attending school as depicted by the blue straight line. The stright line indivcates that the students are still learning at under ordinary level and therefore their undrstanding of phsics is limited. The orange spikes indicate the level of understanding ordinary level physics . The three outliers in the orange section indicate that only three students believe that they have an excellent understanding of ordinary level Physics. Most of the students belive that they have difficulty in understanding Ordinary Level Physics as indicated by the upward spikes at level four, that of below average.This blends well with the students beliefs that ordinary level physics is difficult to comprehend. This belief preludes the attitude and perception towards learning physics. Learners who indicated inconsistant utilisation of visual aids during lecture time were amongst those whose school attendance was irregular.

4.5. SOLUTIONS DERIVED FROM FREQUENTLY UTILISING VISUAL AIDS IN

THE TEACHING AND LEARNING OF ORDINARY LEVEL PHYSICS

This section analyses the challenges faced by teachers in the delivery of teaching instructions to ordinary level physics students by utilising visual aids. The teachers' frequency of utilising visual aids in pursuance of effective and efficient teaching intervention strategy is compared to their understanding physics, academic and professional qualifications. The Likert scale with ranking of 1 to 5 is employed where (1) denotes Degree Level., (2) denotes Diploma Level., (3) denotes Advanced Level., (4) denotes Ordinary Level and (5) is for other Qualifications. The second ranking relates to the understanding of Physics with a Likert scale of 1 to 5 denoting (1) Very High., (2) High., (3) Average., (4) Low and (5) Very Low.

Table 4.5: Frequency in utilising visual Aids in teaching Physics



Source: Researcher's Field work, 2024.

The table above reflects the interviews conducted by the teachers in the endeavour to establish solutions related to enhancing the students' understanding of Ordinary Level Physics concepts and content. The Green frequency spikes indicate the students' perception of highest level of education attained by teachers, as reflected by their delivery of physics instruction in a class set

up. This conforms to the constructivist theory of learning where the student or leaner constructs his or he own understanding of the subject matter in respect of the social set up of his or her environment. Fundamentally constructivism states that through experiencing things and reflecting on their experiences, people construct their own understanding and knowledge about the world (Palit. 2020). The orange spikes indicate the frequency with which the teachers employed visual aids in the teaching and learning of ordinary level physics. The solutions to enhancing the learners understanding of ordinary level Physics lies in the increased utilisation of visual aids in the teaching and learning Ordinary Level Physics.

4.6. How Teachers perceive research results of utilising Visual Aids

The researcher utilised and analysed data collected from school administrators and teachers through interviews, focus groups and discussions with students, and deduced emerging trends which were established in line with the research questions outlined in chapter one.

4.5.1. Teachers perceptions derived from utilising visual aids

In conducting the research, teachers and school heads were interviewed and responded in the following manner.

4.5.1.1. Enhanced student learning

Findings indicated an increased, enhanced and engaging student learning environment when utilising visual aids. T2 stated he following in relation to utilising visual aids:

Active problem based approach has ignited the leaners' interest in the subject such as has never been seen before. Students are making sure that they are punctual to the physics lesson such that I cannot afford to disappoint my students by not meeting their expectations.

T1 went further to state that: *We are humbled by our learners to know that we are doing our best to assist them achieve their best despite the school shortcomings. They all want to be technically oriented people in their lives after school and so are very enthusiastic about Physics.* T1

The School head stated that: *These teachers are more than artisanal in their line of duty. They make sure results are achieved through active problem based approach to teaching, and i am fully supportive of them.*

One parent had this to say: *Never before have we seen such an amazing and loving science teaching in our remote area. I used to dissuade him from going to school, but I now make sure that he does his homework before he goes to sleep even though I dint understand Physics. I understand it as mu son comes to narrate to me what the teacher teaches him*

It was observed that employing visual aids alone as an interactive teaching approach could not achieve the desired approach. The teacher had to act as a facilitator to the learner thereby employing facilitating methods to explain emerging themes. Active problem based approach to teaching was found to be more desirable than the traditional method. The approach piqued interest in the students by having them perform tasks on their own after a brief introduction by the teacher.

4.5.1.2. Flexibility

Teachers had then flexibility to modify lessons to suit the need of the student and make sure that not one student was left behind in pursuit of making the understand the Physics concepts. Teachers derived satisfaction by making sure that the students do exceed even their own expectations.

4.5.1.3. Dependability

Findings indicated that teachers had to be dependable amongst learners for them to achieve their desire results. Where learners fail to depend on the teachers, even their appearance and perception to students is compromised. In this research, such was not the case. The teachers were very dependable and reliable to their learners.

4.5.2. CHALLENGES TO UTILISING VISUAL AIDS

Findings from the research indicated that challenges are inherent in the approach to teaching and learning of ordinary level physics I that teaching materials are inadequate at the school despite the school head and stakeholders doing their best to alleviate the situation.

T1 had this to say on challenges: *Despite our concerted effort to help the student achieve their best, our efforts are weakened by the unavailability of teaching materials and equipment to enhance and enlighten more the class environment when teaching Physics.*

It implies that the school facilitators ought to make sure that the school curriculum encompasses all the stakeholders including the learner, the parent and the teacher. Policymakers ought to engage teachers when conducting studies to change the curriculum. Teachers are the ones who implement the curriculum so their input is critical.

4.5.2.1. Inadequate teaching material

Teachers had difficulty in addressing some of the pertinent concerns with respect to enhancing the students' understanding in that the school had insufficient teaching material such as projectors for clear demonstration of physics concepts in the class. Physical gadgets like cell batteries to demonstrate the flow of electricity in direct current mode were unavailable at the time of conducting the research. to conduct physical experiments were not only unavailable.

4.6. SOLUTIONS TO CHALLENGES

In response to research questions from Chapter one, teachers had the following to say

4.6.1.1. "To what extent do you understand ordinary level Physics as a teacher?"

T2 had the following to say:

I am currently undergoing professional career development where I am in the final year of attaining undergraduate physics degree for education with Bindura University of Education

Science. My understanding of ordinary level physics has been enhanced such that I am now capable of teaching the subject up to Advanced Level.

The response is of one who felt that he or she is not sufficiently qualified and need to upgrade himself or herself to keep abreast with changing theories and philosophies in Physics

4.6.1.2. "What challenges are you facing in the delivery of your daily teaching routine"

There is inadequate supply of teaching materials at this school, such that we do not have basic teaching tools for practical in the physics laboratory. Tools such as vinier callipers for example. Teaching the student from a theoretical perspective reduces the zeal in the student of wanting to learn.

The response indicated that there was an insufficient supply of teaching material at the school. Visual Aids are not sufficient to cover all students when conducting experiments and researches employing visual aids.

4.6.1.3. How often do you utilise visual aids in the teaching and learning of Physics at Ordinary Level?

In research findings, the

Initially the frequency in utilising visual aids was low, somewhat once in two weeks or sometimes once per month. This depended on the subject topic. Some topics may not need visual aids. However, after observing an increased interest in the subject, we increased the frequency of utilising visual aids to enhance the learners understanding of Physics concepts. When learners perform the experiments themselves, it enhances their interest in the subject, increase their cognitive intelligence, their creativity and retention memory. This has led to increased pass rates in the subject at the school.

Both T1 and T2 concurred that frequency in the utilisation of visual aids is greatly compromised in that the is insufficient supply of study material at the school and the nation at large, especially in government controlled schools.

4.7. DISCUSSIONS

Attitude is the basis upon which behaviour is derived. It is defined as "choosing personal actions based on internal states of understanding and feeling." (Dtsco, 2000). In social psychology, it is categorised in three paradigms which are cognitive, affective, and

behavioural (Korur, 2022). Affective attitude refers to feelings of senses associated with an object, cognitive attitude elates to thoughts and beliefs associated with an object while behavioural attitude relates to past behaviours related to an object. It implies that behaviour is a component of two characteristics, that of cognitive attitude and affective attitude. In this context, it means that behaviour is a construct of affection and cogniscence (Smeets et al, 2012). The teacher can pre-emptively have an attitude towards his or her students, which might affect the performance of the student in the teaching and learning of ordinary level physics. Concurrently, the student or leaner might have the same attitude or behaviour towards the teacher depending on how the teacher presents himself or herself at the first instant he or she begins teaching the subject to the students. When this happens, the teacher as the centre of instruction can effect cognitive belief, perceived control and the states of affection. This augers well with Yavoruk (2020) who postulates that "we see what we want to see Each observer already has certain knowledge, beliefs and experience, and belongs to a certain culture" It implies that beliefs s are ingrained in the mindset of the people from cultural beliefs and attitudes. In the same vein. The teacher and the student possess what they believe to be correct about an object or body at the first instant until proven otherwise. This mindest affects teachers and students. For example, the teacher might perceive as insignificant a point in the description of electricity, but which may be a life changing element to the student. Some teachers might utilise the standard of a few students who are intellectually gifted in terms of academic performance an act which might disadvantage other slow learners in the class. It Implies that the teachers as observers might embed their own experience and knowledge in interpreting results obtained from and observation.

Pedagogical approach in the teaching and learning of Ordinary Level Physics is imperative in that it enhances the teacher s in employing visual aids in the teaching and learning of Ordinary Level Physics. Utilisation if visual aids enhances the student performance in that when students are left to conduct their own studier with little interference from the teacher, it provides them with inexplicable experience which lasts longer than when taught in the traditional format

(Sahara et al, 2020). In order to instil an inquisitive mind in the students, they have to be availed the opportunity to utilise visual aids, thus igniting the engineering or scientific mind in the student. They will employ the same techniques in their later years in life. Armed with the basic research methods in physics, leaners surely become exceptional research scientists (Sinha. 2021).

Continueuos professional development initiatives for the teacher ought to be continually provided by the relevant policy makers. Technological advancement are giving rise to innovative research methods. The COVID 19 pandemic introduced new teaching methods such as the utilisation of ZOOM meetings or lectures where the teacher can reach several students at the same time. This reduces the inefficiencies which teachers might be facing during the course of their duty.

From the literature above and on the challenges affecting effective and efficient teaching lesson delivery, Palit (2020) opines that there is need for frequent utilisation of visual aids in their teaching and learning of Ordinary Level Physics. Chala (2020) concurs and postulates that with positive mental attitude in the teacher and the student, lesson delivery becomes highly accommodating, an atmosphere conducive to cognitive development of Ordinary Level Physics students. It allows students to create meaning from conducting experiments on their own, but with little supervision. Student the learn to interpret results on their own.

With respect to challenges faced by the teacher and the student especially on the inadequacy of teaching materials to the teachers, and the learning materials to the students, there is need for collaboration between the teacher and the community from which they teach. Progressing without engaging the local community from which the school gets it students is a failure from start.

There has been progressive development of the educational curriculum where the Government of Zimbabwe (GoZ) is trying to produce a secondary school students capable of working in the industry from the onset/ CALA and STEM projects have been implemented and now the Government seeks to improve the educational curriculum as an intervention teaching strategy MoPSE, 2018).

Teachers cannot be teaching in a vaccum and therefore need the support of the school. Despite shortcomings associated with the teaching and learning of ordinary level physics, the school

from which the researcher conducted the research is spatially distributed in that it is far from other schools in the district. Therefore, the findings from the research are confined to the school A in Mutoko District.

The observations made in the class indicated an increased inters in the physics by the students. There was a very low pass rate of Physics at the School in previous years. The trend has changed after the introduction of the practical utilising visual aids. Traditional methods of teaching have since fallen away from the school.

1.) What can be done to ensure that teachers can adequately prepare and employ visual aids in the delivery of teaching instructions to ordinary level physics learners?

CHAPTER 5: SUMMARY AND RECOMMENDATIONS

CHAPTER OUTLINE

5.1. Introduction

5.2. Summary of the Study

5.3. Conclusions

5.4. Recommendations

5.5. Areas of further research

5.1. INTRODUCTION

This chapter outlines the conclusions derived from the results of the study and the recommendations proffered, which, when adopted, could enhance the effective utilisation of visual aids in the teaching and learning of Ordinary Level Physics at School A in Mutoko District and other secondary schools in the country and beyond. The recommendations emanated from the study conducted in utilising visual aids when teaching Ordinary Level Physics, and from the explored physics concepts and theories under literature review.

5.2. SUMMARY OF THE RESEARCH

In summarising the whole study, the main research objective was to investigate the utilisation of Visual Aids in the teaching and learning of Ordinary Level Physics. In light of the research findings, it was discovered that students need active, participatory problem based Learner Centred Approach (LCP) in utilising visual aids with the assistance of the teacher. The research findings converge with the philosophy of utilising visual aids in the teaching and learning of Ordinary Level Physics. The intricacies of the approach to teaching utilising visual aids was outlined form the literature review in chapter two. The following passages briefly summarise from chapter one to chapter four.

Chapter One: Introduction

This Chapter introduced the subject topic under investigation, that of investigating the utilisation of visual aids in the teaching and learning of Ordinary Level Physics.

Chapter 2: Literature Review

Chapter two outlined the literature review results of utilising visual aids in the teaching of ordinary level Physics. Philosophies and theories relate d to the study were compared and contrasted to that the researcher undertook. Findings indicated that visual aids are an effective and efficient teaching intervention strategy which need further study to continuiosly perfect it.

However, there were challenges inherent in the approach which were observed and articulated in the conceptual framework. This arose after research gaps which were identified and articulated in the conceptual framework indicated in chapter two.

Chapter 3: Research Methodology

Chapter three outlined the qualitative research methodology employed to conduct the research, the research design, the research tools and how data was to be collected and analysed.

Chapter Four: Data Presentation and Analysis

Resultantly, chapter four presented and analysed the research findings in line with the physics philosophies in education. New insights emerged in the delivery of lessons while utilising visual in teaching and learning of Ordinary Level Physics. The insights in chapter four arose from the conceptual framework introduced in chapter two. This framework cited shortfalls in the current teaching and learning approaches to \ordinary Level Physics and proposed an alternative to the challenge. However, after further analysis in chapter for, the observations conducted undertook to further modify the conceptual framework and adopt the observations made, which observations will lead to a modified conceptual framework, enhanced teaching approaches and subsequent national economic development.

This culminated into chapter five where the research is summarised. Areas of further research are proposed at the end of this chapter.

5.3. CONCLUSIONS

From the findings of this research, the following conclusions were drawn for each research question outlined in the chapter one as indicated below.

5.3.1 Research Question1: How well do learners receive, articulate and decipher instructions from utilizing Visual Aids?

5.3.1.1. Frequency of utilizing visual aids

Frequently utilising visual aids enhances the learners' capacity and memory retention, thereby increasing their performance in class.

5.3.1.2. Mastering the Concepts and boosting confidence

Learners need to keep practicing through usage of visual aids so as to master the physics concepts thereby increasing their overall performance on class and in life.

5.3.1.2. Research Question 2: What could be the challenges associated with the teachers' failure to prepare and employ Visual Aids in the delivery of teaching instructions to Ordinary Level Physics learners?

5.3.1.2.1. Inadequate Teaching Material

Inadequate teaching material was the major impediment to the failure by teachers to properly prepare teaching materials when utilising visual aids

5.3.1.3. Research Question 3: 5.1.3. What can be done to ensure that teachers can adequately prepare and employ visual aids in the delivery and teaching of instructions to Ordinary Level Physics Learners

5.3.1.3.1. Continuous professional development

Teachers need continuous professional development to keep abreast with changing trends so as to seamlessly deliver the physics concepts and instructions to learners.

5.4. RECCOMENDATIONS

Pursuant to the conclusions outlined above, the following recommendations are made to ensure efficient, effective and continuous teaching and learning of Ordinary Level Physics.

5.4.1. Conduct continuous professional development courses for the teachers

Teachers must be provided opportunities to professionally develop themselves for better delivery of Physics lessons where they lag behind in terms of technological and professional development. This enhances the teacher understanding of the required visual aids teaching intervention strategies. It also aids in the better delivery of the Physics teaching sessions by the teachers to their respective students.

5.4.2. Motivate teachers in rural areas

Teachers of Physics must be rewarded fpr their dedication to duty, their commitment in having their students at heat such that they become more selfless in the conduct of their duties.

5.4.3. Adequately provide schools with teaching materials

Teaching materials must be adequately provided for at all schools fpr better delivery of the physics lesson.

5.5. AREAS FOR FURTHER RESEARCH

Further studies must be carried out in the following study areas

1.) The use of indigenous languages in the teaching of Physics from early child devilment to University level
2.) Rapid development of technology in the areas of Physics for enhanced economic delivery
3.) Educational Policy Consistancy in physics especially, for development, application and implementation across the nation.
4.) Adoption of Ubuntu in the development of Physics curriculum to capture the beliefs and norms inherent in the African culture. The current curriculum is western based.

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APPENDICES

APPENDIX 1:

QUESTIONNAIRES FOR LEARNERS

A questionnaire is a research instrument comprising a series of questions and prompts employed to gather primary information from respondents (Kabir and Alan, 2015). According to the Oxford Advanced Learners' Dictionary (1997:952) a questionnaire as a written or printed list of questions designed to be answered by a group of people when conducting a survey. It implies that t questionnaire is an instrument designed to extract as much information as possible from participants for the benefit of discovering the underlying issues upon which the research or study is to be conducted.

Questionnaires can be conducted in the closed ended format or the open ended format. The open ended format relates to questions without a specific answer. They enthuse the responded into giving as much information as possible and without fear of prejudice from the researcher, while close ended School A in Mutoko District.

The structure if the questionnaires is such that Appendix one, sections A to D outlines the biological data of the learners, their perspectives relating to research questions, the challenges associated with the teaching and learning of ordinary level physics, and the solutions attributable to the research findings.

Appendix two is concerned with research questions attributable to the teachers in respect of the research being conducted while appendix 3 outlines the research schedule as outlined below.

INTRODUCTION TO THE INFORMANT

Good morning/afternoon/evening. My name is Loriette Nhiwatiwa. I am a secondary school physics teacher conducting research in the utilisation of visual aids as a teaching intervention strategy in the teaching and learning of ordinary level physics. I am seeking your permission and approval to have you as one my respondents. Kindly be advised that you responses are private and confidential and shall be solely for this research. You are also reminded that it is your right to not answer any question should you feel uncomfortable, and, you can terminate the interview at any instant during the process.

Do you have any questions before we proceed?

Yes: *Proceed* No: *Thank the participant and terminate the interview*

I certify that the nature, purpose, potential benefits and possible risks associated with participating in this research have been explained to the volunteer.

Signed (Interviewee) :_____

Signed (Researcher) :_____

Date :_____

SECTION A: LEARNERS' INTERVIEW GUIDE

Biological Data:

1.) How old are you?

2.) Kindly state your gender

3.) For how long have been learning at this school?

4.) Have you ever attended another any other secondary school before coming here?

5.) How easy or difficult is ordinary level physics to you?

SECTION B: Perceptions on the utilisation of visual aids in the teaching and learning of Ordinary Level Physics.

1.) In your view, what do you think contributes to the difficulty in understanding ordinary level physics?

2.) What do you understand about visual aids in the teaching and learning of ordinary level physics?

3.) As a student, how often do you think visual aids should be utilised for you to quickly learn and understand physics concepts?

4.) Which teaching method does your teacher employ for you to clearly understand physics concepts at ordinary level?

5.) In your view, what do you think contributes to the low pass rate of ordinary level physics at your school?

6.) In your view, what can be done to enhance your understanding of ordinary level physics?

7.) What is your perception about your teachers when utilising visual?

8.) Do you think that teachers are adequately prepared when they teach you ordinary level physics at your school?

6.) What can be done to change your perception about the importance of visual in delivering physics instruction?

7.) In your view, why have learners been failing to pass physics at ordinary level?

8.) In your view, what could be the reasons why the learners have been failing to pass ordinary level physics at your school?

9.) What role do you think teachers play in the low pass rate that existed at your school?

10.) What do you think could be done to avoid continuous repetition of low pass rates at your school?

11.) In your own view, how helpful do you think visual aids have been in enhancing the teaching and learning of ordinary level physics?

12.) As a student, what recommendations would you make in light of utilising visual aids in the teaching and learning of ordinary level physics?

SECTION C: Challenges related to the research study of utilising visual aids

1.) What challenges do you face when learning ordinary level physics at your school?
2.) Do you have adequate learning material to make you understand ordinary level physics at your school?
3.) In your view, why have learners been failing to pass physics at ordinary level?
4.) In your view, what could be the reasons why the learners have been failing to pass ordinary level physics at your school?
5.) In your view, do you think teachers contribute to the low pass rate of ordinary level physics at your school?
6.) you think teachers play in the low pass rate that existed at your school?
7.) Is there teacher rotation in the teaching and learning of ordinary level physics ay tour school?
8.) Have your teachers ever taught you in the vernacular language to make you understand physics better?

SECTION D: Solutions to the challenges of utilising Visual Aids

9.) What can be done to change your perception about the importance of visual in delivering physics instruction?

10.) What do you think could be done to avoid continuous repetition of low pass rates in physics at your school?

11.) In your view, what could be the major reasons behind the low interest in taking up physics at ordinary level of study?

12.) What recommendations can you make to improve the delivery of physics lesson at your school.

APPENDIX 2: INTERVIEW SCHEDULE FOR TEACHERS

Introduction to the Informant

Good morning/afternoon/evening. My name is Loriette Nhiwatiwa. I am a secondary school physics teacher conducting research in the utilisation of visual aids as a teaching intervention strategy in the teaching and learning of ordinary level physics. I am seeking your permission and approval to have you as one my respondents. Kindly be advised that you responses are private and confidential and shall be solely for this research. You are also reminded that it is your right to not answer any question should you feel uncomfortable, and, you can terminate the interview at any instant during the process.

Do you have any questions before we proceed?

Yes: *Proceed* No: *Thank the participant and terminate the interview*

I certify that the nature, purpose, potential benefits and possible risks associated with participating in this research have been explained to the volunteer.

Signed (Interviewee) :_____ Signed (Researcher) :_____

Date :_____

Interview No.:	**Interview Date:**
Name of Interviewer:	
Start Time of Interview:	**End Time of Interview:**
Location:	
Name of School/Organisation:	
Department / Form _____	
Designation of Respondent:	
Years in Current Post:	
Sex of Respondent: Female = 1 Male = 2	

Teachers interview guide

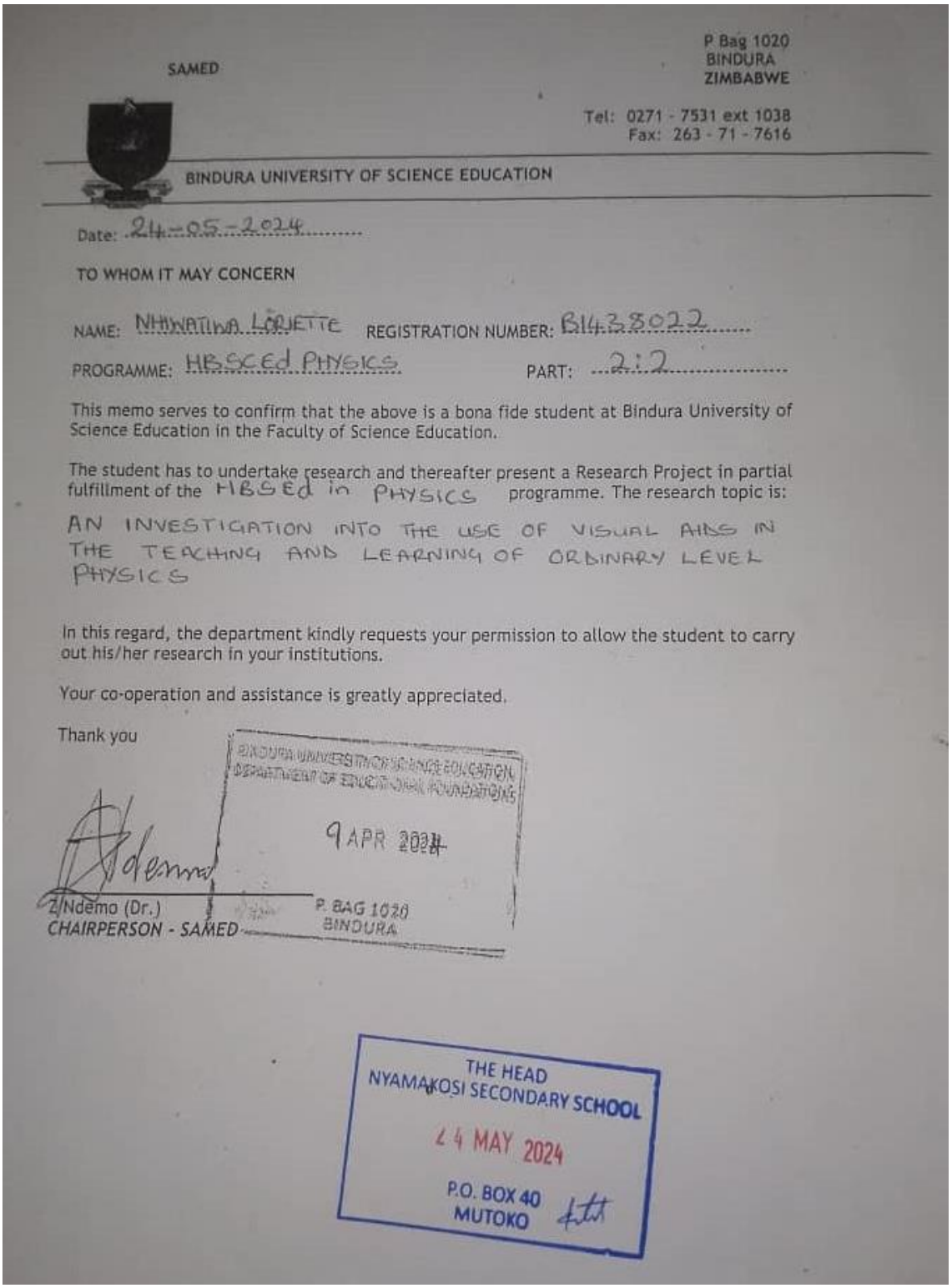
1. What is your gender?
2. How long have you been teaching ordinary level physics?
3. How many physics teachers are there at the school?
4. Do you have any other secondary schools teaching physics at ordinary level near your school?
5. What is your highest teaching qualification?
6. What is your area of specialisation in teaching?
7. On average, how many students do you teach physics per session of ordinary level physics?
8. In your view, how adequate is the school prepared to effectively enhance your teaching and learning of ordinary level physics when utilising visual aids?
9. As a teacher, how do you perceive the importance of visual aids in the teaching and learning of ordinary level physics given the current learning intervention strategies?
10. What do you think should be done to better enhance the perception of utilising visual aids for the best of teachers and learners?
11. How often does the Ministry of Primary and Secondary School provide for your continuous professional development progammes to enhance your teaching effectiveness?
12. Is there some difference in the cognitive intelligence levels of understanding physics concepts between boys and girls?
13. As part of school management, what recommendations would you make to enhance teachers and learners' adequacy and improve service delivery in the teaching and learning of ordinary level physics at School A?

APPENDIX 3: OBSERVATION SCHEDULE

Item to be Observed	Observations
Observations	❖ The teacher observed how each student utilised Visual Aids to enhance their understanding of Physics at Ordinary Level. ❖ The teacher also observed the enthusiasim inherent in students when they perform unhindered visual aids lessons in Physics.
Sequencing of Content	The content of the apparatus was such that it started by identifying the apparatus utilised in the study, the aim of the study, he subject or body of the study, the methods employed and discussions and the conclusion of final report.
Teacher Pupil Interactions	❖ The level of interaction during visual aids teaching was minimal so as to give the student the time to assimilate what the teacher would have taught him over her during presentation time. ❖ Traditional methods of instructional were made, recorded for comparison purposes with a view to enthuse, and pique students by utilising visual aids,
Pupil to Pupil Interactions	❖ The observations made were that students have an affinity to making one another understand Physics concepts when the interact on their own. ❖ This is more enjoyable to students as they want to discover new concepts which might be difficult to comprehand during either traditional method of instruction or the improved and better method of instruction, the visual aids method of instruction. Students utilising visual aids performed better and scored higher than when utilising the traditional method of instruction.

Level of Interaction	The frequency of instruction on visual aids was low at the beginning but the researcher s had to increase their frequency after observing that visual aids, in conjunction with visual aids do enhance student performance inherently,
Use of Indigenous Language	❖ Indigenous language enhanced the understanding of utilising visual aids, especially where the student might have had experience of the subject matter at home. ❖ However, local languages fall short of describing physics concepts fully rightly and correctly. ❖ Learners employed their local languages in explaining physics concepts with one another, a valid point undertaken by the researcher. ❖ Where students and difficulty in explaining the concepts in local languages, the researcher, as their teacher had to intervene and correctly explains the phenomena.

APPENDIX 4: APPROVAL FORM



SAMED

P Bag 1020
BINDURA
ZIMBABWE

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

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: 24-05-2024

TO WHOM IT MAY CONCERN

NAME: NHWATIWA LORETTE REGISTRATION NUMBER: B1438022

PROGRAMME: HBSCED PHYSICS PART: 2:2

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

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

AN INVESTIGATION INTO THE USE OF VISUAL AIDS IN THE TEACHING AND LEARNING OF ORDINARY LEVEL PHYSICS

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

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
9 APR 2024
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Z Ndemo (Dr.)
CHAIRPERSON - SAMED

THE HEAD
NYAMAKOSI SECONDARY SCHOOL
24 MAY 2024
P.O. BOX 40
MUTOKO