EFFECTIVENESS OF "MIT-MEIO" VIDEO INSTRUCTIONS IN LEARNING AND MEMORY RETENTION OF GRADE TWELVE CELL- DIVISION AT NABOYE SECONDARY SCHOOL IN KAFUE

BY

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DECLARATION

I, **Ng`ambi Kate Eggrey**, solemnly do hereby declare that this dissertation is my own work and that all the work of other persons have been duly acknowledged, and that this work has never been previously submitted at this University or any other university for similar purposes.

Signed: …… Date: ……

APPROVAL

This dissertation of Ng`ambi Kate Eggrey has been approved as fulfilling part of the requirements of the award of the degree of Master of Education in Science Education by the University of Zambia.

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ABSTRACT

Technology ranges from the basic notion of tools, to systems which employ or exploit it. Some common examples of technology include videos, simulations, virtual and remote laboratories, games and tablet computing. Though some of these can be useful in the learning of O-level biology topics that are challenging, in Zambia less research has been done to investigate their effectiveness. Therefore, this study investigated the effectiveness of the Mit-Meio video instructions in learning of O-level cell division and memory retention. The study sought to determine the difference in performance between learners who use the Mit-Meio video enhanced instructions and those who do not, determine the difference in the memory retention between learners who use the Mit-Meio video enhanced instructions and those who do not and also establish learners' perceptions on Mit-Meio video enhanced instructions. It employed a mixed methods approach and the sequential explanatory design where quantitative data was collected by pre-testing the learners prior to the introduction of content on cell division topic and post-testing them after administering the treatment (Mit-Meio video) on the topic. A focus group discussion and observation schedule were used to collect qualitative data on perceptions of learners on the Mit-Meio video enhanced instructions. Analysis of quantitative data was done by comparing the means generated using the statistical package for social sciences (SPSS) and normalizing learning gains of the experimental and control groups. Inferential statistics (t-tests) were used to determine if there was a statistical significant difference in performance between the two groups. Qualitative data from the focus group discussion and observation schedule were analysed using qualitative content analysis by grouping data into categories or themes that emerged. The findings revealed a statistically significant difference in performance between the groups and an overwhelming interest in pupils to continue the use of video instructions in addition to the normal way of learning. The study recommended that, in order to overcome the difficulties and make the learning of cell division more effective, learning through the use of visual materials like the Mit-Meio as a supplement to traditional instruction should be encouraged and videos given to learners so that they can watch and comprehend the content.

***Key words**:* P*erformance, Memory retention, Video-enhanced, Cell division*

DEDICATION

This dissertation is dedicated to my loving husband Bruno Tembo and my beautiful daughter Rumbidzai Paige Tembo, for their patience and understanding throughout the process of completing my studies and all good wishing people.

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ACRONYMS AND ABBREVIATIONS

3D	Three dimension
CD	Compact Disc
ICT	Information and Communication Technology
IT	Information Technology
SPSS	Statistical Package for Social Sciences
TI	Traditional Instruction

DEFINITIONS OF TERMS

Memory retention	The ability of learners to remember the content of cell division after a period of time.
Effectiveness	To be able to make learners understand more of the process of cell division hence scoring high marks.
Performance of learners	Marks obtained after the pre-test and post-test.
Mit-Meio	This refers to the mitosis and meiosis cell division video used in this study.

CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter presents the background of the study, statement of the problem, purpose and objectives of the study as well as the research questions. The usefulness of the study is also described briefly together with its scope and limitations. Lastly, the chapter discusses the theoretical framework that guided the study.

1.2 Background

Technology ranges from the basic notion of tools, to systems which employ or exploit it. Some examples of technology include videos, simulations, virtual and remote laboratories, games and tablet computing. Bates states that 'the key component is the intervention of the teacher' (Bates, 2015). The use of educational technology in schools as a means to improve student learning has received extensive attention over the past decade (wellington et al. 1994). With the advent of the internet and a variety of software and hardware applications, the education system has predominantly focused on the acquisition of hardware and computer network infrastructure in the pursuit of educational technology goals (Wellington, 2004).

One well known technological tools used in a class is a video. A video is defined as a digitally recorded content that has sound and motion that can be stored or delivered live, and can be streamed to a variety of devices. It may or may not have the lecturer visible and can include an animated film, or a demonstration. It can also be defined as a form of multimedia that conveys information through two simultaneous sensory channels: auditory and visual. It often uses multiple

presentation modes, such as verbal and pictorial representations (Mayer, 2001).This multiplicity means that video communicates the same information to students through simultaneous learning styles and can provide students with "multiple entry points" into the content (Gardner, 2006). The richness of these forms of information in the video (images, motion, sound, and, at times, text) benefits learners, by enabling them to learn through both verbal and visual means, to view actual objects and realistic scenes, to see sequences in motion, and to view perspectives that are difficult or impossible to observe in real life (Wetzel, 1994). "Most researchers agree that when viewed together, each source provides additional complementary information," thus increasing the chances that comprehension will take place, (Kozma, 1991).

According to Hovland et al., (1949) using audio-visual materials in the classroom is nothing new. Since filmstrips were first studied during World War II as a training tool for soldiers, educators have recognized the power of audio-visual materials to capture the attention of learners, increase their motivation and enhance their learning experience. Marshall (2002) details three theories that explain how learning may occur via well-selected video based on the ability of the entertaining media to engage the learner, activate emotional states, initiate interest in a topic, and allow for absorption and processing of information. The average school age child spends much time watching television; playing video games and exploring other electronic media devices, including the cell phones (Nwanekezi & Kalu, 2012). These exploration and manipulations according to Nwanekezi and Kalu is a great development in education which have further stimulated interest and created enabling environments for learning to take place both inside and outside the classrooms.

The views of the foregoing authors have undermined the fact that the emergence of Information and Communication Technology (ICT) have created a knowledge based society that has changed

the global economy and the status of education (Atsumbe, et al., 2012). Moreover, it is essential for learners to have access to education anytime and anywhere. Hence it is unrealistic to ask students to be in designated places every time to engage in learning (Atsumbe, et al., 2012). Multimedia instruction can deliver instruction anytime and anywhere; and can make instructions available and accessible to learners on multimedia compact discs (CD) and on multimedia files which can be played or viewed on their multimedia mobile devices. This can further facilitate learning outside the school and classroom settings.

The purported strengths of ICT, multimedia technology has made multimedia instruction possible in audio files, video or both files (Gertner, 2011). Multimedia instruction is a vital instrument for transforming traditional paradigm of learning (Mahajan, 2012). It offers a promising alternative in delivering the intended learning content that may not be available in the traditional face to face instruction (Donkor, 2011). Multimedia instruction has become a powerful medium for explanation of concepts, theories and abstract things which make learning more meaningful (Gupta & Sehgal, 2012). It links the images, audio and visual together to provide a multisensory experience for the learner (El-Sayed & El-Sayed, 2013). Gertner (2011) considered multimedia application to consist of at least three of these seven components: text, data, audio, graphics, photographic images, and animation as well as moving pictures. He further noted that multimedia based lectures provide a unique opportunity to present, teach, and internalize information. Judicious use of multimedia resources can substantially increase the quantity and quality of time spent on task; it offers an excellent avenue for focusing the students' attention on specific details on the subject to be taught (Robert, 2011). Multimedia allows students to view actual objects and realistic scenes, see sequences in motion, and to listen to narration (Nazir, Rizvi & Pujeri, 2012).

In addition, multimedia aids retention, which is a preservative factor of the mind (Kundu & Tutoo, 2002). The mind acquires the materials of knowledge through sensation and perception. These materials are preserved in the form of images for knowledge to develop and whenever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible (Alorain, 2012). Multimedia instruction can convey information in a stimulating situation that aids the brain to preserve information in the form of images which can be easily retained and remembered. Nwanekezi & Kalu (2012) observed that students taught with multimedia instruction have high retention score than their counterparts who were taught with traditional teaching methods. This is so because multimedia has certain features that increase the receptive and memory ability of the learner. These feature is focused on the ability of the learner to learn with multiple senses, thus increases student achievement and ensures learning permanency, and improvement of mental process skills that promote deeper learning which increases the rate of retention (Li et al., 2011).

The aforementioned things imply that use of appropriate multimedia in the classroom could result in better academic achievement. Sever et al., (2009) describes academic achievement as the extent to which a student, teacher or institution has achieved their educational goals. It is commonly measured by examinations or continuous assessment. It is centred on the attainment of the objectives of the content of the study. The objectives will cover cognitive, psychomotor and affective educational domains. This will further prepare the learner to acquire practical skills and scientific Knowledge (Olaitan, 1996). Once this is achieved, the learner will be able to live well and contribute greatly in his or her society.

There has been reports of poor performance in cell division among learners in Zambia (Haambokoma, 2002). The high failure rate of learners could partly be due to teaching methods

employed by instructors to teach the learners. In most secondary schools, teaching methods used are mostly lecture and the demonstration methods. Continued use of these traditional teaching methods reduces the ability of students to grasp relevant concepts than when exposed to appropriate teaching techniques. Viable instructional methods that will stimulate and motivate as well as enhance learning and memory should be employed to help the learners of science. Instructional approaches that will ensure quality educational delivery and retention of what is learned need to be explored and not teacher centred approaches that do not help learners to have conceptual understanding of science (Oshinaike & Adekunmisi, 2012).

Robert (2011) makes it clear that the success of any educational enterprise could be measured not only in terms of how much instruction is given by teachers, but also in terms of technologies and media employed to ensure effective delivery and development of learners. The fast-paced, diverse, and technologically advanced world has posed challenges for both teachers and learners. The use of ICTs in the teaching and learning process has become an important feature. There is need for ICT instructions to be used as supplement to traditional method of teaching (Rolfe & Gray, 2011). Tradition instructional methods cannot picture clearly abstracts, difficult concepts and illustrations to the learner. In fact, the traditional technique of instruction has contributed to a lot of frustration among learners especially, the slow learners who always surrender themselves to excessive rote learning and memorization (Odo, Adenle & Okwori, 2012). It is a very difficult task for teachers to take care of each and every student in a classroom comprising many students with different individual needs. It is impossible for teachers to teach every individual according to their pace of learning and level of understanding in a limited period of time. Sharma (2013) pointed out some of the things traditional methods cannot achieve. He noted that teachers using traditional methods are not able to: Provide teaching material according to the needs of each student, teach every

student according to his/her own pace of learning, provide teaching material for as much time as the student requires and guide the students keeping in view their individual differences.

Consequently multimedia instruction can be designed to take care of all the above learning conditions (Gantt, 1998). Hence, there is need for secondary schools in Zambia to take advantage of multimedia technology to illustrate abstract concepts such as those in cell division topic.

While access to computer technology has significantly increased in schools throughout the country and the benefits of using video enhanced instructions are known worldwide, there has been no study in Zambia to investigate the effectiveness of video enhanced instructions in the learning of any biology component or topic and to establish if at all video-enhanced instructions help in memory retention. It was because of this that the current study investigated the effectiveness of video enhanced instructions in the learning of cell division and find out if at all it can enhance memory retention. The findings of the study might help teachers of biology to use effective videos as a supplement in the teaching of challenging topics such as the one in question.

1.3 Statement of the problem

The learning of Biology at secondary school level has proven to be difficult when it comes to certain topics like classification and genetics (Ozcan, 2003). In Zambia the difficult in learning of genetics has mostly been in areas of mutation, variation and cell division. There is enough evidence that these topics are perceived to be challenging to learners (Haambokoma, 2002). Pupils find it difficult to master various stages involved in the two types of cell division namely mitosis and meiosis.

As a result a lot of effort is being made to use various teaching aids including videos to help learners have a better understanding of the named concepts (Oztap, 2003, Woolfit, 2015). However

the effectiveness of the mit-meio video enhanced instructions and if at all it helps in memory retention is not known in the Zambian context. This research therefore, aims at investigating the effectiveness of mit-meio video instructions as a supplement to traditional instructions in learning of O-level cell division and memory retention.

1.4 Purpose of a study

The purpose of this study was to investigate the effectiveness of the "Mit-Meio" video instructions in learning of O-level cell division and the impact of the video on learner's memory retention.

1.5 Objectives of the study

- To compare the performance between learners who use the mit-meio video instruction as a supplement to traditional instruction and those who learn using traditional instruction only.
- To compare memory retention between learners who use the mit-meio video as a supplement to traditional instruction and those who learn using traditional instruction only.
- To establish learner's perceptions of mit-meio video instructions**.**

1.6 Research questions

This study was guided by the following research questions:

- How do learners who use the mit-meio video instructions as a supplement to traditional instruction perform on cell division compared to those who learn using traditional instructions only?

- How is the memory retention of learners who learn using the mit-meio video instruction as a supplement to traditional instructions to those who learn using traditional instructions only?
- What are the learner's perceptions of video enhanced instructions?

1.7 Significance of the study

The findings of the study might help teachers of biology to incorporate appropriate videos in the teaching of most biology concepts that have been observed to be abstract and challenging to teach. With the advantage that high quality video can be streamed quickly into mobile devices in an educational context, pupils might access recommended videos by teachers to watch at their own time and learn biology more. It might provide a guideline to the teachers to develop a strategy for effective teaching and help in developing positive attitude of learners towards science. Lastly, the study might add to the existing literature on the use of technology in the learning of cell division.

1.8 Delimitation of the study

This study was conducted at one secondary school in Kafue district. The school in the area was purposively selected on grounds that there was a projector to use in the learning of the participants who were in the experimental group. The school was also easily accessible by the researcher during the research period.

1.9 Limitation of the Study

This study engaged learners with different level of intelligence; the researcher had no control when it came to selecting pupils with same level of intelligence. According to Gadner's theory of 1983

individuals have different ways of processing information hence different intellectual ability of learners. In this study this was beyond the researcher's control.

The study required six weeks of lessons and tests and this meant teaching at one school for almost the whole term. This means that time was also a limiting factor in this study.

1.10 Theoretical framework

This study was informed by the dual coding theory by Paivio (1971). According to this theory, when visual information enters the brain via the eyes, it triggers the sound associated with the name of the thing in the image, leading to dual processing of both the visual and verbal information with one reinforcing the other. Therefore, observers of images get multichannel and multiple representations of content information.

Dual-coding theory postulates that both visual and verbal information is used to represent information (Sternberg, 2003). Visual and verbal information are processed differently and along distinct channels in the human mind, creating separate representations for information processed in each channel. The mental codes corresponding to these representations are used to organize incoming information that can be acted upon, stored, and retrieved for subsequent use. Both visual and verbal codes can be used when recalling information (Sternberg, 2003). For example, if a person has stored the stimulus concept "living cell" as both the word 'living cell' and as the image of a living cell, when asked to recall the stimulus, the person can retrieve either the word or the image individually, or both simultaneously. If the word is recalled, the image of the living cell is not lost and can still be retrieved at a later point in time. The ability to code a stimulus in two different ways increases the chance of remembering that item compared to if the stimulus was only coded one way.

Paivio found that participants when shown a rapid sequence of pictures as well as a rapid sequence of words and later asked to recall the words and pictures, in any order, were better at recalling images (Paivio, 1986). Participants, however, more readily recalled the sequential order of the words, rather than the sequence of pictures. These results supported Paivio's hypothesis that verbal information is processed differently from visual information and that verbal information was superior to visual information when sequential order was also required for the memory task (Paivio, 1969This multiplicity means that video communicates the same information to students through s).

The principle underlying the dual coding theory, aiming at promoting the learner's performance in class above all in any teaching-learning process inspired this study. In this study, the effectiveness of using the "Mit-Meio" video instructions in learning of O-level cell division on grade twelve biology learners and the impact of the video on learner's memory retention was investigated. The study strived to find out how learners who use the mit-meio video instructions as a supplement to traditional instruction perform on cell division compared to those who learn using traditional instructions only and how the memory retention of learners who learn using the mit-meio video instruction as a supplement to traditional instructions is compared to those who learn using traditional instructions only. The study also strived to find out learner's perceptions on video enhanced instructions?

1.11 Summary

This introductory chapter looked at the importance of video instructions in learning as shown by previous researchers, the possible role of how Information and Communication Technologies (ICTs) plays in the learning and retention of the content learnt. This was done at the same time as

demonstration of the gap in the knowledge using the mit-meio video in the learning of cell division, the benefits resulting from the use of video instructions and the limitations being that the researcher was not able to control the intelligence level of participants. The significance of this study in the contribution to the body of knowledge and the scope of the study was shown. Finally, the study was designed to follow the duo-coding theory by Paivio (1971) which states that when visual information enters the brain via the eyes, it triggers the sound associated with the name of the thing in the image, leading to dual processing of both the visual and verbal information with one reinforcing the other. Therefore, observers of images get multichannel and multiple representations of content information". The theory attempts to give weight to verbal and non-verbal processing.

1.12 Organisation of the Dissertation

This dissertation comprised of six chapters. Chapter one presented the background to the study, statement of the problem, purpose of the study, study objectives and research questions. The chapter also presents the significance of the study, the limitations of the study and delimitations of the study, theoretical framework as well as operational definition of the terms. Lastly, the summary of the chapter is given.

Chapter two reviewed literature related to the topic under study. As such, literature review helps the researcher to develop a significant problem which will provide further knowledge in the field of study.

Chapter three presented the methodology used in the study which includes the philosophical paradigm, research design, population, sample size and sampling techniques. The chapter further explains the research instruments, data quality assurance as well as data collection procedure and data analysis. This chapter ends with ethical considerations.

Chapter four presented the findings of the study as was provided by the participants. The findings were presented according to the study questions. Chapter five discussed the findings of the study

using emerging themes from each objective. Lastly but not the least, chapter six presented the conclusion and recommendations of the study based on the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews literature in line with the learning of cell division, and the effectiveness of video enhanced instructions in learning and memory retention. The review will be done under the following themes Cell division as a challenging topic and the effectiveness of video-enhanced instruction in learning and memory retention.

2.2 Cell division as a challenging topic

Many studies have been done on learning of cell division as a challenging topic at secondary school level. A study performed in England and Wales suggests that misconceptions pupils have concerning the relationship between genes, chromosomes, and the cell contribute to their misunderstanding of inheritance. To have an accurate understanding of how traits are inherited from parents, it is necessary to understand cell division (Lewis, 2000). According to Wright and Newman (2011) pupils have difficulty understanding the process of mitosis and meiosis and this phenomenon has been documented for a long time. In his first study, Chattopadhyay (2005) examined pupil`s understanding of genetic information related to cells and transmission of genetic information during reproduction. The study found that a significant proportion of pupils were confused about the type of similarity/difference of genetic information in cells of different tissues in an individual, particularly in sex cells. In the second study done by the same researcher, (Chattopadhyay, 2012) it was found that when different tissues (somatic and germ) were given to select whether mitosis takes place in them, 39% said ‘yes’ for testis and 51% said ‘yes’ for ovary. In somatic tissues the range varied from 58% to 81%. This indicated that pupils did not

differentiate between mitosis and meiosis simply based on their location in somatic and reproductive tissues. This observation suggests that pupils were not sure about the occurrence of these two types of cell division in individual tissues. In other words they did not understand the topic of cell division. Some misconceptions identified from the study were similar to (Chattopadhyay, 2012) study, where learners did not understand DNA replication, stages of mitosis and meiosis and changes in number of chromosome during cell division.

A study done by Cimer, was aimed at determining the biological topics that students have difficulties learning, the reasons why secondary school learners have difficulties in learning the topics, and ways to improve the effectiveness of students' biology learning. For these purposes, a self-administered questionnaire including three open-ended questions was employed to collect the data. It was administered to 207 11th grade students in the district of Rize, Turkey. The data were analysed both qualitatively and quantitatively. Of the five topics that the students had the most difficulties learning cell division was one of the topics (Cimer, 2011). The main reasons for learning difficulties in this study was found to be, the nature of the topic, teachers' style of teaching, students' learning and studying habits, students' negative feelings and attitudes towards the topic and a lack of resources. Cimer reports that to overcome these difficulties and make learning more effective, the participants suggested such strategies as teaching through the use of visual materials and teaching through practical work (Cimer, 2011).

A study done by Wekesa, revealed that cell division is rated the most difficult topic to learn, learners were found to hold inadequate understanding of cell division and associated underlying concepts such as mitosis, meiosis, chromosomes and chromatids (Wekesa, 2003). These learning problems in cell division arise from improper teaching and learning methods (Wekesa, 2003).

In 2007, Cossa carried out a study with an assumption that practical work does contribute to the teaching and learning of cell biology at Eduardo Mondlane University in Mozambique (Cossa, 2007). In this study the impact of practical work in the teaching and learning of cell biology concepts were investigated, specifically focussing on cell divisions concepts. The study also aimed at determining the students' perceptions of the role of practical work in the learning of cell biology.

The study revealed that the cell biology practical work improved substantially the students' level of understanding of cell division on the four themes: (1) events in the cell cycle; (2) sequence of mitotic phases; (3) sequence of meiotic events meiosis; (4) differences between mitosis and meiosis (Cossa, 2007). Even though this study was, similar to other studies carried out in this area, the learners showed continued a poor knowledge of the basic concepts (e.g. chromosome structure, chromosome number, specific events in prophase I of meiosis, DNA replication) important to understand the whole process of mitosis and meiosis even after laboratory instruction were done (Cossa, 2007). Furthermore, practical difficulties experienced by most learners to use the light microscope during the laboratory sessions influenced negatively the envisaged aims of practical work in cell division.

In another study done by Oztap et al., (2003) where biology teachers were examined in the difficulties they face when teaching cell division in the secondary schools of Turkey, it was found that biology teachers perceive cell division as one of the most difficult topics. Meiosis was in particularly cited as the most difficult to teach, compared to other areas of cell division (Oztap et al., 2003). Suggestions came out from the teachers that the use of different materials such as models, diagrams, pictures, laboratory activities and videos can assist in the teaching of cell division. The suggestions came with the view that these materials alongside textbooks, can help to increase learning potential among learners (Oztap et al., 2003). Emphasis mainly is also put on

teacher centred learning methods (Kiboss, 2002) and rote learning among students is also encouraged (Ozcan, Yildirim & Ozgur, 2012).

Misunderstanding of cell division topic by learners were also reported in a study done by Riemeier & Gropengießer (2010) in a study titled On the roots of difficulties in learning about cell division. Empirical investigations on students´ conceptions of cell biology showed major Misunderstandings of scientific concepts even after thorough teaching. The main aim of the research project was to investigate students´ difficulties in learning cell division topic and to study the impact of learning activities on students´ conceptions. This study revealed that even if the learning and teaching cell division would seem to be an easy task because there are many published papers and school books which propose teaching materials for this topic, the research on students´ conceptions indicated that, even after being taught, students use conceptions which are different from scientific concepts (Riemeier & Gropengießer, 2010).

Confusion about terms such as cell, cell wall, cell membrane, gene, chromosome and allele were reported by (Flores et al., 2003). Problems in understanding the different levels of organisation of multi-cellular organisms (Hackling &Treagust, 1984). Further studies done in 2000 by Lewis and Wood-Robin tells us that learners find Problems in understanding cell processes such as mitosis or DNA replication (Lewis & Wood-Robinson 2000).

Students' difficulties in learning biology topics that are perceived to be difficult have been studied by various researchers across the world (Johnstone & Mahmoud, 1980). Many concepts or topics in biology, including cells, mitosis and meiosis, organs, physiological processes, hormonal regulation, oxygen transport, genetics, Mendelian genetics, genetic engineering, and the central nervous system can be perceived as difficult to learn by secondary school students. Tekkaya et al.,

(2001) found that, genes and chromosomes, mitosis and meiosis, among other biology concepts are considered difficult concepts by secondary school learners. Experiencing difficulties in so many topics in biology negatively affects students' motivation and achievement (Özcan, 2003). Students' difficulties with many topics in biology have stimulated researchers to investigate why students experience such difficulties and how to overcome these difficulties. There are many reasons why students have difficulties in learning biological concepts (Lazarowitz & Penso, 1992). The nature of biology itself and its teaching methods are among the reasons for the difficulties in learning it. Furthermore to Lazarowitz & Penso (1992), the biological level of organization and the abstract level of the concepts make learning biology concept difficult.

In Zambia studies have been conducted on challenging topics. Haambokoma and Mwale (1998) found that learners at two national technical schools in Zambia were of the view that some teachers have difficult in teaching genetics hence pupils do not understand the topic. This topic, has cell division in it that learners mentioned to be of difficult in understanding. Furthermore, the same teachers expressed their views that in the area of genetics there is need for development in terms of the way the topic is taught. The challenging areas identified by pupils when it came to learning biology included cell division, mutation, sex-determination, variation and co-dominance, (Haambokoma, 2002). The study brought out cell division as a challenging topic to learners and the challenges were attributed to limited time when it comes to teaching the topic, inability by teachers to explain clearly to pupils, not teaching the topic, topic taught near examination time, fast presentation of lessons on the topic by some teachers, belief by some pupils that genetics is difficult, lack of appropriate teaching aids to use when teaching the topic and not enough time allocated to teaching the topic (Haambokoma, 2002).

All these studies done focused on misconception rather than on foundational knowledge and scaffolding. To overcome these difficulties in learning cell division and make learning more effective to pupils, strategies of learning through the use of visual materials, teaching through practical work and using various study techniques should be employed in teaching to make pupils understand biology concepts. Therefore this study aimed at using video instructions in the learning of cell division and memory retention.

2.3 The effectiveness of video-enhanced instruction in learning and memory retention

Many studies have been done and published when it comes to computer assisted instructions in helping pupils understand challenging topics in biology. Countries around the globe have invested greatly in this learning technology, and incorporated it into schools at different levels. According to the article "student learning," visual perception is the most developed sense in humans and is the most important way that students learn (Sekular & Blake, 1985). It further states that animation coupled with lecture is more effective than lectures alone. A research done by Oztap (2003) suggests that models and pictorial materials can help students overcome their misunderstandings and lead to a greater understanding of cell division. This study further illustrates that clear relationships among basic structures is of great assistance to students and that various kinds of visualization media, such as static and motion pictures of chromosomes in different stages of cell division could be instrumental in overcoming student difficulties in learning. This is supported by Schnotz &Bannert, (2003) found that text comprehension and picture comprehension are goal-oriented processes of the human cognitive system, in which the individual actively selects and processes verbal as well as pictorial information in order to construct representations that seem to be suited to cope with the present task.

Other studies have shown that visual media use can strengthen understanding, especially of abstract processes that are hard for one to envision in their mind. If students can see an animation of the process, they may be able to learn it more easily than just seeing drawings, this is supported by a study done by (Kletskin, 2012). Eick & King, (2012) also supported the idea that visual media along with traditional methods of teaching can increase student performance, indicating that students learn more with the visual media (Harwood & McMahon, 1997). Studies also show that students' attitudes towards a subject can be improved by using visual media (Eick & King, 2012). This study further shows that improvement in attitude can in turn improve achievement and that although studies have been done on the effects of visual media, few have been done specifically in a secondary science classroom.

In an article entitled "Molecular and Cellular Biology Animations" by McClean & Johnson (2005) it is indicated that motion leads to greater long term memory retention and that images contain more information than text. But both images and words contain associations with their location and surrounding items, and trigger emotions in the subject. Therefore, we can say multimedia presentations like a video animation is beneficial to pupils understanding of the dynamic nature of cell division process and this is in line with what (Hockley, 2008). He found, that when pairs of pictures are shown to subjects, they recall the images, but also the combinations that were presented. The emotional content of images also affects memory results recall and recognition is more likely for motional than neutral images.

In most pupils' classrooms, teachers use traditional styles of teaching. These types of teaching are described by Wolfe (2001) as rote rehearsal. Pupils should use the strategy known as elaborative rehearsal. Once a pupil elaborates on information, they are more likely to understand and retain the information over a longer period of time, (Nuthall, 2000). Pupils need to see meaning in order

to remember. The meaning in learning can be enhanced by the use of technological tools like a video. Most pupils grow up with digital settings than their teachers, (Juke, 2008). For this reason, students of the 21st century may understand and retain more information if it comes to them through a technological medium. Online tools that promote content creation among students, like videos are more effective strategies than traditional methods (Miller, 2009). In a study done by Cyril (2015) the students in the experimental group, performed better in retention test than those in the control group. Hence the researcher concluded that multimedia instructions have more effect on learning achievement and retention.

The effectiveness of learning with technology has been tackled from both sides. There is evidence that the use of technology (video) increases achievement and self-efficacy (Liu et al., 2006), but some studies indicate that the use of technology in certain areas is not beneficial to students (Cramer & Smith, 2002). Despite Cetin (2014) showing that video-enhanced biology general instructions increase the pupils interest in biology and makes learning more permanent. The researcher also reported that video enhanced instructions' participants complain about problems of language used in videos and internet connection required to access and download the video is expensive. According to Miller (2011) tasks subjects are engaged in while exposed to images or text have a great influence over subsequent recall. He questions Paivio's1970s theory because he did not find evidence that images automatically call up their names that are then encoded verbally. Instead, he surmises that semantic and verbal coding may happen only when the subject finds it purposeful for task performance.

According to Gardner's theories of Multiple Intelligence, there are Eight Different Potential Pathways to Learning (Gadner, 2006). Gardner's model would state that using static and dynamic modelling as the primary source to teach only targets the spatial pathway. Therefore, dynamic and

static models may not be beneficial for students who learn better through one of the other pathways (Polk, 2013). An analysis was done to compare both raw score means and normalized learning gains of the experimental and control groups. No statistically significant differences due to animations were found in these comparisons, though student engagement and class discussion were increased by the use of animations based on teacher observations. Assessment tests were used to measure achievement, and pre and post surveys, were used to determine the effect of videos on attitude. The surveys showed no significant change in attitude towards video use or the content studied, however, the surveys indicated that students felt positively about the use of videos in the classroom (Perry, 2013).Though there seems to be a lot of research done on the use of video enhanced instructions in a classroom, little has been done in Zambian context.

2.4 Summary of literature review

The reviewed literature in this chapter indicates that a variety of technology learning aids such as photographs, film and video enhanced instructions improve performance of learners in a classroom. A few studies done have shown no difference in performance and memory retention, but increase in interest of learners in learning biology. However, the literature does not provide specific information on the use of video-enhanced instructions in the learning of cell division and if video-enhanced instruction makes learning permanent to secondary school pupils

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter presents the methodology that was used in the study. It begins with the description of the research design that was employed, targeted population, sample size, sampling procedures and research instruments. It also describes the data collection procedures, and how this data was analysed in order to answer the three research questions. It further describes the ethical considerations that were made during data collection and discusses the validity and reliability, giving details on how factors that could have influenced the study were managed. It ends with a summary of key issues

3.2 Research design

This study used a mixed methods approach which is a procedure for collecting, analysing and "mixing" both quantitative and qualitative data at some stage of the research process within a single study (Creswell, 2014). The rationale for mixing is that neither quantitative nor qualitative methods would be sufficient by themselves to capture the effectiveness, perceptions and details of the use of the mit-meio video instructions in the teaching of cell division. The method of inquiry was sequential explanatory mixed methods design which consists of two distinct phases (Creswell et al., 2014). In the first phase, the quantitative, data was collected using experimental design. The goal of the quantitative phase was to determine if there was a difference in performance between the treatment group and the control group. The numerical data was also used to determine a difference in memory retention between the two groups of learners and to allow for selecting informants for the second phase. In the second phase, a qualitative multiple case study approach

was used to collect data through a focus group discussion. The rationale for this approach was that the quantitative data and results would provide a general picture of the research while the qualitative data would supplement the results of first phase. Figure 1 shows the plan used in collecting data of the study.

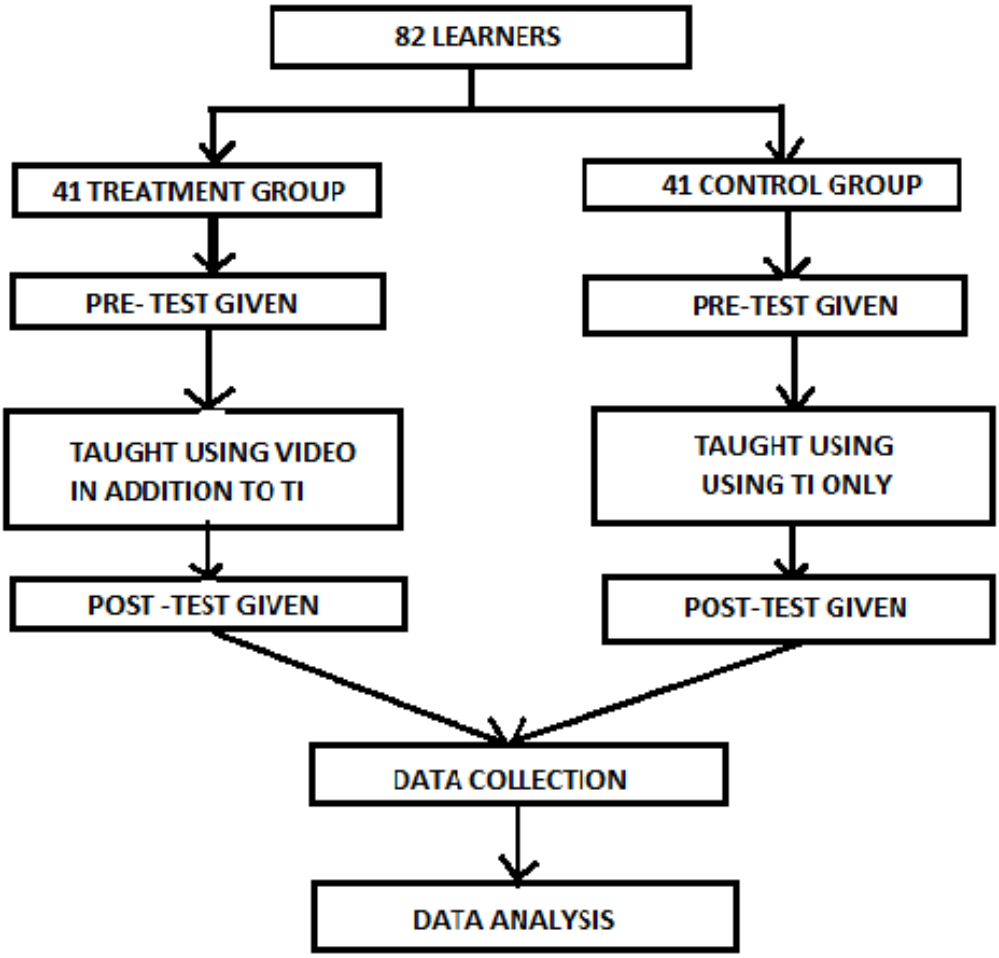

Figure 1. Design plan of the study

3.3 Research sites

The study was done at Naboye secondary School in Kafue District of Lusaka Province.

3.4 Study population

Teaching of biology is compulsory at secondary level in Zambia, hence the targeted population of about 400 grade twelve learners doing biology at Naboye secondary school in Kafue district was used in the current study. The population was deemed fit because cell division is a topic taught to grade twelve pupils.

3.5 Sample size

The sample size comprised 82 grade twelve learners of biology. This number was arrived at using Krejcie and Morgan (1970) table. This is a table showing the population number with its corresponding sample size number. The population in this study was 400 and the tabulated figure for sample size was 196, but the researcher adjusted the sample size to 82 in order to be able to properly monitor the experimental group. The eighty-two learners were divided into two groups. One group of learners were assigned in the experimental group and the other were in control group.

3.6 Sampling technique

First, the study employed stratified random sampling to select the learners who participated in the two groups of learning. Stratified sampling involves dividing the population into homogenous groups, then randomly selecting the sample from the two strata using simple random sampling (Cohen, 2005). In this study learners were first divided into two groups (boys and girls) in order to obtain a sample representative of the whole population in terms of sex. A random selection of participants was then done. Two types of paper marked 1 and 0 was put in a box for pupils to pick, according to gender, randomly. Those who selected pieces of paper marked 1 became participants in the research.

After randomisation, two groups of participants were formed, experimental and control.

3.7 Data collection instrument

The following were the instruments used for data collection:

(i) Test

The pre-test and post-test on cell division were used to collect quantitative data for the study. Twenty structured questions were used in the tests. The questions were prepared by the researcher who happened to be a biology teacher at a secondary school in Kafue. The data collected was in form of raw scores and was for measuring the performance and memory retention of learners on the cell division topic. A test used is attached to this dissertation as Appendix A.

(ii) Focus group discussion guide

There was a group of learners selected to answer questions on the effectiveness of the mit-meio video used in the learning of cell division. This group of learners consisted of five learners and were drawn from the experimental group. The purpose of the focus group discussion was to confirm or seek clarification on the data collected using the first instrument (pre and post-test). This instrument is attached to this document as Appendix B.

(iii) Observation schedule

Observational data are attractive as they afford the researcher the opportunity to gather 'live' data from 'live' situations. The researcher is given the opportunity to look at what is taking place in situations rather than at second hand (Patton, 1990). In this research the instrument enabled the researcher to understand the context of the learner's environment, also to see things

that might otherwise be unconsciously missed during the learning process and to discover things that learners might have not been free to talk about in a group discussion. Because observed incidents are less predictable there is a certain freshness to this form of data collection that is often denied in other forms, e.g. interviews or a test. The observation schedule used in this study is attached to this document as Appendix C.

3.8 Data collection procedure

Data was collected over a period of 6 weeks. The cell division topic has three subtopics namely: mitosis, meiosis and the importance of cell division in plants and animals. In the first week pre-test were administered and lessons started in the same week. The learning process covered the following topics under cell division:

i. Mitosis

- Definition for mitosis.
- Stages of mitosis.
- Importance of mitosis in plants and animals

ii. Meiosis

- Definition for meiosis.
- Stages of meiosis.
- Importance of meiosis
- The differences between meiosis and mitosis.

The learning process went on for three weeks after which the post-test were administered. After another three weeks a test was again given to determine the impact of mit-meio video instructions

on memory retention. Five grade 12 learners were selected from the experimental group to take part in the discussion on the use of the mit-meio video instructions. The discussion guide had questions supplied by the researcher. Rather, the reliance is on the interaction within the group who discuss a topic supplied by the researcher (Morgan, 1988). The learners were allowed to interact with each other rather on what they think and feel on the use of video learning. It is from the interaction of the group that data was collected to answer the research question number three on perception of learners.

3.9 Data analysis

Data was analysed using the two approaches quantitatively and qualitatively. Quantitative data was analysed by comparing the means of post-test scores (descriptive statistics) of the two groups of participants including t-test values (inferential statistics) generated using the Statistical Package for Social Sciences (SPSS) to see which group performed better. Numerical data for memory retention test was also analysed in the same way by comparing the means of the test which was given after three weeks of writing the pre-test of the two groups.

Qualitative data from focus group discussion was analysed thematically. Responses from the focus group discussion of learners (qualitative data) was grouped into categories or themes that emerged from the findings. This data were analysed using the qualitative content analysis which according to (Mayring, 2014) is the process that allows the researcher to extract the objective meanings and themes which is either clearly observable or hidden in a given piece of information. The inductive qualitative content analysis was used in this study for that purpose.

3.10 Ethical consideration

The study took into account all possible and potential ethical issues. Respondents were assured of high levels of confidentiality. In addition, the respondents were informed that the information gathered was purely for academic purposes and no name would be revealed or used. As rightly noted by Wimmer and Dominick (1994), the principle of confidentiality and respect are the most important ethical issues requiring compliance on the part of the researcher. Efforts were made to ensure that the study was undertaken in a morally acceptable manner. To ensure that this was done the following were ensured.

1. Permission was sort from District Education Board Secretary to conduct the study in the district.
2. Permission was sort from the school management for the study to be done in the school
3. Heads of science department was asked for assistance in the use of a projector.
4. Permission was sort from the pupils who participated in the study and had to be taught for a period of two weeks.

3.11 Validity and reliability of instruments

3.11.1 Validity

Validity is the strength of our conclusions, inferences or propositions. More formally, Cook and Campbell (1979) define it as the best available approximation to the truth or falsity of a given inference, proposition or conclusion.

In attempting to improve the validity of the instruments in this study, the content of the test was confirmed by matching the test questions to specific objectives required by the biology syllabus.

The test was developed on the basis of Blooms taxonomy, a senior lecturer and an expert biology teacher who teach biology were asked to validate the test by providing their opinions about the quality of the instruments, to ensure that the prepared items were appropriate for student thinking level and ability, comprise correct biology terms and the sentences are easy to understand and not misleading to learners. Both the lecturer and the expert teachers recommended revision of some questions based on Biology Syllabus. Some of the questions appeared ambiguous. After correction by the two biology experts the test was given to an English teacher for verification in terms of language and clarity of purpose so that the translation does not change the real meaning of the questions. All these adjustments and changes made to the instrument were done before the main study was undertaken.

The research design used in this study to collect data was pure experimental, this method requires a strict control of threats to internal validity (Cohen & Manion, 1990). Threats to the internal validity may occur throughout the research process. The threats to internal validity are insufficient knowledge during data collection, analysis and/or interpretation. During data collection, possible threats to internal validity are instrumentation issues, order bias, and researcher bias in the use of techniques (Ongwuegbuzie, 2003 Tashakkori & Teddlie, 1998). In this research some of the threats to internal validity that were controlled include:

1) **Instrumentation:** Instruments can introduce serious errors in experiments. With human observers or judges or changes in instrumentation and calibration, error can result from changes in their skills and levels of concentration over the course of the experiment (Cohen, Manion & Morrison, 2000).

   In this study to control this threat, there was consistency at each point of administering the test and the same test was given in the pre-test and post-test.

2. **Mortality**: This threat occurs when subjects drop out of your study, and this leads to an inflated measure of your effect. For example, if as a result of a stricter attendance policy, most students drop out of a class, leaving only serious students in the class (those who would participate at a high level naturally) - this could mean your effect is overestimated and suffering from a mortality threat (Trochim, 2006). The loss of subjects through dropout often occurs in long-running experiments and may result in confounding the effects of the experimental variables, for whereas initially the groups may have been randomly selected, the residue that stays the course is likely to be different from the unbiased sample that began it.

   This threat was controlled in this study by assuring all the participants in the experimental and control groups that they will both benefit from the learning in an equal way. The learners to the two groups were also randomly selected and none left.

3. **History**: This threat can occur when a historical event affects your program group such that it causes the outcome you observe (rather than your treatment being the cause). Such events can produce effects that can mistakenly be attributed to differences in treatment in time between pre-test and post-test observations (Trochim, 2006).

   During the time of the learning process in this study, no major event took place to disturb the study. The researcher had to identify a time frame for the study to take place in which no any external events or changes had to occur.

4. **Maturation**: This is a threat that is internal to the individual participant. It is the possibility that mental or physical changes occur within the participants themselves that could account

for the evaluation results (Trochim, 2006). In general, the longer the time from the beginning to the end of a study the greater the maturation threat. For example, if by chance, the students who are participating in the study on class participation all "grew up" naturally and realized that class participation increased their learning, that could be the cause of your increased participation. Maturation between any two observations subjects change in a variety of ways. Such changes can produce differences that are independent of the experimental treatments.

In this study the amount of time was shortened, the study was done in 6 weeks in order limit maturation.

5. **Testing**: This is simply when the act of taking a pre-test affects how that group does on the post-test. The administration of a pretest prior to the program may convey knowledge to the participants. Such effects can include sensitizing subjects to the true purposes of the experiment and practice effects which produce higher scores on post-test measures (Campbell & Stanley, 1963). Students may become forewarned that there is an emphasis on participation, they may increase it simply as a result of involvement in the pre-test measure – and thus, your outcome could be a result of a testing threat and not treatment.

   To control this threat the researcher kept an eye on this threat by not telling the participants that there would be a post-test and that the results would be compared to those of the other group.

6. **Diffusion or imitation:** this occurs when individuals in the intervention group interact with those in the control/comparison group. Such cross-contamination via sharing of

information can lessen the differences between the intervention and control/comparison group (Cohen, et al., 2011).

In this study this factor was avoided in that there was no contact between the experimental group and the control group when the intervention was introduced. The two groups were kept as far apart as possible.

7. **Regression**: This is the tendency of extreme pre-test scores to revert back toward the population mean, such that when individuals are selected for programme participation based on extreme pretest results their posttest scores will tend to shift toward the mean score, regardless of the efficacy of the programme (Cohen, et al., 2011).

   This was avoided by not selecting participants based on extreme performance or scores, the participants were randomly selected from a population of 400 learners.

3.11.2 Reliability

Reliability is the consistency of your measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. In short, it is the repeatability of your measurement. The pilot study of the Cell division test was conducted three weeks before the main study.

The aim of the pilot study was to determine whether the test instrument developed for the main study was appropriate for the context aimed at in terms of its content and structure. It also sought to test the effectiveness or otherwise of the research methods in order to ascertain the possible weakness in the instrument. In addition, the pilot study helped me to explore the suitability or otherwise of the statistical procedures to be used to analyze and interpret the data gathered in the main study. In order to establish reliability an external consistence procedure of a test retest method

was used in this study. Test-retest reliability refers to the temporal stability of a test from one measurement session to another. The procedure is to administer the test to a group of respondents and then administer the same test to the same respondents at a later date. The correlation between scores on the identical tests given at different times operationally defines its test-retest reliability. Test/Retest is the more conservative method to estimate reliability of the instrument.

The three main components to this method according to cook and Campbell (1979) are that you implement your measurement instrument at two separate times then compute the correlation between the two separate measurements. A test/retest assume there is no change in the underlying condition (or trait you are trying to measure) between test 1 and test 2.

The participants in the test/retest of this study were eight grade twelve pupils from another school in the same district where the study was to take place. The participants of the pilot study had already completed the cell division topic.

The coefficient of reliability falls between 0 and 1, with perfect reliability equaling 1, and no reliability equaling 0. The general rule is that reliability greater than 0.8 are considered as high (Downing, 2004). In this study coefficient ratio of the test/retest was found to be 0.85.which tells us that the instrument used in the study was reliable.

Despite its appeal, the test-retest reliability technique has several limitations (Rosenthal & Rosnow, 1991). When the interval between the first and second test is too short, respondents might remember what was on the first test and their answers on the second test could be affected by memory. Alternatively, when the interval between the two tests is too long, maturation happens. Maturation refers to changes in the subject factors or respondents (other than those associated with the independent variable) that occur over time and cause a change from the initial measurements

to the later measurements. During the time between the two tests, the respondents could have been exposed to things which changed their opinions, feelings or attitudes about the behaviour under study. To overcome this challenge in this study the two tests were administered a week apart. This difference in time was neither too short to make the participants remember the test or too long to enable them to gain much knowledge in the topic.

3.12 Summary

This chapter has presented the methodology used in this research in terms of research design, target population, sample size, sampling procedure, research instruments, data collection procedure, data analysis, ethical issues, and validity and reliability. The next chapter presents the findings of the study.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Overview

This chapter presents the findings of the study on the effectiveness of the "mit-meio" video instructions in learning of o-level cell- division and memory retention-a case of a selected secondary school in Kafue district. The findings are presented quantitatively and qualitatively, according to the objectives of the research. The three main objectives were; to compare the performance between learners who use the mit-meio video instruction as a supplement to traditional instruction and those who learn using traditional instruction only, to compare memory retention between learners who use the mit-meio video as a supplement to traditional instruction and those who learn using traditional instruction only and to establish learner's perceptions on mit-meio video instructions.

4.2 Research question 1.

How do learners who use the mit-meio video instructions as a supplement to traditional instruction perform on cell division compared to those who learn using traditional instructions only?

a) Pre-tests performance on cell division between the two groups

Table 1 below shows the sample statistics for the pre-test given to the learners before learning took place.

Table 1. Sample statistics for pre-test

Group	N	Mean	Std. Deviation	Mean difference	t	df	Sig.(2-tailed)
Experimental group	**41**	**19.2683**	**9.65408**	**-1.8292**	**-0.713**	**40**	**0.480**
Control group	**41**	**21.0976**	**10.75362**				

The sample t-test was conducted for the Pre-test given. Table 1 shows the mean, number of learners, standard deviation and mean difference for the experimental group and the control group. For the experimental group the mean was 19.2683, N was 41 and standard deviation was 9.65. For the control group the mean was 21.0976, N was 41 and standard deviation was 10.75. The level of significance was set at 0.05 ($p<0.05$). The analysis of data showed that t-calculated was - 0.713. The critical value from the table was 0.480. This means that, there was no significant difference in performance between the control group and the experimental group before introducing video instructions, both samples were at the same level in terms of their prior knowledge in the cell division topic.

a) **Post-tests performance on cell division between the two groups.**

Table 2 below shows the sample statistics for the post-test given to the learners after learning took place.

Table 2. Post-test performance statistics on cell division between the two groups

Group	N	Mean	Std. Deviation	Mean difference	t	df	Sig.(2-tailed)
Experimental group	41	58.1707	17.66904	25.85366	7.133	40	0.000
Control group	41	32.3171	15.25195				

The sample t-test was conducted for the post-test given. Table 2 shows the mean, number of learners and standard deviation for the experimental group and the control group. For the experimental group the mean was 58.1707, N was 41 and standard deviation was 17.66904. For the control group the mean was 32.3171, N was 41 and standard deviation was15.25195. The level of significance was set at 0.05 ($p<0.05$). The analysis of data showed that t-calculated was 7.133. The critical value from the table was 0.000. According to this data the calculated t-value (7.133) was greater than the critical value from the table (0.000). This means that, there was a significant difference in performance between the control group and the experimental group after introducing video instructions, the two groups were not at the same level in terms of their knowledge in the cell division topic. The changes in perfomance that occurred were due to the intervention that the researcher used.

4.3 Research question 2.

How is the memory retention of learners who learn using the mit-meio video instruction as a supplement to traditional instructions to those who learn using traditional instructions only?

Table 3 below shows the sample statistics for memory retention given to learners in the two group after a period of three weeks from the date of post test.

Table 3. Memory retention sample statistics

Group	N	Mean	Std. Deviation	Mean difference	t	df	Sig.(2-tailed)
Experimental group	41	53.2927	16.53064	6.58537	1.631	40	1.111
Control group	41	46.7073	17.76970				

The sample t-test was conducted for the memory retention test given. Table 3 shows the mean, number of learners and standard deviation for the experimental group and the control group. For the experimental group the mean was 53.2927, N was 41 and standard deviation was 16.53064. For the control group the mean was 46.7073, N was 41 and standard deviation was 17.76970. The level of significance was set at 0.05 ($p<0.05$). The analysis of data showed that t-calculated was 1.631. The critical value from the table was 0.111. According to this data the calculated t-value (1.631) was greater than the critical value from the table (0.111). This means that, there was a significant difference in performance between the control group and the experimental group after introducing video instructions, the two groups were not at the same level in terms of retaining the content which they had learned two weeks before writing the test on the cell division topic.

Findings were also shown graphically as figure 2.

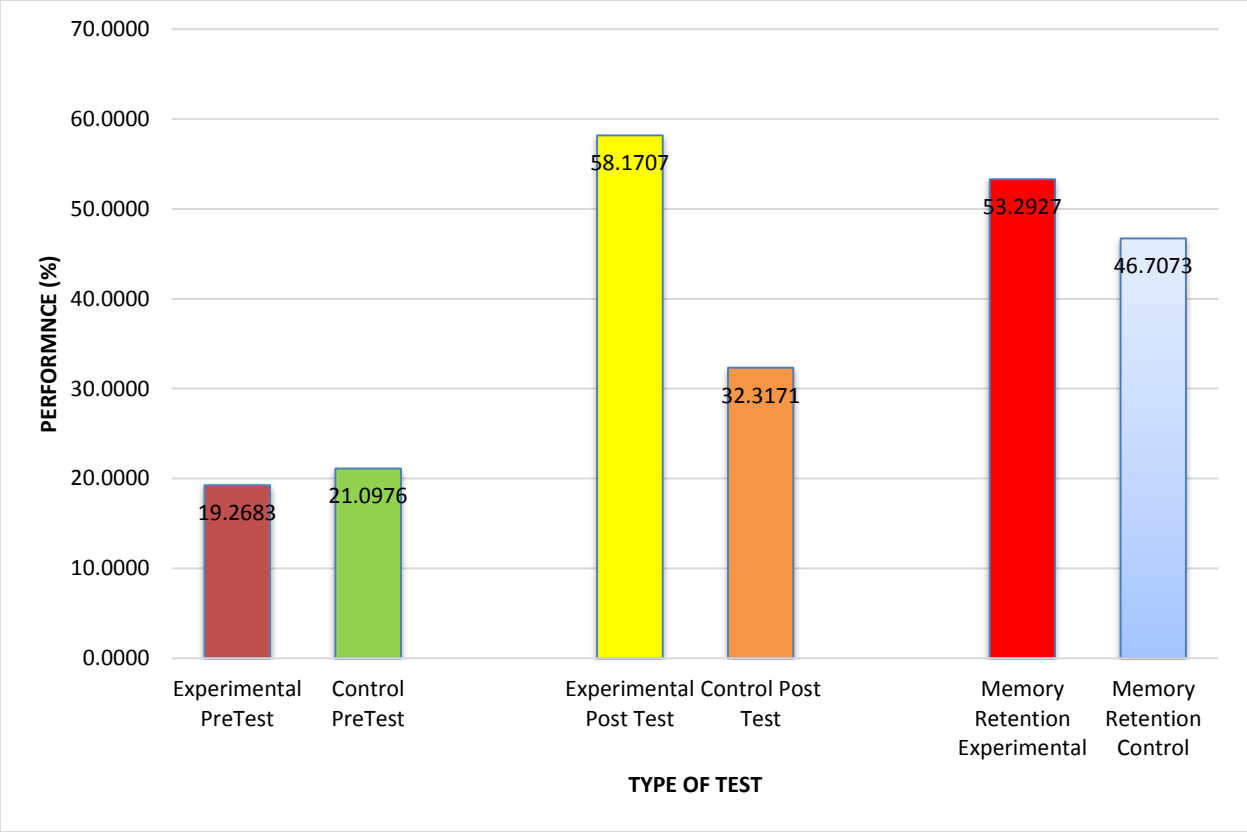

Figure 2. Graph of mean in pre-test, post-test and memory retention

4.4 Research question 3.

What are the learner's perceptions of video enhanced instructions?

Findings from focus group discussion.

Learners reported various perceptions regarding the use of video in the lerning of cell division.

4.4.1 Learners interest in the use of video instructions

The study showed that the learners who used video instruction found the learning more interesting and better than traditional instruction.

On the question of how interesting they find the use of video facilities in the learning of cell division, one grade twelve pupil said:

> *"Yes, yes it is very interesting in that we see what the teacher is teaching and not just listening to the teacher and writing notes"*

Another learner answering the same question went on to say:

> *"Ah, madam the video thing itself is not something that we can just watch when a teacher is teaching. I think even the way work is being shown or presented on power point is also quite important and makes the learning interesting, because we usually see what the teacher is explaining".*

According to the learners views the use of video when learning cell division was more interesting than when they learn using the tradition way of a teacher standing in front of them and explaining on how cell division occurs.

4.4.2 Better understanding of content

On the question of how helpful learners find the use of video facilities in understanding of the concepts of genetics (cell division), one of the learners had this to say:

> "*Just the way we are advised to use different materials when we are studying, if for example a teacher brings a video to use when teaching, we will be able to understand the topic from different perspectives"*

Another learner responding to the same question on better understanding of content when video instructions are used, saying:

When you are watching a video you get to understand better because words are explained in action.

"The other reason madam, they make the lesson to be understood better because words are explained in action."

Therefore, when videos are used as a supplement to traditional instruction, learners understand the content better.

4.4.3 Advantages of using video instructions.

The learners were further asked to say what they regarded as any advantages associated with the use of video instructions in the learning of cell division. Some of their responses were that the use of a video has the capacity of being paused and repeatedly listening to it. One of them stated:

"Videos are good in that you can pause a video, but you can't pause a teacher. And when a teacher teaches on something……. that is, they can't repeat that lesson even if you've not understood, but with a video you can rewind to listen to what you missed without any words being changed"

Another learner added that:

"The fact that we are living in a technical world, a lot of people are more interested in technology other than using books, where a teacher comes, tells you to read from the book. Our minds finds it better when it's watching a video"

In the discussion time, learners added that they find it easy to understand when a teacher teaches using a video where they are able to see what is being talked about.

One learner stated:

"Time also is saved when using a video, because if at all a video is shown you understand better and not going back to the books on and on".

Another learner explained that:

> *"It's also easy for teachers to teach, instead of them going to the board to write down with a marker ,so when you have a video you just point then explain on what is being watched".*

From the views of the participants who responded to the question on advantages of video instructions, it came out that learning using a video has advantages than the use of tradition instructions only.

4.4.5 Disadvantages of using video instructions

However, like any other instructions used in learning, not all is good about video instructions according to some of the interviewed learners, teaching using video instructions makes some teachers to become lazy, some other learners responding to the same question ,access to recommended videos by teachers can prove to be difficult in that the streaming down of a video to a portable device like a phone can prove to be so difficult in that there is need in the first place to have a phone where you can be able to watch a video, in addition there is need to download the video which can be expensive to some learners who can't afford to buy talk time or bundles. To this effect one learner complained:

> "*Some teachers can become lazy when teaching using a video, and this would make us the learners to lose out. Instead of a teacher explaining more on a particular*

topic, they can just bring in a video, make us watch and off they go. And that can be bad madam"

4.4.6 Changes that can make learning using video instructions more meaningful

Findings indicated that the video instructions being considered to be useful in class should be audible enough, shown at a reasonable rate, must be clear enough and the language used must be easy to understand, should be colorful to attract attention of learners and must be a representation of reality.

One grade twelve pupil for example when asked a question on changes that can be made to improve the use of video instruction facilities in the learning of cell division, said:

"Madam when the teacher is teaching using the video, it should be loud enough and should be clear also"

Another learner said:

"Ah ah…they should also be easy to understand, they should also have bright colors"

Improvements can be done by teachers to select a good video to be used in class, as suggested by the two learners. Video instructions must be audible enough to reach the learners watching, must be explained in simple language for the learner to find it easy to understand and must be made of bright colours to attract the learner's attention.

4.4.7 Findings from the observations

A number of things were observed about the experimental group, firstly participants were very punctual for lessons and the class attendance was good as can be seen from the number of learners who sat for a pre-test the same number sat for the post-test and the memory retention test. Once the learners were in class, the teacher went on teaching using traditional instructions which mainly was lecture and discussion methods, then watched a video on what was taught. The behaviour of the learners in the experimental group was fairly good. The attention to the learning process was high and no learner was seen to be reluctant in the time of learning, especially when the video for the learning instruction was playing.

The performance in the post-test was far better than that of the learners in the control group as can be seen from the difference in the mean between the two groups in Table 4. The learners in the control group also showed the zeal in learning in that they were willing to be watching the video instruction and listening to the teacher's explanation even after the learning time was over.

The learners in the control group were also punctual for lessons just as those in the experimental group. This group was not given the treatment as the experimental group. They learnt the same content on cell division but using traditional instructions only.

The attention to the learning process was observed to be a little bit lower than in the experimental group. This was seen in the repetitive way of the teacher telling them to stop making noise. After writing the post-test, their performance was lower than for the experimental group.

4.5 Summary

The findings from the field were presented quantitatively and qualitatively in this chapter, as provided by learners who took part in the study. According to the presented findings, the mit-meio video was found to improve performance by about 26 and the memory retention by about 7. The attitude of learners towards video instructions was generally found to be positive.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Overview

This chapter discusses the research findings based on the purpose of the study which is to investigate the effectiveness of using the "Mit-Meio" video instructions in learning of O-level cell division on grade twelve biology pupils and the impact of the video on learner's memory retention. The discussion is also based on the objectives which were: (1) To compare the performance between learners who use the mit-meio video instruction as a supplement to traditional instruction and those who learn using traditional instruction only. To compare memory retention between learners who use the mit-meio video as a supplement to traditional instruction and those who learn using traditional instruction only. (3) To establish learner's perceptions on mit-meio video instructions.

5.2 Performance and memory retention of learners on cell division topic

The results in Table 1, Show a slight difference in the mean scores between the two groups. The Sample t-test was conducted for the Pre-test on cell division. The level of significance was set at 0.05 ($p<0.05$). Comparison between the mean score for Pre-test between experimental group and control group are shown in the same Table. In the pre-test analysis the t-calculated value was -0.713 and the critical value from the table was 0.480. Table 1 shows that there is no significant difference between the two groups. These results indicates that both samples (experimental and control group) were at the same level in terms of their prior knowledge in the cell division topic.

The post-test results are shown in table 2. The experimental group was higher (58.1707) than that of the control group whose mean was (32.3171). The sample t-test was conducted for the post-test given. The level of significance was set at 0.05 ($p<0.05$) like in the pre-test. Comparison between the mean score for Pre-test between the experimental group and the control group are shown in the same Table 2. The analysis of data shows that the experimental group outperformed the control group by a big margin of 25.86. Table 3 shows the results in memory retention of learners in both groups. The results on memory retention indicate that learners in the experimental group outperformed those in the control group with the mean difference of 6.58.

Video instructions have positive impacts on learners' learning outcomes such as learner's performance and memory retention. Effectiveness of video instructions on learners' post performance and post memory retention has been shown statistically in this study. Analysis of the descriptive and inferential statistics of the t-test showed that the treatment group had gained high scores in their post-test and post memory retention test than the pre-test where both group performance was same. These results indicate that video instructions enhance performance and memory retention on the learning of cell division topic. The mean difference between the experimental group and the control group was not as high as the difference in performance, the minimal difference in memory retention might be attributed to the fact that during the break, learners in the control group who were not taught using the video might have spent the time studying hence almost performing well as the experimental group. However t-test analysis of the data collected showed that there was a significant difference in learner`s performance and memory retention between the group who learnt with video instructions and the group who learnt using traditional instructions only. The group which had video instructions as supplement to traditional

instructions attained significantly higher scores in the post-test and post memory retention test compared to the group which leant using traditional instructions only.

The findings of this study are supported by the findings of previous similar studies that showed that realistic simulation or 3D multimedia simulation has positive impacts on learner`s performance, understandings and memory retention compared to students who learn using traditional teaching method only (Kiboss, 2002; Kiboss & Ogunniyi, 2003; Kiboss, Ndirangu & Wekesa, 2006; Tanui, 2003). Multimedia allows students to view actual objects and realistic scenes, see sequences in motion, and to listen to narration (Nazir, Rizvi & Pujeri, 2012). The mit-meio video allowed learners to view the cell in 3-dimention as cell division was happening in the video, this gave the learners a better understanding of the content.

5.3 Perception of learners on video instructions

The study also set out to investigate the Perceptions of learners on video instructions in the learning of cell division.

The majority of respondents regarded the learning of cell division using video instructions in addition to traditional instructions to be interesting as compared to learning using traditional instruction only. The study also revealed a number of factors which makes the learning of video instructions to be interesting to learners. One of the reasons cited were that learners are able to see what the teacher is teaching and not just listening to what the teacher is saying. On the same point learners confessed that video instructions is not something which they just watch when a teacher is teaching. The way work is shown or presented on power point is also quite important and makes the learning interesting, because learners are able to see what the teacher is explaining. The study also revealed a number of advantages involved in using video instructions when learning cell

division. Some advantages mentioned included learners opportunity to understand the topic from different perspectives, they make the lesson to be understood better because words are explained in action, and Videos can be paused and replayed to listen to what the learner missed.

In the study time was also reported as an advantage of using video instruction, learners also added that they find it easy to understand when a teacher teaches using a video where they are able to see what is being talked about.

However, like any other instructions used in learning, not everything reported was good about video instructions according to some of the interviewed learners, what came out of the study is that the teaching using video instructions makes some teachers to become lazy. Access to recommended videos by teachers can prove to be difficult in that the streaming down of a video to a portable device like a phone can prove to be so difficult in that there is need in the first place to have a phone where you can be able to watch a video, in addition there is need to download the video which can be expensive to some learners who can't afford internet or data bundles.

The study also revealed a number of changes that can be done to improve the learning using video instructions which included making them audible enough, not showing at a fast rate, must be clear enough and the language being used must be easy to understand, should be colorful to attract attention of learners and must be a representative of reality.

5.4 Summary

The results of this study showed that there is better learner achievement and memory retention in biology when students use the mit-meio video instruction in addition to traditional instruction in the learning of biology as can be seen from the result in table 2 above. The study also revealed an enormous positive attitude of learners towards the use of video instructions used in the study. This

came from learner's views on what they think about video instructions as compared to tradition instructions used by most teachers.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

This chapter concludes the study and also makes recommendations based on the major findings of the study.

6.2 Conclusion

The mean difference in the pre-test was 1.82927 and was statistically insignificant. The mean difference in the post-test was 25.85366 and was statistically significant. These finding indicates that the Mit-Meio video instructions has a positive effect on learners' academic performance. This is in line with Gadner`s theory that The power of video instructions is in its multi-sensory ability which stimulates many senses of the learners, This multiplicity means that video communicates the same information to students through simultaneous learning styles and can provide students with "multiple entry points" (Gardner, 2006) into the content. The mean difference in memory retention was found to 6.58537. After data analysis this also showed to be significant. These findings on memory retention were in line with (Miller, 2011) who found that learners get engaged in tasks while exposed to images or text which have a great influence over subsequent recall.

6.3 Recommendations

(i) For pupils' better academic achievement and positive attitude development, the mit-meio video instructions should be used in teaching cell division topic.

ii) Teachers of biology should adopt the use of video instruction and take up a role in selecting appropriate videos on specific topics. This will enable them to cater for diverse learning styles of students in their classrooms as this, will improve academic achievements in Biology.

iii) Government should provide more funds and grants to equip laboratories, studios and workshops that will facilitate production of multimedia instruction.

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APPENDICES

Appendix A: Test

DURATION: 30MINUTES

***INSTRUCTIONS*:**

1) **This paper has two sections A and B section A has 10 multiple choice question. For each question there are four possible answers A, B, C, and D. Choose the answer you consider correct and circle it.**

2) **Section B has 10 questions. Write the answer in the spaces provided in the question paper.**

SECTION A

1. Which of the following happens when a cell divides?

A. The cell's volume increases.

B. It becomes more difficult for the cell to get rid of wastes.

C. Each daughter cell receives its own copy of the parent cell's DNA.

D. It becomes more difficult for the cell to get enough oxygen and nutrients.

2. The 5 stages of the cell cycle in order are

A. Interphase, Prophase, Telophase, Anaphase and Metaphase.

B. Interphase, Anaphase, Prophase, Metaphase and Telophase.

C. Interphase, Prophase, Metaphase, Anaphase and Telophase.

D. Interphase, Metaphase, Anaphase, Prophase and Telophase. .

3. How many chromatids make up a chromosome?

A. 2

B. 4

C. 3

D. 1

4. During which phase of mitosis do chromosomes become shorter and thicker (condense)?

A. Interphase

B. Telophase

C. Prophase

D. Metaphase

5. During which phase of mitosis do the chromosomes line up along the middle of the dividing cell?

A. Prophase

B. Telophase

C. Metaphase

D. Anaphase

6. During normal mitotic cell division, a parent cell that has four chromosomes will produce two daughter cells, each containing

A. Two chromosomes.

B. Four chromosomes.

C. Eight chromosomes.

D. Sixteen chromosomes.

7. An insect has 42 chromosomes in each of its muscle cells. How many chromosomes are there in its egg cells?

A. 42

B.30

C. 25

D. 21

8. Which of the following does not occur during the process of mitosis?

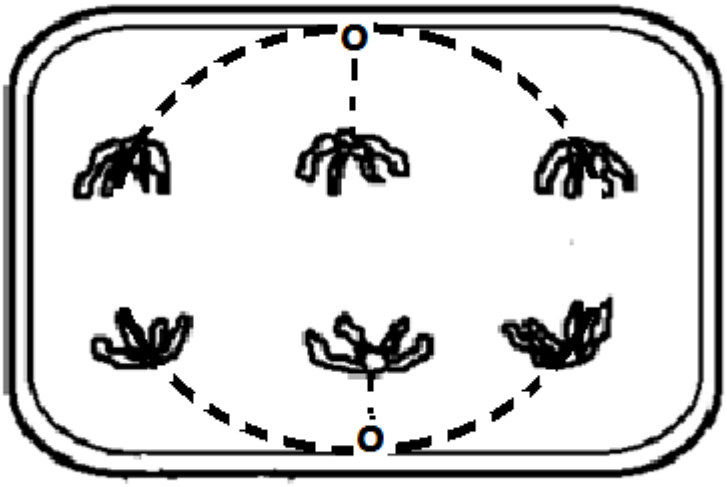
A. Chromosome replication

B. Formation of spindle fibers

C. Cross-over

D. Cytokinesis

9. The diagram below shows a stage in cell division.



How many chromosomes will be present in each daughter cell after this division?

A. 6 chromosomes as a result of mitosis.

B. 6 chromosomes as a result of meiosis.

C. 3 chromosomes as a result of meiosis.

D. 3 chromosomes as a result of mitosis.

10. One of the advantages of meiosis is that

A. it ensures that there is a diploid number of chromosomes during fertilization.

B. it plays a vital role in growth and repair.

C. Asexual reproduction occurs.

D. There is cell multiplication at the end of cell division.

SECTION B

INSTRUCTIONS: ANSWER ALL QUESTIONS. WRITE DOWN THE CORRECT ANSWER IN THE SPACE PROVIDED.

11. At what stage in mitosis would you find two nuclei in a cell? _____

12. Give a reason why meiosis takes place only in organisms that reproduce sexually? _____ .

13. When do the centriole's spindle move chromosomes to the middle of the cell? _____

14. During which phase of mitosis does chromatin change to chromosomes?

15. State one difference between mitosis and meiosis _____.

16. During which stage of the cell cycle does DNA replication occur?

_____.

17. What name is given to the number of chromosomes found in a reproductive cell?

_____.

18. What is the longest stage of the cell cycle? _____.

19. Mention one part in animals where meiosis takes place. _____.

20. If an organism has 100 chromosomes, how many chromatids would the organism have during metaphase? _____.

Thank you for your participation.

Appendix B: Focus Group Discussion Guide

I would like to have a discussion about your view of the use of video in the teaching learning process at your School. There are no right or wrong answers. Please share your true opinions and feelings with me. The discussion will be kept confidentially. Please feel free to participate.

1. In which ways do you and your teachers use the video facilities in learning of genetics?

2. Do you find the use of video facilities in the learning of genetics interesting?

3. How does the use of video facilities help you understand the concepts of genetics?

4. Do you think most teachers should use video facilities in the teaching of genetics?

5. Are there any challenges in using video facilities? If yes what should be done to overcome the challenges.

6. What do you think should change in the way these video facilities are used in teaching and learning activities? Why should it change?

Thank you for your time and participation!

Appendix C: Observation Schedule

OBSERVATION OF LEARNING

CODING: a. not at all.

b. in rare cases.

c. most of the times.

d. all the times.

1. Pupils report for lesson.

a.	b.	c.	d.

2. Pupils report for lesson on time.

a.	b.	c.	d.

3. Pupils are well behaved during the lesson.

a.	b.	c.	d.

4. Pupils able to interact with learning video instruction during lesson.

a.	b.	c.	d.

5. Pupils able to answer the exercise correctly after learning using video.

a.	b.	c.	d.

6. Pupils show interest in learning in a class with video than the class without video.

a.	b.	c.	d.

7. Pupils perform better in a class with the mit-meo video than in a non mit-meo video class.

a.	b.	c.	d.

Record of any other relevant information on the differences in performance and memory retention between pupils using a mit-meio video and those that are not. _____

Appendix D: Raw Data

EXPERIMENTAL GROUP **CONTROL GROUP**

CANDIDATE NUMBER	PRE-TEST SCORE	POST-TEST	CANDIDATE NUMBER	PRE-TEST SCORE	POST-TEST
1	25	70	**1**	15	25
2	15	55	**2**	35	20
3	20	50	**3**	10	25
4	5	35	**4**	35	25
5	10	65	**5**	25	25
6	15	20	**6**	20	45
7	15	55	**7**	20	30
8	15	70	**8**	15	20
9	15	100	**9**	20	65
10	20	65	**10**	15	25
11	35	75	**11**	20	35
12	20	45	**12**	25	20
13	20	90	13	20	25
14	15	65	**14**	15	35
15	5	30	**15**	30	20
16	10	35	**16**	30	55
17	25	60	**17**	15	10
18	20	35	**18**	20	30
19	20	40	**19**	50	60
20	15	55	**20**	55	65
21	5	65	**21**	30	35
22	30	75	**22**	10	30
23	45	70	**23**	15	30
24	15	70	**24**	20	25

25	15	55	**25**	10	30
26	25	55	**26**	10	70
27	15	50	**27**	10	25
28	30	65	**28**	20	30
29	10	10	**29**	25	25
30	10	65	**30**	10	10
31	15	50	**31**	15	20
32	20	65	**32**	20	30
33	20	65	**33**	20	65
34	35	90	**34**	15	15
35	15	65	**35**	25	30
36	20		**36**	10	20
37	20	60	**37**	10	25
38	10	60	**38**	45	35
39	20	55	**39**	15	25
40	25	60	**40**	15	40
41	50	70	**41**	25	50

Appendix E: Consent Form

I am a student at the University of Zambia, pursuing a Master of Educational with science education. I am conducting a study on the effectiveness of the "mit-meio"video enhanced instructions in the learning of o-level cell division and on memory retention at Naboye Secondary schools in Kafue. I need to get your honest opinion in order for me to accurately write on the above topic. The Ministry of General Education Science, has authorized the study. Be assured that the information you will give will be kept confidentially. If you are willing to participate in this study, please write your name in the spaces provided below. Should you feel at any point of the study that you cannot continue to participate, you are free to withdraw from the study.

Participants

Name: ……..

Sign: …….

Date: …….

School …….

Researcher

Name ……..

Sign: …….

Date …….

School …….