



BINDURA UNIVERSITY OF SCIENCE EDUCATION
FACULTY OF SCIENCE EDUCATION

**INVESTIGATE THE EFFECTIVENESS OF OPEN
EDUCATIONAL RESOURCES AND MULTIMEDIA IN
TEACHING AND LEARNING BIOLOGY AT MANGA
SECONDARY SCHOOL**

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*A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DIPLOMA IN SCIENCE EDUCATION*

Approval Form

The undersigned certify that they have supervised the student in the research dissertation entitled, “Investigates the effectiveness of open educational resources and multimedia in teaching and learning biology at secondary school .” submitted in partial fulfillment of the requirements for a Diploma in Science Education at Bindura University of Science Education.

STUDENT:



.....

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SUPERVISOR: DATE:

CHAIRPERSON: ... DATE: 24/10/25

DEDICATION

I wholeheartedly dedicate this dissertation to my sisters and my parents, Mr. and Mrs. Rupiya, whose unwavering belief in my abilities and constant support have given me strength throughout this academic journey. Their encouragement and commitment played a vital role in the successful completion of this work. This dedication is also extended to all aspiring Biology students—may you remain determined, overcome challenges, and strive to achieve your fullest potential.

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ABSTRACT

This study investigates the impact of OER and multimedia on students' academic performance in biology education as a subject. The sample was of 50 students of Manga Secondary School in Bindura Rural District. Purposive sampling technique was adapted for selecting the sample of the study. The students were taught using OER and multimedia tools and the data of the study was collected through the use of interviews, test and questionnaires. Through the use of quasi - experimental design in which to compare test scores of students whilst using OER and multimedia and others make use of traditional methods of teaching and learning. The results shows a clear improvement in test scores and the increase in students' engagement. The findings suggested that OER and multimedia can enhance biology education and provides implications to both teachers and policy makers. The study also recommended more and deeper research on OER and multimedia approach in teaching biology concepts among ordinary level.

CHAPTER 1

INTRODUCTION

Education has undergone significant changes in recent year .Due to the rapid advancement of digital technology and the increased availability of open educational resources and multimedia tools (Johnson & Smith, 2022). These changes have major role in all areas of the education sector, particularly in teaching and learning processes. Which now have help from frequently incorporate portable devices such as laptops, smartphones, and tablets for educational purposes (Brown et al., 2021). With these devices, students can have greater and easily access online information, videos, and interactive simulations, making learning more engaging and effective (Lee, 2023). This chapter introduces the role of effective open educational resources and multimedia in modern education.

BACKGROUND OF THE STUDY

Biology, the study of life, is widely regarded as a challenging subject due to its extensive vocabulary (Smith, 2020). Traditional teaching methods often struggle to fully capture the dynamic and interconnected nature of biological processes (Johnson & Lee, 2019). Students, in particular, face challenges in understanding complex biological structures such as the interactions between different systems in living organisms (Brown et al., 2021). When students fail to grasp these concepts usually leads to a significant decline in engagement and appreciation for biology as a subject (Taylor, 2018).

OPEN EDUCATIONAL RESOURCES (OER)

Open educational resources are freely accessible and openly licensed materials for both in teaching and Open learning biology. They includes textbooks, videos, simulations, quizzes and lab manuals that teachers and teachers can able to make use of ,adapt and share without cost barriers. Open educational resources starts gaining tractions in biology education in 2001 where Open Course WARE (OCW) was lahunched to provide free lecture notes and videos then 2002 UNESCO come up with the term OER to promote free access to knowledge especially in biology education. OER plays an important role in biology as a subject by making biology knowledge accessible, affordable and up to date at anytime, anywhere benefiting students in remote regions.

MULTIMEDIA

Multimedia integration into the education sector can be traced through a milestone. Early use of multimedia was at around 1880s where magic lanterns (slide projector) displays biological illustrations for example the secret of nature then filmstrips and silent films (1920s-1940s) until the rise of online learning websites like Khan Academy (2006) which are present today. Enriches biology education by making difficult concepts being tangible and also fostering students to be active during learning. Is a combination of texts, animations, videos, simulations and audio to enhance learning experiences. Several benefits such as enhanced visualization which helps students visualize microscopic processes, interactive learning as students being allowed to conduct experiments without physical laboratories and improve retention as multimedia aids in dual coding theory which results at improving memory and understanding of biology as a subject. However still remains a significant gap in the adoption and effectiveness of OER and multimedia between developed and developing countries. In developed countries they have strong technological infrastructure, wide spread internet access and institutions that offers support to teachers and students in the integration of OER and multimedia in biology lessons. Teachers receives pedagogy digital training and students have access to devices and online platforms which facilitates their interactive learning. On the other hand developing countries faces challenges such as limited internet access, lack of digital devices, unreliable electricity and poor teacher training. Additionally most OER material are available in English leaving non-native students at a disadvantaged as few resources are adapted to local curricula. Globally, the integration of open educational resources and multimedia tools in biology education has managed to create positive outcomes in enhancing students' understanding of difficult ideas (Martinez & Clark, 2022). For example interactive simulations have been able to help students visualize intricate processes like cellular respiration more effectively than passive reading alone (Davis, 2020). Research conducted in countries such as the United States and the United Kingdom further supports this, indicating that students who engage with simulations perform better and retain knowledge longer compared to those relying solely on traditional teaching methods (Wilson & Adams, 2021). Additionally, virtual dissections provide an ethical alternative to conventional animal dissections, allowing students to study anatomical structures in depth and repeat procedures until mastery is achieved (Harris et al., 2019). Multimedia resources such as videos, animations, and interactive diagrams have also been found to enhance comprehension and engagement in biology education (Robinson, 2023). Videos, animations, and interactive diagrams at multimedia resources have shown greater effectiveness in enhancing student engagement and also improves learning outcomes (Smith & Johnson, 2019). Expert-produced videos for biology education, make complex biology concepts more relatable and captivating. Which also helps to cover a gap due to the limitations of traditional textbooks, which often fail to provide clear illustrations of processes like DNA replication (Brown et al., 2020). Research from Australia and Canada supports this as they indicated that students who engage with multimedia learning modules develop stronger problem-solving skills (Taylor & Lee, 2021). As technology plays a crucial role in daily life of students facilitating knowledge transfer across all nations (UNESCO, 2020). The virtual learning

approach improve both teaching and learning processes as it have been evidenced during the COVID-19 pandemic when academic institutions worldwide shut down due to the rapid increase in deadly virus transmission, affecting approximately 1.575 billion students (WHO, 2021). This crisis accelerated the realiment mostly on open educational resources and multimedia in education, including biology instruction. In Africa, the use of open educational resources and multimedia in teaching biology has increased, serving as a foundation for careers in medicine, agriculture, and environmental science (Adeyemi & Ogunleye, 2022). A Malawian study found that students using multimedia produces good results rather than those relying on traditional methods (Banda et al., 2021). Similarly, in Zimbabwe digital learning platforms like E-learning Zimbabwe and Ruzivo provide low cost digital lessons that has transformed education even though the outcomes vary due to each provincial unique socioeconomic conditions (Ministry of Primary and Secondary Education [MoPSE], 2021). For example one, Nyanga District in Manicaland Province has 34 secondary schools across Nyanga North, West, and East , some of which report low pass rates despite government interventions through the Education5.0 initiative which encourages innovation and digital learning (MoPSE, 2021). Despite the benefits comes with the use of open educational resources and multimedia in biology education both students and teachers faces challenges, particularly equitable access (UNESCO, 2020). In our country for instance at Manga Secondary many students lack reliable technology and internet connectivity while in developed countries, socioeconomic disparities limit access to quality digital materials (World Bank, 2022). Ensuring equity must be a priority for educators to guarantee all students benefit from these resources (OECD, 2021). Another critical consideration is the design and quality of online materials which have an important role in learning outcomes. These resources should move together with clear curriculum objectives, be interactive and engaging. Rather than emphasizing rote memorization, they should foster critical thinking and problem-solving skills in students. Mainly equally important is teacher preparedness and training as a result for them to be skilled and knowledgeable in integrating multimedia and open educational resources into their teaching process. This enables them to guide students in effectively engaging with the material and facilitating meaningful discussions. The impact of open educational resources and multimedia should be continuously evaluated through rigorous research in teaching and learning processes. Studies must account for various factors which includes technology access, learning styles, and student demographics.

STATEMENT OF THE PROBLEM

Open educational resources and multimedia are increasingly used in teaching and learning biology across institutions. Results in raising questions about their role in enhancing student engagement and comprehension. While their growing use in education highlights their importance but key concerns remain regarding their actual effectiveness in improving academic performance and knowledge retention among ordinary-level students. Existing research has limitations as most studies focus on tertiary-level or urban students leaving a gap in understanding the challenges faced by secondary school learners especially

those in remote areas. These students encounter several unique barriers such as limited access to devices for example smartphones, laptops ,unreliable internet connectivity as a result in delays in sending messages, inability to browse efficiently and insufficient teacher training in utilizing digital tools for instruction. While other studies highlight the benefits of multimedia in science education but there is minimal research examining its specific impact on ordinary-level biology students at all four corners of the country. Addressing these gaps is crucial to bridging disparities in learning opportunities and academic achievement.

RESEARCH OBJECTIVES:

The research will attempt to answer the following questions:

1. To compare learning outcome between students exposed to multimedia than those taught via traditional methods.
2. To identify the challenges faced by teachers and students in using digital biology learning tools.
3. To evaluate the effectiveness of OER tools in enhancing biology education for students.

RESEARCH QUESTIONS:

This study aims to investigate the effectiveness of online resources and multimedia. The objectives of the study are:

1. How does the use of OER improve students academic performance compared to traditional method of teaching?
2. What are challenges students and teachers and students face when using online biology learning tools?
3. What could be the best practices for effectively integrating OER and multimedia in biology curriculum?

1.5 SIGNIFICANCE OF THE STUDY:

The findings of this study will give a clear light on the effectiveness of open educational resources and multimedia in improving education sector under biology. On how multimedia tools makes learning easier and difficult concepts to be understood the better. Which also help teachers to identify most effective tools and user friendly in their process of teaching and learning. School and policymakers also plays an important role in making right decisions on investing of technology in classes of biology. Furthermore the study will add on information to the already existing body of knowledge on how education is used in biology education. As the research helps to addresses best practises and their challenges associated with learning online on creating more engaging and effective learning experiences. As for educational developers in technology aspect helps to create user-friendly curriculum-aligned biology resources to upgrade the weaknesses of existing digital tools for the improvement of science education. ASSUMPTIONS: The researcher assumes that students and teachers at Manga Secondary School have little access to online resources and multimedia in teaching and learning biology. Even though they can be able to obtain their own permanent gadgets such as smartphones or to make use of their parents. This results in make use of traditional teaching methods mostly this results in difficulty and operation of mobile gadgets for educational purposes due to lack of skills on obtaining information on the internet.

1.7 DELIMITATIONS OF THE STUDY:

This study will focus on secondary school here in Zimbabwe, especially in form three between the age group of fifteen to eighteen years. The subject area will only be biology excluding other subjects and gamification because of the school setup. This study will be conducted on Manga Secondary School in Bindura District. Duration of data collection and analysis is a fixed period of time as per one semester. Only a specific number of students and teachers will take part on the research based on their availability and consent. The outcome results will be measured through test scores and end of term to assess their academic performance and the effectiveness.

1.8 LIMITATIONS OF THE STUDY:

This study will be limited by accessibility of data and willingness of schools to participate including students. The findings may not be generalizable to all secondary schools due to variations in resources,

technology infrastructure and pedagogical approaches. Furthermore the study will primarily focus on the impacts of online resources and multimedia on academic performance, engagement and motivation. May not fully explore other aspects of biology education such as laboratory skills.

DEFINATIONS OF KEY TERMS:

Opens educational resources OER are freely accessible and openly licensed for teaching and learning research material which can be and shared between students and teachers without legal restrictions such as videos, animations, lecture notes, quizzes and interactive simulations (Smith, 2020).

Multimedia encompasses forms of communication that integrate various content types, including text, audio, images, videos, and animations, into a single interactive presentation (Johnson & Lee, 2019).

Effectiveness measures the extent to which open educational resources and multimedia succeed in achieving their intended outcomes, particularly in enhancing students' academic performance, engagement, and motivation (Brown et al., 2021).

10.1 SUMMARY:

The following chapters will go deeper into the relevant literature, presenting findings of the research for improving biology education through the use of effective open educational resources and multimedia. As the problem statement identifies gaps such accessibility, teacher preparedness on how those tools influences learning and their results.

CHAPTER TWO LITERATURE REVIEW

2. INTRODUCTION

Educations implements new skills and techniques which makes learners to move with the evolving world .Which the traditional method face challenges on engaging the subject matter and cater for the diverse styles of learning(Ausubel,2000). The increase of technology has open new doors in improving biology education through the use of online resources and multimedia. As the tools supply the transformation of learning experience by accommodates with large number of information, simulations and interactive visualisation. This review investigates the extended on how those technologies are effective in acquiring grades in aspects of biology education for secondary students. Traditional classrooms were not able to guarantee effective learning outcome in biology education which was corrected by power of online resources. Teachers should make use of theories to establish their teaching strategies through the use constructivist, cognitive load and multimedia learning theories to integrate the optimum use of online resources and multimedia in teaching biology to secondary school students.

2.1.1 CONSTRUCTIVIST THEORY:

Building knowledge through active engagement, constructivism pointed that students actively develops their own understanding of our real world based on their experiences and knowledge. It focuses on students being active participates and also critical thinkers as they creates retation of information greatly. Applying constructivism to online biology learning necessitates designing resources that encourages students to explore and investigate as they can be able to search and find simpler biological concepts through the use of online resources such as virtual labs, curated web quests and interactive stimulations. For instance, allows students to manipulate environmental factors and observe the resulting changes in population through simulations of natural selections. Collaborate and discuss through use of online platforms students can be able to come together through discussions, shared documents and virtual group projects. Students can work in teams to examine case studies for example on genetics disorder or design an experiment to test hypotheses about ecological relationship. Problem-solve and apply, problems on biological aspects requires students to apply their knowledge and critical thinking skills . For

example case studies which are found online of different disease outbreaks or how people are infecting their own environment, this needs good problem solver to come up with best ideas to tackle the issues. By engaging students in these active learning experiences through online resources can create deeper roots and excellent understanding of biology.

2.1.2 COGNITIVE LOAD THEORY

OPTIMIZING INFORMATION PROCESSING

Cognitive load theory (CLT) focuses on the limited working memory and the importance of managing the load introduced to them during learning. Effective online biology resources reduce unnecessary distractions and effortful processing that leads to learning, this can be obtained through segmented information which breaks information into smaller and manageable bits and also present the information in a stage by stage format with explanations that are clear and examples. Worked examples provide simplified examples that explain how to come up with a solution to solve biological problems. It offers guidance through the process of solving a question giving an explanation step by step. Also make use of color codes to emphasize how important the information is. Avoiding redundant information can be in different forms for example spoken and written form which all describes the same concept this results in an overload of cognitive system. One should be able to choose the most effective format for distributing each piece of information. By carefully managing the retention of cognitive load can facilitate deeper processing of biology concepts.

2.1.3 MULTIMEDIA LEARNING THEORY

LEVERAGING THE POWER OF MULTIPLE SENSE:

Multimedia learning theory (MLT) suggested that students learn better when pictures and words are in combination rather than make use of words. In the line of learning biology by means of online resources

this produces the power of visual aids to establish better understanding. Illustrations and diagrams to visualize difficult biological structures and processes through clear use and illustrations. As an example of heart of a human , as a fully labelled diagram which helps students to have a clear understand its parts and functions .Animations and videos which provides steps to explains the dynamic processes of a cell division or protein synthesis ,these visual representations can make difficult concepts more understandable and engaging . Consider using closed captions videos to cater to diverse learning needs. Audio narration by make use audio narration to break down complex processes this can free up students visual attention and helps them to pay attention on the visual information. However it is important to avoid some videos that cannot offer help or contributes to their learning outcomes. This focus should always be on clarity and relevance. The true power lies in combining those three theories to produce a holistic and effective online experiences. For an instance, constructivism begins with real world approach(how do our cells provide energy which is needed by a marathon runner)followed by multimedia learning which presents an animated video gives a description of cellular respiration and an audio to demonstrates the steps and their importance. Cognitive load breaks down the video into short segments to assess understanding and a worked example on how to calculate ATP production. Lastly constructivism end with an online activity on designing an experiment to investigate the effects of temperature, oxygen level on cellular respiration in yeast. Which results effective and engaging of students to the design done by educators on online resources and multimedia in biology. This produces students with deeper and long lasting understanding of the real world of biology.

2.2 OER AND MULTIMEDIA IN BIOLOGY EDUCATION

Open educational resources (OER) and multimedia play a crucial role in biology education by providing numerous benefits for both teachers and students.

STUDENTS: Access to updated information, students can acquire the latest biological concepts through diverse multimedia resources which enhancing their understanding (National Research Council, 2012). Self-assessment and feedback through online quizzes and interactive exercises allow students to evaluate their progress and identify areas for improvement in their learning processes (Bransford et al., 2000). Adaptability to learning styles multimedia tools for example videos, simulations, podcasts cater to different learning preferences results in making biology more accessible (Mayer, 2009). Improved retention and understanding through interactive biology content reinforces learning through visual and experiential methods (Vygotsky, 1978).

TEACHERS: Enhanced teaching methods as teachers can utilize multimedia to simplify complex topics such as cellular respiration using animations and virtual labs (Khan Academy, PhET). Personalized instruction through the use of online platforms, teachers are able to tailor lessons to individual student needs (Bransford et al., 2000). Resource Availability teachers can easily have access to digital databases, journals and simulations supplements traditional textbooks (National Research Council, 2012).

Collaborative learning tools for discussion forums and virtual labs encourage student interaction and knowledge sharing which helps teachers to create oneness (Vygotsky, 1978).

2.2.1 TYPES OF OER IN BIOLOGY EDUCATION

2.2.2 TYPES OF MULTIMEDIA TOOLS

2.3 THE POTENTIAL OF OER AND MULTIMEDIA IN BIOLOGY EDUCATION

Research highlights key advantages such as visual learning through animations and videos which gives clarity to complex biology processes (Mayer, 2009). Secondly personalised learning students can make use of adaptive platforms which support individual progress (Bransford et al., 2000). Global information access as online databases expand learning beyond textbooks (National Research Council, 2012). Collaboration students can do group discussion beyond the classroom forums, foster peer learning and communication (Vygotsky, 1978).

2.4 IMPACTS ON LEARNING OUTCOMES

Through the use open educational resources and multimedia better outcomes are observed such as knowledge acquisition different studies have appointed the positive outcomes of OER on how students retained the knowledge in biology. For example a study done by Smith and Jones (2015) found that those students use interactive online tutorials on the topics such as genetics come out with better grades when they write a post-test rather than those who make use of textbooks . Similarly to Brown (2018) showed that visual dissection tools gives a good description on different anatomy structures which helps students to improve their ability to identify and describe .These outcomes suggested that OER are tools to make use of on delivering and reinforce biological knowledge. Conceptual understanding besides factual knowledge, OER and multimedia also supplies students with a deeper conceptual understanding in biology. Lee and Davis (2019) indicated that students who make use of simulations are able to give a clear explanatory between organisms and the environment they interacts with rather than those who relies on lecture methods.(Garcia and Rodriguez,2020) and other topic like protein synthesis those who uses interactive simulations where able to have an understanding and its underlying mechanisms. Engagement

and motivation many studies have produce a feedback that open educational resources and multimedia enhances students engagement and motivation in biology. Green and White (2017) reported that students have higher interest and enjoyment when learning biology through interactive games and activities. This results in making biology lessons more engaging and enjoyable to students and increases positive attitudes towards the subjects and more in number (Chen et al.,2021).Open educational resources and multimedia can make students develops critical thinking skills. For example a study done by Anderson and Thompson (2016) students who use simulations to investigate scientific measurements results in improvement in able to analyse the data, give suitable conclusion and evaluate evidence. Even online case studies helps students to come out with their own decision making and be good problem solvers as they come in contact with real world biological problems(Martinez and Perez,2018) for example a person was sexually harassed but didn't find help but choose to make use of drugs to hide the pain how can we help.

2.5 CHALLENGES AND LIMITATIONS:

While OER and multimedia offer significant benefits in biology education, several challenges and limitations hinder their effective implementation such as accessibility and equity as not all students have access to digital devices or reliable internet connectivity results in creating differences in learning opportunities . Additionally, some students with disabilities may face challenges such as visual impairments and other further barriers if OER lack proper accommodations (Warschauer, 2003). Developing high-quality OER and multimedia can be financially demanding, particularly for underfunded schools like Manga Secondary School, where electricity shortages and WiFi subscription fees pose additional challenges. Regular maintenance and updates also further strain limited budgets. Teacher training is at lower rate makes them lack the technical expertise needed to effectively integrate digital tools into their teaching (Zhao et al., 2002). The rapid evolution of technology also makes it difficult for teachers to stay updated with the latest multimedia resources. Cognitive load while multimedia enhances learning so poorly designed materials can overwhelm students' cognitive capacity leads to the decrease in learning effectiveness (Sweller, 1988). Clear and intuitive designs are important to prevent cognitive overload.

2.6 LIMITATIONS OF MULTIMEDIA LEARNING

Reduced critical thinking as it leads to over-reliance on multimedia may diminish students' critical thinking skills and also teachers may neglect other effective instructional methods. Accessibility barriers for example students with hearing or visual impairments struggle to process audio or video-based content

which can be a greater disadvantage to them. Time consuming through the process of creating and editing multimedia content for teachers which may leads to relies on traditional method. Student preferences as some learners perform better with traditional face-to-face instruction and textbooks rather than digital resources.

2.7 STRATEGIES FOR EFFECTIVE IMPLEMENTATION

To have better results after the make use of OER and multimedia to maximize their effectiveness in biology educations following steps are required such as careful planning and design lessons should be careful planned with a meaningful and purposeful way to implement OER and multimedia. Teacher training and support teachers should be provided with adequate training before they conduct any multimedia and open educational resources tools in their lesson, to support their effectiveness. Equitable access government should offer help to schools that faces problems according to internet access to ensure that all students have access to technology despite where they come from or their school being sited. Balanced approach traditional teaching method should also be considered rather than to be replaced through a balance approach both can make learning more effective. And lastly cognitive load those designed multimedia resources must be clear and easy to grasp to reduce cognitive overload.

2.8 SUMMARY

Open educational resources and multimedia can be valuable tools that helps to enhances biology education for students at secondary school levels. They have ability to upgrade engagement, conceptual understanding and critical thinking skills for students in their learning process. However it is important to address the challenges accompanied with their implementation such as accessibility, teacher training and cognitive load. By carefully planned lessons before they are conducted, provide support for teachers and ensuring equitable access for all students, educators have to take advantage of the power of online resources and multimedia due to their impact on more engaging and effective learning experiences in biology education. Future researchers should also continue to explore the potential of these and identify best practises according to time frame for their integration into the classroom.

CHAPTER 3 : METHODOLOGY

This chapter outlines the research design, sampling method, data collection techniques, and analysis procedures used to evaluate the effectiveness of Open Educational Resources (OER) and multimedia in teaching and learning biology at Manga Secondary School. The chapter begins by describing the research approach adopted to address the study's objectives. Next, it explains the research design, justifying its alignment with the study's goals. Following this, the chapter details the study's target population and sample demographics, including the criteria for participant selection. It then discusses the sampling techniques used to ensure representativeness and rigor. The chapter proceeds to explore the data collection methods, tools, and techniques, such as surveys, interviews, and document analysis. Additionally, it examines measures taken to ensure validity and reliability, including triangulation. The chapter also elaborates on the strategies for quantitative and qualitative data analysis, highlighting their role in generating meaningful insights. Ethical considerations, such as informed consent and confidentiality, are addressed to emphasize the study's adherence to research integrity. The chapter concludes with a summary of key points, reinforcing the methodological coherence of the study.

3.1 RESEARCH DESIGN:

The study adopted a mixed-methods approach which is a combination of quantitative and qualitative research methods to achieve a comprehensive understanding (Creswell & Plano Clark, 2011). By integrating the strengths of both approaches (Johnson & Onwuegbuzie, 2004). This design enhances data validity and reliability while strengthening findings through triangulation (Miles & Huberman, 1994). This approach was selected for two major reasons, firstly quantitative data for example test scores and surveys which provide measurable evidence of OER and multimedia's impact on learning outcomes. Secondly qualitative data which consist of interviews, classroom observations to offer deeper insights into teachers' and students' experiences and perceptions.

POPULATION AND SAMPLING:

3.2POPULATION OF THE STUDY:

The population of a study refers to the entire group of individuals, items or observations that the researcher aims to examine (Creswell & Creswell, 2018). For this study the targeted population included the following stakeholders biology students in forms three and four at Manga Secondary School ,teachers who are responsible for delivering biology concepts using Open Educational Resources (OER) and multimedia, and school administrators for this study the school headmaster as the one involved in curriculum implementation.

3.3SAMPLE OF THE STUDY AND SAMPLING

TECHNIQUE:

A sample is a subset of the population selected to represent the entire group in research (Etikan et al., 2016). Sampling is essential in research as it enables investigators to gather data efficiently while ensuring validity and reliability.Particularly when studying large populations (Saunders et al., 2019). This study consisted of 53 participants which consist of 50 students, 2 biology teachers and the school headmaster. Students at Manga Secondary School were selected using a convenience sampling which is a non-probability method where participants are chosen based on their availability, willingness to participate and with certain characteristics for example their age between the age group of 15-18 years(Bryman, 2016). This approach was adopted due to its practicality, cost-effectiveness and logistical feasibility which aligned with the study's scope. For biology teachers a purposive sampling (also called judgmental sampling) was used where participants were selected based on their expertise and relevance to the research objectives (Palinkas et al., 2015). This technique allowed the researcher to examine the effectiveness of OER and multimedia in biology instruction. The same purposive sampling method was used to select the headmaster as their leadership . Due to the role provided critical insights into policy implementation and resource allocation for technology integration in education (Cohen et al., 2018).

3.4 DATA COLLECTION METHODS:

Various data collection methods were applied to assess the effectiveness of Open Educational Resources (OER) and multimedia in biology education. The following methods were detailed:

Surveys and Questionnaires:

To gather quantitative data on student engagement, comprehension, and attitudes towards using OER and multimedia. Multiple-choice and Likert scale questions assessed students' perceptions of resource accessibility, usability, and impact on learning outcomes.

Interviews:

To collect qualitative insights from both students and teachers regarding their experiences with OER multimedia resources. Semi-structured interviews allowed for in-depth discussions covering challenges and benefits perceived by participants.

Classroom Observations :

To observe the implementation of OER and multimedia in real-time classroom settings. Observations focused on student engagement levels, interaction with multimedia tools, and teaching strategies employed by educators.

3.5 DATA COLLECTION PROCEDURE:

The data collection procedure for this research project on the effectiveness of Open Educational Resources (OER) and multimedia in teaching and learning biology at Manga Secondary school at ordinary level involves several key steps:

Permission and authorization ,initially the researcher seeks formal authorization from the authorities at Manga Secondary School to conduct field research on their premises. This step ensured compliance and cooperation with the school's administration.

Selection of participants as the study will target biology teachers and students at Manga secondary schools. A purposive sampling method will be applied to ensure that participants have relevant experience with OER and multimedia tools in their teaching and learning processes.

Instruments for data collection:

Surveys is a method of gathering information from a certain group of people typically through questions or interview. So structured questionnaires will be distributed to both teachers and students to gather quantitative data on their experiences and perceptions regarding the use of OER and multimedia in biology education.

Interview is a conversation between two or more people typically where one person ask and the other answers. Will be done through semi-structured interviews which will be conducted with the school headmaster to gain deeper insights into their challenges and the perceived impact of these resources on student learning outcomes.

Tests is an assessment of something such as knowledge, skills, or quality. The test used in this study were carefully selected from Manga Secondary School past exam questions. So the use of test as an instrument was to mainly gather data. Pre and post-test were used to identify the problem which leads to poor academic performance for students. Both pre and post-test contains one section of essay type questions.

Classroom observations is a process where observers watch and record the lesson process, students behavior and classroom dynamics. The observation will be carried out to assess the actual implementation of OER and multimedia tools during biology lessons and also to focus on student engagement and interaction. Also observe the biology teaching resources checklist at Manga Secondary School.

Data collection timeline outlines the schedule and milestone for collecting data, start and end dates. Data collection will take place over a period of four weeks, ensuring ample time for participants to respond and for observations to be conducted without disrupting the regular school schedule.

3.6 DATA ANALYSIS

Data analysis will involve both quantitative and qualitative methods:

Quantitative Analysis: The survey data will be analyzed using statistical software for example Excel to perform descriptive statistics such as means, standard deviations and inferential statistics to identify correlations between the use of OER or multimedia and student performance (Smith & Johnson, 2020). The results will be presented in tables and graphs for clarity (Brown et al., 2019).

Qualitative Analysis: Interview transcripts and observation notes will be analyzed using thematic analysis, coding the data to identify recurring themes and patterns related to the effectiveness

of OER and multimedia in enhancing biology education (Braun & Clarke, 2006). The qualitative data will provide context to the quantitative findings, enriching the overall understanding of the research topic (Creswell & Creswell, 2018).

3.7 VALIDITY AND RELIABILITY:

Ensuring the validity and reliability of the research instruments is crucial for the credibility of the findings:

Content validity to be done on the survey and interview questions which will be developed based on existing literature. Expert consultations to ensure they correctly measure the intended constructs related to OER and multimedia effectiveness (Hair et al., 2019).

A Cronbach's alpha test will assess internal consistency, with a value of 0.70 or higher indicating acceptable reliability (Tavakol & Dennick, 2011). The consistency of qualitative findings will be enhanced through comparing data from surveys, interviews and observations to corroborate results (Denzin, 2017).

3.8 ETHICAL CONSIDERATION:

Ethical considerations are paramount in conducting research through the involvement of human participants (Smith, 2020). The following measures will be done to ensure ethical compliance through informed consent where participants will be provided with detailed information about purpose of the study, its procedures and their rights. Written consent will be obtained from all participants also including parental consent for minors (Johnson & Lee, 2019). All data collected will be treated with strict confidentiality and participants' identities will be anonymised in reports and publications to protect their privacy (Brown et al., 2021). Voluntary participation, Students will also participate in the study according to their willingness. Participants are free to withdraw at any time without any consequences (American Psychological Association [APA], 2017). Ethical approval, the research proposal will be submitted for review and approval by an institutional ethics committee. As to ensure compliance with ethical standards in research (World Health Organization [WHO], 2018). By adhering to these methodologies particularly the study aims to provide a comprehensive understanding of the effectiveness of Open Educational Resources (OER) and multimedia in enhancing biology education at Manga Secondary School, ordinary level (Taylor, 2022).

3.9SUMMARY

In summary the chapter has provided a comprehensive roadmap for the data collection and analysis processes integral to our investigation (Clark, 2021). It commenced by establishing the fundamental framework for the study and firmly anchored in the chosen research methodology (Patel, 2019). The study navigated through the intricacies of the research approach and design, offering a clear understanding of the study's organizational structure (Adams & White, 2020). The exploration extended to the characterization of the study's participant demographics, elucidating the composition of the research population (Robinson, 2018). The research then ventured into the realm of sample selection, meticulously considering various approaches that guided our choices and informed our research methodology (Harris et al., 2021). The chapter unveiled the meticulous planning behind data collection, encompassing methodologies, techniques, and tools thoughtfully selected to acquire robust and comprehensive data (Wilson, 2020). With unwavering commitment, the research scrutinized the study's validity and reliability, recognizing their vital roles in ensuring the trustworthiness of our findings (Lincoln & Guba, 1985). Moreover, ethical considerations took center stage, reflecting the study's dedication to responsible and principled research conduct (Resnik, 2020). This chapter has laid the solid groundwork for the subsequent phases of the study (Mitchell, 2019).

CHAPTER 4

Introduction

This chapter is a presentation, interview, analysis and discussion of the collected data. The raw scores of the collected data from students pre- and post-test were used for the analysis. The presentation, analysis and discussion of the result were done with respect to the three research questions posed to direct the study.

4.1 Demographic Description of Respondents

Age of Students : are represented in Table 1

AGE OF STUDENTS	FREQUENCY	PERCENTAGE1
15	10	20
16	20	40
17	10	20
18	10	20

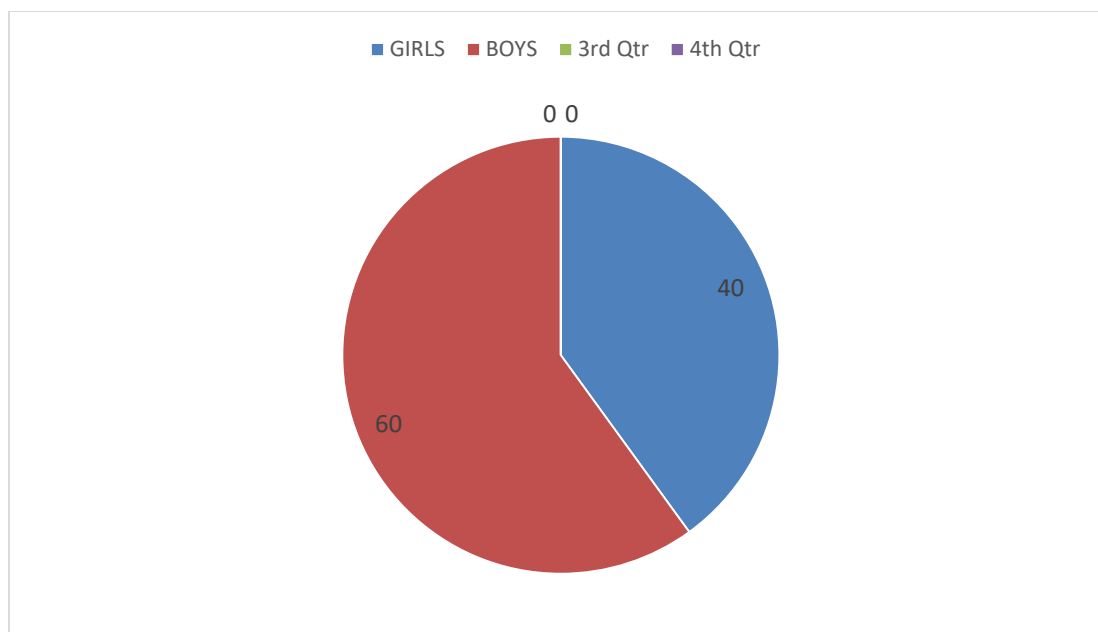
Majority of students are sixteen years with a 40%,15years records 20%,17years represented by 20% and 18years represented by 20%.

Gender of Students : are represented in Table 2

GENDER	FREQUENCY	PERCENTAGE
MALE	30	60

FEMALE	20	40
TOTAL	50	100

Graph below shows the frequency and percentage of students according to their gender.



KEY: Red - male students

Blue- female students

Out of total of 50 students 30(60%) are boys while 20(40%) are girls.

4.3 Q.1 How does the use of open educational resources and multimedia improve students academic performance compared to traditional method of teaching.

Type of resources such as textbooks (print) mentioned that they usually use when they're conducting their lessons and realia whilst video are rarely used.

Resources used by teachers

NUMBER	RESOURCES	FREQUENCY	PERCENTAGE
1	videos	4	16
2	print	15	60
3	realia	6	24

The total number of respondents was 100% since teachers preferred prints as the mostly used at 60% resource in teaching and realia 24% while video 16% is the least used resource . This calls the source of information being passive and must activated to facilitate the use of OER in their teaching and learning process

Biology resources checklist:

TEXTBOOK	TITLE	AVAILABILITY		NUMBER IN SCHOOL
Recommended by the ministry for students		Adequate 10	Inadequate 20	scarce
Supplementary books for teachers	Principle of biology	5	10	scarce
References books for teachers	Teachers guide	2	7	moderate
References books for students	Principles of biology	1	10	scarce
OTHER TEACHING AIDS	NAME			NUMBER IN SCHOOL
Commercially manufactured charts	Respiratory, digestive and circulatory system	60	40	Hanging on walls
Models	Human skeleton, heart, kidney	30	70	Worn out
Teacher made	Charts	40	60	hanging
Equipment	Apparatus, microscope, magnifying lens	45	55	Some cracked
Realia	Bottled specimens	40	60	

Results from observation checklist:

Table reveals that supplementary books, students references books, models were scarce in the school. Also shows that commercially manufactured charts, equipments and realia were available in reasonable number that could be satisfactorily used for teaching and learning process. Glassware, slides and other apparatus that can be shared among students were considered to be sufficient. But there is a lack of teaching aids such as videos, audios and audio visual were largely lacking this results in lessons done through the traditional method of teaching.

Analysis of test results with respect to the research question one:

	MEAN	NUMBER	St.deviation
PRE-TEST	14	25	4.6
POST-TEST	15	25	15.3

The table shows comparison of pre and post-test between the students who experienced traditional teaching methods and OER teaching. A group of 25 students were taken as a control group. The mean of pre-test was 14 while mean of post-test was 25. This shows a good progress to students which were exposed to OER method in teaching biology. Students have answered the question on the topic of digestive system on pre-test (traditional method) which influence their answers in the post-test (OER method). To determine whether the performance has increased between students scores .OER shows moderate improvement of 11% in test scores compared to traditional method out of 25 students. Blended approaches yield the highest gains which leads to an increase of 25% pass rate.

The response from the survey were analysed by calculating the percentage and frequency Microsoft excel software. The table represent percentage scored by students between 0-49% wc level of agreement on the item considered as low. Based on standard norm 50% considered mean score while 75% and above considered the highest.

Interpretation of % scores.

PERCENTAGE	SCORE INTERPRETATION	STUDENT SCORE
75-100	HIGHEST	60
59-75	PASS	25

OER has improve learning through active learning as they promote engagement for students.OER also reduces financial barriers as most resources are free and at lower cost such as Ruzivo and E-learning Zimbabwe. Flexibility accommodates self-paced learning which diverse students needs .So a combination of OER and traditional method create a balanced approach for better students academic performance. The school as well should invest in infrastructure to support digital learning.

Research question2:

What are challenges students and teachers face when using OER and multimedia biology learning tools?

Respondents	Distribution	Collected	% Response Rate
Headmaster	1	1	100
Teachers	2	2	100
Students	50	40	80

SD-strongly disagree and SA-strongly agree

QUE NUMBER	YES	PERCENTAGE	NO	PERCENTAGE
1	25	50	25	50
2	30	60	20	40
3	40	80	10	20
4	40	80	10	20
5	15	30	35	70
6	30	60	20	40

Based on students feedback 120 % of yeses shows that they generally have challenges from using those resource . However teachers guidance hinders a greater challenge on how to use OER and multimedia tools which results in some prefer traditional teaching methods. Also technical challenges due to difficulty on accessing digital resources. Teachers are the ones who should play a crucial role for better performance.

TEACHERS

QUE NUMBER	YES	PERCENTAGE	NO	PERCENTAGE
1	2	100	0	0
2	0	0	2	100
3	2	100	0	0
4	2	100	0	0
5	2	100	0	0

The study reveals that 80% of teachers responds shows greater challenges with integrating open educational resources and multimedia into their lessons. This significantly highlighted the need for targeted support and training to clear out those challenges and ensure effective integration.

RESULTS OF THE INTERVIEW:

The in-depth interview was organized with the school headmaster to find out some reasons which leads to poor academic results and solutions that they might suggest.

First question asked, Are there barriers on accessing OER and multimedia tools in your school: if yes why? and if no why? , the answer was yes because the school is located in remote areas with limited internet connectivity and adequate infrastructure. So accessing those resources can be a challenge due to slow internet speed and lack of reliable electricity. So the head suggested that the students might also make use of Ruzivo and E-learning Zimbabwe platforms as well.

Question 2: what support does the school provide to integrate these tools, yes the school provide support such as basic training for teachers. However we need comprehensive training and resources to effectively integrate OER and multimedia tools into the curriculum. We are working on improving and explore partnership with other sources to enhance our digital capabilities.

The finding suggested that through addressing those challenges the school can acquire improved structures, adequate training and effective integration of OER and multimedia resources.

Students challenges :

CHALLENGES	PERCENTAGE	REMARKS
Lack of digital literacy	45	Difficulty in navigating OER platforms
Poor internet access	35	Hinders access to multimedia resources
Overwhelming content variety	30	Confusion
Limited interactivity	25	Passive learning with some OER

Majority of students agreed that they were very confident to answer any biology questions after using OER and multimedia instructional packaged tools. They also agreed that those tools enhances individual learning and better performance in biology through the learning process.

DISCUSSION

The challenges identified through questionnaires, interview with the school headmaster, teachers and students reveals a complex interplay between technological, pedagogical and systemic barriers to effectively integrating open educational resources and multimedia tools in biology education. While access remains a bigger challenge due to device shortages, internet connectivity and a debate on infrastructure. Multimedia tools demand a greater shift into the teaching method approach yet adequate training leaves teachers with a struggle to have a balance between dynamic digital content with exam driven syllabi. However teachers observe that well-designed tools can contribute for deeper understanding and students engagement of biology concepts. Crucially students voice must also be included in school dialogue because of their feedback on usability and learning preferences as they produce a clear picture on the gap between resources potential and classroom reality . Ultimately the use of open educational resources and multimedia is not merely a logistical upgrade but a paradigm shift towards collaboration, student-centered learning and demand for systemic support to realise it's transformative promise.

Q.3 What could be the best practices for effectively integrating open educational resources and multimedia into the biology curriculum.

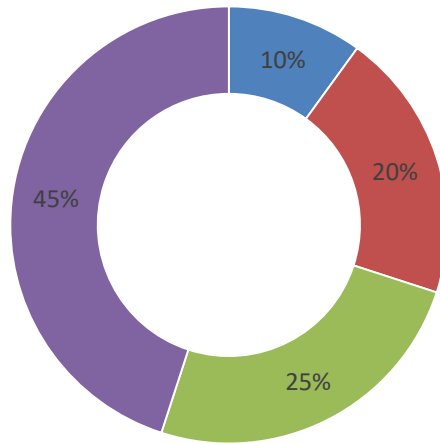
A survey conducted among students and teachers revealed the following trends:

ASPECTS	PERCENTAGE	KEY FINDING
Awareness of OER	45	Most teachers are aware of OER but only lowerly use them
Videos and interactive simulations	25	Use of E-learning Zimbabwe are commonly used rather than videos, simulations (multimedia tools)
Barriers of OER adoption	20	Lack of training, time consuming
Preferred OER formats	5	Most teachers prefer videos
	5	E-books (interactive content)

Survey results on OER and multimedia in biology education

Piechart

■ Video and Ebooks ■ Barriers of OER ■ Simulations ■ Aspects of OER



Analysis of test results with respect to the research question 3:

The question is mainly to observe if the use of OER and multimedia in teaching and learning biology how they brought difference in students achievement between their pre and post-test after learning the circulatory system. To determine whether the performance has increased between scores among students in the test performance. A sample t-test analysis was used to analyse the scores from the test given.

Table shows pre-test of boys :

SCORES	NUMBER	SUM	MEAN	Std,deviation
0-10	30	60	2	22,8
10-20	30	180	6	18,1
20-30	30	450	15	9
30-40	30	280	9	0
40-50	30	250	8	1,26

Aggregate mean:40

GIRLS

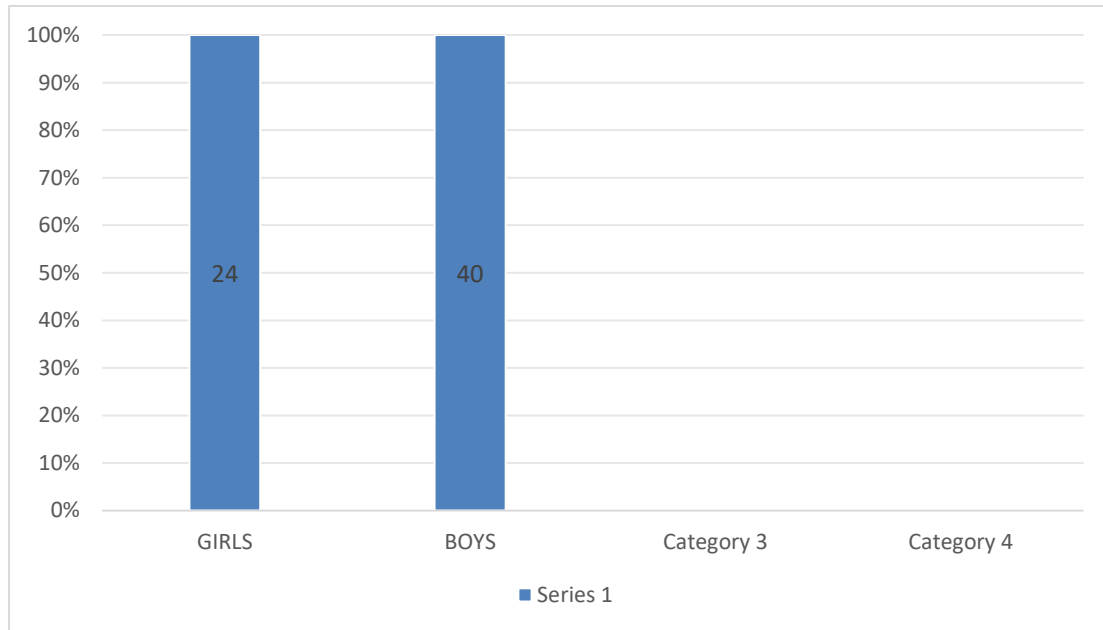
SCORE	NUMBER	SUM	MEAN	Std-deviation
0-10	20	70	3,5	15,5
10-20	20	80	4	4,9
20-30	20	150	7,5	36,8
30-40	20	120	6	18
40-50	20	50	2,5	29,4

Aggregate mean:24

The aggregate mean score for biology students in table1 for boys is 40 while in table 2 mean is 24 for girls.This results shown above is when before the implementation of OER and multimedia in the biology curriculum. The pass rate is very low as the pre-test have been conducted as a result of less awareness

and many barriers to OER and multimedia adoption. As most students were only aware of Ruzivo and E-learning Zimbabwe which are not usually used as well.

Graph: PRE-TEST RESULTS



Post-test after the integration of open educational resources and multimedia into the biology curriculum.

POST -TEST:BOYS

SCORE	NUMBER	SUM	MEAN	Std-deviation
0-10	30	0	0	0
10-20	30	40	1,3	27,7
20-30	30	300	10	17,8
30-40	30	250	17	7,9
40-50	30	600	20	7,9

Aggregate mean:48

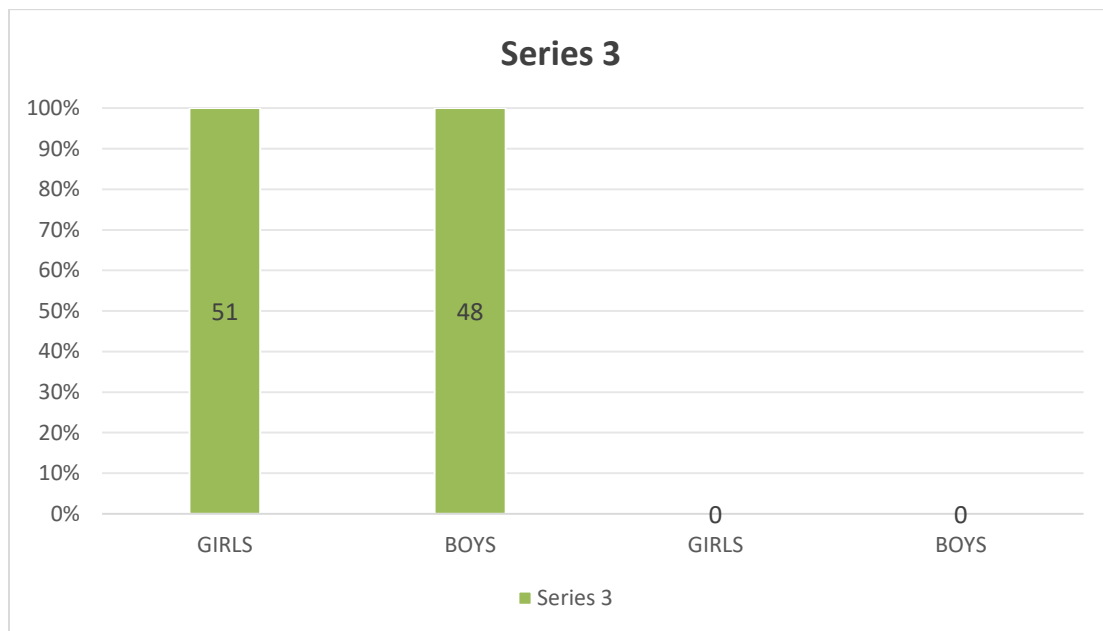
GIRLS

SCORE	NUMBER	SUM	MEAN	Std-deviation
0-10	20	0	0	0
10-20	20	0	0	0
20-30	20	150	7,5	34,2
30-40	20	600	30	18,2
40-50	20	250	13	1,6

Aggregate mean:51

After the implementation of OER and multimedia into the biology curriculum students academic performance increases due to the flexibility as they were able to fit into different learning needs and also reduces textbooks expenses for both teachers and school board. These resources allow students to work with real-world biological data and also fosters critical thinking and analytical skills (Tenopir et al., 2011). Instructors should scaffold data analysis by providing guided exercises that progressively increase in complexity, ensuring students develop confidence in interpreting scientific data. For example, learners can create infographics using Canva or contribute to Wikipedia articles on biological topics, reinforcing their understanding while contributing to public knowledge (Wiley & Hilton, 2018).

COMPARING RESULTS:



DISCUSSION:

Proper attribution of OER and multimedia is essential to model academic integrity through faculty training and support for teachers as they are the curriculum implementers in teaching. Multimedia need to be blended together with traditional teaching methods for effective results. Students-centered approach to encourage students to create their own OER materials for example explainer videos. Furthermore , teachers should encourage peer discussions via online forums or flipped classroom models in which students may use to analyse OER materials before class and engage in deeper discussions during sessions (Bishop & Verleger, 2013). As integration of OER and multimedia into biology curriculum enhances accessibility, engagement and better learning outcomes and achievement.

SUMMARY:

This research aim was to investigate the impact of OER and multimedia on academic performance of students who learn biology at Manga Secondary School. Furthermore, challenges associated with their use as videos and simulations require high frequency bandwidth so through the use of YoBooks and Eneza Education which delivered both textbooks and revision exercises via SMS or low bandwidth apps which makes the learning process more effective. The findings has shown that the use of open educational resources and multimedia significantly improve students academic performance far much better than traditional teaching methods.As a increase in test scores which are noticable and enhances students engagement. To effectively integrate OER and multimedia tools into the biology curriculum, teachers should align resources with learning objectives, evaluate resources quality and teachers training support. However the study highlights the potential of OER and multimedia to enhances biology education and emphasise the importance of careful planning and implementation to overcome problem associated with them and ensure successful integration. As they collapse the bridging digital devices and also fostering inclusive learning.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

INTRODUCTION:

This chapter presents a summary of the obtained findings from the study on improving student performance in biology at Manga Secondary School. It also outlines the conclusions drawn from the research . Provides certain recommendations to address the challenges that have been identified. Additionally, and some suggestions for further research on enhancing biology pass rates at the Ordinary Level are being discussed.

5.1 Summary of Findings

The study was conducted due to the persistent low pass rates in biology at Manga Secondary School. As a results to students' perception of the subject as difficult and mostly reliance on traditional teaching methods (Chitanana, 2020). The research sought to investigate the effectiveness of Open Educational Resources (OER) and multimedia in enhancing biology performance compared to traditional method teaching approaches. Key research questions guiding the study included: how does the use of OER improve students' academic performance compared to traditional teaching methods? ,what challenges do students face when using multimedia and OER in biology learning? and what are the best practices for effectively integrating OER and multimedia into the biology curriculum? The study's significance was highlighted for different stakeholders which includes the government, schools, teachers, students and examination boards.

Chapter 2 reviewed existing literature, revealing that while OER and multimedia enhance learning. Challenges such as inadequate teacher preparedness, limited internet access, and unreliable electricity hinder their effectiveness (Mtebe & Raisamo, 2014).

Chapter 3 detailed the mixed-methods research design as a mixture of both quantitative (questionnaires) and qualitative (interviews) data collection methods. Students and biology teachers completed questionnaires, while the school head participated in an in-depth interview.

Chapter 4 presented and analyzed the findings, indicating that poor performance in biology stems from multiple factors, including: lack of resources such as textbooks, laboratory equipment and digital tools. Insufficient teacher training in modern teaching methodologies and

Financial instability limiting schools' ability to provide necessary learning materials which helps to improve students academic performance. Inconsistent electricity supply affecting the use of digital resources as they require electric power and use of projectors.

5.2 CONCLUSION

Based on the findings, the study concludes that:

The integration of OER and multimedia in biology education can significantly improve student performance. Through the use of them results in making learning more interactive and engaging ,also makes students to be motivated and like to learn biology as a lesson (UNESCO, 2019). Challenges such as inadequate infrastructure, poor internet connectivity, and lack of teacher training have a great impact on the effective use of digital learning tools in rural schools (Jowi, 2018). Financial limitations at both school and government levels restrict the procurement of necessary resources. If this continues to go further like this exacerbating poor performance in science subjects.

5.3 RECOMMENDATIONS

To address the challenges identified, the following recommendations are proposed:

For school administration should provide continuous professional development for biology teachers particularly in ICT integration and modern teaching strategies, invest in alternative power sources such as solar systems and generators to accommodate after electricity disruptions and lastly be able to establish partnerships with NGOs and also private sector stakeholders to secure funding for digital learning tools.

For the government and ministry of education ,increase funding for rural schools to improve their infrastructure which includes computer labs and reliable internet access. Develop policies that promote the make use of OER in schools and also ensures equitable access to digital learning materials (OECD, 2020). Organize and inform them in time for regular teacher training workshops on innovative teaching methodologies.

For Non-Governmental Organizations (NGOs) and development partners should donate computers, projectors and other digital learning tools to under-resourced schools so that students also stay up to date with the moving technology and support teachers training programs especially those in colleges and universities must have to obtain such training whilst at school.Assist in setting up e-learning platforms to supplement classroom instruction with out leaving anyone out of the box.

Further Research

A longitudinal study could assess the long-term impact of OER and multimedia on student performance in biology. Comparative research between urban and rural schools could highlight disparities in resource availability touching all four corners of the country and their effects on academic results.

5.4 FINAL CONCLUSION

This study underscores the need for a paradigm shift in biology education at Manga Secondary School. Creates a movement from traditional methods to technology-enhanced learning. While challenges exist but strategic interventions involve government support, teacher training, and infrastructure development can importantly improve student performance. By adopting OER and multimedia in teaching and learning process schools can create a more engaging and effective learning environment Ultimately boosting biology pass rates which results in high point at the Ordinary Level.

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APPENDIX

I am a student doing a diploma in science education at Bindura University of Science Education and Technology majoring in biology and chemistry. I am requiring information for my research project. The research topic is about to investigate the effectiveness of open educational resources and multimedia in teaching and learning biology at secondary school in Bindura Rural District. You have been selected as one of the participants who can contribute significantly to this study. May you kindly respond to all items in the questionnaires and interview as honestly and fully as you can. The data is collected for academic purpose only. Thank you in advance for your cooperation and participation. Please do not write your name or identity on the questionnaires.

APPENDIX A

QUESTIONNAIRES FOR STUDENTS

Please tick the appropriate box for questions:

1) What is your sex	FEMALE	MALE
2) Do you have any smart phone of your own or at home	MY OWN	HOME

3) Do you have internet access at your school	YES	NO
4) Is there a computer lab at your school	YES	NO
5) During lessons time do you interact with multimedia tools and OER	YES	NO

Tick one appropriate box which answers the questions:

QUESTIONS	YES	NO
1) I often face technical challenges (slow internet, devices issues) when using OER or multimedia		
2) There are so many OER options available making it hard to choose the best one		
3) I need more guidance from teachers on how to use OER and multimedia effectively		
4) I find multimedia biology tools more engaging		
5) I struggle with managing my time when learning independently with digital resources		
6) I trust the accuracy and quality of OER biology materials		

APPENDIX B

QUESTIONNAIRES FOR TEACHERS.

Please tick the appropriate box for questions:

1) How long have you taught sciences, since you have done with your academics?

4-5years

10-20years

5-10years

20-40years

2) What is your highest qualification?

Diploma

Masters

Degree

PhD

3) What is your biology pass rate since you came to this school?

0-10%

40-60%

10-40%

60-100%

4) Do you have internet access at your school?

YES

NO

5) Have you ever attended any ICT workshops?

YES

NO

Tick one appropriate box which answers the questions:

QUESTIONS	YES	NO
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1) I spend too much time searching and adapt OER material for my biology lessons		
2) I have received adequate training on how to apply OER and multimedia tools in teaching		
3) It is difficult to find OER that align well with my curriculum requirements		
4) Some of my students struggle with using digital tools effectively for learning		
6) I find it hard to keep updated together with OER biology materials		

APPENDIX C

INTERVIEWS QUESTIONS FOR SCHOOL

HEADMASTER :

1) Are there barriers on accessing OER and multimedia tools in your school?

ANSWER:.....

2) How do you evaluate the quality and relevance of OER and multimedia tools for your biology curriculum?

ANSWER:.....

3) What technical challenges arise when combining OER and multimedia in lessons?

ANSWER:.....

4) What support does the school provide to integrate these tools?

ANSWER:.....

5) Have you observed difference in understanding, motivation or exam performance?

ANSWER:.....