

CHINHOYI UNIVERSITY OF TECHNOLOGY



SCHOOL OF ART AND DESIGN

DESIGNING AN ENGAGING E-LEARNING USER INTERFACE FOR PRIMARY SCHOOL LEARNERS IN ZIMBABWE.

By

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A thesis submitted in fulfillment of the requirements for the degree of Master of Philosophy
in Website Design and Development in the School of Art and Design at Chinhoyi University
of Technology.

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August 2025

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DEDICATION

I dedicate the work to all teachers who have a passion for teaching with technology, and the will to make a difference in every learner's life. I also dedicate this thesis to my mother Anna Ndlovu, for teaching me to be strong, to never stop believing and follow my dreams even if all odds are against me, hats off. I will forever cherish and be mindful of what she taught me.

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ABSTRACT

The design of an engaging e-learning User Interface for Zimbabwean primary school students, specifically Grades 4–7, is the subject of this study. The specific objectives of this study were to explore the learning preferences of primary school learners in relation to e-learning interfaces in Zimbabwe, to design an e-learning user interface that maximizes engagement for primary school learners in Zimbabwe and to evaluate the effectiveness of designed user interface through user testing feedback mechanisms. The total respondents were 28 (16 learners, 10 teachers and 2 headmasters) purposively picked from school two schools in Nyabira Cluster, Zvimba District, Mashonaland West Province. The research followed an interpretivism philosophy and inductive approach to design an interactive, accessible and culturally sensitive e-learning user interface prototype. Open ended questionnaires, interviews, document analysis and observations of learners, facilitators and headmasters were used to gather data. Thematic analysis, narrative analysis and document analysis were all used in the data analysis. The results show that learners prefer interactive, multimedia-rich content while unreliable internet connectivity and expensive data plans prevent effective e-learning adoption. In order to improve usability, teachers underlined the necessity of offline functionality, teacher training, and localised content. The study designed Educulture user interface prototype with user-friendly navigation and adaptive learning tools. The prototype was presented to participants and their interactions were observed. Researchers documented real-time feedback, including user comments and suggestions, to evaluate usability and identify areas for improvement. Based on user feedback and evaluation accessibility, interactivity, cultural relevance and simplicity must be given top priority in the design of an e-learning user interface for Zimbabwean primary school learners.

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CHAPTER I

INTRODUCTION

1.0. Background

Technological advancements are driving the global integration of technology in education. The evolution in education is characterized by a transition from distance learning to electronic learning and then to mobile learning, corresponding to the Industrial Revolution of the 18th-19th centuries, the Electronics Revolution of the 1980s, and the Wireless Revolution of the 20th century (Keegan, 2002; Jiang & Turner, 2017). In this context, the researcher believes that the traditional face-to-face method of learning has been surpassed but serves as a foundational stage that establishes the basis for all subsequent learning methods mentioned. The key components of e-learning include learning agents, tools, disciplines, and platforms (Osadcha, 2021). Conversely, many designers lacked references for creating suitable e-learning User Interfaces (UI).

Over 1.575 billion learners worldwide were affected by the closure of educational institutions due to COVID-19 measures (UNESCO, 2020). China led the way in providing massive online education to millions of students (Nhongo & Tshotsho, 2021; Huang et al., 2020; McAleer, 2020). Various platforms like Udemy, Blackboard, Teachable, WizIQ, LearnCube, Google Classroom, and Thinkfic were utilized to facilitate online learning (Mhindu, 2020). In addition, WhatsApp proved to be an effective e-learning tool in an Indonesian Senior High School, offering a cheap and flexible solution for teaching English as a Foreign Language (EFL) (Sausanti & Tarmiyi, 2016, as cited in Mhindu, 2020). Globally, education systems are increasingly designing technology tools and platforms that cater to students' habits, preferences, and needs to maximize engagement and learning outcomes (UNESCO, 2022). The diversity of learners in online environments requires facilitators to recognize and understand cultural differences, aiming to design optimal online platforms that meet learners' needs.

In order to effectively engage learners from a variety of backgrounds Ogunleye & Afolabi (2022) stress the significance of cultural sensitivity in user interface design. According to (Wang et al., 2018; Zhang (2005) emphasises how Confucianism shapes Chinese culture and fosters a great regard for educators. Chen et al., (2021) discovered that although UK pupils prefer interactive features and entertaining animations, Chinese primary school kids prefer

interfaces with a clear visual hierarchy and succinct instructions. (Hofstede, 2018) emphasises that to prevent alienating students, UI design must take cultural conventions, beliefs, and communication styles into account. To connect with the intended audience, cultural sensitivity should be reflected in language, imagery and general aesthetics. Chinese researchers, like Li et al. (2020), have explored gamification in primary education, finding that elements such as points, badges, and leaderboards enhance learning engagement by fostering competition and motivation.

Technology and digital learning resources are integrated into educational systems in Sub-Saharan Africa (World Bank, 2020). Access to educational technology is greatly impacted by socioeconomic constraints and a lack of infrastructure in Nigeria (Akintola et al., 2019). Due to things like limited internet connection, a variety of languages, and cultural differences, the area also faces particular UI design issues. In South Africa, Moyo (2021) highlights how crucial it is to integrate regional languages, cultural allusions, and well-known learning methods into instructional technology. This guarantees that students can relate to the material and feel a connection to the interface. To increase access to learning through technology, nations in the region are creating and putting into practice national digital education strategies (UNICEF, 2018).

Self-isolation and social distancing techniques make it difficult for pupils in Zambia to get academic consultations from their facilitators and the school (Sintema, 2020). COVID-19 may be viewed as a springboard for digital education, which would involve utilising social media sites like Facebook and WhatsApp, which are the most popular among Zambia's youth (Mulenga & Marban, 2020). A digitalised virtual classroom was introduced in Zambia at this time, allowing students to access classes via smartphones and other internet-connected devices (Ministry of Education, 2020). Studies on the digital divide in Sub-Saharan Africa emphasize the need for UI designs that are accessible on low-bandwidth connections and adaptable to diverse device capabilities (World Bank, 2021).

UX design best practices call for deep understanding of the socio-cultural context and needs of the target user group when designing products for diverse global markets (IDEO, 2015). Ogunleye & Afolabi, (2022) note that mobile technology plays a central role in bridging the digital divide and they concentrate on the requirement of mobile-responsive and mobile-

friendly components. In Uganda it was found out that the inclusion of accessibility features such as alternative text, audio description and customizable interface, (Okello et al., 2020). Scholars acknowledge that in order to achieve inclusivity and accessibility for students from diverse linguistic origins, e-learning systems must support several languages (UNESCO, 2017).

Ogunleye & Afolabi, (2022) highlight the importance of accurate translations, considering cultural nuances and linguistic variations to enable effective communication. Cultural sensitivity studies in Sub-Saharan Africa underscore the need for UI designs to be sensitive to the values and norms of local populations (Ogunleye & Afolabi, 2022). Cultural dimensions, such as individualism versus collectivism and power distance should be included to ensure UI elements resonate with the target group (Hofstede, 2018). Ogunleye et al., (2018) note that, in Kenya found that gamified learning platforms improved students' academic performance and fostered a positive learning attitude. One can point out that this approach can be particularly effective in Zimbabwe, where traditional teaching methods often lack interactive elements.

The e-learning strategy in Zimbabwe for schools is a multi-ministerial program that includes the ministries of ICT, Postal and Courier Services and Primary and Secondary Education (Nyamudzodza et al., 2021). Online technologies are a vital pillar of the development of digital economy in the National Development Strategy 1 2021 to 2025. The e-learning approach is included in the SMART Zimbabwe 2030 Master Plan, a cabinet-approved government priority program for innovation in Science and Technology development for the years 2019 to 2030. In Zimbabwe 51% of the population is the school going age and in 2018 there were 6 288 primary schools with 2 755 970 learners in Zimbabwe (Annual Education Statistics Report, 2018). Dzinotyiweyi and Taddese (2020) note that 91.91% is the net enrolment for primary learners in Zimbabwe, and there is a shortage of ICT laboratories, hence the classrooms are poorly equipped. Fifteen percent of primary school teachers possess basic computer skills (MoPSE 2018), although the Education Sector Strategic Plan (ESSP) advocates for specialist rooms for ICT and STEM (Dzinotyiweyi and Taddese 2020). In addition, the authors highlight that the ICT Policy for Primary and Secondary Education (2019–2023) aligns with the Constitution of Zimbabwe, the Zimbabwe Agenda for Sustainable Socio-Economic Transformation

(ZIMASSET), the Education Act, the National Policy for ICT, and the Education Sector Strategic Plan.

Musarurwa (2018) notes that Zimbabwe has a National Information Communication Technology (ICT) policy that acknowledges the role of ICT in schools, which was launched in 2018, and 5 out of 11 of its objectives relate to ICT in Education. Dzinotyiweyi and Taddese (2020) highlights that 55% of primary schools have access to electricity and 26% have internet connectivity. This shows limited access to reliable internet connectivity, and outdated technology infrastructure presents significant challenges for effective e-learning (Moyo 2023). The challenges are being faced, though MoPSE (2019) is claiming that ICTs are being used effectively and efficiently throughout the education sector, enabling all learners to achieve their full potential and become productive, responsible citizens. The scholar also argues that limited access to reliable internet connectivity and outdated technology infrastructure present significant challenges for effective e-learning. At the national level, household ownership of mobile phones is high, 89.4% but low for computers, 15.2% resulting in 126 learners per computer (Dzinotyiweyi and Taddese 2020). This emphasizes the need for cost-effective e-learning platforms that are sustainable for the local context (Moyo, 2023). In the same scenario, there is a need for careful consideration of learning objectives, content delivery methods, and assessment strategies to ensure alignment with national educational standards, MoPSE (2023).

The move to online technologies for learning purposes exposed Zimbabwe's deep digital cavity and inadequate e-learning infrastructure, presenting numerous challenges for primary school learners Friedman, 2021. Ruzivo's digital library and Zimbabwe e-Learning Passport website provide open educational resources, but they lack engaging interface design and local relevance (Vota, 2020). Dzidzo Paden tablets were distributed to some schools, but few students could access content independently due to usability issues (Gadzikwa, 2021). Remote lessons were also conducted through video conferencing platforms like Zoom and Google Classroom during school closures. WhatsApp is also used for instant messaging, recorded lectures, assignments, assessments, and communication between teachers, parents and students (Mhizha, 2020). The MoPSE partnered with educational technology company Yoza to offer video lessons via satellite television through the Government's Learning Passport initiative (Chutgar & Kanjee, 2021). The scholars add on that, when the country switched to online learning it encountered

several problems which include unstable internet connectivity that posed a major barrier, as only 40% of Zimbabweans have access to the internet.

When designing for children, it is important to take a child-centric approach and apply developmentally appropriate UX design (Read et al., 2017). Chan et al. (2016) postulate that in terms of interaction design, these technologies should be designed so that regardless of age, cognitive and physical impairments, a person should be able to use and interact with them effortlessly. Husseni et al (2021) note that the usability of e-learning platforms is measured by their user adaptive level, screen understanding level, satisfaction, and learnability. Harte et al (2017) suggest that the issue of design processes, like human human-centered approach, which involves the end user through the product's progress and testing process, can be necessary in confirming that the product meets the needs and abilities of the user, especially in terms of usability and user experience.

The "one-size-fits-all" approach used by e-learning platforms such as Ruzivo, Akello and the Zimbabwe E-learning Passport ignores the varied age, educational and cultural needs of learners in Zimbabwe. Their capacity to assist students from primary school to high school is restricted by the absence of age-sensitive interfaces and focused content. The unique needs of various learners' groups are not met by this generic design. Because of this, these platforms are unable to satisfy the learning needs of Zimbabwe's student body. There is a need for UI designs that are optimized for low-bandwidth connections and adaptable to diverse device capabilities (Moyo, 2023). Infrastructure, language support, cost-effectiveness, and curriculum alignment are some of the unique UI design issues Zimbabwe faces. One can point out that to guarantee successful communication, calls for precise translations that take linguistic variances and cultural quirks into account. The researcher can create an e-learning platform that is not only interesting and successful but also culturally aware, easily accessible, and long-lasting for Zimbabwean primary school learners by comprehending these global, regional, and local UI design challenges. This project has the potential to empower young people and close the digital divide, which would improve Zimbabwean education going forward.

1.1. Statement of the Problem

Despite the current globalisation trend and advancements in telematics, integrating e-learning into Zimbabwean primary schools continues to present a number of difficulties. Chikurubi

(2017) in Chikanyawu (2022) indicates that the utilization of e-learning as a learning tool at the primary level remains problematic, as school heads claim success, which is never reflected in actual practice. It means a lack of successful implementation and availability of e-learning materials for young learners. Sintema (2020) clarifies that e-learning ventures are mainly focused on higher education, with little attention given to primary and secondary students, thus failing to create successful e-learning platforms for these younger age groups. The Ministry of Primary and Secondary Education (MoPSE) has attempted to introduce online technologies, but it has not embraced these initiatives completely, resulting in a plateau in e-learning investment in primary schools. Main challenges include low teacher preparedness, inadequate digital infrastructure, and a lack of curriculum-aligned content (Maonde & Mutsvara, 2021). Dzinotyiwei and Taddese (2020) further mentioned concerns about the lack of age-related infrastructure and furniture, which will further exacerbate the less productive application of educational technology. Research by Nhongo and Tshotsho (2021) indicates that the majority of teachers are not even aware of the existing e-learning platforms, such as Akello and Ruzivo, and attempts at utilizing the facilities are met with failure. The lack of awareness and non-utilization point to the insufficient attention to contextually relevant e-learning solutions and age-sensitive interface design in Zimbabwe. There is a notable gap in research investigating the socio-economic and pedagogical factors influencing the adoption of educational technology in African schools (Adekola et al., 2022). Despite the growing body of literature in online education, there remains a lack of clear understanding regarding its impact on children, as noted by Rao (2023). In this study, the researcher aimed to explore the needs of primary school learners to design in full UI specifically for grades 4 to 7, thereby enhancing the effectiveness and accessibility of e-learning in Zimbabwean primary education. The project is also filling the yawning gaps that were reviewed during COVID-19 pandemic crisis, such as the need to harness online learning technologies within formal and non-formal settings.

1.2. Research Aim and Objectives

1.2.1. Aim

The main aim of the research project was to design an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe

1.2.2. Research Objectives

The following were the main research objectives:

1. To explore the learning preferences of primary school learners concerning e-learning interfaces in Zimbabwe.
2. To design an e-learning UI that maximizes engagement for primary school learners in Zimbabwe.
3. To evaluate the effectiveness of the designed UI through user testing feedback mechanisms.

1.4. Research Questions

1.4.1. Main Research Question

The main research was:

How can an engaging e-learning UI be designed to meet the user preferences of primary school learners in Zimbabwe?

1.4.2 Sub-Research Questions

The sub-research questions were:

1. What are the learning preferences of primary school learners in Zimbabwe regarding e-learning interfaces?
2. Which design elements can enhance engagement for primary school learners in an e-learning environment?
3. How effective is the designed UI in meeting user needs based on user testing and feedback?

1.5. Significance of the study

E-learning platforms help in the transformation of education, and they are characterized by creativity, interaction, and the development of skills. Basharat (2018) in Rahaman et al (2021) technology is the mainstream in the 21st century as it is enhancing the effectiveness of learning. The shift to the online mode of learning is one of the biggest motivating factors for a paradigm shift in curriculum development (Elmunsyah et al, 2020). In the context global knowledge-based society, online technology serves as a fundamental component. The User Interfaces (UI) design of e-learning platforms, as well as their design elements, should be developed using a human-centered design approach. This ensures that the platforms are not only functional but

also tailored to meet the needs and preferences of users, enhancing the overall learning experience. This research is of great value to the learners, teachers, designers, and to the Ministry of Primary and Secondary Education (MoPSE) in different ways that enable smooth ways of its operation.

1.5.1. To the Learners

Online technologies and e-learning platforms enable learners to share information and data relatively. The development of an e-learning platform with usable interfaces helps learners in rural schools and disadvantaged communities to bridge the gap between rural and urban schools. The platforms are also beneficial to learners as they help and motivate learners to rely on themselves as well as to stir learners' interest and satisfy their needs towards learning.

1.5.2. To Designers and Developers

The research helps designers and developers to improve in their design standards to meet learners' needs. It also enables them to stand firm in the competitive technological environment and help them to increase their fan base as they will know the expectations of end users. The research also helps them to evaluate themselves to see if they are in good track of fulfilling their users' demands. Furthermore, the study helps designers to come up with usable web interfaces and e-learning platforms that meet and satisfy the expectations of end users as well as bringing new insights in the development of UI.

1.5.3. To the Teachers

The study is of great importance to the teachers as it will determine the degree of use of e-learning platforms at the primary level. The development of usable UI on e-learning platforms will promote the bond between learners and teachers as they become more concentrated on learners, check homework individually, and have extra classes with them.

1.5.4. To the Ministry of Primary and Secondary Education

The study plays a crucial role to the Ministry of Primary and Secondary Education as it gives the foundation for future studies. In addition, this allows MoPSE to explore the children's interaction with e-learning platforms as well as their usability through their UI/UX. The study

is also useful to MoPSE as it can be used as a yardstick to evaluate the usefulness and accessibility of online learning interfaces.

1.6. Delimitation of Study

This study relates to the design of engaging eLearning UI for grade 4 to 7 learners in the context of Zimbabwe. Although there are many schools in Zimbabwe, the study will target schools in Mashonaland West Province, Zvimba District, due to convenience to the researcher. This helps the gathering of adequate and reliable answers that can be generalized across the education sector. The respondents of this study are learners, teachers, and headmasters of the selected schools from the Ministry of Education in Zimbabwe. The study is demarcated to a period of between 2023 up to 2025.

1.7. Limitations of the Study

A significant limitation of this research was the participant's understanding of the topic. When the researcher presented the topic and its scope, it became evident that participants struggled to distinguish between e-learning, UI and e-learning content. This confusion arises partly because e-learning has numerous definitions and is still relatively new on a global scale. The definition of e-learning varies depending on the researcher's perspectives and the study's objectives. Nonetheless, there is a subtle distinction between e-learning, user interface, and e-learning content, and researchers employed triangulation as a strategy to address this issue.

1.8. Definition of Terms

a. E-learning – is the provision of educational content (electronic) through the media based on the computer and its networks to the recipient in such a way that allows the possibility of active interaction with this content and features together with its peers only simultaneous or not synchronized and the possibility of completing this learning in time and place and at the speed that suits Conditions and abilities, as well as the possibility of managing this learning also through these media (Gorbunova and Kalimullin, 2017; Gorbunova and Mokeyeva, 2017; Khrulyova and Sakhieva, 2017; Kvon et al., 2018; Levina et al., 2017).

b. User interface – According to Marcus (2002), it is a shared boundary across which two or more separate components of a computer system exchange information. It is the point of human-computer interaction and communication in a device (Guntupalli, 2008).

c. Online Technologies – Online technologies refer to the infrastructure and components that make modern computing (Pratt, 2022). These technologies refer to all of the devices, networking components, applications and systems that, when combined, make it possible for people and organizations such as businesses, nonprofit agencies, governments and criminal enterprises to interact with one another in the digital world.

d. Experience – It refers to the experience between a human being and a system. It is the feeling users experience when using a product, application, system or service (Berni & Borgainni 2021). Hellweger (2015) defined it as a holistic journey user's transverse as they use a product not only does it include their direct interactions with the product, but also how it fits in with their overall task completion process

1.9. Dissertation Structure

The research has six chapters that are arranged as follows;

1.9.1. Chapter 1: Introduction

The chapter introduces the research project and the worthiness of the research project. It provides background information highlighting the benefits of UI design to enhance e-learning at primary school learners. Problem statement and sub questions helped to unpack the need to conduct this study in the context of Zimbabwean Primary School learners. Aims and objectives were formulated to guide and provide blue print for research methodology so as to achieve the research aim. The chapter concludes with a summary of the main points from the Chapter.

1.9.2. Chapter 2: Literature Review

This chapter is a review of literature on e-learning UI. The theoretical framework was also included to guide in the study and inform the philosophical stand point and view of the world helping the researcher to understand the phenomenon. Theories of designing are discussed to contextualize the study. It also unpacks the current state of e-learning user interface for platforms in Zimbabwe for primary school learners. The chapter examines user interface (UI), user experience (UX), Human Centred Design Approach (HCDA), Technological accessibility as well as culture relevance of e-learning UI for primary learners in Zimbabwe. The voice of the researcher is added to strengthen and contextualize the study.

1.9.3. Chapter 3: Research Methodology

The Chapter provides a guide for carrying out the study and research paradigm to address the questions. The research design in this study is interpretivism and the qualitative study is analyzed through qualitative methods. Methods of carrying out the study are also discussed together with selection of participants, data collection, analysis and ensuring trustworthy in qualitative approach as well as ethical issues.

1.9.5. Chapter 4: Data Presentation and Analysis

The aim of this chapter is to report on the findings of the topic under study. Findings gathered from document reviews, observations, interviews and questionnaires with learners, teachers and school heads are included in this chapter.

1.9.5. Chapter 5: Summary, Conclusions and Relations

The chapter presents a summary of key empirical research findings. It also provides answers to initial research questions and conclusion as well as areas for further study. Recommendations and findings are used to inform the design process of e-learning UI for grade 4-7 primary school learners using the HCD approach.

1.9.5. Chapter 6: UI Design using HCD approach

This chapter provides the practical application of Human-Centered Design (HCD) principles to create an effective User Interface (UI) for e-learning platforms targeted at Zimbabwean primary school students in Grades 4-7, building on the fundamental knowledge and insights acquired from Chapters 1–5. The design process takes an interpretivist and qualitative approach, guided by the research methodology described in Chapter 3, making sure that the viewpoints and experiences of learners, facilitators, and school administrators are at the centre of the UI design. A thorough documentation of the design process shows how user input and the results of empirical research are converted into useful design components.

1.10. Chapter Summary

The chapter offers a thorough summary of the research on designing an engaging UI for an e-learning platform for Zimbabwean primary school learners. By describing how the researcher

discovered a significant gap that requires investigation in order to provide workable solutions, it sets the stage for the study. The chapter presents research objectives and questions intended to address the problem, outlining the problem statement and stressing the difficulties encountered in contemporary e-learning environments. The study's importance is also examined, with a focus on how it might improve the educational experience for students in primary school. Additionally, it outlines the research's scope, identifies any limitations that might have an impact on the study's conclusions and defines important terms that are necessary to comprehend the context of the study. All things considered, the chapter establishes the framework for a targeted investigation into creating an interesting e-learning user interface for Zimbabwean primary school students.

CHAPTER II

LITERATURE REVIEW

2.0.Introduction

This chapter's goal is to assess Zimbabwe's e-learning platforms' user interfaces, with a focus of creating an engaging interface for primary school learners. This review aims to provide insight into how user interface design can be utilised to enhance learning experiences in the nation by analysing previous studies and initiatives. The review also aims to identify knowledge gaps and provide guidance for upcoming studies. The review looks into a number of factors, including cultural appropriateness, user experience (UX), human centred design approach (HCDA), localised platform instances, and technological accessibility, and how they affect students' learning outcomes. This review offers insight into the achievements, challenges, and prospects that come with creating an efficient e-learning user interface for Zimbabwean students based on a critical analysis of the literature. The chapter will also elaborate on the theories that will guide the investigation for subsequent research chapters. The review looks into a number of factors, including cultural appropriateness, UX, HCDA, localised platform instances, and technological accessibility, and how they affect students' learning outcomes.

2.1. Theoretical Framework

The theoretical framework plays a crucial role in guiding research, providing a foundation, and connecting all components of a postgraduate thesis or dissertation (Grant & Onsaloo, 2014; Imenda, 2014; Ravitch & Riggan, 2016; Bless, 2022). Adom et al. (2023) emphasize that the theoretical framework supports the research's premise and is built upon established theory in a related field. It helps researchers formulate their research questions and ensures coherence throughout the study. The use of theoretical frameworks is common in qualitative research, as they provide a basis for understanding and analyzing phenomena. The researcher examines one theory and one model, which will guide the study: The Semiotic Theory and ADDIE Model help to understand and interpret phenomenon while a model offers a systematic methodology to achieve a specific outcome. Integrating both allows for more comprehensive analysis leveraging the strength of both conceptual understanding and practical application.

2.1.1. The Semiotic theory

The term semiotics, derived from the Greek word ‘semeiotikos’, refers to the study of signs and symbols; their use, interpretation and meaning within a specific context (Chandler, 2017). Semiotics encompasses the understanding of signs as well as their representation through voice and picture (Eco, 1976; Danesi, 2021; Nöth, 2020). Pierce (1998), considered the father of semiotics, categorized signs into icons, indexes and symbols. In interface design, icons rely on visual resemblance, navigation buttons function as indexes of location or control and language-based elements operate symbolically (Galizia, 2019). Sonesson (2022), builds on Chandler’s work by examining visual and multimodal semiotics, highlighting how signs function in digital and artistic contexts. Kull (2020), extends these principles to biosemiotics, illustrating how Peirce’s theories apply beyond human communication. Together, these scholars validate the enduring significance of semiotic theory while expanding its frameworks to address contemporary modes of signification. This theory is worth employing in developing effective e-learning user interfaces (UI) for Zimbabwean primary learners with diverse cultural backgrounds and learning patterns.

Semiotic theory posits that meaning is not an inherent quality of symbols or objects; instead, meaning is created through the relation between the signifier and the signified and is mediated by shared understanding and cultural codes (Galizia, 2019). Every element in web interface design, including buttons, icons, and colour, has a purpose and has the power to greatly affect user comprehension and engagement (Mirsarraf et al., 2018). This viewpoint is supported by recent studies that show how design components work as a visual communication system. According to Norman and Nielsen (2022), UI elements such as buttons and icons are important signifiers that direct user behaviour by way of perceived affordances. Zhang et al.’s empirical research from 2022 shows that usability is directly impacted by icon design, with poorly made icons increasing cognitive load and decreasing efficiency.

Equally important are colour semantics; Al-Rubaie and Al-Khalifa (2023) demonstrate how colour selections have emotional and cultural connotations that influence user interpretation. Chen and Park (2023) describe how motion semiotics is used to convey functionality at the micro level through subtle interactions (such as button animations). This relationship is further quantified by Raptis et al. (2022), who demonstrate that button visual attributes (such as shape

and shading) can change click-through rates by up to 34%. All of these studies support the idea that web interfaces are semiotic systems in which each design element encodes meaning and shapes user behaviour and thought. Designers must prioritize the cultural iconography and conventions indigenous to Zimbabwe, which is a highly symbolic and visually represented country. Through the use of recognizable imagery taken from Zimbabwean folklore or Zimbabwean traditional art forms, designers will be able to increase learner interest and comprehension.

The Piercian Semiotic Triangle, developed by philosopher and logician Peirce (1998), is a useful tool for web designers, particularly in designing the user interface (UI) of websites for novice learners. The triangle (Figure 2.1). breaks down the elements of a sign into three components: the representamen, the object and the interpretent. Marsarraf et al. (2018) hold that the images presented in a web interface are all signs that symbolize or convey meaning to the user.

Figure 2.1 illustrates the Piercian Semiotic Triangle for web interface design.

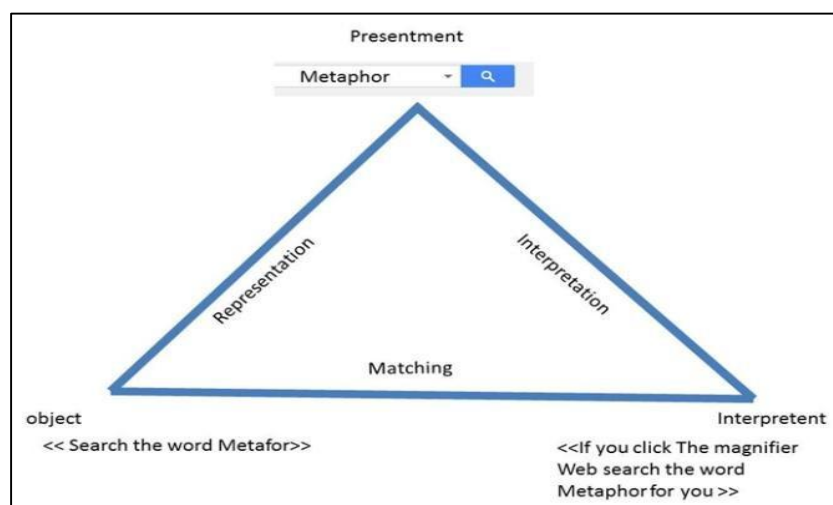


Figure 2.1: A semiotic model of a user-interface signs to search the web for word Metaphor (Mirsarraf et al.,2018:21)

At the middle of the triadic model is the representamen, or the sign itself. In interface design, this can be in the form of icons, buttons or graphics laid out on a webpage. These graphical components are the most common methods of interaction between the user and the interface. This constitutes what is being represented by the sign in the real world, such as actions, concepts or emotions. It is necessary that the users know the meaning and how the sign works.

The interpretant is the user's interpretation of the sign. It entails the mental representation or cultural meaning that the user attaches to the representamen and the object. The interpretant is highly subjective and may differ based on personal experiences and cultural variation.

Norman (1988) cited in Mirsarraf et al. (2018) stresses that one of the critical aims of a user interface is to assist users in forming an accurate mental model of the system. Simple and clear language, combined with visual prompts, can significantly improve understanding especially for individuals with low English language proficiency. As an acknowledgment of student diversity in learning styles, semiotic theory can inform the creation of multimodal interfaces that facilitate a range of learning styles. To illustrate the practical use of the Peircean triad, imagine an elementary school children's website with a game. Here, a big, brightly colored "play" button could be the representamen, announcing the beginning of the game. The interpretant is the user's understanding that clicking the button will initiate the game. By maintaining consistency and alignment between the representamen, object and interpretant throughout the website, primary school learners will intuitively grasp how to interact with other elements and navigate the interface. The use of the Piercian semiotic in web interface design is crucial as it provides a straightforward triadic model that helps create signs in ways that the audience understands (Littlejohn, 1999:330; Marsarraf et al., 2018).

2.1.2 ADDIE Model

The ADDIE model, which stands for Analysis, Design, Development, Implementation and Evaluation, was developed in the 1970s by the Center for Educational Technology at Florida State University for the United States Army (Branson, 1975). It remains the most commonly used model for instructional design. The model allows designers to progress from a general concept to a more detailed one, facilitating the analysis of the target audience's needs and informing the design process (Rossi, 2021; Perella & Borrelli, 2020). This model complements the Human-Centered Design (HCD) approach and enables different professionals to work in parallel on their respective areas of expertise (Bonaiuti et al., 2017). Figure 2.2 shows the ADDIE process.

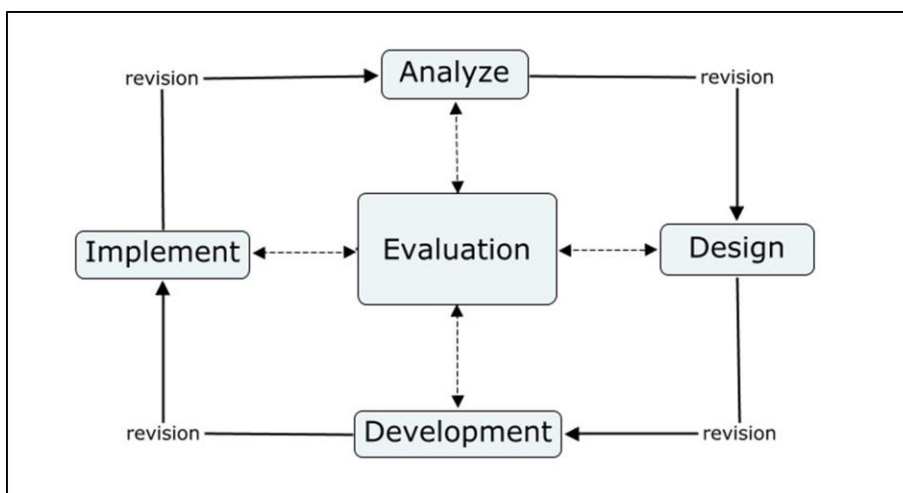


Figure 2.2: ADDIE Model.

Source: Centre for Educational Technology (1970)

Muruganatham (2015), notes that the analysis phase is an essential precursor to all the subsequent phases of instructional design, as well as the ADDIE model. In this phase, potential instructional issues, objectives and an analysis of the knowledge and skills needed for the instruction are determined. The design phase involves outlining the process by which the learners will attain the desired learning outcomes. The designers aim to create user interfaces that are simple to utilize and enjoyable, based upon interactive communication amid users and computer programs (Perella & Borrelli, 2020). Kurt (2017) highlights the importance of following a systematic process and some rules during the design process. The development phase involves the real creation of assets and materials defined in the previous design phase, such as lessons, simulations and exercises (Mayfield, 2011). Lastly, the implementation stage entails the actual delivery of the course or program to the learners.

Yeh and Tseng (2019) believe that the instructors ought to be monitoring the attitudes and behaviors of the learners throughout the learning process since these observations are great contributions to the evaluation process. The evaluation process assesses the effectiveness and efficiency of the instruction program and entails formative and summative evaluations. Faghih et al. (2014) also argue that the design process should start with the clear definition of the target audience, that is, their age, education, motivation and goals. Schneiderman (1997) in Lucia and Prella (2020) highlights the importance of following certain rules in interface design, such as

giving users control, reducing memory load and maintaining consistency. This model places users at the center of the design process as in HCD approach.

2.2. User Interface Design and eLearning Platforms

2.2.1 Definition and Components of a User Interface (UI)

A User Interface (UI) signifies the interaction nexus between a user and a digital device or application. Sridevi (2014) notes that an architectural blueprint is incomplete without essential elements such as doors, windows and utility connections. In the realm of software, these elements are akin to interface design. UI comprises all user-engaged components, with language serving as an interface for communication (Trymata, 2023; Pidoco.com, 2014). UI design encompasses three core aspects: developing interfaces between software components, facilitating interactions with nonhuman information producers and consumers and designing interfaces mediating human-computer interactions (Sridevi, 2014). Key elements, such as buttons, text, images, sliders and text entry fields, aim to provide an intuitive and efficient control mechanism (Pidoco.com, 2014). Adaptive design, accommodating various screen sizes and devices, enhances user experience (Alqurni, 2023). User-Centered Design (UCD) methodologies involve users throughout the design process, ensuring usability by understanding their needs and preferences, ultimately enhancing satisfaction and engagement (Uizard, 2023; Alqurni, 2023).

In UI design, software elements must be systematically organized to ensure a coherent layout guiding users through content easily (Trymata, 2023). This comprehensive approach includes the device's aesthetic appeal, response time and content presentation (Techtarget.com, 2014). UI design's intersection with human behavior is as crucial as technological considerations (Sridevi, 2014). Typography, involving font selection, sizes, spacing and text arrangement, enhances readability and conveys brand identity (Uizard, 2023). Color schemes play a pivotal role in evoking emotions and enhancing engagement by highlighting key elements (Trymata, 2023). Interactive components, such as buttons and sliders, are essential for a seamless user experience (Uizard, 2023). A well-designed UI fosters user interest, interaction and satisfaction (Priyadarshini, 2023), incorporating intuitive layouts, clear navigation, visual appeal and responsive interactions, ensuring continued user engagement (Amy Graphic Design, 2024). Personalization features, social integration and emotional design further augment user

engagement and satisfaction (Priyadarshini, 2023). As digital platforms evolve, the significance of UI design in enhancing user engagement and satisfaction remains paramount.

2.2.2 Principles of User Interface Design

A comprehensive grasp of UI design principles is crucial for developing efficient and user-friendly interfaces. Core principles include simplicity, consistency, visibility and feedback (Nielsen, 1995). Simplicity ensures intuitive navigation, reducing cognitive load on users. Consistency maintains uniformity in design elements such as fonts, colors and layouts across the platform. Visibility guarantees that essential options and tools are readily accessible, while feedback offers clear responses to user interactions, enhancing their experience and confidence (Shneiderman, 2016). Sridev (2014) notes that UI design involves studying human behavior as much as technology. Mandel (1997) in Sridev (2014) introduced three golden rules: empowering users, reducing memory load and ensuring consistency. Miya and Govender (2023) concur with Bakos (2019), emphasizing that excellent product experiences often begin with UX design, which then informs UI design, both critical for the success of digital products or websites.

Usability, accessibility and aesthetics are vital components of effective UI design. Usability refers to how easily users can navigate and interact with the platform, aiming for a seamless user experience (ISO, 2018). This stems from the understanding that UX is a powerful tool in product development (Sharma and Tiwari, 2021). Accessibility ensures that platforms cater for individuals with diverse abilities, adhering to standards like the Web Content Accessibility Guidelines (WCAG) (W3C, 2018). Sharma and Tiwari (2021) identify types of UIs: Character User Interface (CUI), Graphical User Interface (GUI) and Natural User Interfaces (NUI), which use voice, motion, gestures and biological signals to understand human intentions more intuitively. These contribute to aesthetics, focusing on visual appeal, which significantly impacts user engagement and satisfaction (Tractinsky, 1997). Designers can produce useful and captivating interfaces by striking a balance between usability, accessibility and aesthetics.

2.2.3 Usability

In the context of e-learning, usability is the degree to which an e-learning application is accessible, effective, efficient and satisfying for its intended users (Alshehri et al., 2019).

Fawareh and Al-Bardeen (2021) state that the notion of usability in e-learning applications encompasses several aspects, including ease of use, ease of learning, effectiveness and user satisfaction in achieving learning goals, as well as the efficiency with which tasks are accomplished. Gari and Henin (2021) add that usability entails various dimensions including the clarity and intuitiveness of the user interface, the availability and accessibility of learning materials, ease of navigation within the application, the responsiveness of the system and the overall user experience. In this regard, Chu et al. (2020) highlight that usability is at the core of e-learning applications since it has a direct impact on learners' motivation, engagement and learning outcomes.

2.2.4 E-learning systems

E-learning encompasses the application of technology in improving and simplifying the various processes within universities (Nguyen et al., 2020). Mergel et al. (2018) say these systems have tremendously altered how educational organizations function in delivering services, offering several benefits such as improved efficiency, improved transparency and considerable cost savings. Brown, Saxena, and Wall (2021) say that e-learning systems have extensively revolutionized educational organizations through improved efficiency, transparency and cost-effectiveness. As such systems develop, they will certainly become more pivotal in the delivery of educational services.

2.2.5 E-learning

E-learning is a learning method that involves all electronic types of education, such as the use of the Internet, intranets, extranets, satellite broadcasts, video and audio tapes, interactive television, and CD-ROMs (Mastan et al., 2022). Coman et al. (2020) describe e-learning as "electronic learning," "electronically mediated learning," or "digitally delivered learning." Learning is done by means of current information and communication technologies (Kiget, 2014). E-learning also uses instructional applications such as computer-aided instruction (CAI), computer-based digital CD-ROMs, the Web, and the Internet to support and manage the learning process. It is used at all levels of education, namely primary and secondary as well as tertiary education.

2.2.6 E-learning Application

An e-learning program, also known as a learning management system (LMS) or an online learning portal, is a computer application that serves as a virtual resource designed to provide learning material and resources within a computer setting (Peng and Dutta, 2023). Zardari et al. (2021) define an e-learning application as a dynamic and accessible platform that enables students to engage in learning activities, join discussions, access course content, submit assignments and get feedback from the instructor. Lew et al. (2019) suggest that such applications typically provide functionalities like communication tools (such as chat and discussion forums), multimedia content delivery (like videos and interactive presentations), progress tracking, collaborative learning tools and assessment functions. In addition, the platforms can be accessed across various devices including smartphones, computers, laptops and tablets, which allow students to access educational materials at any given time and from any place where internet connectivity is present (Sari and Henin, 2021).

2.3. Human Centered Design Approach (HCDA) in Education Technology

2.3.1 Principles of Human Centered Design Approach

Lubis and Shahri (2022) argue that the Human-Centered Design (HCD) process is a contemporary design thinking methodology that promotes the embracement of a participatory mindset in mainstream design practice so that co-creation with the intended user can take place. This is crucial as it takes into consideration the needs and capabilities of the users, specifically regarding usability and overall user experience (Harte et al., 2017). The demands of learners are crucial in design because they guide the creation of prototypes that can be tested and assessed to fit the intended users. To achieve usability of e-learning user interfaces, target demographics are actively involved in the design process (Krippendorff, 1998; Knight and Jetsioutine, 2006; Chatti et al, 2019), and creative industries view this as a more open philosophy of co-creation than more conservative manufacturing industries (Dorrington et al., 2016). This is because users rate platforms based on their interface rather than their functionality and a badly designed interface can lead to significant mistakes, which is why many elearning platforms are never employed in the educational system.

When building e-learning platforms, learner satisfaction is the most important feature that predicts real usage of the e-learning system (Mahomadi 2015; Chatti et al, 2019), and learners affect system quality (Mahomad 2015; Cidra et al 2018). In this situation, the designers may

experience the world through the eyes of the target user (Abrás et al., 2004; Hanington, 2017). Stakeholder involvement aids in the development of solutions that benefit everyone in the society, resulting in market-based solutions and encouraging social innovations by understanding people (Lubis and Shahri 2022) and testing the solution with real users (Norman, 2013).

The primary goal of HCD is not to demonstrate design talents, but to solve problems using ethnography, which entails in-depth study of groups of people by observing or participating in their lives (Madden, 2010). The needs and capacities of learners are taken into account, making designers aware of the learners' physical and mental limits. In this scenario, designers use cultural probes to empathize with and taste the participants' true experiences (Martin and Hanington 2019). In the HCD approach, stakeholders and design specialists collaborate in a design activity to create the best solution that works for the target group. According to Rouse (1991) as cited in Lubis and Shahri (2022), the HCD strategy improves human capacities, overcomes human limits, and increases user acceptability. Designing an e-learning platform begins with analyzing the learners' goals, skills, interests and inclinations, so that the platform is appropriate for the target learners. This is because understanding the consumers during the design process contributes to the establishment of an engaging and efficient user experience (Knight & Jetsioutine 2006; Garret 2011).

Hasani et al., (2020) postulates that HCD is an alternative method to genius design in which designers depend not only on their assumptions and expertise. Despite its widespread acceptance (Safa 2010), there is no uniform definition of UCD and how it is used (Galiknesi et al 2003). In the absence of well-defined UCD methodologies, there are three frequent phases: gathering, design and assessment (Hasani et al., 2020). Chatti et al. (2019) propose four separate actions in the HCD process: observation, ideation, prototyping and testing. Sommerville (2000) proposed the UCD design process, which includes development and refinement stages to meet user demands. The design approach contributes to a full grasp of learner requirements, sociology, psychology and their viewpoints in e-learning platform user interfaces.

Somerville's (2000) design method, presented in his book "Software Engineering" (6th edition), is a formal method of user interface design that can be particularly helpful in designing

interfaces for primary learners. The process starts with establishing a clear understanding of the tasks and needs of the intended user group. Madden (2010), as quoted by Lubis and Sahri (2022), stipulates that this aim can be met through either observation or direct participation in the lives of the researched subjects so as to enable the attainment of thorough and detailed know-how of varied cultures and subcultures, including the subjects' views and behaviors, and the contextual aspects that cover them, such as auditory, visual, spatial and locational. This aspect is of particular relevance to elementary students, whose cognitive faculties and learning styles differ considerably from those of adults. Lubis and Sahri (2022) argue that Human-Centered Design (HCD) empowers non-technical stakeholders, including students and teachers, to be actively involved in the design process. By observing how they behave, designers can tailor the interface to meet specific learning objectives, maximizing both engagement and accessibility. The initial design on paper allows for early feedback from end users, allowing designers to detect and solve usability problems before investing time in more sophisticated prototypes.

Somerville's spiral approach, with its recurring cycles of testing and prototyping, is essential in making sure the resulting interface is usable and effective. Aligning with Lubis and Sahri (2022), there should be a close partnership between learners, educators, designers, researchers and developers in co-designing meaningful indicators that actually address the needs of their users. The creation of operational and dynamic prototypes provides more realistic testing with primary learners and valuable feedback is gained from their interaction with the interface. This circular process, along with feedback from users, allows designers to refine the interface, making it more intuitive and fun for younger users. This approach adheres to user-centered design principles, making certain that the interface is developed in consideration of the tastes and abilities of the intended users (Preece et al., 2019).

2.3.2 Application of HCDA in E-learning

The effectiveness of e-learning relies heavily on the design of the learning experience. HCD emerges as a crucial approach to ensure that e-learning platforms are user-friendly, engaging and ultimately, successful in achieving their educational goals. This is because HCD involves iterative cycles of research, design, prototyping and testing, ensuring that the final product meets the specific requirements of its intended audience (Preece et al., 2019). Alsumait and

Al-Osaimi (2010) argue that applying HCDA in e-learning helps in creating interfaces that are intuitive and motivating for learners thus specific guidelines are required for kids rather than relying on general design guideline as indicated by Jamailar et al (2009) in Yuani (2017). One can point out that HCD emphasizes understanding the needs, behaviors and capabilities of users throughout the design process. For primary learners, this involves designing with considerations for their developmental stage, ensuring that the content is accessible, engaging and supportive of their learning objectives. According to (Large and Belsheti (2006); Fidel et al (1999); Hersh (1999); Large and Beshenti 2016 in Yuan (2017) children rely on visual indication or visual cues rather than textual information hence they interact through activity icons and other visual indicators on Graphic User Interface (GUI).

HCD approach is crucial for children since they interpret visual differently than adults and designers should consider immature cognitive development and void experiences of association to produce high recognizable age-appropriate icon design (Yuan 2017). This translates to increased user satisfaction, motivation and ultimately better learning outcomes. HCD prioritizes user needs, leading to platforms that are easy to navigate, visually appealing and engaging (Lee, 2018). Yuan (2017) opines that Sabina Idlers the founder of UXKids brings the notion of Child Centered Design (CCD) approach so that designers apply what they learned from kids to design a usable elearning interface. This is crucial because it fosters inclusivity, ensuring that e-learning platforms are accessible to learners with disabilities (Nielsen, 2010). Application of user preferences and incorporating interactive elements, HCD can create engaging learning experiences and this can be achieved by including games, personalized learning paths and collaborative activities (Lai and Hwang, 2017).

Children have short term memory and it is harder for them to have good interpretation and command of visual cues on specific graphic interface as adults too as indicated by Gelman (2014) in Yuan (2017). HCD is applicable in designing user friendly interfaces because it offers framework for enhancing the effectiveness of e-learning platforms. It prioritizes user needs, engaging in iterative design processes and focusing on accessibility hence it creates online learning experiences that are engaging, user-friendly and ultimately successful in achieving their educational goals. As e-learning continues to evolve, embracing HCD principles will be crucial for creating innovative and effective learning environments that meet the needs of diverse learners in the digital age

2.4. Learning Styles, Experiences and Perceptions for Effective Educational Outcomes

2.4.1. Learning Styles in e-learning

The effectiveness of learning styles in educational technology is still up for debate in current research. Although frameworks such as Kolb's Experiential Learning Theory (Kolb & Kolb, 2018) and VARK (Fleming, 2020) continue to have sway, recent research highlights neuromyths, the fallacy that strict style-based instruction leads to better results (Newton & Miah, 2023). For example, when instruction was strictly aligned with purported learning styles, a meta-analysis conducted by Wong et al. (2021) did not find any significant performance gains. Rather, multimodal strategies that make use of AI-driven adaptive learning (Luckin et al., 2022) exhibit promise by dynamically modifying content formats (such as videos and quizzes) in response to real-time engagement metrics. Baker (2023) points out that there are still difficulties in avoiding algorithmic bias and cautions against relying too much on predictive analytics, which could perpetuate learning disparities.

2.4.2 Learner Experiences in Technology-Enhanced Environments

Learner experiences (UX) in EdTech have come under increased scrutiny since 2020 due to the shift to hybrid learning. According to research, emotional design is crucial (Pekrun, 2021), and interfaces that encourage curiosity and lighten cognitive load improve retention (Mayer, 2022). Conversely, structural barriers such as digital literacy gaps (Selwyn et al., 2021) and device scarcity (UNESCO, 2023) distort experiences for marginalised learners. Low-tech innovations such as SMS-based learning in Zimbabwe (Chikomba et al., 2022) and culturally responsive design (Ladson-Billings, 2023) are examples of solutions. In order to prevent widening gaps, new technologies such as virtual reality labs (Jensen & Konradsen, 2023) must be accessible to all.

2.4.3 Learner Perceptions and EdTech Adoption

Personalisation and social presence are becoming more and more important in determining how useful EdTech is perceived (Borup et al., 2023). Gamification increases perceived value when it is in line with educational objectives (Sailer & Homner, 2024), but excessive use runs the risk of trivialising content (Nand et al., 2023). According to studies, people in the Global

South are sceptical of AI tutors because they prefer human interaction (Vavoula et al., 2023) or mistrust data privacy (Zembylas, 2024). Co-design approaches reduce discrepancies between developer assumptions and user needs by having students prototype tools (Garcia et al., 2024). According to longitudinal data (Luckin, 2025), clear benefits communication is essential for long-term adoption for example this app reduces dropout rates by 20%.

2.5. Challenges and Considerations for E-learning in Zimbabwe

2.5.1. Socio -cultural challenges

Use of electronic technology in delivering learning material and instruction is now a viable solution to quality and access concerns in education everywhere. Close adherence to the socio-cultural context wherein e-learning is implemented is key to effective delivery. Socio-economic inequalities are often the underlying cause of disparate access to computers, internet access and dependable energy (Mabweaza, 2018). This may leave out rural communities and low-income households, increasing the existing education disparities. Zimbabwe's ICT infrastructure has constraints, such as unstable internet connectivity in urban and rural areas that inhibits the uninterrupted offering of e-learning programs. As Chigwedere (2019) explains, an unstable and affordable internet connectivity limits e-learning to offer flexible and ubiquitous learning opportunities. Zimbabwe is a multilingual country with Shona, Ndebele and English as official languages. The majority of e-learning content is in English alone, which is a disadvantage to learners who prefer their mother languages (Mutasa, 2014). This is an indication of the lack of culturally appropriate material, which inhibits interaction and understanding. E-learning products that are not customized to the local environment can disconnect from the experiences and culture of the students (UNESCO, 2013).

Traditional attitudes towards learning in Zimbabwe are major hindrances in the adoption of e-learning. The emphasis on pedagogy and memorization based on instructors may cause hesitation towards learner-oriented, self-paced approaches usually associated with e-learning (Moyo & Zemura, 2013). Societal norms focusing on respect for elders and hierarchies may need to be broken when constructing e-learning interactions to promote inclusivity and acceptable learning behaviors. The majority of Zimbabwean students face drastic financial barriers to accessing internet access and e-learning devices. Further, the economic status of the majority of homes may require them to prioritize basic needs over scholarly ambitions.

Learners from low-income communities may not have the time or resources to fully participate in e-learning initiatives (Chigwedere, 2019).

2.5.2. Technological accessibility

Unequal ICT access to and utilization, or the digital divide, is the greatest obstacle to the accessibility of e-learning in Zimbabwe (Mabweaza, 2018). This is due to low internet penetration in rural regions estimated at 12% (Mlilo et al., 2017; Boer & Asino, 2023). Socio-economic differences frequently create differences in the availability of fundamental hardware and software, such as computers, access to the internet and a stable power source (Nhengu 2023; Chigwedere, 2019). Despite increasing access to the internet and mobile phones in Zimbabwe, a personal computer or smartphone capable of withstanding e-learning remains unaffordable to students due to its high cost (Chitiyo & May 2018). According to Fuhraman et al. (2020), the majority of individuals understand technological integration only from the monetary point of view and ignore the fact that money spent in schools is not the solution to problems. The lack of digital equipment disadvantages rural populations and low-income households, aggravating existing educational disparities and impeding their participation in e-learning possibilities.

According to Machisa et al. (2023) and Tsimba et al. (2022), the lack of computer laboratories and other critical ICT resources is a significant impediment to incorporating e-learning into the curriculum. Tsimba et al. (2022) explain that primary schools in Goromonzi District lack the requisite technical devices and equipment to enable e-learning, which impedes successful implementation and other critical e-learning programs. The lack of necessary hardware affects the smooth delivery of e-learning programs. This might be attributed to elderly school administrators who are technophobic, complicating e-learning adoption and oversight (Machisa et al., 2023; Boer & Asino, 2022), contributing to a high learner-computer ratio and inadequate e-learning implementation (Fankayi, 2022). As a result, the government should launch subsidy programs to make low-cost personal computers, tablets and mobile devices more accessible to low-income learners.

According to Bali (2018), teachers did not have the training or experience of teaching online and the opportunity to design their courses thoughtfully with the help of instructional designers and educational technologists resulting in poor implementation of online programs. Teachers

also lack skills and confidence in using ICT as exposed in COVID 19 and teachers used commodity teaching as excuses due to fear as they printed workbooks collected by parents (Boer et al., 2022). WhatsApp was used to communicate with parents when they could not collect materials, audios, text and picture were send explaining and giving instructions. Gachago et al. (2020) lament that there is no one-size-fits-all approach to e-learning implementation, therefore learners' culture, age, level and sociology should be taken into account. This is because learners lack self-regulatory learning (SRL) and the internal desire to learn inappropriately (Boer et al 2022). Schools vary in terms of digital literacy and attitudes towards technology, as well as in terms of learners and pedagogical techniques (Bali, 2018).

The absence of regular and cheap internet connectivity limits e-learning's ability to provide flexible and ubiquitous learning opportunities for all learners (Moyo & Mtetwa, 2013). Technological accessibility includes the capacity to use e-learning platforms and efficiently traverse the digital learning environment. Learners in remote locations or older populations lack the digital literacy abilities required to properly utilize e-learning materials (Mutasa, 2017). Zimbabwe's digital divide disproportionately affects women, low-income students and members of historically marginalized communities (Mlilo et al., 2017). Learners who do not have private access to telecenters, such as Community E-learning Centres, must rely on public access points. The accessibility disparity is greater between rural and urban locations. While urban residents have somewhat better infrastructural access, rural areas still face lengthier blackouts, lower device ownership and a lack of fundamental digital literacy and technical skills (Chitiyo & May, 2018). This might lead to sentiments of irritation and disenfranchisement, compromising their learning experience.

While primary learners increasingly have access to the internet and devices, many lack the digital skills and literacy required to effectively employ online or blended learning approaches. Zimbabwe's education system, in particular, cannot be left behind because it continues to rely on traditional classroom learning, with educators and most students lacking critical digital skills required for self-paced online learning such as conducting online research, using learning software and collaboration tools (Makamure, 2020). Chigona and Liguori (2019) emphasize that instructors encounter capacity shortages when it comes to implementing technology-enhanced education. Comprehensive training will be necessary to properly realize the benefits of e-learning throughout Zimbabwe's school system. One can point out that the required digital

literacy and e-learning courses for both students and instructors are critical to maximizing free resources and online lectures.

2.6. E-learning User Interface for Primary learners

2.6.1. Engagement and motivation

E-learning platforms have enormous potential to improve education in Zimbabwe. However, for elementary students, merely having access to technology is insufficient. Creating a UI that encourages engagement and motivation is critical for successful learning. Farrington et al. (2017) emphasise the value of play-based learning in primary education, particularly for young students in impoverished nations. An e-learning UI with gaming dynamics, interactive components and age-appropriate challenges may dramatically boost engagement. This is consistent with the notion of gamification, which uses game-like aspects in non-game environments to improve motivation and learning (Kapp, 2012). David & Glore (2010), as described in Kashabale (2021), aesthetics is concerned with the feelings, effects, moods and emotions that tie people to a product. Integrating elements such as points, badges and leader boards may generate a sense of success and healthy competitiveness resulting in sustained engagement.

Aesthetics is a discipline of philosophy that studies art and beauty, as well as how we perceive and appraise items based on the information we receive from other sensory inputs (Mbipom & Harper, 2009; Zhang, 2009; Maity et al., 2016). Incorporation of culturally appropriate content and narrative components into the e-learning UI can be very effective for elementary students. Aesthetic attributes of an E-learning interface design include layout structure, overall consistency, naming conventions, font and color consistency, information-dense layout and readability (Alsheri et al., 2019). Similarly, the UI can use local proverbs, folk tales and fiction that occurs in the familiar environment to facilitate easier and meaningful learning, enhancing learners' sense of cultural pride and identification.

Maity et al. (2016) found that aesthetics influences the perception of usability and users' overall experience of online services and thus is extremely important in E-learning system design. The UI must be pleasing to the eye and supportive of various learning styles. Using stunning colors, interesting images and animation can enhance focus and memory of young students (Mayer, 2014). For catering to visually challenged or limited users with higher costs of expensive

devices, UI needs to be constructed in accessible fonts, color contrast and responsiveness to different sizes of screens. Satisfaction is among the principal variables that considerably affect e-learners' entire experience of learning environments (Bowyer & Chambers, 2017).

The effective use of E-learning tools and environments is associated with increased learner satisfaction and learning agility (Chen et al., 2018). There should be prohibition of complex jargon and instructions should be given in a simple and straightforward manner. Providing timely and positive feedback practices is essential. Kim et al. (2018) posit that agility captures the capacity to continue learning and desire to apply things learned to new situations. Offering students feelings of freedom and autonomy within the e-learning interface could enhance student motivation. This could include providing students with a freedom to select their learning paths from a led set of activity choices, the selection of avatars or personalizing learning space to a limited extent. Creating an e-learning user interface that promotes engagement and motivation among Zimbabwean primary students' needs an integrated approach. Through integrating play, cultural relevance, imagery appropriate for age and reward, the platform can make learning an enjoyable as well as rewarding experience.

2.6.2. Usability and Accessibility

The efficacy of e-learning systems for primary school students is dependent on a useful and accessible user interface (UI). Usability offers a seamless and intuitive learning experience, whilst accessibility ensures that all learners, regardless of ability, may benefit from the platform. According to David et al. (2014) and Hofaman et al. (2010), an e-learning user interface should represent usability, memorability, error frequency and subjective satisfaction. Primary learners have particular cognitive and motor ability limits, as noted by Lai et al. (2012), who argue that these constraints should be recognised when developing technology for children.

System navigation might be appropriately conceptualised employing various sub dimensions, including navigational support: the degree to which navigational alternatives are shown on each frame to encourage memorability; reliable links: how precise and trustworthy the hyperlinks are; Clarity of Sequence: the amount of clarity and order of pages so that consumers do not become disoriented. Quit and return with ease: Users may quickly depart the E-learning system and return to their most recent place (Kishabale, 2021). The World Wide Web Consortium

(W3C) Web Content Accessibility Guidelines (WCAG) provide a comprehensive framework for developing accessible web content. These rules include text replacements for images, keyboard navigation and compatibility with assistive devices like screen readers.

Meyer et al (2015) conclude that poorly designed interfaces distract students, raise stress and reduce the quality of learning results. Creating a functional and accessible e-learning user interface for Zimbabwean primary learners necessitates a thorough strategy. Educators may develop a genuinely inclusive learning environment by prioritizing user-centered design principles, adding accessibility features and ensuring the platform accommodates to varied learning styles and abilities. The user interface is critical to any e-learning platform (Centre for Disease Control and Prevention, 2013; Kashabale & Sharifali, 2018; Kashibale 2019), and the appearance of e-learning serves as a medium of communication to determine the extent of engagement (Centre for Disease Control and Prevention, 2013; Kashabale 2022).

2.6.3. Cognitive load and interface design

E-learning systems have huge promise for engaging young learners and instilling love of learning. According to Yuan (2017), research investigations have indicated that youngsters are increasingly using digital platforms like websites, applications and video games. The success of eLearning systems is dependent on UI design that reduces cognitive burden while optimizing the learning experience. Cognitive load is the amount of mental work used by learners in processing information (Sweller, 2011). Ribaupiere (2001); Byrnes (2008) and Piaget (2007) explains that children go through four phases of cognitive development: sensorimotor (0-2 years), pre-operational (2-7 years), concrete motor (7-11 years), and formal operational (adolescence through childhood). Primary school learners, with their growing cognitive capacities, have a restricted capacity for information processing, necessitating more suitable interface design (Yuan 2017). Excessive cognitive load in e-learning interfaces can cause irritation, disengagement and poor learning results (Van der Meij & van Merriënboer, 2017). Age group and gender, in addition to education, personality and training, should be regarded essential user factors (Large & Beshenti 2006; Horton 1994; Yuan 2017).

Cognitive load theory (CLT) offers useful insights for developing e-learning interfaces that reduce cognitive stress in young learners. CLT proposes three categories of cognitive load: intrinsic, which results from the complexity of the learning material itself; extraneous, which

results from irrelevant aspects in the interface design; and germane, which is the cognitive load required for learning. Effective UI design seeks to reduce superfluous load while increasing the chance for relevant load. Students are supported by clean, visually simple interfaces. Moeller et al. (2014) report that the use of a clean structure, few words and uncomplicated navigation prevents unnecessary load and allows students to focus on the most pertinent learning material. Motivation is improved and recalling can be increased in young students using attractive pictures, animation and interactivity (Mayer, 2005). However, it is necessary that these graphics share a tight relationship with the learning objectives and do not add complexity. Dividing information into consumable chunks, i.e., bite-sized lectures or practice, decreases the cognitive load associated with processing large amounts of information at once (Sweller, 2011). This enables young learners to concentrate on manageable chunks of information and progressively build upon their knowledge.

Games, quizzes and simulations can promote active learning and strengthen retention of content by presenting an interesting learning environment (Clark & Mayer, 2016). This necessitates careful planning to ensure that the interaction is properly related to the learning objective and reduces unnecessary cognitive strain. Designers should create designs based on their intended users (Jamail et al., 2009). Yuan (2017) notes that Idler (2024), creator of UXKids, introduced the concept of Child Centered Design (CCD), emphasizing that designers should use what they learnt from the kids to design. Primary students thrive on positive reinforcement and timely feedback. To recognize successes and urge students to continue studying, e-learning interfaces might include elements such as points, badges and progress bars (Ryan & Deci, 2017). Feedback should be specific, actionable and delivered constructively to guide learners towards mastery.

2.7. Localized e-learning solutions

2.7.1. Ruzivo Digital Platform

The Ruzivo digital platform, introduced in 2019 by the Higherlife Foundation, is an interactive learning platform designed for primary and secondary students (Ruzivo, 2019). The implementation of online programs like Ruzivo indicates a poor understanding of the diverse nature of the education system, as noted by Bali (2018) and Gachago et al., (2020). Despite this, the Ministry of Primary and Secondary Education (MoPSE) has shown support for ICT

initiatives in education, such as the Schools Computerized Program in 2000, the Presidential e-learning program in 2011 and the introduction of electronic ministry application platforms in 2016. Ruzivo Digital Platform, as presented by Ruzivo (2019) and cited by Nhongo & Tshotsho (2021), aims to close the marginalization of students in rural areas by providing them with access to 21st-century learning approaches, in a bid to raise well-informed future leaders who will be instrumental in developing Africa. The platform aims to transform and enhance learning in Zimbabwe through the use of innovative technological interventions (Ruzivo, 2019).

A study by Nhongo and Tshotsho (2021) examined the challenges of online learning in rural Zimbabwean settings during COVID-19 lockdowns. The findings indicated that a number of the teachers in such environments were not familiar with the Ruzivo digital platform and could not grasp its functions despite efforts to seek information through online media. Notably, MoPSE (2018) reported that only 15% of primary school teachers possess basic computer skills and this is partly what drives a negative attitude and resistance in the usage of e-learning platforms by students and teachers. Moreover, it should be noted that three out of four primary school students reside in the rural areas (MoPSE, 2018). The figures highlighted call for specific interventions in bridging the digital literacy divide and promoting equitable access to learning resources in these regions. Notwithstanding the Ministry of Primary and Secondary Education's insistence on the utilization of the Ruzivo online platform as a means of continuous learning under lockdown, the research referred to by Nhongo & Tshotsho (2021) revealed a significant absence of awareness and usage of the platform among rural Zimbabwean teaching personnel.

2.7.2. Akello Digital Classrooms

Ruzivo online platform, which was unveiled in Zimbabwe on 28 May 2020, is a local endeavor to offer access to online curriculum lessons that are purposely crafted for primary to secondary level students (Chronicle, 2020). The online platform was crafted by Cassava Smart-tech, which is a diversified digital services business entity under the Higherlife Education business unit of Econet (Nhongo & Tshotsho, 2021). However, as the nation continues to progress in its adoption of ICTs in education, there remains an under addressed gap in creating inclusive e-learning platforms that cater to all levels of education and also consider cognitive development.

Failure to cater for learners' varying levels can result in a poor user interface, which can discourage students from utilizing such learning platforms.

As put forth by Nhongo and Tshotsho (2021), the Akello platform, as much as it offers both synchronous and asynchronous learning modalities, is seen as elitist as it locks out students from underprivileged and rural backgrounds. This highlights the importance of careful planning and implementation of e-learning programs. Hodges et al. (2020) highlight the critical role played by cooperation between teaching staff, administrative staff, parents, and students in the successful implementation of practical e-learning platforms. It is essential to refrain from using technology in the absence of adequate experience, as the practice is likely to result in errors and a feeling of insecurity among teachers and students, which can eventually cause a negative attitude towards technology (Weller, 2020).

The lack of abundant research on the deployment of e-learning platforms in Zimbabwe has resulted in an abundance of platforms that are characterized by inadequate user interfaces. An example is provided by Akello and Ruzivo, two online platforms operated by the same organization and serving the same function, as noted by Nhongo & Tshotsho (2021). The authors take the view that the replication of Ruzivo by Akello was unnecessary; rather, they should have put more emphasis on creating more elaborated learning and educational platforms for all. Here, we can see the need to involve the users in the design process in order to improve the platform and to ascertain that the platform fits the requirements of the target audience

2.7.3. The Zimbabwe Learning Passport

Within the context of leveraging technology to close the educational gaps, particularly during periods of crises such as the COVID-19 pandemic, the Zimbabwe Learning Passport (ZLP) is a vital intervention. The Learning Passport, launched in 2021 by UNICEF in collaboration with the Ministry of Primary and Secondary Education (MoPSE), aimed at promoting inclusive access to quality education for students who encountered challenges such as poverty, marginalization and limited connectivity (Abrahamian & Feki, 2021). The ZLP is distinguished as an online content platform under MoPSE by providing free access to over 1,000 educational resources in the form of radio lessons, syllabuses, teachers' guides, learning modules, and interactive materials. This is supported by findings of Chigona & Chigona (2020), which show

that localized e-learning platforms can effectively reduce education inequalities in developing nations through responsiveness to specific socioeconomic and cultural circumstances. The ZLP assisted in upskilling teachers, learners, and youth, an essential factor to enable effective learning in the 21st century while ensuring the continuity of teaching education amid school closures (Mavengere, 2021). Besides, ZLP increases access and equity in learning through addressing marginalized groups' demands for commercial e-learning platforms, attained by offering both local and international content (Abrishamian & Feki, 2021).

The fact that the rollout of the Zimbabwe Learning Passport was so rapid is in itself a reflection of its success; in its first week, 70,000 enrolled, 25% of the 300,000 target for 2021 (Abrishamian & Feki, 2021). This aligns with the findings of Mugochi & Mutasa (2022), who argue that the adoption of digital platforms within learning institutions has the potential to enhance equity and accessibility, particularly for marginalized and rural groups. Platform design with both online and mobile applications for Android devices is a testament to its flexibility to fit into the Zimbabwean digital infrastructure, which still struggles with internet connectivity despite having a staggering mobile phone penetration rate of 89.4% (DHS, 2019). Such collaborative initiatives as the GIGA project, aimed at enhancing internet connectivity nationwide, reflect Zimbabwe's broader dedication to transforming education through digital literacy and ICT adoption. Chikwature and Oyedele (2020) further point out the necessity of resolving infrastructure concerns, including access to devices and connectivity, challenges that ZLP has tried to mitigate through its demands for offline capability. Digital literacy is also strengthened and usage is encouraged by advocacy campaigns of UNICEF and teacher training programs. ZLP is a very good example of how digital innovation can provide equity and inclusion in education through its alignment with regional and international agendas for ICT in education (Abrishamian & Feki, 2021; Mavengere, 2021).

2.7.4. Adaptive learning technologies

The introduction of e-learning systems has transformed the learning landscape by exposing young students to a wealth of information (Kaoni et al., 2023). Yet, both classroom-based and online learning contexts tend to adopt a one-size-fits-all approach, disregarding young people's varying needs and learning styles. Yuan (2017) highlights the importance of not making the assumption that children's interpretations and interactions with symbols and metaphors are the

same as those of adults. Conventional e-learning approaches neglect to completely consider the dramatic physiological and cognitive changes that children experience throughout development (Large & Belsheti, 2006; Gelman, 2014). It is therefore important to take these aspects into consideration and modify e-learning experiences to reflect the special needs of young children.

In conventional e-learning methods, learners are typically exposed to a pre-established framework of content that does not take into account their understanding or learning rate. Such rigidity has the potential to cause frustration and boredom, particularly in younger learners with diverse learning styles and capabilities. Kaoni et al. (2023) suggest a method with three dimensions of adaptability in e-learning: content, navigation, and presentation. For instance, consider a classroom setting where every student, irrespective of his or her reading capacity or favored learning modalities, is provided with the same book. This practice would naturally cause irritation and monotony in students. In the same way, e-learning platforms are confronted with the challenge of accommodating varied learners, making it evident that flexible and adaptive online learning methods are needed in accordance with adaptive learning models (El Janet et al., 2018). It is essential to customize e-learning experiences according to individual learners' unique requirements to achieve optimum participation and successful learning outcomes.

Adaptive learning systems offer a promising solution by dynamically adjusting the learning experience based on the individual characteristics of a particular learner. El Janet et al. (2018) highlight that adaptive learning is an interdisciplinary field that combines computer science and human sciences. This approach has the ability to combine various kinds of information, such as the background knowledge of a young student assessed through pre-tests, the learning pace tracked by the system, and his or her learning style—visual, auditory, or kinesthetic—determined through fun activities. El Bachari et al. (2010) emphasize that adaptive learning promotes a unique learning experience adjusted for the specific attributes of each student. Kaoni et al. (2023) cite Parten & Mancine (2000) and Quzdar (2015) in defining three levels of e-learning platform adaptation to young students: content adaptation, navigation adaptation, and presentation adaptation. Adaptive interfaces personalize learning to individual interests and needs, stimulating and encouraging young students. No longer do students need to wrestle

with content that is too challenging or repetitious; instead, they are able to achieve a sense of success in a nurturing educational setting, which fosters an internal motivation to learn.

The prospective future of adaptive learning in early education is especially promising since technological innovation allows researchers to create novel methodologies (Ennoumani & Mhani, 2019). Among the most prominent methods in this field is gamification, an integration of game design elements into education models to create personalized paths of learning that enhance intrinsic motivation and a sense of accomplishment in early learners. Firdausiah (2019) underscores the significance of utilizing unsupervised learning methodologies to forecast learner styles, thereby enabling the classification of learners according to their respective styles and the application of supervised learning approaches. The integration of Artificial Intelligence (AI) to provide immediate feedback and personalized interventions can significantly improve the educational experience by identifying specific learning deficiencies and delivering timely support as required. Artificial Intelligence (AI), according to Kaoni et al. (2023), refers to concepts and technologies that replicate human intellectual functions and enable computers to undertake tasks related to cognition, like learning and reasoning. This capacity makes platforms capable of tailoring information, navigation, presentation, preferences, skill level, prerequisites and learning objectives to each learner's individual needs. Additionally, developing UI design principles that are tailored to adaptive learning experiences can help young learners intuitively navigate the interface and fully benefit from personalization.

2.8. Designing an engaging e-learning UI for primary learners in Zimbabwe

2.8.1. Cultural relevance and localization

Culture can be implicit and hard to understand because it is vague and complex (Asri et al., 2023). Munasighe (2017) in Hanis et al. (2023) indicates that it is not simple to be aware of culture. Relevance in culture is required for their success in Zimbabwean education, particularly on e-learning platforms. Aljam & Alobaidy (2018) stress the need to take into account the cultural context while developing e-learning platforms, since culture involves a broad array of human activities and behaviors. Standard interfaces that are not culturally meaningful may give users a feeling of disconnection and reduce participation, possibly expanding the digital divide (Munasighe in Hanis et al., 2023).

Culturally relevant design (CRD) is about designing user experience that identifies with the cultural heritage, value system, and knowledge structures of the target population (Hanis et al., 2023). Culture is shaped by history, values, beliefs, and surroundings, and the adoption of CRD factors in e-learning interfaces will significantly impact Zimbabwean primary learners (Hanis et al., 2023). User-Centered Interaction (UCI) can also be employed to align the user's intentions and preferences (Alsswey & Alsmanae, 2021; Hasani et al., 2020). Employing shared cultural references, personality, dialects, habits, religion, and narratives can capture the interest of young learners and render learning more relevant (Hasani et al., 2020; Hasani et al., 2023). For example, an e-learning course that teaches foundational mathematics concepts by using Zimbabwean folktales or traditional counting rhymes will have a greater chance of reaching young students and encouraging them to interact with the content.

Presenting learning material in a setting that is culturally familiar enables the primary learners to connect new knowledge with old knowledge, leading to better understanding and retention (Lewis and Sauro, 2021). Culturally contextualized design (CCD) adds strength to cross-cultural communication and interaction, responding to audiences from cultures that differ (Munasinghe, 2017). E-learning sites that support local languages, proverbs or local heroes can help young learners develop a stronger cultural base so that they can construct meaning more effectively. This is achieved by making primary school children in Zimbabwe feel at home and culturally proud since they can identify with their own culture on the e-learning platform (Abudul et al., 2022). This cultural connection has the ability to make learning more enjoyable and motivate active engagement with the learning material.

Localization, being one of the core elements of culturally responsive design (CRD), is not limited to mere translation of information to local languages (Asri et al., 2023). Localization calls for adapting the interface along with learning material to the respective cultural context of Zimbabwean primary school students. This can be achieved by using languages such as Shona or Ndebele as the primary language of teaching, rendering it more understandable and accessible (Zanjani et al., 2017). Aljam and Alobaidy (2018) argue that the UI needs to be dimensioned for culture, and this encompasses attributes such as metaphors, navigation, mental models, appearance, and interactivity. This way, learners do not have any additional linguistic hindrances when studying new topics. By employing familiar imagery, such as local scenes,

fauna or cultural symbols, the visual interface can be more engaging and create a sense of familiarity among young students (Akram & Khani, 2020). For instance, an e-learning system that uses images of everyday life in Zimbabwean society or illustrates traditional dress and artifacts would render learning more engaging and culturally relevant.

Developing learning experiences and illustrations based on the Zimbabwean environment enables the young learner to link the materials with their environment and life and leads to higher subject matter understanding (Abdullah, 2020). For instance, an online course offering easy science subjects may employ local plants and animals or everyday objects at home in Zimbabwe. Culturally responsive design is a practical way to develop interactive e-learning interfaces that bridge the digital divide for Zimbabwean primary school children. Through the use of local languages, cultural icons, and common contexts, e-learning platforms can establish a sense of belonging, enhance learning performance, and prepare young learners for success in the digital era. With e-learning evolving in Zimbabwe, centering culturally informed design principles at the forefront will create more inclusive and meaningful learning experiences for all primary learners, regardless of background or location.

2.8.2. Gamification and interactive elements

The integration of technology in education has brought about a transformative impact on learning, particularly in developing countries like Zimbabwe (Handayani et al., 2020). E-learning platforms offer convenience and enhance the learning process and quality (Handayani et al., 2020). Conversely, engaging young primary school learners can be challenging. To address this, gamification, which involves applying game design elements to non-game contexts, has emerged as a promising solution to enhance learner engagement and motivation (Deterding et al., 2011). Games support the development of critical thinking skills and multitasking, which are essential for problem-solving techniques (Goksun & Gusov, 2019). By incorporating game mechanics such as points, badges, leaderboards, and challenges, e-learning platforms can create a more interactive and rewarding learning experience (Hamari et al., 2014). This, in turn, leads to increased participation, improved knowledge retention, and better academic performance (Kapp, 2012). Gamification helps students understand and motivates them to actively participate in the e-learning process (Handayani et al., 2020).

The use of gamification in primary education is particularly relevant due to the developmental stage of young learners (Hayanto & Hansun, 2020). Research has shown positive results when applying gamification methods in educational applications designed for elementary school learners (Hayanto & Hansun, 2020). Gamified e-learning platforms can leverage the natural curiosity and enjoyment of playful learning experiences in children of this age group (Pivec, 2016; Handayani et al., 2020). However, when implementing gamification in Zimbabwean primary education, it is important to consider the local context, including factors such as limited access to technology, varying levels of digital literacy, and cultural preferences (Moyo & Chitiga, 2019). Learners have diverse needs and requirements for how content and programs should be presented (Lim et al., 2013). Therefore, careful consideration and adaptation are necessary to ensure the effective implementation of gamification in the Zimbabwean primary education system.

To capture students' attention and enhance engagement, teaching content should include visually appealing elements such as infographics and animations (Phunkaew et al., 2019). Interactive elements like quizzes, simulations, and virtual field trips promote active learning by involving students in the learning process (Mayer, 2014). These interactive features allow students to deepen their understanding, develop critical thinking skills and retain information more effectively. Additionally, interactive elements provide immediate feedback and opportunities for collaboration, making e-learning more engaging (Kishabale, 2021). Research suggests that content interactivity positively influences learner satisfaction and academic achievement (Zimmerman in Kishabale, 2022). By incorporating culturally relevant content and interactive elements that align with local learning practices, e-learning can be more effective for Zimbabwean primary school students (Moyo and Chitiga, 2019). This approach fosters a sense of ownership and encourages active participation in the learning process (Clark & Mayer, 2016).

2.9. Conceptual Framework

The conceptual framework is a set of specific ideas that can be used within the larger theoretical framework. A theoretical framework informs the conceptual framework. While a theoretical framework describes the theoretical underpinnings of my research based on existing research, a conceptual framework allows the researcher to draw his own conclusions, mapping out the

variables that the researcher may use and the interplay between them. For the purpose of conducting this study, the researcher drafted the conceptual framework in Figure 2.8.

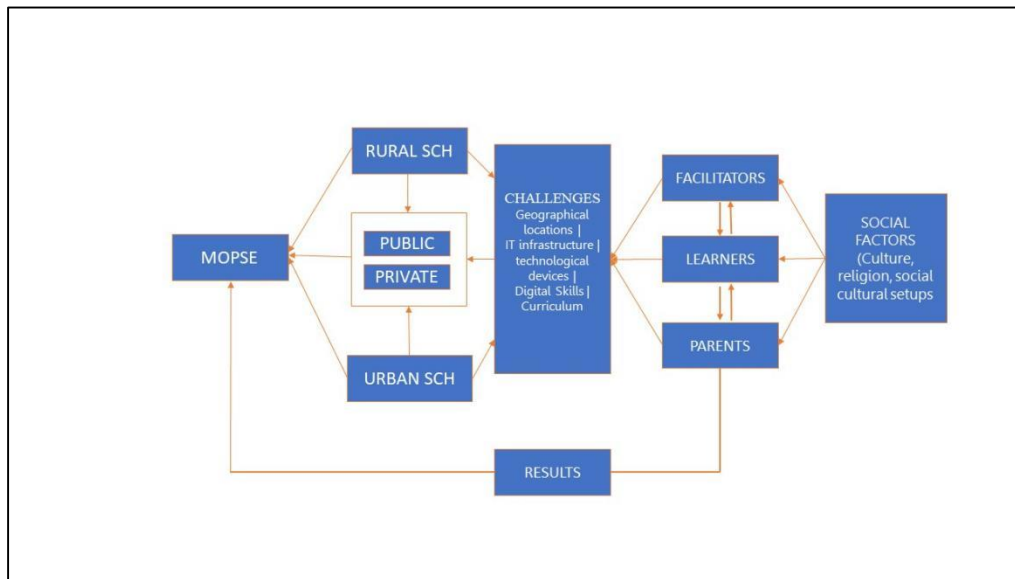


Figure 2.4: Design Conceptual Framework

Source: Author (2025)

The Ministry of Primary and Secondary Education (MOPSE) plays a crucial role in formulating curriculum, policies and frameworks to facilitate the introduction and implementation of e-learning. Their ICT policies serve as guiding principles for the development and utilization of e-learning. The Vision for ICT policy in MoPSE (2019) is to ensure that ICT is used effectively and efficiently in the education sector allowing all learners to reach their full potential and become responsible citizens. This means technology should be integrated into education in a way that supports learning and development at the same time, promoting the ethical use of ICTs.

Dzinotyiweyi and Taddese (2020), state that the ICT policy outlined by MoPSE (2019) focuses on four key areas: technical infrastructure, e-resources, capacity building, and sustainability. The availability of digital devices, infrastructure, and geographical location significantly impacts the delivery of e-learning. For instance, schools in rural areas are disadvantaged when they lack proper internet and device accessibility, thereby impairing the proper roll-out of e-learning. Attitudes towards e-learning among the facilitators and administrators directly affect learners' involvement and experience as well. Also, harmony between teachers, learners, and parents when making use of the e-learning platform affects them directly.

Attitudes of students, cultural context, and availability of tools are critical factors influencing their receptiveness to e-learning as well as the effectiveness of the interfaces used (Chikanyawo, 2022). Social and cultural factors need to be considered while designing e-learning interfaces to make them relevant and inclusive. Students are treated as independent agents of their learning and whose experiences guide their learning outcomes (Hase & Kenneyon, 2007; Chikanyawo, 2022). Experience and feedback on e-learning implementation are valuable information to MoPSE and guide policy improvement and the planning of interfaces that are responsive to educational objectives.

The development of e-learning interfaces that are sensitive to group values and cultural orientations is crucial to building a meaningful user experience (Bakos, 2020). Key stakeholders and various influencing factors need to be considered during the development process. Tailoring interfaces to infrastructure, culture, and context enables full realization of the potential of education from technology. This comprehensive approach acknowledges the perspective and role of all stakeholders in the e-learning context.

2.10. Chapter Summary

This chapter examines the body of research on eLearning user interfaces (UI), with a focus on developing captivating learning environments for four and seven Zimbabwean students. By reviewing prior studies, the researcher hopes to find gaps and possibilities in current understanding. The author also discusses the challenges that arise while implementing e-learning programs and identifies crucial success criteria. The review emphasized the significance of assessing implementation procedures, particularly in the Zimbabwean setting. This is consistent with the Semiotic Theory and the ADDIE model as frameworks for research. By using current ideas on eLearning UI design and the HCD technique, the researcher placed the research study within the larger academic area and provided useful insights into building excellent e-learning experiences for Zimbabwean students in grades 4-7.

CHAPTER III

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the research design and methodological choices the researcher made. This includes the purposes and reasons for selected methodologies. This study is designing an engaging e-learning User Interface (UI) for primary school learners in Zimbabwe. The research's aim is to design an engaging e-learning UI for primary school learners in Zimbabwe. The chapter discusses a research methodology which comprises of the paradigm, philosophical stand point, approach and strategy employed in the study. In addition, the design encapsulates methods of data collection and how the data was analyzed. Towards the end of the chapter the researcher discusses factors affecting the trustworthiness of findings and how they were addressed together with ethical considerations. A summary of the Chapter concludes the section.

3.1. Rationale for research on designing an e-learning UI for primary School learners

The aim of this study was to design an engaging User Interface (UI) specifically for primary school learners in Zimbabwe, targeting Grades 4 to 7. User Experience (UX) serves as the foundation for creating exceptional UIs, as it helps designers clarify what users want and need (MacKenzie, 2014). UX and UI can be compared to an iceberg, where UI is the visible part above water and UX represents the significant but hidden portion below the surface. Recognizing the critical role of UX informs the choice of research methodology and study design, ensuring a comprehensive approach. UX plays a pivotal role by aiding the researcher in understanding the target population through techniques such as personas, user stories, user research and usability testing, which are all essential components of action research (Norman & Nielsen, 2018). Fig 3.1 shows the relationship between UX and UI by Mackenzi, 2014

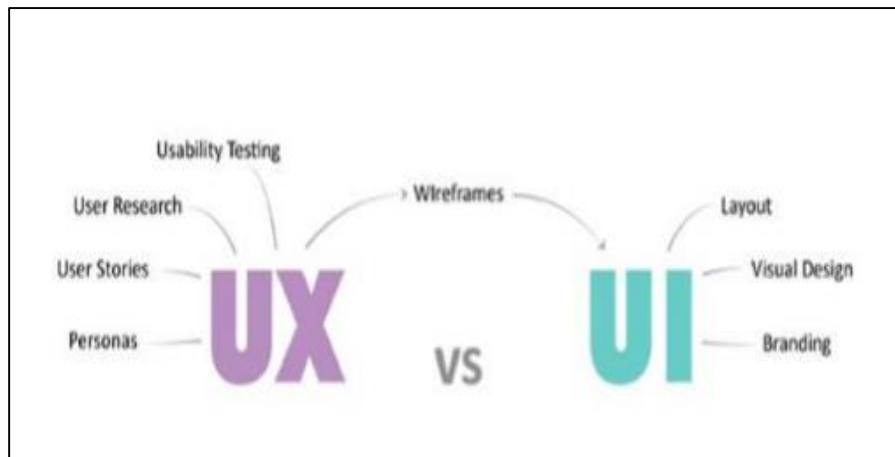


Figure 3.1: Relationship between UX and UI

Source: Mackenzi (2014)

This understanding helped in crafting wireframes, determining layout, visual design and branding, which are central to achieving the core aim of the study of designing engaging UI for primary learners. To effectively capture and analyze these intricate user experiences, the researcher has selected a qualitative research methodology. This method is suitable since it enables a thorough investigation and dissection of people's common experiences, offering important insights into their requirements and preferences, which are essential for creating a user interface that is not only useful but also interesting and simple for young learners (Creswell & Poth, 2018).

3.2. Research Process

The Research Onion Framework, served as a meticulous guide for the research methodology in this study on creating an e-learning user interface for primary school learners (Saunders et al., 2018). Establishing a thorough and superior research design was made possible in large part by this framework. The researcher was able to defend every aspect of the research design by methodically removing each layer of the research onion, making sure that every choice was firmly based on the goals and research questions. From the research philosophy to the techniques for data collection and analysis, The Research Onion offers a clear framework that makes it easier to conduct a cogent research process. This consistency is essential for upholding the research's integrity and guaranteeing that the techniques selected are appropriate for meeting the particular requirements of the study (Saunders et al., 2019). The Onion Framework is Illustrated on Figure 3.2 below:

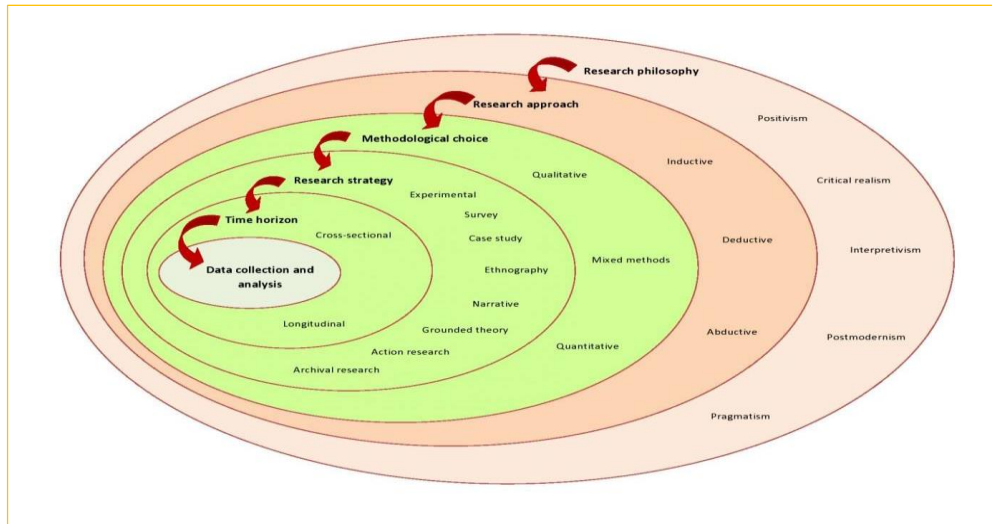


Figure 3.2 The Onion Research Framework: Source: Sanders et al (2018)

Importantly, the Research Onion distinguishes between the tactical aspects of data collection and analysis and the overall design. While the inner layers of the onion highlight the particular strategies used in data collection and analysis, the outer layers concentrate on the research philosophy and approach, laying the groundwork for the study. This framework made sure that the qualitative methodology used in this study was suitable for thoroughly comprehending and dissecting the common experiences of primary school teachers and students. The Research Onion offered a methodical approach to creating an engaging e-learning platform that satisfies the needs of Zimbabwean primary school students by assisting the researcher with key stages of the research process (Saunders et al., 2018).

3.3 Research Philosophy

In this study the researcher adopted an interpretivist research philosophy, which emphasizes understanding human behavior and experiences from the participants' perspectives (Neuman, 2014). Agiboneji (2016) cited in Chikanyawo (2022) interpretive school of thought helps the researcher with a philosophy underpinning and informing the researcher's choice of research questions, methodology and intentions. Gemma (2018) extrapolates that truth and knowledge are subjective as well as culturally and historically situated based on people's experience and understanding them. This philosophy aligns with the Human Centered Design approach, as it seeks to understand the subjective experiences and needs of the learners in their natural learning environments. According to Chikanyawo (2022) in his study on the implementation of e-learning at primary level, interpretive paradigm helped the researcher to interpret the

participants' three levels of interaction, namely the philosophical, social and technical levels which are also useful when designing UI for primary learners in Zimbabwe.

Interpretivism is embedded in ontological and epistemological assumptions which helped to guide the researcher's view (Chikanyawo 2022). Martens and Maclughilin (2004) in Chikanyawo (2022) ontological dimension address questions of reality as it mediates and provides common knowledge about usability of e-learning platforms. In his research he also included Neumen (2014)'s thoughts of epistemology focusing on defining how we know, what we know and the most valid to reach the truth thereby differentiating truth and falsehood. The researcher through unstructured questionnaires, interviews, observations and analysing documents managed to uproot the underlying phenomenon on the usability of e-learning.

Gemm (2018) also notes that there is a distinction between natural and social world and more importantly social organisation and experiences form people's perceptions of reality. In his writing he included Bryaman's (2008) four approaches to interpretivism. First is hermeneutics (Heidegger, 1962) which emphasize on interpreting or understanding text or documents and their deeper meaning. For example, Charalambose (2010) states that, patience's signs, and symptoms are regarded as form of text waiting for the nurse to come and interpret them. In this study learners where exposed to e-learning technology and through actions were observed and interpreted to design engaging UI for primary school learners. Verstehen (Weber,1947) helped on the understanding perceptions of primary learners to understand why a phenomenon exist and why they behave the way they do when exposed to e-learning platforms. Social symbolic interactionism (Mend, 1962) which construct meaning from social interactions, people's behaviour, perceptions and experiences.

3.4. Approach to Theory Development

An alternative strategy for formulating a theory was used in this study, which was an inductive approach in the form of inductive reasoning. An in-depth understanding of teachers' and students' experiences with e-learning user interfaces (UIs) was obtained through interviews and the distribution of questionnaires (Saunders et al., 2019). In order to develop more comprehensive understandings of participants' interactions with e-learning user interfaces, the study collected particular data from them. The approach was effective because it enabled

analogical reasoning which was valuable in the designing of age appropriate UIs as it draws conclusion about something based on simulation of another thing through going for small details to big ideas. This encouraged gathering clues and connecting dots guided by evidence. The researcher is of the view that development of the theory or framework through gathering information from participants to solve problem at hand can be equated to the design of e-learning UI since it contributes to generation of new knowledge and contextual problem solving.

Saunders et al, (2019) describe inductive approach as one that allows researchers to have a broad perspective. This approach enables researchers to explore complex events by examining collected data rather than relying on existing data. This method is useful in user-centered design (UCD), where the goal is to prioritize the user experience throughout the development process (Suryono, 2020). The researcher was not confined to fixed view points as complex events were unpacked which included psychology of learners, age, culture, sociological factors and their thought process enabling the designing of an appropriate UI. In order to support the iterative design process and action research strategy used in this study, the approach was chosen for its exploratory power, contextual understanding, participatory perspective and knowledge generation. The method works well because it emphasises data-driven strategy to guarantee that the e-learning user interface is designed with practical use in mind rather than merely theoretical presumptions.

3.5 Methodological Choice

To create a solid study methodology for creating an interactive e-learning user interface (UI) for primary school learners, a multi-qualitative research design was used. This was necessary to guarantee the efficacy and involvement of the user interface designed for young students. The Research Onion model (Saunders et al., 2019) informed the methodological selection, providing an effective research process and informing the selection of a suitable time horizon as well as the overall study design. As the research emphasis has been on participants' subjective, socially constructed accounts of explanation, qualitative design aligned with interpretive philosophy (Denzin & Lincoln, 2018) has become especially appropriate in this research. Conducting the research in the natural environment with an interpretivist approach facilitated building a rapport as well as gained the trust that allows for rich knowledge regarding

a group of people with e-learning interfaces as experienced by students at the primary level (Saunders et al., 2019). In order to attain a profound understanding of how the user interfaces for e-learning were created and how the learners did things, learned, and interacted with other people, qualitative research in the field of UI design observed the learners' behavior, perception, experience, and process. This was relevant to this study on primary school children's UI design in that it captured our desire to understand how they used e-learning interfaces. Thomas (2011), defines it is best described as the process of using purposeful and systematic data collection, analysis and explanation to arrive at dependable solutions to problems. Tuckman & Harper (2012), it is a systematic and careful approach to learning and addressing problems (Bhattacharyya, 2006). This qualitative research focused on exploring and understanding the meaning individuals or groups ascribe to a social or human problem (Creswell, 2014; Holliday, 2007).

Qualitative research was an appropriate choice for this study since it focused on comprehending the meanings that people or groups assigned to a social or human problem (Creswell, 2014). The method produced rich, contextually relevant information by enabling the collection of non-standardized data that could be categorized for analysis. By valuing uniqueness, culture, and social justice, this inductive approach made sure that the study recorded the complex interactions between primary school students and e-learning user interfaces (Rovai et al., 2014; Tracy, 2013). The study successfully contributed to the creation of an engaging e-learning platform prototype that satisfied the particular requirements of Grade 4 to 7 students in Zimbabwe by adhering to qualitative approaches. The prototype spans from low fidelity UI prototype which was then improved to medium fidelity UI prototype which is clickable testable to get user feedback.

3.6 Research design

The study was based on the premise that scholars, teachers and learners collaboratively improve their understanding and practice. Action research as a self-reflective inquiry by participants in social situations to enhance the rationality and justice of their practices, understanding and the situations where these practices occur (McNiff, 1988; Saunders et al 2019). Action research is conducted with people who benefit from the actions, findings and resulting changes (Wilkinson 1996; Mertler 2021) as exemplified by the learners and teachers from selected schools in Zvimba District, Mashonaland West Province, who participated in

this study. The collaborative involvement of researchers, teachers and learners not only facilitated professional development but also allowed for the collection of valuable best practice data to be used in the designing of e-learning UI. This approach helped to interpret participants' views by exploring their needs and perceptions to develop a usable interface.

Grundy (1995) and Reason (2006) in Saunders et al. (2019), action research aims to promote participation and improvement through improving activities, the environments in which these practices occur and the understanding of both. This aspect was crucial for this study as stakeholder participation provided insights into expected UI usability improvements, facilitating deep exploration of the issues. Guided by Saunders et al. (2019), the researcher adopted Kemmis and McTaggart's (1982) four fundamental aspects of the action research process planning, acting, observing and reflecting creating a dynamic, iterative cycle. This strategy proved relevant for the study "Designing an Engaging E-Learning UI for Primary School Learners in Zimbabwe" as it supported continuous refinement based on practical feedback and collaborative input.

Figure 3.3: Action Research Cycle.

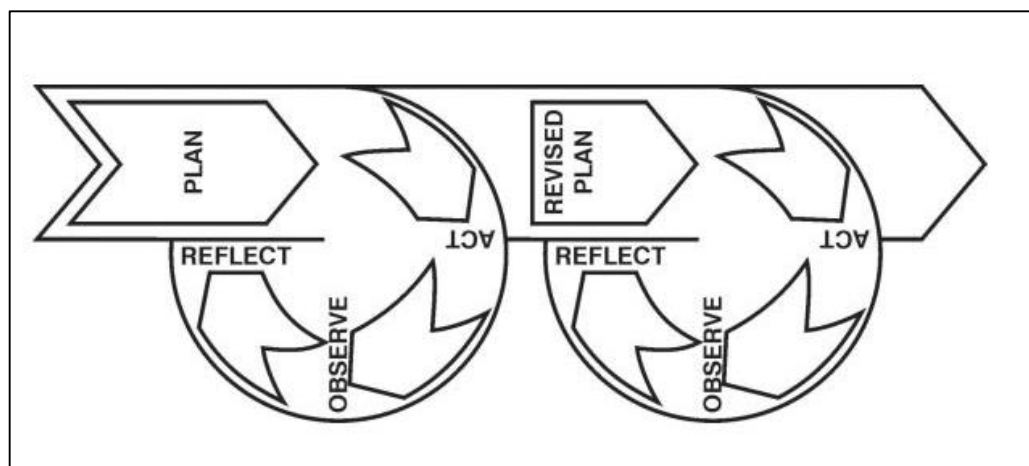


Figure 3.3 Action Research Framework: Source: Kemmis and McTaggart's (1982)

The research was broken down into two phases (Phase 1 and Phase 2) following Kemmis and McTaggart's (1982) major aspects of planning, acting, observing and reflecting. The aspects were crucial in this design and make project of designing engaging UI for primary learners as it provides essential data and helped in determine the design process.

3.6.1 Phase 1

The planning phase was the initial action development stage, data were gathered through document analysis, interviews, and questionnaires (Cohen et al, 2018). In research, planning is where the research questions and objectives are defined and methods and procedures for collecting and analysing data are selected (Cresswell & Cresswell, 2018). This approach allowed for in-depth analysis of learner experiences and meanings when using online websites and their user interfaces (UIs) (Kvale & Brinkmann, 2015). In addition to this, existing UIs for e-learning technology capabilities were discussed and observed along with lessons, lab equipment, and related e-learning tools (Lichtman, 2010). Findings gathered under this phase were then presented and discussed in Chapter 4 of the research. This phase also directed the development of recommendations and findings, which had been explained in Chapter 6 (Merriam & Tisdell, 2016). These same recommendations directed the development of a preliminary design for a paper prototype that was subsequently transformed into a UI through processes illustrated on a paper driven by the research findings and recommendations (Rossman & Rallis, 2017).

3.6.2. Phase 2

Phase 2 of the research study, as outlined in Chapter 5, involved putting the design plan into action, monitoring its effectiveness, and reflecting on the findings (Kemmis & McTaggart, 2018). This phase was characterized by the cyclical process of design, which is a characteristic of action research (Cresswell, 2020). Phase 2 started with the execution of the design plan, which involved prototyping a new UI based on the findings and recommendations of Phase 1 (Bryson, 2020). The new UI was subsequently tested for usability among teachers and students from schools A and B. This testing provided valuable feedback and identified possible areas of improvement (Krug, 2019). Interviews and observation were also conducted to find out more insights from the and penetrate any grey areas (Creswell & Creswell, 2018). This helped to determine how well the new UI was and what trends, themes, and what had to be improved (Miles et al., 2020). Reflection was a critical component of this Phase because it allowed the researcher to set out implications of the findings and provide further findings and recommendations to teachers and learners (Schön, 2017). Reflection also informed action and subsequent refinements of the design process.

3.7 Time Horizon

Saunders et al. (2019), highlight that there are two primary types of time horizons: longitudinal and cross-sectional. Given the length of the study and the fact that it is a Master of Philosophy project, a longitudinal horizon was chosen. The selected time horizon allowed the reanalysis of data, and this was appropriate since the study follows action research strategy which enabled the research to be conducted in two phases. Phase one is data collection, analysis, and recommendation, and phase two iterative design of UI, allowing examination development of UI using data collected and recommendations from phase one. Eldeman (2017) avers that longitudinal studies gain valuable secondary data, which gives a global measurement of trust across the world and how it is changing locally. This is relevant in designing UI over time for primary learners that is culturally sensitive, age-appropriate, and effective in building trust.

3.8 Population

The research focused on Grade 4 to 7 primary learners, teachers, and school headmasters from the Nyabira Cluster in Zvimba North District, Mashonaland West Province. Within this cluster, which comprises seven schools, the researcher purposively chose two schools, referred to as School A and School B. The total target population included 1,224 learners and 44 teachers, resulting in an overall total of 1,268 individuals. In research terminology, a population is defined as the complete set of participants who meet specific criteria (Ghihiramay, 2017). The entire group possessed certain characteristics that piqued the researcher's interest (Chikanyawu, 2022), and the sample was drawn from this population. Both schools are equipped with computer laboratories, with School A having one lab that contains 17 functional computers and School B having a lab with 19 functional computers. This similarity in their facilities meant that both schools shared comparable characteristics.

3.9 Sampling procedure and Sample size

Sampling is the process of choosing a specific number of observations to represent a larger population (Kothari, 2020). In this study, the researcher utilized purposive and convenience sampling methods. Geographical proximity was a key factor in selecting participants, as it was challenging to reach individuals in various parts of the country. Two schools were chosen purposefully, in Nyabira Cluster, Zvimba District, Mashonaland West Province as they were

convenient for the researcher, who is a student at Chinhoyi University of Technology and resides in Chinhoyi, thus minimizing costs.

Additionally, the researcher had taught at one of the chosen schools in the past, which made it easier to interact with staff and students. The researcher also used reflexivity and multiple data collection methods to validate findings and triangulate results in order to reduce researcher bias. In order to maintain consistency and reduce the impact of previous relationships on the data, standardised procedures were put into place and peer review was pursued. By employing purposeful sampling, the researcher gathers substantial information, allowing for a meaningful description of the findings' impact on the population. The study sample consisted of 16 learners, 10 teachers and 2 heads from each school. Specifically, in School A, 8 learners, 5 teachers, and 1 headmaster were selected, while School B had the same number of participants chosen. The chosen sample supports the objective of qualitative research, which is to investigate in-depth, context-specific insights into perceptions and lived experiences. The sample size was purposefully selected to ensure diverse yet manageable qualitative data, capturing multiple stakeholder perspectives while maintaining depth of analysis. By prioritising depth over breadth, this method allowed for rich, in-depth comprehension as opposed to generalisations.

3.10. Research Instruments

In this study, qualitative research instruments and tools were used to collect non-numerical data, providing detailed insights into participants' experiences, emotions, and social contexts (Adosi, 2024; Research Prospect, 2024). Interviews, questionnaires, observations, and document analysis helped the researcher to explore and gain a deeper understanding of the learner's experiences in using e-learning UIs, as noted by Adosi (2024). Hence, this was a multi-method qualitative study (Saunders et al., 2019). The use of instruments is further explained below.

3.10.1 Document Analysis

Document analysis was used as a data collection tool in this study. In the mind of the researcher, analysing existing documents is of great importance since it helps in providing comprehensive insights into existing practices and trends. This approach ensures that the design is grounded in evidence-based practices and informed by the latest developments in the field, ultimately

leading to a more effective and user-friendly e-learning environment for young learners (Ahmad Faudzi et al., 2023).

3.10.2. Questionnaire guide

Murebwa et al., (2024) notes that questionnaires are a self-report data collection instruments or a tool that each research participant complete as part of the research study. This allowed deep explorations of user's experiences in e-learning UIs. The method was valuable for gathering diverse perspectives and detailed information about the participants' views on e-learning user interfaces (Creswell, 2014).

3.10.3. Interview guide

The research interview is a purposeful conversation between two or more people (Saunders et al., 2019) and the researcher asked concise questions whilst listening attentively to the participants talking. Interviews were conducted in phase 1 with the headmasters and ICT teachers to collect primary data, while Phase 2 included learners and teachers during the usability testing and feedback stages. The free talk about the topic explored helped learners and teachers to unleash their experiences, behaviour and beliefs on their interaction with e-learning UIs hence this was non-directive. In this study the researcher explored the topic of designing UI for primary learners to understand meanings which were then incorporated in the designing process. Since the study adopted Action Research strategy its major focus was put on participants' perceptions by recording their experiences in using e-learning UIs hence more input was derived from participants. One to many in-depth research interviews with a group of participants from School A and B were conducted respectively to explore UI aspects through a group discussion that was facilitated by the researcher. This method was valuable for gathering diverse perspectives and detailed information about the participants' views on e-learning user interfaces (Creswell, 2014).

3.10.4. Observation checklists

It involves the systematic watching and recording behaviors, events and interactions as they occur in their natural settings. The method provided rich data about the context, activities and social dynamics that may not be captured through other instruments. Observations were used to triangulate questionnaire and interview results and offer a holistic impression of the research

environment (Patton, 2015). The observational approach was used to complement the action research cycle that concentrates on the human-centered design approach since the teachers and learners were actively engaged in the research process. The iterative process played a crucial role in the designing of e-learning interfaces through the collection of adequate information from the participants.

Integration of observation in the study helped the researcher to develop the UI design iteratively based on real-time feedback from students and teachers in primary schools. Observations provided invaluable information on learners' use of the e-learning system, identifying usability issues and guiding user experience enhancement. The approach ensures that the design is user-centered, addressing learners' requirements and maximizing engagement and effectiveness (Dick, Carey, & Carey, 2019; Branch, 2022). Combining action research and observation formed an effective, iterative design process that reacts to the evolving needs of the users.

3.11. Data collection process

3.11.1 Document Analysis

By systematically examining ICT Policy (2022-2027), National E-learning Strategy, Heritage Based Curriculum (2024), Syllabi (HBC grade 4-7), Schemes of Work (HBC Grade 4-7) and Lesson Plans (Grade 4-7), researcher identified successful design elements and common challenges faced in current e-learning interfaces (Bowen, 2009; Liu and Yu, 2023). The method proved its importance through enabling triangulation of data, to ensure that findings are corroborated by multiple sources, which enhances the reliability and validity of the study (Adosi, 2024). In addition, understanding the historical and situational context through document analysis helped to create a user interface that is not only effective but also culturally and contextually relevant to primary school learners (Suryono, 2020).

3.11.2. Open ended Questionnaires

Open ended questionnaires were distributed to participants to provide answers on their own (Saunders et al., 2019) and were submitted to the researcher when completely filled. De Vaus (2014) in Saunders et al., (2019) the questions were predetermined and answered without a researcher being present, this eliminated bias from researcher's interference. The questionnaires were delivered by hand to each respondent and collected later in the day to avoid

spoiling and missing some respondents. In this research open-ended questions were distributed to teachers and learners in both schools to allow them to give answers in their own way (Fink 2016 in Saunder et al 2019).

3.11.3. In-depth Interviews

The researcher visited each of the sampled schools and held interviews with the purposively selected teachers. After reading the introductory letters, participants signed consent forms. In-depth interviews were carried out and were effective since they not predetermined or have written down themes or questions to structure or guide the course of the interview (Saunders et al., 2019) hence they were entirely exploratory and emergent. The method allowed both the researcher and interviewee time to probe further for clarity (Stuckey, 2013). The interviews were useful since they provided a subjective approach which was linked to the perspective that views about the social world are socially constructed. This provided deep exploration of participants' varied views on the designs of UI considering learner's varied backgrounds. This helped the scholar to be able to explore points of interest and clarify and confirm meanings. The researcher is an expert in the field of UI design and he had ideas pertaining to aspects that he wants to explore from participants. The use of prompts emerged from what the interviewee during the course tells during the interview facilitate in-depth exploration of the UI aspects for primary school learners (Saunder et al., 2019). Interviews were conducted in phase 1 with the headmasters and ICT teachers to collect primary data, while Phase 2 included learners and teachers during the usability testing and feedback stages. The free talk about the topic explored helped learners and teachers to unleash their experiences, behaviour and beliefs on their interaction with e-learning UIs hence this was non-directive.

3.11.4. Observation e-learning facilities and learners' interaction on Educulture platform

The observational approach was used to complement the action research cycle that concentrates on the human-centered design approach since the teachers and learners were actively engaged in the research process. Non-participant observation was used to collect data to substantiate the implementation of e-learning in action, but without interfering with its processes. It was selected because it is unobtrusive and very flexible, as well as oriented to the discovery of knowledge. The iterative process played a crucial role in the designing of e-learning interfaces through the collection of adequate information from the participants. The approach ensures that

the design is user-centered, addressing learners' requirements and maximizing engagement and effectiveness (Dick, Carey, & Carey, 2019; Branch, 2022). Observation gave direct access to phenomenon under study (Creswell, 2013). The researcher only directly observed what was happening during the phase two evaluation and feedback when the learners were introduced to the educulture platform, took notes and recorded in the observation guide. The technique allowed the researcher to be a non-participant, observing the participants without actively taking part in the activities (Nieuwenhuis, 2007).

3.12 Pilot study

Prior to the primary investigation, a pilot study was conducted to ensure the effectiveness of the research tools and procedures. This initial stage involved a small number of participants. This step was essential in spotting possible issues with the interview questions and questionnaires, enabling adjustments to increase their relevance and clarity. Early resolution of these issues significantly improved the validity and reliability of the main study.

3.13 Data Analysis Procedure

Thematic analysis, narrative analysis and document analysis were all used in the data analysis.

3.13.1 Thematic Analysis

This technique was employed to identify, examine and display patterns in the qualitative information acquired from interviews and open-ended questionnaire answers. Coding the data, identifying important themes and interpreting the results in light of the study's goals were all steps in the process (Braun & Clarke, 2019). The context in which the observation occurred, along with the researcher's personal prejudices and presumptions, were taken into account when analysing the data gathered through observation (Creswell, 2019). Thematic analysis was chosen for its methodical approach to dealing with vast amounts of qualitative data, which ensures that essential themes are accurately collected and examined.

3.13.2 Narrative Analysis

Using this method, complex narratives that reflected the experiences and viewpoints of the participants were produced from the interview data. It was employed in this study to analyse the narratives and stories that surface from the data (Riessman, 2017). The selection of narrative analysis was based on its ability to give a comprehensive picture of the background

and chronology of the events that the participants described. This tactic helped to advance knowledge of the contextual and personal factors that affect how learners interact with e-learning user interfaces. A qualitative analysis technique called narrative analysis looks closely at the stories people tell in a given setting in order to understand human experience and motivations (Al-Saraf, 2023).

3.14. Measures of Trustworthiness

The researcher focused on four concerns which arise from qualitative approach to research. These Includes credibility, transferability, dependability and confirmability as indicated by Korstjens & Moser, (2018).

3.14.1 Credibility

According to Korstjens and Moser, (2018) Credibility is concerned with truth value of research findings and It is the confidence that can be placed in the truth of research findings. Credibility demonstrates that the subject has been accurately identified and described (Chikanyawo, 2021) and in a publicly accessible manner (Nowel et al., 2017). Credibility ensures the perspectives are from respondents hence the interpretation come from original perspectives of participants as indicated by Korstjens & Moser (2018). In this study the researcher employed prolonged involvement and member checking to ensure credibility of the study.

3.14.1.1 Prolonged involvement on the research site

In an intentional effort to better understand the behaviour, attitudes and knowledge of participants from School A and School B with regard to the use of e-learning user interfaces, the researchers decided to spend more time with them. A hallmark of qualitative research, this extended interaction enabled the researcher to gain a nuanced understanding of the participants' experiences (Creswell, 2019). The researcher was able to obtain rich, contextualised data by fully immersing themselves in the research site, which would not have been feasible with more surface-level techniques. A classic example of action research in action is the researcher's iterative design process, which involved creating an e-learning user interface and making adjustments based on participant feedback (Kemmis & McTaggart, 2020). Research backs up this strategy, indicating that user-centred design can result in more successful and captivating educational experiences (Laurillard, 2019).

3.14.1.2 Member Checking

By enabling participants to confirm, amend, or supplement the researcher's interpretations, member checking was used to guarantee transparency in the study of creating a user interface (UI) for Zimbabwean primary school students, improving the findings' validity, accuracy and credibility (Korstjens & Moser, 2018). As participants verify the analysis's accuracy and offer input on the researcher's findings, this procedure helped to remove researcher bias and brought the analysis into line with their viewpoints (Birt et al., 2016). A fundamental tenet of action research, the researcher's inclusion of participants' voices through direct quotations in the analysis validated the claims and resolved inconsistencies while empowering participants (Kemmis & McTaggart, 2020). This collaborative approach ensures that the findings are reflective of the actual experiences and viewpoints of the primary school learners and educators, leading to a more reliable and effective UI design.

3.14.1.3 Transferability

This is a crucial aspect of trustworthiness in qualitative methods. Houghton (2013) cited in Chikanyawu (2022) following the same research process should lead to the production of the final report hence this should help other researchers to repeat the study with similar conditions in other settings and come up with similar results. Sample was purposively selected based on similarities of grade 4 to 7 learners and their teachers. The research finding should be transferable to primary school learners within the schools which operate under MoPSE learning. Lemon & Hayes, (2020) researchers should be able to replicate similar study using the same demographics on different research site and come up with same results which enables the designing of elearning UI for primary school learners. The researcher is of the view that transferability can be biased due to other factors such as technological advancement, curriculum review and design which tend to influence the methods of teaching and learning.

3.14.1.4 Dependability

Recorded data during data collection was secured on gadget with password so that access was restricted to the researcher only. All research activities, including data collection, recording and analysis, were the researcher's responsibility.

3.14.1.5 Confirmability

In an e-learning user interface design for pupils in primary school in Zimbabwe, confirmability plays a key factor in the aspect of attaining credibility. Confirmability is seen as how closely the research findings match the collected data (Kyngäs et al., 2020). To establish confirmability, the researcher took several steps, including giving a clear explanation of the data collection processes, giving a clear and open description of the data analysis process, giving quotes or excerpts from the data to validate the findings, and giving an explanation of the study limitations and the potential biases that could have influenced the findings (Creswell, 2020; Miles et al., 2020).

The researcher's action was verifiable and ensured credibility of the research results. This was critical in the case of creating an e-learning UI where the results informed the development process. Kyngäs et al., (2020) note, confirmability guarantees that research results are reliable and trustworthy. Through the establishment of confirmability, the researcher boosted validity and research credibility of outcomes, thus leading to the establishment of an effective UI for pupils in primary school.

3.14.1.6 Peer Debriefing

Including peers or colleagues who have experience in the research topic may help to shed light on the research process, analysis and interpretation thus making the results more reliable. These peers can challenge interpretations and provide alternative views. Including these measures, the research will have a high level of reliability and validity in qualitative studies and also ensure credibility of qualitative outcomes in User Interface Design for primary school students.

3.15. Ethical Considerations

Creswell (2012), emphasises the significance of respecting the research setting and participants, ethical considerations were crucial in this study. Parents, school heads (School A and B), and the MoPSE Provincial and District Education Offices all gave their consent for the data collection. In compliance with university regulations, the CUT Graduate School granted ethical clearance. Two schools in the Nyabira Cluster's Zvimba District served as the sites for data collection. As a visitor to the study site, the researcher made sure that each participant

gave their informed consent. To protect the respondents' identities, the research report was kept anonymous and the responses were handled with the utmost confidentiality, used only for academic and research purposes. Every participant in the study gave their consent (Creswell, 2019).

3.16. Chapter Summary

This chapter described the technique for gathering and analyzing data when carrying out the study. A qualitative approach was adopted, with qualitative methodologies for analysis, to effectively address the research subject. The chapter evaluated and defended the procedures for participant selection, data collecting and analysis, as well as strategies for ensuring the credibility of qualitative research. Ethical considerations included gaining permission from CUT Graduate School and respective authorities in MoPSE to carry out research, minimizing site interruption and maintaining participant confidentiality and anonymity. The researcher considered himself as a guest, which ensured respect for the research location and participants. The following chapter presented data collected, analyzed it, established findings and made comments based on the obtained data.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

4.0. Introduction

This Chapter presents the findings from the data collected through various methods including document analysis, questionnaires, interviews, and observations. This chapter reports the data in a coherent manner, interpreting the results based on the experiences and feedback of learners, teachers and school heads regarding e-learning user interfaces (UIs) in Zimbabwe's primary education system. The analysis highlights the themes and patterns that emerged during data collection, as well as provide insights that are crucial for the design of an engaging and culturally relevant e-learning UI for primary school learners.

4.1 Overview of Data Collection

A total of 16 learners, 10 teachers and 2 school heads participated in the study from selected schools in the Nyabira Cluster of the Zvimba District. This multi-method qualitative study offered rich qualitative data which were analyzed through thematic and narrative analysis frameworks. Table 1 below shows number of respondents from School A and B.

Ser	Headmasters	Teachers	Learners	Total
School A	1	5	8	14
School B	1	5	8	14
Total	2	10	16	28

Table 1: Number of Respondents

4.2 Demographic Data

This section presents detailed demographic data regarding the participants from both School A and School B, including students and teachers. The data highlights key characteristics such as gender, age distribution, grades, experience with e-learning tools and educational qualifications. Hinde (2014), notes that, demographic overview enables the researcher to spot patterns or trends within particular subgroups, which helps to contextualise the findings covered in the following sections.

4.2.1 Student Demographics

The demographic data collected from School A and School B were significant to the learning tendencies of primary school learners regarding e-learning interfaces in Zimbabwe. The specific statistics on gender break-down, age break-down and computer use did not merely position the participants within the research but also raised the validity of the results.

4.2.1.1 Gender Distribution

According to the demographic information gathered, there are five boys and three girls among the participants in School A, and there are five girls and three boys in School B. The balanced gender distribution was found significant in the context of exploring learning preferences related to e-learning interfaces for primary school learners as it allows for an understanding of how different genders may interact with e-learning interfaces. This is crucial in identifying varying preferences that can affect engagement levels (Almasri, 2022). Additionally, this mixed-gender perspective helps to ensure that the design of the e-learning user interface can cater to the interests, motivations and needs of both boys and girls. However, future studies may emphasize potential differences in e-learning preferences between genders.

4.2.1.2 Age Breakdown

The range of ages among students (with School A students primarily between 8-13 years and School B students between 10-14 years) as shown on Figure 4.1. This age range allowed for segmenting data analysis by developmental stages.

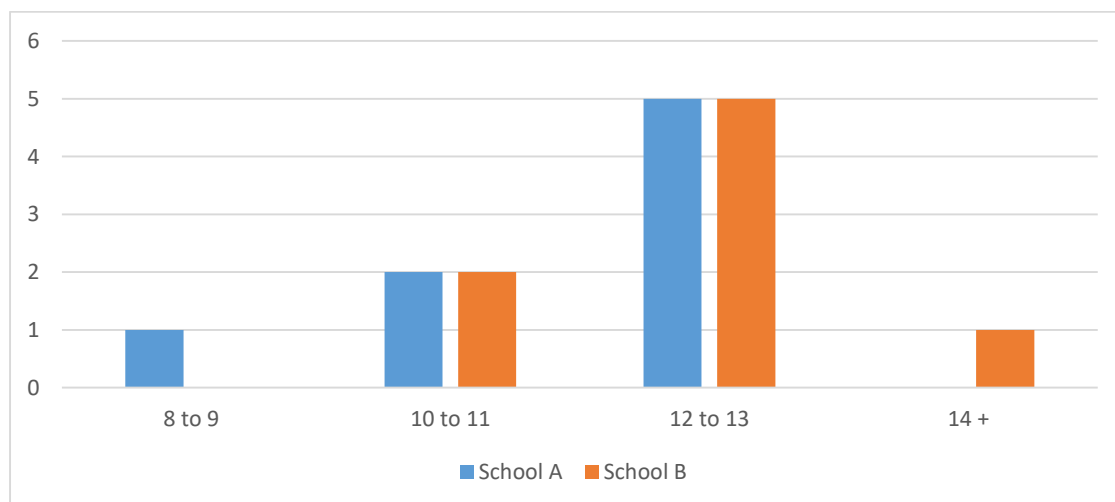


Figure 4.1 Age Distribution of student participants

The research established that younger primary learners have different learning needs and preferences compared to older peers. Similar findings were obtained by Ross-Gordon (2011). The e-learning therefore considered age-appropriate features, such as cognitive load and the complexity of tasks, which may vary with age. Engaging students differently based on their age can optimize the learning experience (Wolfson, Cavanagh & Kraiger (2014).

4.2.1.3 Grade Distribution

The grade distribution in School A and B are shown on Figure 4.2. Understanding the grade distribution allowed the researcher to segment the data by grade levels. This segmentation revealed how learning preferences may vary across different developmental stages.

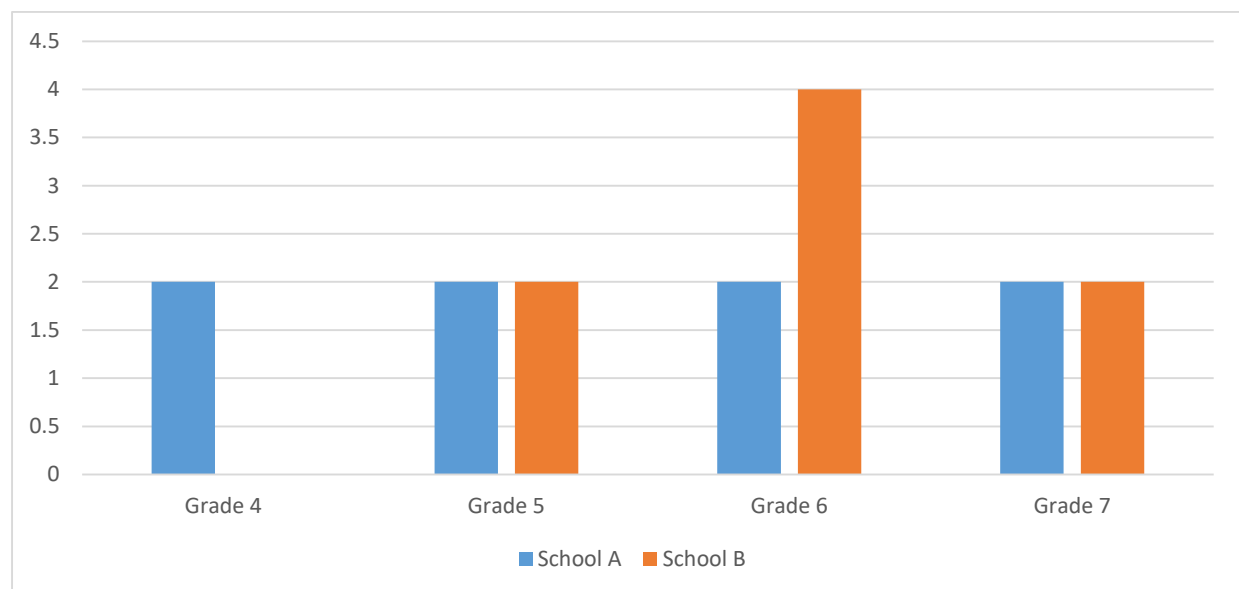


Figure 4.2 Grade Distribution of student participants

The research established that younger students (like those in Grade 4) have different technological exposure and learning preferences compared to older students (like those in Grade 7). Further to this, different grades represented different cognitive and social development stages as previously established by Lai & Hong (2015). Analysing preferences within specific grades, informed a development of an e-learning user interface that caters to the specific needs and abilities of each grade level, making the content more relevant and engaging. The findings of the study also shed light on how well the e-learning interface complies with the learning objectives and curriculum standards for every grade. For the interface to support the desired learning outcomes, this alignment is essential (Gil-Jaurena & Kucina Softic, 2016).

Most significantly, these study findings helped UI designers organise the e-learning environment, especially with regard to the use of text and images. The findings of the study led to the decision to give younger grades more interactive and visual content, while giving older grades more text-based materials and analytical exercises.

4.2.1.4 Student Demographics on Technology Usage

According to the research, all eight students in School A reported using computers for learning; none of them said they did not. Every student uses WhatsApp as their e-learning platform thus they report using it nearly every day for research related to schoolwork and homework. In contrast, two students at School B did not affirm using computers for learning, while six students did. Students mentioned Google (2 students), WhatsApp (4 students) and Ruzivo (2 students) as e-learning platforms.

Similar to School A, all students in School B indicated that they use these tools for research on homework and schoolwork, but their frequency of use varied, with responses indicating daily, once a week and twice a week usage. These research findings provided significant insights on two critical aspects on Understanding Engagement with E-Learning Tools and Targeted E-Learning Interface Design as detailed and analyzed below.

4.2.1.4.1 Understanding Engagement with E-Learning Tools

The findings indicate that all students in School A actively use computers for learning and utilize WhatsApp as a primary e-learning platform. This trend highlights the acceptance and reliance on technology among students, suggesting that an e-learning interface should leverage popular tools and platforms (like WhatsApp) that students are already familiar with, maximizing engagement and usability. However, the divergence in computer usage (with 6 out of 8 students affirming use in School B) may underscore the necessity to understand barriers that may prevent some students from engaging with e-learning. Addressing these barriers (which may be technological, emotional or contextual) can lead to increased engagement across diverse learner demographics.

Understanding that students primarily use e-learning tools for homework and research informs the development of features that support these activities. These could include integrated

research tools, collaboration features for group projects and guided access to educational resources that simplify information gathering. The reliance on platforms like WhatsApp indicates a preference for collaborative work. The learning process can be enhanced and a sense of community among students can be developed by creating an e-learning interface that encourages engagement, dialogue and peer support.

4.2.1.4.2 Targeted E-Learning Interface Design

The gathered research findings revealed important information regarding the most popular e-learning platforms and how frequently they are used. The researcher created a user interface that integrates or mimics the features of these platforms based on insights into the tools that students prefer (e.g., WhatsApp for communication and collaboration). This ensures that students are comfortable and involved with the learning interface. Furthermore, because the results showed that students use their e-learning resources on different timetables (daily, weekly), the researcher was guided in creating an interface that supports flexible learning paths that accommodate a range of schedules and levels of engagement. Instead of being overpowered by inflexible systems, this can help guarantee that all students can incorporate e-learning into their daily routines (Benkhalfallah & Benkhalfallah, 2024). Schools can allocate resources to particular technologies more effectively and efficiently by knowing which tools students find most useful.

4.2.2 Teachers Demographics

The demographic information about the teachers' gender distribution, age distribution and computer usage that was gathered from Schools A and B was crucial because it gave the research context and depth and helped with the creation of a user interface that maximises engagement for elementary school students. Students' interactions with e-learning interfaces are mediated in large part by teachers (Dahleez et al., 2021). Therefore, being aware of these demographics enabled the researcher to comprehend any potential biases or teaching philosophies that might affect students' preferences for online learning.

4.2.2.1 Gender

According to the gender demographics of the teachers at both schools, there are three men and seven women overall. The researcher was able to comprehend the possible impact of gender

on teaching styles, interactions with students and attitudes towards technology and e-learning by knowing the gender distribution of teachers. This is especially crucial in cultural contexts where participation and engagement in educational settings may be impacted by gender roles (Valenzuela, 2014). Figure 4.3 displays the gender distribution for School A and School B.

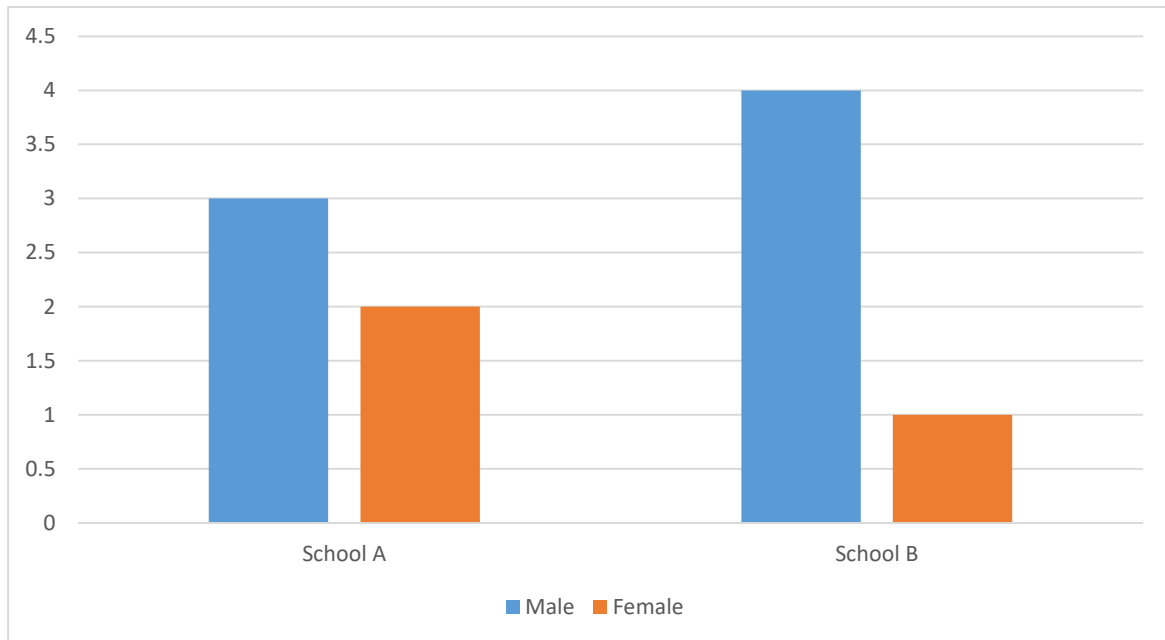


Figure 4.3 Gender Distribution of Teachers Participants

The gender distribution helped to develop the ideal e-learning model and provided information for the study on the likely influences of the interactions between different genders of teachers and learners. Different pedagogical approaches, communication styles and emotional support mechanisms may be used by male and female educators (Hagenauer et al., 2016). Understanding these specifics aided in the study's comprehension of how students react to various teaching and communication philosophies, which in turn informed the design of e-learning programs that serve a varied student body. It was noted that learners' perceptions of gender roles and inclusivity in educational resources may be impacted by the experiences of female teachers, which may have an impact on the inclusion of gender-sensitive materials.

4.2.2.2 Age range for teachers

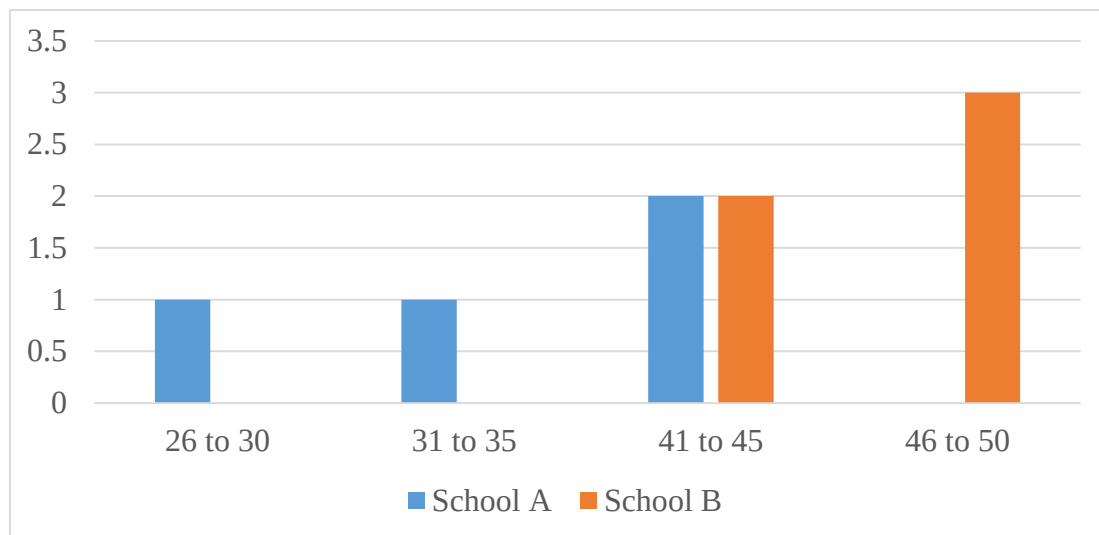


Figure 4.4 Age Distribution of Teachers Participants

One teacher in School A is between the ages of 26 and 30, one is between the ages of 31 and 35, two are between the ages of 41 and 45 and three are 50 years of age or older, according to the age distribution of the teachers. School B, on the other hand, has a slightly older demographic among its teaching staff, with three teachers between the ages of 46 and 50 and two teachers between the ages of 41 and 45. Figure 4.4 provides a diagrammatic representation of this.

According to the study, older teachers had varying degrees of skill and favoured conventional teaching techniques, whereas younger teachers (those between the ages of 26 and 30) were more accustomed to technology and cutting-edge teaching strategies. The experience and comfort level of teachers with technology are frequently correlated with their age (Culp-Roche, Amanda, et al, 2020). The researcher was able to anticipate and integrate various teaching styles into the design of e-learning interfaces by comprehending this variance. It was discovered that some of the more senior educators had varying educational backgrounds, which influenced how they perceived the needs and preferences of their students. The researcher learnt more about how these perceptions affect teachers' e-learning facilitation strategies, including the content they prioritise and the engagement tactics they employ, by analysing their age demographics. The age of teachers can reveal how comfortable and familiar they are with technology. According to the responses, older teachers might need more assistance and training, while younger teachers might be more skilled at using contemporary e-learning resources.

4.2.2.3 Qualifications and Experience

The design and implementation of an e-learning interface for primary school students can be greatly impacted by knowing the credentials and experience of the teachers in Schools A and B. The qualifications were illustrated graphically as follows in Figure 4.5

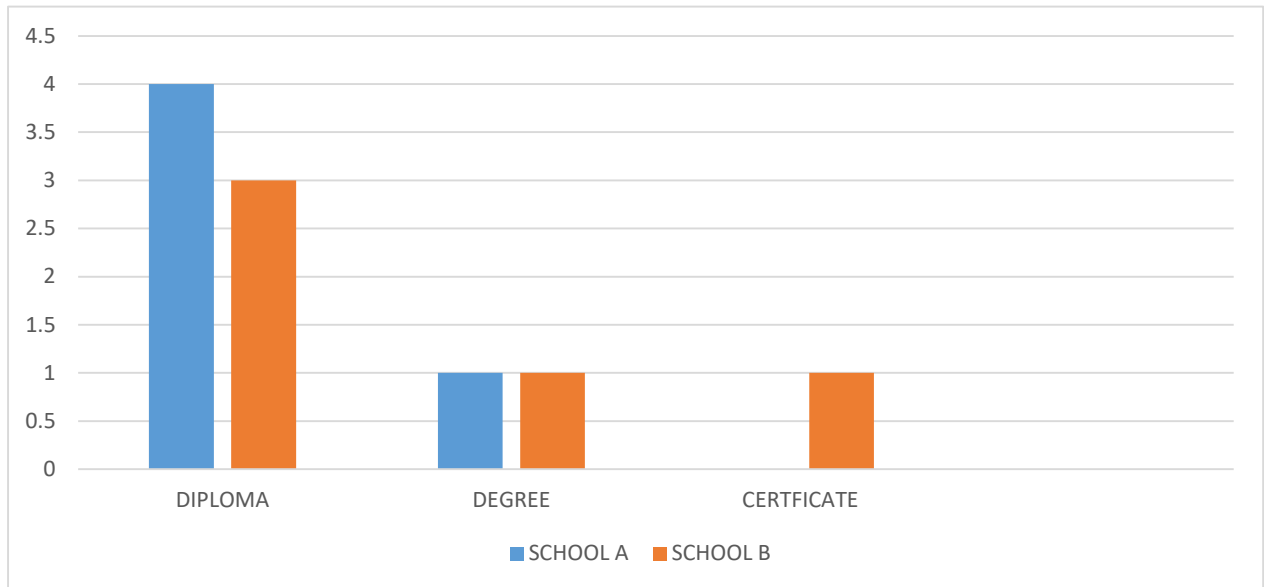


Figure 4.5: Teacher Education Level

Teacher experience was also illustrated graphically as follows in Figure: 4.6

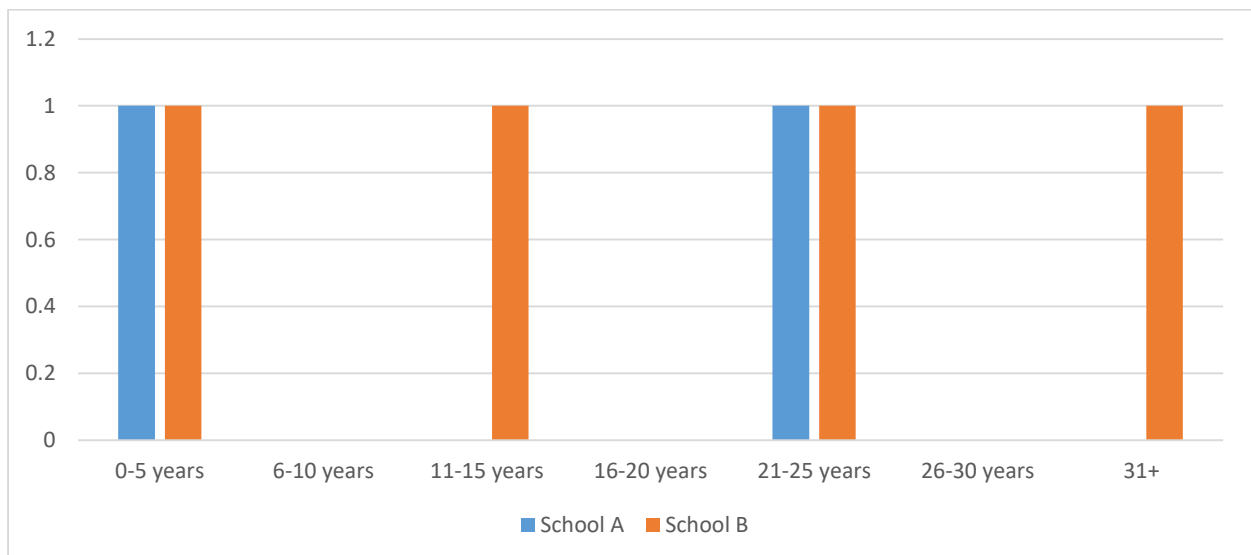


Figure 4.6 Teaching Experience

It was determined that four of the teachers at School A reported having diplomas and one of them has a degree. When asked about their teaching experience, the responses showed a diverse range with three teachers have between 11 to 15 years of experience, one teacher has

21 to 25 years, another has 26 to 30 years, and one teacher has less than 5 years of experience. This indicates a mix of mid-career and highly experienced teachers, with one relatively new educator. In School B, three teachers reported having diplomas, one teacher holds a certificate, and one teacher has a degree. In terms of teaching experience, the responses revealed a broad spectrum; one teacher has over 31 years of experience, one has 11 to 15 years, one has 21 to 25 years, one has 16 to 20 years, and one has less than 5 years of experience. This suggests a balanced mix of qualifications and a wide range of teaching experience among the staff, from highly experienced veterans to newer educators.

The above findings were analyzed. With four teachers holding diplomas and one with a degree in School A and a similar distribution in School B, this highlighted the baseline academic competency among the teaching staff of the study sample. Understanding these qualifications was crucial for addressing pedagogical approaches in e-learning since qualified teachers are better equipped to integrate technology effectively into their teaching methodologies as previously established by Akram, Huma, et al, (2022). The range of teaching experiences also provided insights into the potential pedagogical styles and openness to innovative teaching methods. The study established that the presence of highly experienced teachers (those with over 20 years of experience) presented some levels of resistance to change or adaptation compared to newer teachers who were found to be more acquainted with contemporary pedagogies including technology-enhanced learning. Recognizing this helped in creating an e-learning interface that accommodates these educational differences.

4.2.2.4 Teachers Responses on the Use of Technology in Classroom

In School A, the responses regarding access to technology in the classroom reveal that the Environmental Science teacher does not have access to computers, projectors or interactive boards. Conversely, the Science and Technology, Social Science and Physical Education and Art teachers all reported having access to these technological resources. In School B, the situation was found to be mixed; the English teacher and the Science teacher do not have access, while the Math teacher, Social Science teacher and Computer Science teacher do have access. Overall, both schools exhibit a blend of teachers with and without access to essential educational technology, which may impact their teaching effectiveness and student

engagement. The obtained research results highlighted significant disparities in access to educational technology among teachers at two primary schools.

The obtained results underscored the unequal distribution of technological resources among teachers within the same educational institutions. It was also discovered that these differences have an impact on the general learning environment and the opportunities accessible to elementary school pupils, especially with regard to their exposure to technological tools that promote participation and ease learning. Teachers who have access to technology can improve their teaching methods by using resources like computers, interactive whiteboards and projection equipment. On the other hand, some teachers may find it more difficult to use e-learning techniques successfully due to limited access, which could lower student engagement and learning results. The study took into consideration differentiated e-learning designs that consider both high-tech and low-tech solutions because of the disparity in access to technology. Creating a user interface (UI) that works with different types of technology guarantees that learning experiences are inclusive. The study findings were assessed to have heralded a call for educational authorities to reassess resource distribution in schools. Highlighting the gap in technological resources can inform policy changes aimed at providing equitable access to technology, fostering an environment where all teachers can effectively engage students.

Considering that some teachers lack access to advanced technologies, the study explored the incorporation of more straightforward, text-based e-learning interfaces or mobile applications that can function on basic devices. This ensures that technology does not become a barrier but instead supports learning across different contexts. The mixed results from both schools could encourage designing e-learning platforms that promote collaborative projects among classes headed by different teachers with varying technological resources. Recognizing the gaps in technology may lead to initiatives aiming to involve parents and the community, seeking ways to support schools with technological resources (such as funding for computers) that ensure equitable access and engagement.

4.3 Document Analysis

Documents such as the ICT Policy for Primary and Secondary Education and the National E-learning Strategy underlined the government's commitment to integrating technology into the

education system. However, they also revealed gaps in implementation, particularly regarding teacher training and accessibility of resources as outlined in the hereunder findings and analysis.

4.3.1 ICT Policy for Primary and Secondary Education in Zimbabwe (2022-2027)

The analysis of the document "*ICT Policy for Primary and Secondary Education in Zimbabwe*" was first done as guided by the first objective of “*explore the learning preferences of primary school learners in relation to e-learning interfaces in Zimbabwe*”. The policy’s vision for ICT integration aims to enhance educational outcomes through the use of technology, which aligns closely with the research focus on e-learning platforms. Essentially, the policy vision strengthens learner engagement and utilization of digital tools. In addition, the policy emphasizes the building of infrastructure, such as computers and access to the internet, which is central to the understanding of how access or lack thereof affects learners' experience and attitudes towards e-learning. This aspect brought a lot of light to the real-world challenges and opportunities that influence the deployment of e-learning interfaces in primary schools. To these ends, this document analysis pointed to the necessity of resolving pragmatic concerns, such as unequal access to technology, in order to extend e-learning to all learners on a level playing field. The policy focuses on enhancing learning outcomes through ICT integration implies an imperative for e-learning interfaces preferred by learners. This decrease is referring to the necessity of developing user-friendly, interactive and adaptive e-learning platforms that cater to the diverse needs and learning styles of primary school students.

Another critical aspect of the policy is its focus on curriculum development, which integrates ICT into the teaching-learning process. This aspect was seen to best fit in this study because it allowed the researcher to look at how the curriculum addresses various learning styles and preferences. It was then concluded from such analysis that the e-learning interfaces must be specially designed to support the diverse needs of the learners in order to make them inclusive and efficient. Also emphasized by the policy is teacher training and support to effectively utilize the ICT tools. Based on this analysis, the e-learning interface must be designed such that it supports the vision of the policy to improve the outcomes of education using technology. For this research, it meant coming up with a platform that targets learner engagement and interaction, turning it into a passive learning platform but an immersive and interactive

experience as previously instructed by Digout and Samra (2023). It was believed to add gamification elements to make learning engaging and fun, multimedia elements (videos, animations and audio) to respond to multiple learning styles and keep learners interested and turn the interface into intuitive and user-friendly, even for young learners with low digital literacy.

To address the Infrastructure challenges that were identified in the Policy, the e-learning interface has to be designed so that it can function efficiently even in low-resource settings. For this purpose, arrangements were made to develop a light weight, low-bandwidth version of the platform that will be accessible on low-end devices and slow internet. Integration of offline mode so that learners can download material and study offline was also a consideration. Of particular note is that the need to optimize the mobile interface came first as the research found that majority of the students had widened access to WhatsApp platforms and smartphones. The policy also addresses equity and inclusion, with especial emphasis on providing equal access to ICT resources to all.

This focus is necessary in terms of understanding the barriers that particular students may find in accessing e-learning interfaces, particularly in poorer or rural zones like Zvimba. There are also policy mechanisms for evaluating and monitoring success in ICT in education, which helped the study to understand to what degree that e-learning interfaces meet the needs of primary level students. The policy encourages stakeholder and community participation, which can influence the development and implementation of e-learning policies.

4.3.2 National E-learning Strategy

The second document which was analyzed in pursuit of this study was the National E-learning Strategy. The National E-learning Strategy for schools in Zimbabwe is a joint initiative of the Ministries of Information Communication Technology, Postal and Courier Services and Primary and Secondary Education. It is in line with the National Development Strategy 1: 2021-2025, which identified the contribution of Information Communication Technologies (ICTs) towards a digital economy. This is among the initiatives in the SMART Zimbabwe 2030 Masterplan, of transforming Zimbabwe into a knowledge-based economy (Dube and Zivengwa, 2022). By enhancing the utilization of ICTs across the education sector, the project

seeks to enhance access to educational resources as well as to universalize education, particularly in under-resourced areas such as Zvimba. The strategy emphasizes the necessity of having a strong communications infrastructure to minimize challenges posed by crises like the COVID-19 pandemic and to facilitate a shift from teacher-centred to student-centred learning.

The strategy's emphasis on a shift from teacher-centred to learner-centred learning is also consistent with the research focus on determining how primary school learners prefer to engage with e-learning interfaces. With its emphasis on learner-centred approaches, the strategy provides a roadmap for developing interfaces that are customized to the unique needs and interests of young learners. The objective of the strategy to improve access to learning resources in poor areas for example, Zvimba district recognizes the necessity to take contextual matters, such as infrastructural limitations and socio-economic disparities, into account when researching learner attitudes.

The Strategy's focus on increasing use of ICTs and standardizing education across Zimbabwe set the stage for this research on developing an e-learning interface that is scalable, inclusive and effective. It demands interfaces that can be accessed by all learners everywhere, regardless of geographical or economic means. In the same vein, the Strategy's emphasis on reliable communications infrastructure demands that interfaces be designed that are resilient and responsive to emergencies, with the goal of providing continuity in education.

To enable the e-learning project, various stakeholders, including the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ) and telecommunication operators, are providing equipment and connectivity, especially in rural areas. The e-learning system is based on some of the key enablers that comprise expanding broadband infrastructure, standardizing devices for schools and building digital capacities for educators (Mpofu et al, 2024). According to the Strategy, the program plans to develop mobile applications and multimedia content for e-learning by June 2021, with training for 3,000 teachers in basic digital skills. It also directed that a multi-stakeholder coordinating structure, involving various government ministries and agencies, will guide the program to ensure effective implementation and transformative outcomes for rural learners. A check with the authorities revealed that the program failed to take off the ground. One Respondent A explained;

“While these initiatives marked significant progress, challenges remained regarding infrastructure, especially in rural areas where internet connectivity was limited. Additionally, the accessibility of devices (smartphones, tablets, and computers) posed another barrier.”

Despite the highlighted limitations, it was found out that the strategy’s focus on developing mobile applications and multimedia content for e-learning aligns with the first two research objectives of understanding how primary school learners prefer to engage with digital interfaces. Multimedia content, such as videos, animations and interactive activities, is likely to resonate with young learners and cater to their diverse learning preferences. One significant finding from this document analysis was the focus on training teachers in digital skills, which emphasises the value of educator readiness in enabling successful e-learning experiences and is crucial to comprehending how students engage with e-learning platforms.

4.3.3 Heritage-Based Curriculum (HBC) 2024

The Heritage-Based Curriculum (HBC) emphasizes equipping learners with skills and competencies to participate in a knowledge economy, according to Zimbabwe's ICT Policy (2022-2027). Integration of technological and scientific education into the HBC provides a strong foundation upon which user interfaces for e-learning can be designed effectively. Inclusivity, equity and learner-centered education guiding principles offer a platform upon which user-friendly interfaces can be created to accommodate different learner needs. The emphasis on digital literacy and infrastructure—internet connectivity, digital equipment and specialist rooms points towards the necessity of creating interfaces that facilitate easy access and use. The emphasis on bridging the rural-urban divide, improving the teaching skills and offering solar-powered solutions ensures that technological constraints in underprivileged areas are being addressed meaningfully.

HBC's compliance with unhu/Ubuntu philosophy underlines the requirement for cultural sensitivity in e-learning design. Multiculturalism and heritage preservation bring a unique methodology to interface design that is respectful and inclusive of local culture and values and yet globally relevant. The columns of physical and digital infrastructure in the curriculum

ensure learners are introduced to modern, accessible technologies which foster adaptability and lifelong learning. By prioritizing user-friendly and accessible designs the e-learning interface can empower students and teachers alike, allowing education to be an inclusive, accessible and innovative pursuit by all Zimbabweans.

4.3.4 Schemes of Work

The study reviewed that the schemes extracted from both schools do not incorporate elearning teaching strategy as shown in Figure 4.7, Figure 4.8, Figure 4.9 and Figure 4.10.

7	Quantifying numbers Comparing numbers using , > , < or =	-Compare any two numbers by inserting the correct sign between them	Problem solving Understanding Knowledge	Grade 4 Maths National Syllabus page 26	-teacher will explain and demonstrate -group work to pairs -feedback from the groups -written work individually
	Quantifying numbers Comparing numbers using , > , < or =	-Compare any two numbers by inserting the correct sign between them	Problem solving Understanding Knowledge	Grade 4 Maths National Syllabus page 26	-Recap on previous lesson -Practising listing the odd numbers -Groups practise and report back -Written exercise and revision -Written exercise

Figure 4.7: Grade 4 Mathematics

Week ending	Topic	Objectives	skills	S.O.M	Media	Methods/activities	Evaluation
Week 1 Lesson 1	TOPIC:HEALTH AND HYGIENE K.C- Human body S.C Digestive system -In the mouth	During the lesson learners should be able to- identify parts of the digestive system	Identifying Describing Explaining	Heritage Based Curriculum, Science and Technology Junior syllabus grade 3-7 2024-2030 Page 45	Print media Model of digestive system Electronic media	<i>Assumed knowledge:</i> learners know their body parts. <i>intro:</i> learners say their body parts 1. The facilitator explains and demonstrates on digestive system in the mouth. 2. Learners explain what happens to food they eat while the facilitator assists the learners. 3. Learners in groups discuss on digestive system while the facilitator assists them. 4. Learners give feedback from their group findings while the facilitator assists them. <i>CON:</i> Learners answer oral questions from the facilitator.	
Lesson	TOPIC: HEALTH AND	During the lesson learners should	Identifying Describing	Heritage Based	Print media Model of	<i>Assumed knowledge:</i> learners know their body parts. <i>intro:</i> learners say their body parts	

Figure 4.8 Grade 5: Physical Education and Arts

WEEK	TOPIC /CONTENT	OBJECTIVES	COMPETENCIES /SKILLS	S.O.M	MEDIA	METHODS AND ACTIVITIES	EVALUATION
1	Identity: Community Contribution to the Family	By the end of the lesson pupils should be able to: - Identify the various ways in which the community contributes to family life. - Explain the significance of community support in family well-being. - Appreciate the role of community in fostering family values	Communication, Social Awareness, Analytical Skills	HBC National Syllabus, Social Sciences Textbook pg. 10	PICTURES, Concrete media	- Introduction: Discussion on community contributions. - Pupils share their knowledge on community support. - Lesson Development: Teacher demonstrates community contributions using PICTURES and concrete media. - Pupils practice identifying contributions in groups. - Written Work: Describing the significance of community support. - Conclusion: Recap and feedback.	

Figure 4.9 Grade 6: Social Sciences

Weekly aim(s): 3.2 To help learners to acquire and apply mathematical concepts and skills and use them as tools in study, work, leisure and everyday transactions through use of technology.							
1 Lesson 1	NUMBER Whole numbers (0-10 000 000) <i>Numerals</i>	<i>During the lesson learners will:-</i> identify, read and write numbers in numerals and words in the range.	Writing Reading Counting	Mathematics Junior syllabus grade 3-7 (2015-2022) Page 49	Abacuses Number lines cards	Assumed knowledge: Learners have learnt about whole numbers in the previous grade. Intro: Learners count together in tens up to 10 000 000. 1. Learners identify numbers in numerals and match them with numbers in words while the facilitator assists them. 2. In groups learners write the number in words while the facilitator assists them. 3. Learners give feedback from their groups while the facilitator assists them. 4. Learners write an exercise in their exercise books individually. Con: Learners under the guidance of the facilitator revise work written	
Lesson 2	NUMBER Whole numbers (0-10 000 000)	<i>During the lesson learners will:-</i> identify, read and write numbers in numerals and	Writing Reading Counting	Mathematics Junior syllabus grade 3-7 (2015-	Chart with numbers in words	Assumed knowledge: learners are able to read numbers in the range (1-10 000 000) Intro: Learners read the number line on the walls. 1. The facilitator explains on reading and writing numbers in words and numerals. 2. Few learners	

Figure 4.10 Grade 7: Mathematics

From Grade 4 to 7, subjects such as Mathematics, English, Shona, Science and Technology, Physical Education (PE) and Arts are taught using diverse methods. These include discussions, written exercises, group work, oral questions, fostering cultural diversity and building digital competencies. Schemes from both schools integrate both traditional media and Information and Communication Technologies (ICTs). For Grade 5 learners, cross-cutting themes in Social Sciences emphasize creativity, critical thinking, cultural diversity and inclusivity. In PE and Arts, ICT tools such as gadgets, magazines and pictures are utilized as teaching media.

Additionally, learners engage with resources like the internet, collaborative activities, flash cards and watches. Within subjects like English and Shona, students are encouraged to use computers for interactive activities such as puzzles, riddles and quizzes. Certain learning areas, teachers still rely on traditional classroom methods. These involve using concrete media like flash cards, work cards and real objects. The research revealed that ICT is primarily as a supplementary tool for enhancing traditional methods. Its use as e-learning software remains limited. Despite this, e-learning holds potential for promoting collaboration, inclusivity and knowledge sharing, as highlighted by the ICT Policy (2022) and the teaching schemes.

4.3.5 Checklist of E-learning Facilities

The research reviewed that the schools have an e-learning checklist however it was noted that on the ground some of the checklist elements are partially available or not available as shown on Table 2 below.

SER	LAB	INTERNET	TABLETS	POWER	INTERACTIVE BOARDS	DIGITAL PLATFORM	DIGITAL CONTENT	COMP
Sch A	01	Available	-	Yes	-	-/ W/APP	-	17
Sch B	01	Available	-	Yes	-	-/ W/APP	-	19

Table 2: E-learning Facilities Checklist

4.4 Analysis of Observations, Questionnaire and Interviews Responses

The collected data from Questionnaires and interviews were analyzed under two thematic topics from the first and second objectives of exploring the learning preferences of primary school learners in relation to e-learning interfaces in Zimbabwe and designing an e-learning user interface that maximizes engagement for primary school learners in Zimbabwe.

4.4.1 Exploring the Learning Preferences of Primary School Learners and Teachers' Insights in Relation to E-Learning Interfaces in Zimbabwe

4.4.1.1 Student Preferences

The study through questionnaires and interviews established that in the realm of e-learning, the most commonly used platforms among students at School A and School B are WhatsApp, Google, Ruzivo and AI Meta. According to the participants, these platforms serve various educational purposes, from facilitating communication and collaboration to providing access to learning resources. The majority of the participants revealed that they use WhatsApp for group discussions and sharing study materials, while Google offers tools for research and document creation. Ruzivo which focus on Zimbabwean educational content, was said to be providing tailored resources that resonate with local learners. The study showed that homework assignments and challenging questions used the AI Meta system.

Most learners express their learning preference through interactive education tools that offer exceptional student engagement opportunities. Students greatly enjoy doing quizzes and watching videos alongside playing games with animations through AI Meta due to the dual benefits of keeping them engaged throughout learning new topics. Their preferences are shown on Figure 4.11.

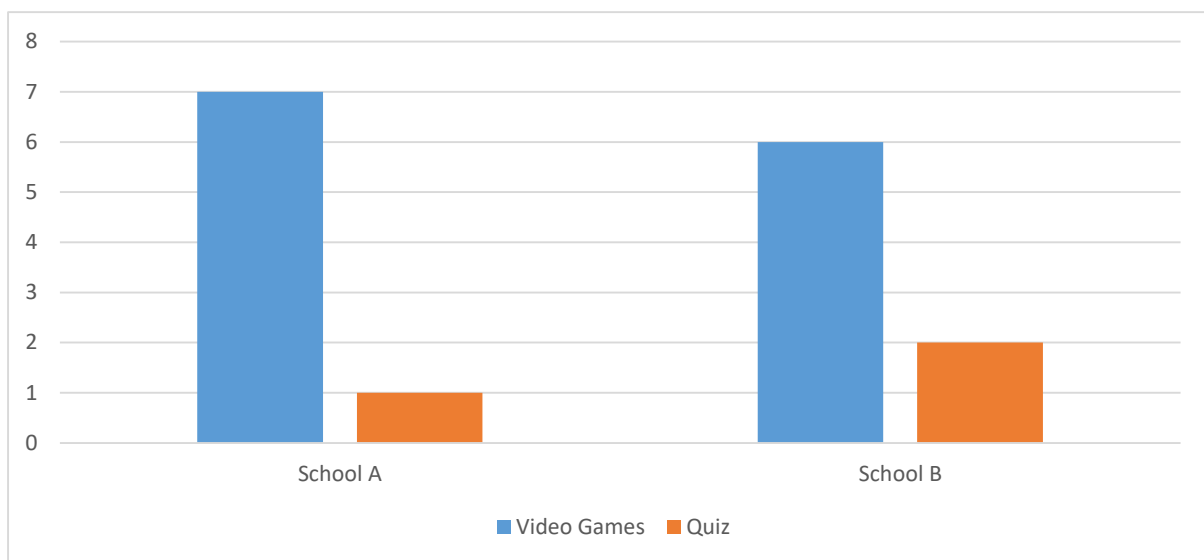


Figure 4.11. Students Preference in Receiving Instruction in E-learning

According to their feedback the research simplification tools along with fun research experiences provided by Google and PowerPoint received significant value. The tools permit students to engage actively while discovering concepts creatively making them more likely to retain information, (Richardson & Mishra, 2018). Students highly prefer educational materials in multimedia formats that incorporate videos and animations and cartoons along with educational games. The selected content format clearly attracted learners in addition to keeping them interested throughout learning sessions. Students benefit from interactive quizzes that provide drag and paint functions and typing tools because these activities let them actively work with content directly which results in better understanding and knowledge maintenance.

The learners encountered multiple substantial obstacles while using these e-learning tools according to our study findings. High data expenses presented a significant challenge for learners who faced difficulties in stable resource access due to the costs. The learners supported unlimited free access to essential platforms since high costs make it difficult for learners from poor backgrounds to pursue educational opportunities. Learners experienced additional challenges because of insufficient internet connectivity which created ongoing difficulties when trying to interact with digital content through online sessions.

The data from the research study shows essential details about how students present their opinions about e-learning platforms and what their educational encounters demonstrate. The learners from School A and School B predominantly utilize WhatsApp as well as Google and Ruzivo and AI Meta for educational purposes. Learners select WhatsApp as their main communication tool but they make the most use of Google as their research platform. Because Ruzivo presents education material that reflects Zimbabwean cultural characteristics its content successfully engages local learners. AI Meta shows its worth as a homework assistance tool while addressing complex questions so schools require platforms offering specific academic help. The educational preference of students focuses on interactive content that integrates multimedia elements that combine games and quizzes with videos and animations. Active learning through quiz-based activities proves important for educational participation because it offers dynamic material engagement (Banna, Jinan, et al, 2015).

Several obstacles prevent the proper utilization of e-learning resources because students face expensive data plans and limited no-cost platform access while also experiencing inadequate internet connections. The obstacles leading us to believe that the educational system urgently requires fundamental transformation in order to increase e-learning resource availability. The research data concerning student interface preferences underwent analysis through the Semiotic Theory along with the ADDIE Model as conceptual frameworks. According to Peirce's Semiotic Triangle the signifier (interface elements) needs to match learners' contextual realities and cultural aspects within e-learning platforms. Resources that use relevant cultural symbols in interface design help students at the primary level to understand better and become more engaged in their learning activities. The development of e-learning systems required the ADDIE model application so researchers could address identified needs and preferences during the study. This design process requires builders to perform multiple cycle improvements which include detailed analysis of audience requirements for developing interfaces with user-friendly designs that serve young learners based on tested data. Educators require training to implement these systems effectively. The iterative design method provides an inclusive framework which enhances student response and leads to better student success and engagement.

4.4.1.2 Teacher Insights

Teachers identified several engaging features that capture students' attention and enhance their learning experiences. Among these, pictures, videos, games and quizzes stand out as the most

effective elements. From the interviews conducted, these interactive tools were said not only making learning more enjoyable but also help to reinforce key concepts, allowing students to absorb information. By incorporating engaging features, teachers were of the insights that educators can foster a more stimulating classroom environment that encourages active participation and collaboration as suggested by Cassum & Gul (2017).

However, despite the potential benefits of these engaging tools, teachers revealed that they encounter numerous challenges that hinder their effective implementation. A significant barrier was the inadequate availability of ICT devices, which limits both teachers' and students' ability to fully engage with digital learning resources. Additionally, frequent electricity cuts were said to be disrupting lessons and access to e-learning platforms, further complicating the situation. One respondent B put it strongly in this regard;

“The power cuts are unbearable! The standby generators simply cannot handle 12 hours of electricity outages during crucial working hours. When the power goes out, most mobile networks typically go down as well, severely limiting access to essential Internet platforms like WhatsApp. This situation is unacceptable and must be addressed immediately!”

High data costs were also highlighted pose a substantial challenge, making it difficult for both teachers and students to consistently access online materials. The current situation emphasizes that teachers need better infrastructure together with more resources to successfully implement e-learning in classrooms.

The study of teachers' perspectives demonstrates essential information about e-learning platforms' engagement tools alongside the barriers they encounter when implementing these platforms. The teaching staff highlighted interactive content which includes pictures, videos, games and quizzes to engage learners and fortify major ideas. Educational findings support multimedia instructional methods to develop better student understanding and this evidence receives scientific backing from Clark & Mayer (2023). Using semiotic theory teachers can improve learning outcomes through cultural imagery selection that engages students with their backgrounds while building stimulating classrooms through team-oriented ADDIE model implementation.

4.4.2 E-Learning User Interface that Maximizes Engagement for Primary School

Students and teachers from School A and School B offered suggestions to enhance e-learning user interface (UI) design through traits such as Simplicity and Intuitiveness, Visual Appeal, Accessibility, Cultural Relevance and Engagement Features and multiple more factors.

The students and teachers agreed that an e-learning user interface design must be both intuitive and straightforward to maximize primary school learner engagement when students lack adult support. Basic user interface design focused on creating an approachable system for independent operation by learners who need minimal supervision in their navigation. These submissions resulted in a well-structured dashboard which includes prominent buttons labeled "Start Lesson" and "Practice Quiz" as well as "Games" so students can easily discover their necessary functions. The development team concluded clear instructions need to accompany all tasks alongside visual indicators that include directional arrows and highlighted sections along with action-representing icons (such as search and courses) that use easy-to-understand language suited for young students. Users should find next-module navigation labeled with instructions which say "Click here to go to the next fun activity." The method provided dual advantages of decluttering confusion while additionally creating learner confidence which resulted in better content understanding. Your platform should optimize both convenience and ease of use because this user-friendly approach creates conditions which develop student autonomy and maintain their learning drive.

The survey results show that visual appeal stands essential for creating e-learning systems which effectively capture and maintain the focus of primary school learners. The research results showed similar findings as Lu and Hanim (2024) discovered. Bright attractive colors together with appealing child-oriented graphics create an exciting environment that attracts young learners to the platform according to their assessment. The application of happy color patterns together with cartoon illustrations that portray animals or familiar nature scenes should create a space that invites young students with welcoming feelings. It was determined that interactive elements including animations should produce cheerful "dings" as rewards for correct answers. The integration of bouncing stars and interactive buttons helps students transition from passive to active learning while activating sounds or visual effects through clicks. Studies have shown that interactive benefits boost learning satisfaction by creating

powerful memories that enhance student conceptual understanding. The platform achieves enhanced student motivation by focusing on attractive visuals and enjoyable interactive features that deliver an enjoyable learning immersion (Kalmpourtzis, 2018).

Almost all stakeholders affirmed accessibility as the fundamental design aspect for remote primary school e-learning interfaces because of restricted connectivity and technological capabilities in those regions. The platform needs to support low-bandwidth operation which ensures smooth functionality despite unreliable internet speeds. We made the project interface work with light graphics so students accessing poor domain connections would not experience time-consuming delays or breaks when learning from the system. The platform needed offline capabilities because it should let learners and teachers download lessons, videos and interactive activities ahead of time for accessing materials when without internet connectivity. One respondent C in this regard suggested that;

“We will appreciate if the e-learning platforms allows a student in a remote village to download a week’s worth of math lessons and practice exercises while at school, then complete them at home without worrying about connectivity issues.”

The decision was made to build the platform with offline capabilities and low-bandwidth support because this approach ensures student access to equal education despite geographical locations or internet availability.

The survey data from teachers confirmed cultural significance as a key need for interface design work that meets the needs of remote learners in elementary school. The recruitment process for the prototype's localization emphasized the positive effects of delivering content which mirrors student cultures as well as customs and local experiences through relevant characters and examples. One respondent D suggested that;

“A math problem could involve counting local fruits or animals, or a reading lesson might feature folktales from the region, helping students connect with the material on a personal level.”

Additionally, it was strongly suggested that multilingual support is crucial to ensure comprehension and inclusivity; where the interface should be available in multiple languages, including local dialects, to accommodate diverse linguistic backgrounds. The platform achieves cultural and linguistic gap bridging through culturally relevant content and multilingual options as Arcinas (2025) advocated it would do thereby providing accessible learning to students despite their personal backgrounds.

All the student feedback stressed the importance of developing 'video games' since it turns educational experiences into a pleasurable and rewarding adventure. Ibisu (2024) confirms this finding which demonstrates that engagement features are foundational for creating e-learning user interfaces that keep primary school students interested and motivated during remote learning. One Respondent suggested that;

“The platform could allow students to earn a "Math Master" badge for completing a series of arithmetic challenges or unlock a new level after mastering a set of vocabulary words, creating a sense of achievement and encouraging them to progress further.”

Students needed interactive quizzes with instant feedback according to suggestions made by users which served to maintain constant student engagement. The student gets to view a science quiz question response accompanied by a "Correct" message followed by a cheerful animation. *You're a science superstar!"* In case of an incorrect response the system would provide a subtle direction through "Almost" as feedback. Plants cannot grow without sunlight which you should always keep in mind. The study published by Wong and Yang (2017) revealed that students obtain learning reinforcement coupled with improved motivation while feeling more confident when they receive immediate feedback during real time. The interactive quizzes and learning systems on the platform develop an educational environment that sustains student engagement while helping students develop affection for their learning process.

The program incorporation required teacher support tools that included real-time progress tracking to help educators watch student performance and detect parts where specific learners need supplementary materials. According to one participant the system needs a dashboard which presents metrics involving quiz results alongside task duration records plus achievement levels to let educators detect students having issues with fractions or reading comprehension

so they can deliver specific help. Proposed was a complete resource center providing teachers with access to a collection of teaching materials including adaptable lesson plans and printable worksheets and interactive activities. One Respondent suggested;

“A facilitator preparing a Science and Technology lesson on the water cycle could download a ready-made lesson plan, a short animated video and a hands-on experiment guide, saving time and ensuring high-quality instruction.”

It was obtained that by equipping teachers with progress tracking tools and a robust resource library, the platform not only supports educators in delivering effective instruction but also enhances the overall learning experience for students, fostering academic growth and success as previously established by Thomas (2016).

Collected responses also revealed the importance of parental involvement as a component of an effective e-learning user interface. The parent dashboard feature enables parent tracking of child progress enabling them to view academic achievements together with areas of improvement as well as achievement results. The e-learning platform design specified parent access with a login feature to monitor their child's quiz scores together with completed assignments accompanied by teacher feedback. The platform's supportive access for parents combined with its practical guidance will build educational cooperation to connect school and home and improve child learning success according to Ishimaru (2019).

The research responses brought valuable technical support needed to achieve successful deployment and prolonged usage of e-learning user interfaces. A dependable support system similar to a helpdesk should exist to resolve technical difficulties associated with problems related to system logins and software errors and network issues. A technical support system with accessible resources at its disposal would enable this platform to eliminate interruptions and boost confidence among users so they can dedicate their efforts to education rather than system issues.

Safety and privacy were found to be paramount in designing an e-learning user interface for primary school learners, particularly in remote areas where digital literacy and awareness of online risks may be limited. Most responses revealed that there was a worry for online safety.

Child safety must be a top priority, ensuring that the platform is free from inappropriate content, ads, or external links that could harm young users as previously found by Gillett, Stardust and Burgess (2022). For example, the platform could use content filters and moderation tools to block access to unsuitable material and create a secure, ad-free environment where students can focus solely on learning. Additionally, robust data privacy measures are essential to protect the personal information of students and teachers. This includes encryption of sensitive data, secure login processes and compliance with privacy regulations to prevent unauthorized access or data breaches.

A reliable feedback system serves as an essential element for enhancing the e-learning user interface through assessment of teacher and learner requirements particularly in geographic locations with special challenges. The platform needed continuous updates through user feedback processes in order to adapt into a better form while fixing real-time problems. The platform will adapt by offering more detailed explanations and supplementary practice exercises when teachers inform about challenging math content for their students. The platform's interface becomes easier to navigate when students share their difficulties with the navigation system. The platform required teacher and student involvement during its testing phase through a pilot test to obtain essential understanding about usability and effectiveness levels. Construction of the platform during assessment revealed a lesson uncovered by instructors where simulation performance suffered on restricted internet speed so development teams optimized this aspect before extensive deployment.

Teachers emphasized that the interface needs educational integration with curriculum materials to become effective and applicable for educational use. A relevant educational interface needs to maintain curriculum guidelines established by the nation for its learners' development. The platform needs to provide lessons and assessments about multiplication and division which match the learning goals from third-grade national curriculum standards. Enhanced learning results from supplementary materials that are developed as additional resources to enhance the existing curriculum. The platform should incorporate interactive timelines and videos and printable worksheets for students to obtain detailed knowledge about local cultural heritage subjects during social science lessons.

4.7 Chapter Summary

The research results focus on essential aspects which must be resolved when designing interactive e-learning interfaces for primary school learners in Zimbabwe. The e-learning experience requires cultural relevance and usability combined with social interaction features according to the feedback from learners and educators through their research studies. Data analysis in this section will direct the development of design aspects that satisfy primary Zimbabwean learners as described in Chapter 6 of the iterative process.

CHAPTER V

USER INTERFACE PROTOTYPING AND DESIGN

5.0 Introduction

This chapter details the prototype development process, which was directly shaped by the research findings from Chapter Four and the actionable recommendations outlined in Chapter six. The project started its implementation through the fundamental stages of empathizing and problem definition following Kemmis and McTaggart's (1982) Action Research Cycle framework. The research used a combination of data collection instruments to study user needs using a multi-methods qualitative approach. Multiple data collection methods encompassed document analysis and in-depth conversations along with structured questionnaire administration and observational study techniques that produced extensive user conduct and system necessity information. The researcher utilized systematic data analysis to understand and classify the main problems e-learning users face. The analytical work helped define both the range of issues while generating an accurate problem definition. The design phase (Phase Two) incorporated evidence-based research findings that directed the development of targeted pedagogically sound solutions. The research findings formed the basis for the prototype's architecture and features implementation while concentrating on delivering the recommendations for the first two study objectives.

5.1 Phase two

The execution of constructed intervention along with systematic observation and reflective outcome analysis served as the vital components of this phase which connects to Kemmis and McTaggart's (2018) framework for action research. This phase demonstrates an iterative pattern consistent with action research methodology as explained in Cresswell (2020). This implementation followed strict guidance from Phase 1 empirical findings and Bryson's (2020) specific recommendations to promote evidence-based development. This stage was guided by the following process of implementing user testing and feedback mechanisms and evaluation of the effectiveness of designed UI.

The phase maintained a consistent methodology following the action research paradigm by prioritizing practical implementation and outcome measurements. This method served to

establish both academic integrity while maintaining practical significance when examining the effects of an e-learning platform.

5.1.1. Ideation

Relying on the principles of design thinking (Swarnadwitya, 2020), the designer engaged in extensive ideation to develop potential solutions for the observed challenges. The ideation process provided room for free exploration of emerging ideas that were not foreseen previously in the research process. The designer employed brainstorming techniques to expand creative thinking, which yielded some viable solutions at the expense of design flexibility. The concept design process produced several of the foundational design deliverables, including:

1. An initial site map establishing the platform architecture.
2. Detailed wireframes establishing the e-learning system's wireframe structure.

These graphical illustrations were developed with the assistance of CorelDraw software, constituting the first physical articulations of the proposed e-learning system's design. The wireframes, in particular, defined a skeleton framework that outlined the user interface elements and their interrelations within the system. This step successfully translated abstract ideas into physical design proposals without closing options for further development.

5.1.1.1 Site Map

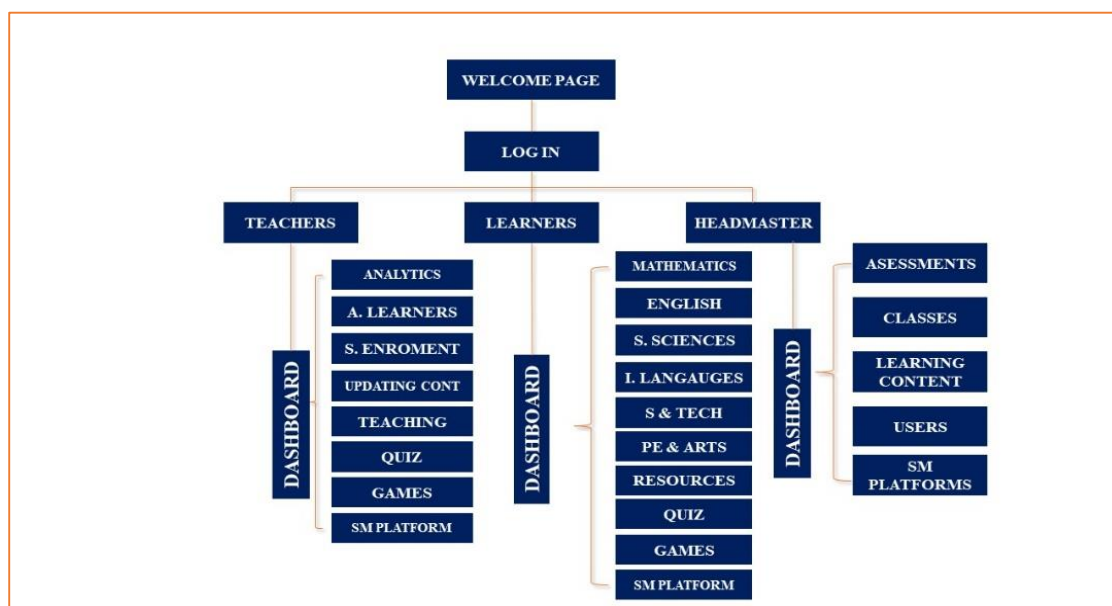
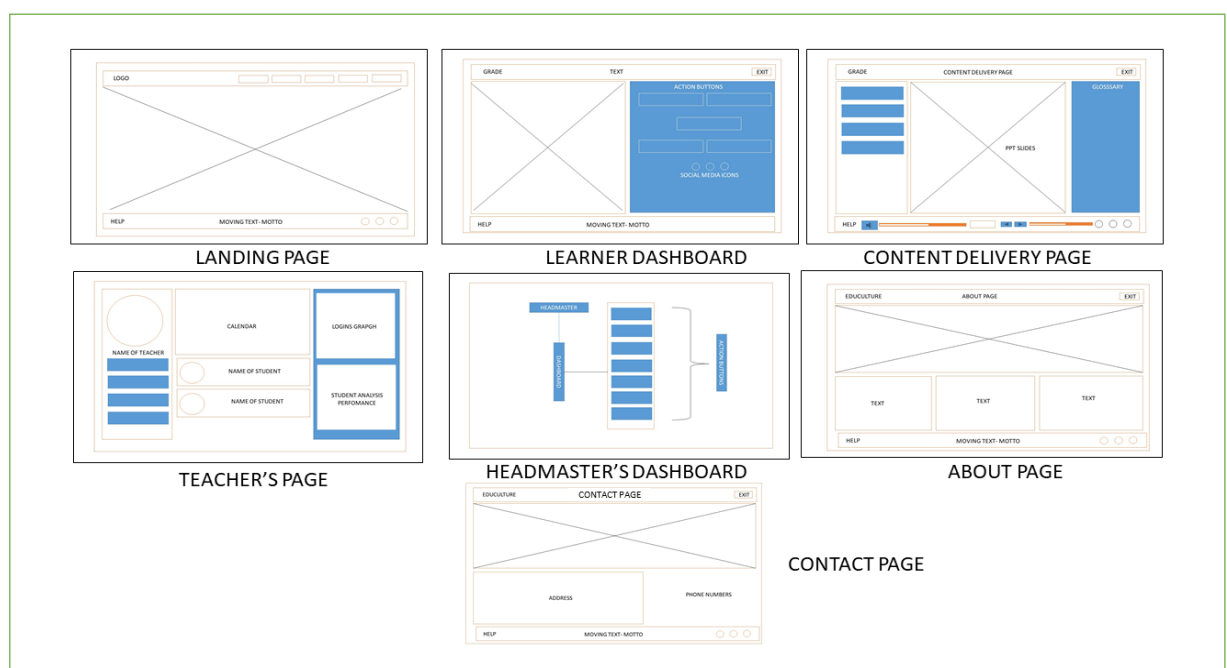


Figure: 5.1 Site Map

The site map served as a detailed master plan for the Educulture site, clearly specifying all pages and their hierarchical organization. This graphical documentation played an important role in the design process by guaranteeing that all of the user needs located in the research results were systematically addressed. By applying information architecture principles, the site map organized related content into logical groupings, establishing an intuitive navigation pattern that enhanced user experience and platform discovery. As a strategic summary, the site map enabled designers' capacity to find and fill gaps in content through collaborative review with educators and administrators prior to implementation. The platform's architecture features distinct entry points for its three groups of users (learners, teachers and school administrators), each of which logs in to view role-specific dashboards.

For ensuring optimal usability without compromising security features, the system demands that students be registered by teachers according to correct grade levels, from which students can access well-defined study materials through individual dashboards. School administrators are given supervisory control through dedicated monitoring software so that they can observe all platform activities as well as impose proper behavior in virtual classrooms. The access tiered system provides both educational functionality and administrative control of the e-learning environment.

5.1.1.2 Wireframe



Figures 5.2: Educulture prototype UI wireframe

A vital stage in web design is wireframe design which allowed the designer to see how a UI should be organized and structured before devoting time and resources to more in-depth design and development. The wireframe enhanced usability, guaranteed alignment with project objectives, and enabled early feedback by delineating key components and their positioning (Harley, 2021). It functioned as a guide, allowing the designer to spot possible problems with functionality, content hierarchy and navigation before moving on to low, medium and high fidelity prototypes (Buley, 2019). Wireframes also improved communication between clients, developers and designers, reducing miscommunication and streamlining the design process (Nielsen Norman Group, 2022). Wireframe was essential in the design of Educulture's UI prototype, guaranteeing a user-centred approach that improved the overall educational experience.

5.2. Ideation: Low Fidelity Prototype

This stage involved developing low-fidelity visual drafts of the Educulture platform, outlining its layout, structure and features. The designer created initial sketches of the UI components, aligning with the research insights and the sitemap's framework. Concepts were tested and adjusted to enhance usability and minimize potential issues. This iterative approach allowed for continuous improvement of the design through feedback from both target users and fellow designers. Wireframes are shown on subsequent pages starting from Fig 6.3. which is the landing page for Educulture e-learning platform.

a) Landing Page

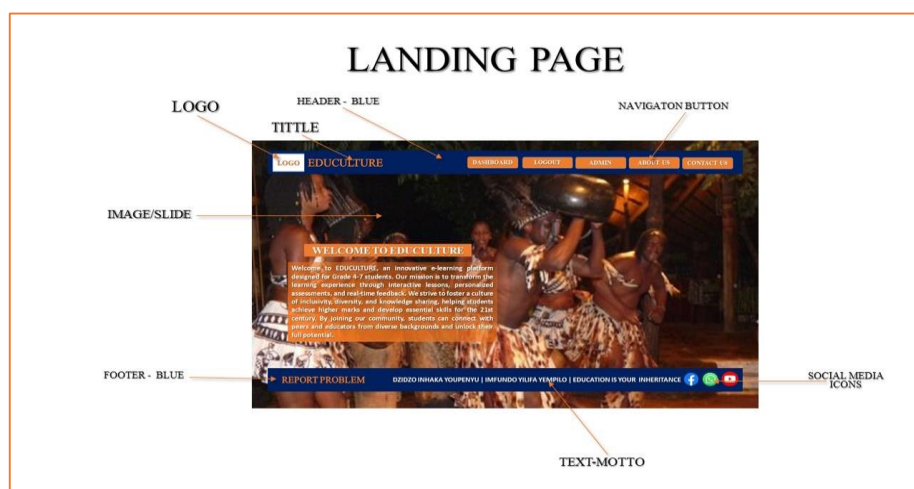


Figure 5.3. landing page

b) Learner Pages (i) learner's Dashboard



Figure 5.4 Learner's Dashboard

ii. Content Delivery Page

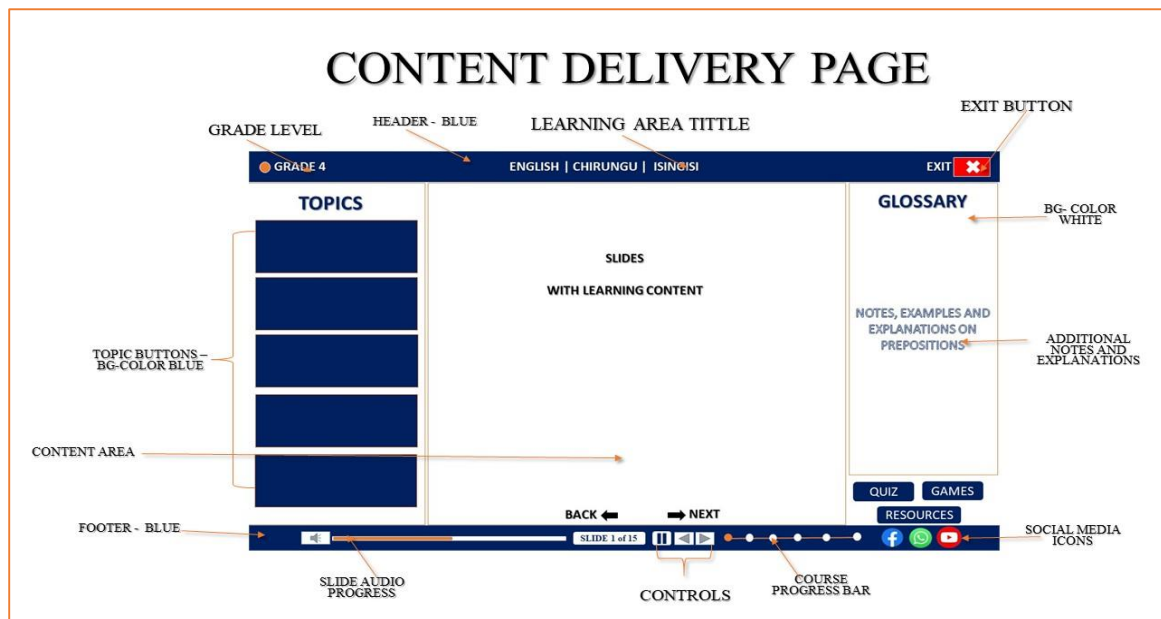


Figure 5.5 Content Delivery Page

c. Teacher's Dashboard



Figure 5.6 Teachers' Dashboard

d. Headmasters' Dashboard

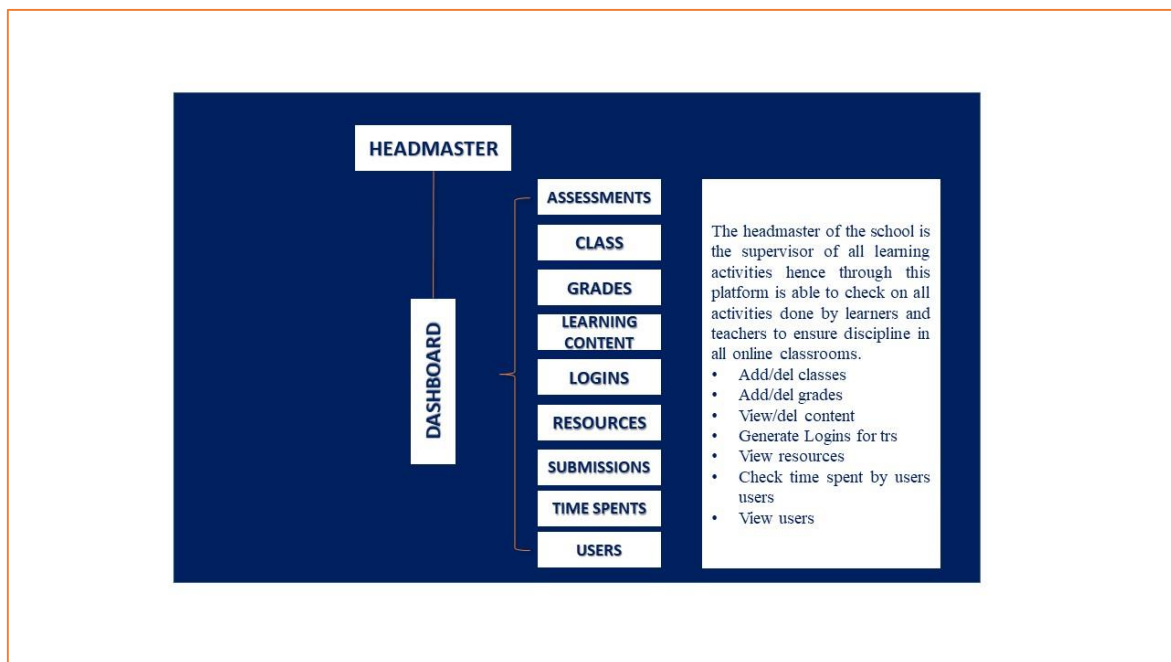


Figure 5.7. headmasters' dashboard

e. Information Pages (i) About Page

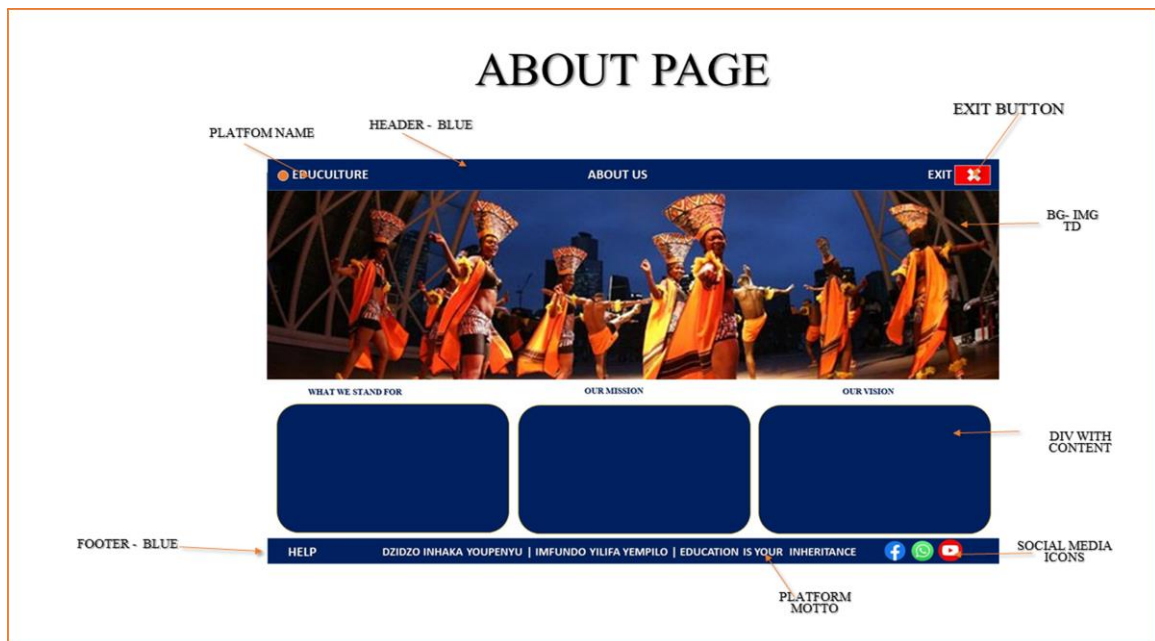


Figure 5.8. About Page

(ii) Contact Page

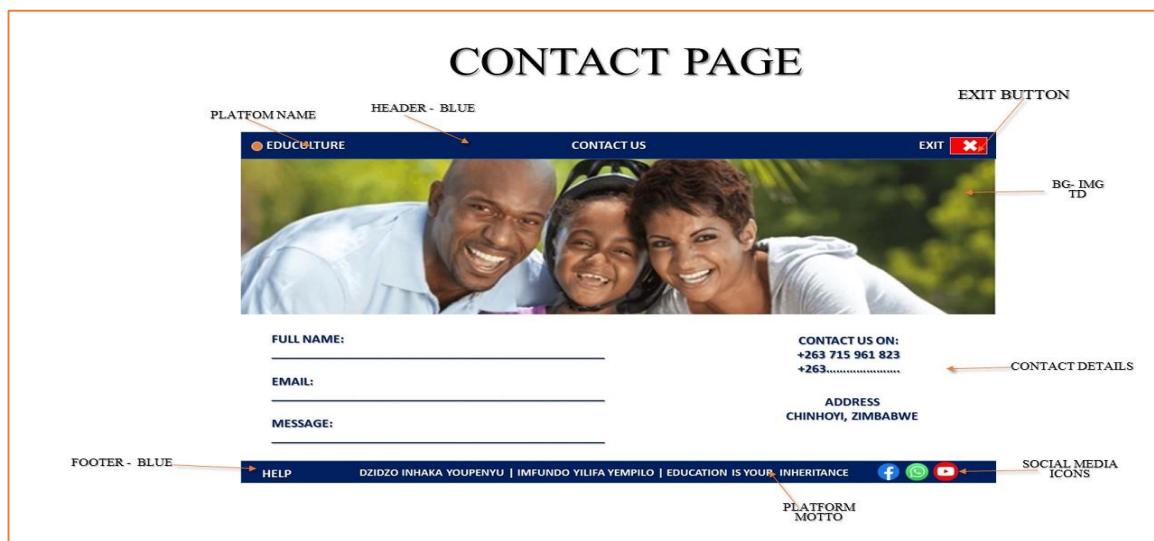


Figure 5.9. Contact Page

5.3. Prototyping: Educulture Medium Fidelity Prototype

The designer developed a medium-fidelity prototype for Educulture, incorporating interactive elements that closely resemble the final e-learning platform. This clickable and testable version showcases the layout, functionality and user experience, allowing the designer to refine the design, validate assumptions and engage with stakeholders. By identifying and correcting errors early, this process helped optimize the platform before moving into full-scale development. Fig 5.10 Shows Educulture e-learning pages.

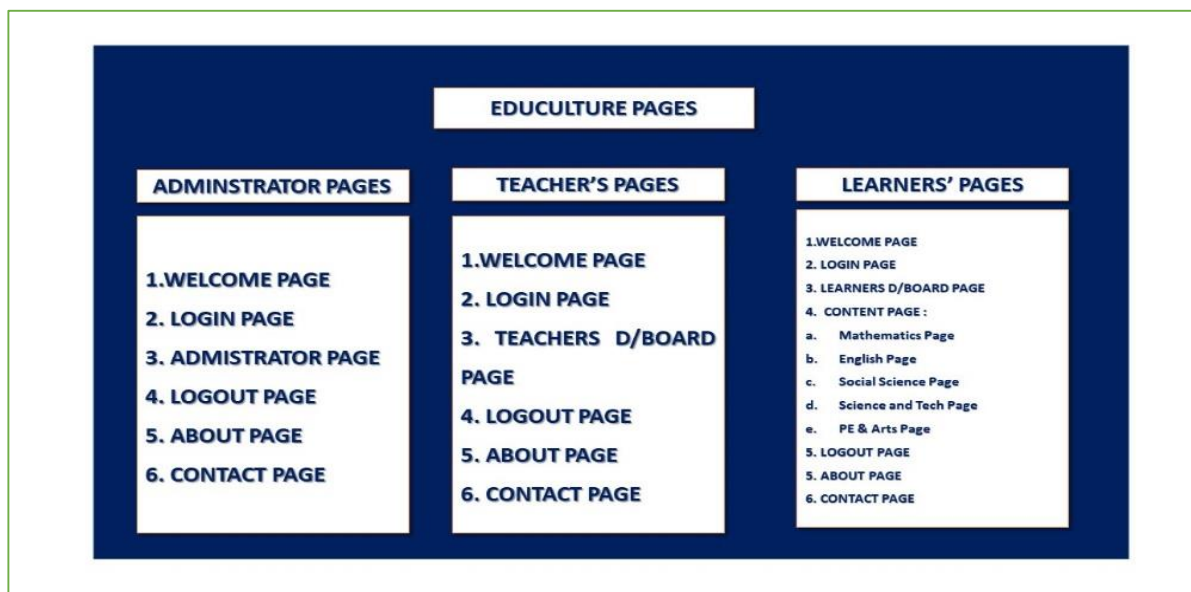


Figure 5.10 Educulture Pages (<https://aitd.co.zw/>)

NB: The Educulture e-learning platform is accessed through the address bar using the link (<https://aitd.co.zw/>)

Logins

- (a) Administrator (Username: P19900F | Password: educulture)
- (b) Teacher (Username: E2527896V | Password: educulture)
- (c) Student (Username: E2598036X | Password: educulture)

5.3.1 The Educulture E-learning Platform (<https://aitd.co.zw/>)

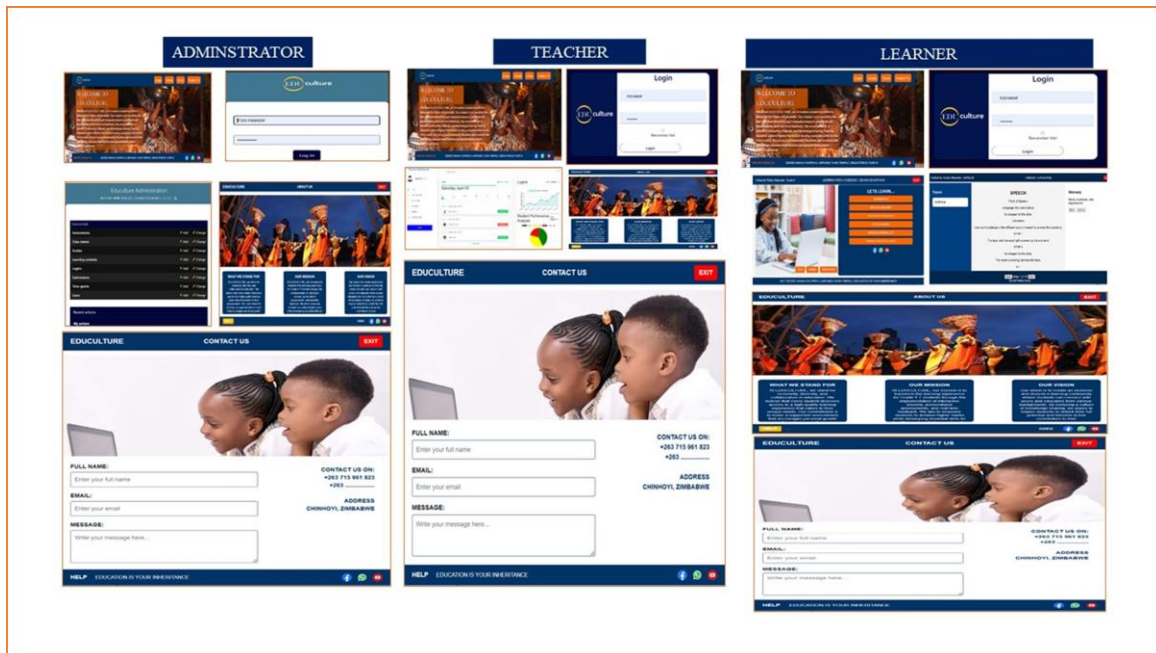


Figure 5.11 Educulture E-Learning Platform (<https://aitd.co.zw/>)

5.3.2 The Educulture E-learning Platform User Manual (<https://aitd.co.zw/>)



Figure 5.12 Educulture User Manual (<https://aitd.co.zw/>)

5.3.3 Responsiveness

The Educulture e-learning platform is responsive to following devices in Fig 6.12



Figure 5.13. Device Responsiveness (<https://aitd.co.zw/>)

The Semiotic theory has greatly influenced the creation of the Educulture e-learning platform, especially when it comes to the use of Peirce's (1931–1958) triadic model of signs, which consists of the representamen (sign vehicle), object (referent) and interpretant (meaning). This theoretical framework offers a strong basis for comprehending how the platform conveys instructional materials and features to its various users, including administrators, instructors and students. Semiotic principles informed the iterative design process of the platform, which started with low-fidelity paper prototype and progressed to medium-fidelity prototype based on research findings and recommendations (Chapters 4 and 5 of this study) (Chandler, 2007).

At the representamen level, the interface elements of the platform act as well-made signs. The logo on the left side of the header works as an indexical sign, showing the platform's identity and creating brand recognition (Nöth, 1990). The four buttons that are coloured orange act as symbols whereby orange is normally used to represent action and interactivity on the web (Kress and van Leeuwen, 2001). The photos on the home page act as signs that represent Zimbabwean education, creating clear visual associations for local users (Eco, 1976).

The object level of the semiotic triad indicates that the platform is a full e-learning system. It is capable of supporting learning that occurs simultaneously, at different times and a combination of both (Alqurni, 2022). There are three major pages of the platform:

Administration, Teacher and Learner. Each major page contains six subpages, totaling 21 pages. This layout is a sign system in which every component signifies various functional areas. To administrators, it is a way of managing users. To educators, it is a means of content delivery and management of students. To students, it is an interactive environment to learn (Norman, 2013).

The interpretant level illustrates how various users interpret the platform's signs according to their professions and cultures. For instance, the login buttons are interpreted differently: administrators see them as means of managing users, teachers interpret them as gateways to teaching resources and learners perceive them as connections to learning materials (Saussure, 1916). The multimedia elements, like interactive quizzes and games support active learning and participation, in line with modern teaching methodologies (Clark and Mayer, 2016). The bottom progress bar shows a marker of accomplishment and the top-right corner exit button follows standard UI conventions, making it easy for all to understand (Peirce, 1931-1958). The semiotic construction of the platform includes its supporting pages. The About page explains the mission and vision of the platform and serves as a meta-sign that places the whole system in the context of Zimbabwe's education system.

The contact page is an indexical sign that points users to potential lines of communication, while social media icons at the footer are symbolic signs representative of connectivity and extended learning communities (Kress and van Leeuwen, 2001). Semiotically, the structure of content on the website by topics positioned on the left and explanatory remarks seen in sections highlighted in grey on the right is forming a visual syntax that is leading learners through the learning content. This structuring based on Western reading convention (left-to-right) and the utilization of color distinction (grey areas) to represent secondary information (Chandler, 2007). The incorporation of Google Slides in content dissemination is a fusion of sign systems that mix conventional presentation methods with interactive e-learning aspects (Alqurni, 2022).

Semiotic analysis illustrates how the Educulture platform effectively employs various sign systems to produce a unified user experience. However, emerging developments can further improve cultural semiotics through the incorporation of more localized visual metaphors and symbols with strong resonance among students in Zimbabwe (Nöth, 1990). Additionally, the platform can be improved with more prominent signifiers focused on accessibility features to facilitate inclusive interpretation from users of varying capabilities (Norman, 2013).

5.3.4 Typography

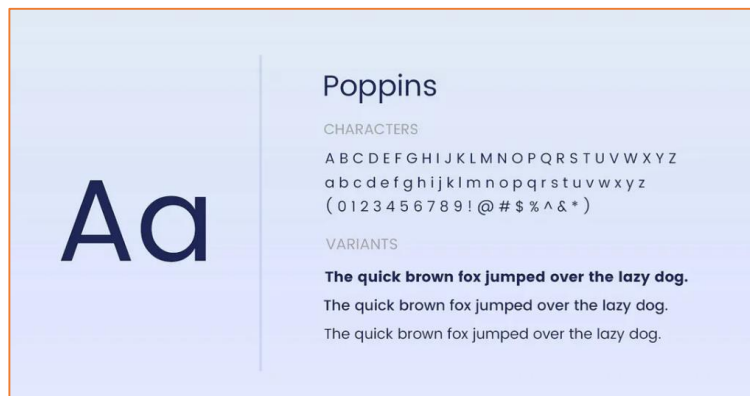


Figure 5.14 Poppins

Poppins does a great job with Zimbabwe's Grades 4 to 7 Educulture e-learning platform because of its flexible, inclusive and modern design elements. Poppins' clear, rounded forms make it easy for learners of the developmental reading age to read and comprehend (Walker, 2001). In order to promote ethnic harmony among Zimbabwean groups, the Poppins typeface provides cultural neutrality, flexibility and the avoidance of prejudice (Lupton, 2010). To improve readability in all languages used by the school community, including Shona, Ndebele and English, Poppins provides language-independent uniformity in x-height and clean letterforms (Legge and Bigelow 2011). The Poppins letters satisfy accessibility requirements at WCAG 2.1 level A conformance, allowing students with a range of learning abilities, such as vision impairments or cognitive difficulties (W3C, 2018). Poppins uses gender-neutral forms that give the class a unisex environment (Benton, 2017). Because of its simple typography, linguistic flexibility and variety and accessibility by being inclusive of all users, Poppins is a perfect fit for the platform.

5.3.5. Color Psychology

Fig 5.15 Shows the colors used in the designing of Educulture e-learning platform.



Figure 5.15 Color: Blue and Orange

In order to improve accessibility, inclusivity and user engagement, the Educulture e-learning platform for Grades 4 to 7 learners in Zimbabwe makes good use of the blue and orange colour combination. In Zimbabwe's multicultural population, blue is widely accepted due to its cultural neutrality and connotations of trust, calmness and focus, which create a safe and stress-free learning environment (Hallock, 2003; Kuschel and Monberg, 2014). Orange, which is linked to vitality, inventiveness and optimism, counterbalances blue by bringing vitality and excitement, inspiring younger learners (Elliot, 2015). Together, they stabilize dynamism and calmness while arousing curiosity and attention (Farley and Grant, 1976). High contrast is WCAG-compliant and improves visibility and legibility, which benefits students with intellectual or visual impairments (W3C, 2018). The colours' gender-blindness and cultural neutrality prevent stereotyping and create an inclusive, equitable environment for all users. The site becomes welcoming, useful and convenient for people from all walks of life thanks to the careful use of blue and orange.

5.4. User testing and feedback

Key tasks were successfully finished by the administrators; on average, adding a user took 30 seconds and uploading content took 40 seconds. One headmaster's comment demonstrates how these findings validate Norman's (2013) discoverability principle in interface design:

"The platform is straightforward and easy to navigate once you understand it."

With users asking for "a quick tutorial or onboarding guide" to speed up first-time use, the initial learning curve observed by participants supports Krug's (2014) findings regarding the need for onboarding support. An optimistic comment from another administrator:

"With regular use, I believe we can complete tasks even faster"

The learnability principles delineated by Shneiderman et al. (2016) are reflected in this. Most teachers (70%) completed tasks efficiently, meeting Sauro and Lewis (2016) usability benchmarks for learner enrolment (20 seconds), content upload (30 seconds) and virtual connection (40 seconds). According to one teacher:

"The interface is clean and user-friendly".

Nielsen's (2012) usability heuristics about minimalist and beautiful design are echoed here. However, problems with internet dependability are affecting schools. A teacher confirms the issues Selwyn (2019) brought up regarding the use of technology in classrooms. Rogers' (2003) diffusion of innovation theory about late adopters is consistent with the 30% of teachers who need help. Carroll's (1990) minimal manual approach is supported by their recommendation for "tooltips or help icons," and their requests for offline functionality demonstrate the growing importance of inclusive design in educational technology (Seale, 2020). Prensky's (2001) description of digital natives was supported by the students' exceptional adaptability, as evidenced by their 5- to 6-second login times and 10-second learning area selection. Positive comments such as:

"Logging in and finding my learning materials was very easy".

This demonstrates that the platform adheres to the multimedia learning principles proposed by Mayer (2009). However, Google Slides' loading delays (15 to 20 seconds) draw attention to bandwidth issues that align with UNESCO's findings from 2021 on digital education in developing nations. One learner requested for AI features:

"I'd like to see more features added, like Artificial Intelligence".

This is in line with the increasing demand for individualized education (Luckin et al., 2016). The testing found areas for improvement that are consistent with well-established research on

educational technology while validating the core usability of Educulture e-learning platform. The platform would be at the forefront of user-centred educational technology design with these improvements, which would also address existing limitations (Norman, 2013). Strong potential for broad adoption and successful implementation in educational settings is indicated by the overwhelmingly positive response from all user groups.

5.4.1 Effectiveness of Designed UI

Administrators, teachers and learners have all expressed satisfaction with the Educulture e-learning platform's usability, engagement and content delivery. Nonetheless, some issues with administrative tasks, navigation and interactivity point to areas that need work. Deeper understanding of the platform's advantages and disadvantages is provided by this analysis, which is in line with current academic research on e-learning platforms.

5.4.2. Usability and Navigation

Educulture's dashboard's ease of use and clarity are among its most praised attributes. The ability to access all subjects from a single location is valued by learners:

"I like that I can easily access my lessons and see all the subjects in one place."

– (Learner 1).

In a similar vein, facilitators find the platform's design useful for monitoring student progress:

"The platform is well-structured and monitoring students' progress is simple."

- (Teacher 2).

A fundamental tenet of Nielsen's usability heuristics visibility of system status and a fit between the system and the real world is reflected in this interface design's simplicity (Hetseвич, 2021). The platform streamlines instruction and learning by lowering cognitive friction by allowing teachers and learners to engage with tools and content in an intuitive manner. Reducing user annoyance and guaranteeing seamless navigation depend heavily on effective resource access and well-defined content structures. Notwithstanding these advantages, user reviews indicate difficulties recovering passwords and navigating the platform's various sections:

"It can be difficult to log in if I forget my password." – (Learner 3)

Usability problems that may disproportionately impact users with low levels of digital literacy are reflected in such difficulties. Systems that disregard user diversity run the risk of alienating those who require the most assistance, as Norman (2013) notes. Headmaster 2's recommendation exemplifies this issue:

"It would be helpful to have a quick tutorial for new users."

The notion that guided onboarding can improve first-time user experiences and lessen initial confusion is supported by Mayer's (2022) research. Including tutorials and help prompts would enable students to use the platform more confidently and guarantee that no user is left behind because they are not accustomed to using digital environments.

5.4.3. Engagement and Interactivity

The use of animations, quizzes, and real-time feedback by Educulture greatly increases student engagement:

"I enjoy the quizzes because I can see my score right away." - (Learner 4)

While another teacher noted that:

"The tests are excellent for rapidly evaluating students." – (Teacher 3)

According to Tulsiani (2024), gamification is the process of incorporating game elements like challenges, feedback loops and instant rewards into instructional materials. These interactive features show how gamification principles can be applied effectively. The instant reward system increases student motivation and fosters a culture of continuous, low-pressure evaluation. Through feedback and repetition, this type of engagement not only maintains focus but also strengthens comprehension. Headmaster 2 noted:

"learners remain motivated and involved through interactive activities."

Learners also indicated that they wanted more gamified material in science and mathematics classes. This suggests that the platform's cross-disciplinary interactivity is lacking. Content-specific gamification improves motivation and comprehension, according to research by Sensei LMS (2024). By creating interactive resources that are discipline-specific, like math puzzles or science simulations, Educulture could better accommodate a range of learner preferences.

Throughout the academic career, gamification should be extended throughout the curriculum to guarantee constant engagement and encourage active learning.

5.4.4. Visual Design and Aesthetics

Educulture's aesthetic appeal is frequently commended for its welcoming, light-colored interface and simple design:

"The vibrant colours make me happy as I learn." – (Learner 6)

While another teacher responded:

"It's very easy to navigate quickly because the orange and blue buttons stand out." – (Teacher 5)

These remarks are in line with the ideas of emotional design in education, which hold that carefully selected visual components can affect motivation, lower anxiety and affect mood (Plass and Kaplan, 2023). Users become more receptive to content and involved in their learning tasks when colour psychology and intuitive spacing are used to create a positive affective state. Since there are no physical classroom cues in online learning, aesthetic design becomes an essential part of instructional presence. This visual balance was aptly summed up by Headmaster 2:

"The colours are engaging for learners while maintaining a professional appearance."

Effective visuals, according to Clark and Mayer (2022), should enhance comprehension in addition to drawing attention. This is achieved by Educulture's design, which separates content areas from navigation buttons using colour and layout. This harmony between visual appeal and practical clarity reduces unnecessary mental strain and enhances usability for all users. In this sense, the visual design of Educulture supports both instructional effectiveness and emotional engagement.

5.4.5. Content Delivery and Comprehension

Learner autonomy and flexible material engagement are made possible by Educulture's self-paced learning model:

"I don't feel under pressure because the platform allows me to move at my own pace."
(Learner 6)

Whilst another teacher responded as follows:

"It facilitates the explanation of abstract concepts." – (Teacher 6)

These observations are consistent with the fundamental concepts of Cognitive Load Theory, especially the significance of segmentation and pacing (Holland and Muilenburg, 2023). Learners are better equipped to handle cognitive load and prevent overload when they have control over the information flow. This is particularly helpful for abstract or complicated subject areas where students might require more time to think and process information. This structure also helps teachers because it makes differentiated instruction easier.

On the other hand, students have also complained that automated slide transitions can be too quick, which interferes with learning. This indicates a mismatch between the platform's design and the flexibility that users require. According to Kalyuga (2023), effective comprehension requires adaptive learning systems or those that react to the learner's input and pace. Educulture could better accommodate a range of learning speeds and give students greater autonomy by implementing slide controls that can be adjusted. By doing this, the platform would be even more in line with best practices in instructional design and cognitive science.

5.5. Assessment and Feedback

The instant feedback mechanisms of Educulture's formative assessment tools are highly valued.

"I like it because the quizzes are fun and I can see my score immediately." – (Learner 8)

This strategy is consistent with previous research by Black and Wiliam and is further reinforced by e-learning Industry reviews from 2023, which highlight the value of prompt, low-stakes

feedback in fostering student learning. In a single learning session, prompt responses assisted students in recognizing their areas of weakness, modifying their learning approaches and reinforcing accurate information. This promotes metacognitive awareness and aids in self-regulation. Teachers, however, emphasized the necessity of more thorough assessment data:

*"We require better admin tools and more thorough feedback for every question."
(Teacher 9).*

A weakness in the platform's analytics capabilities is exposed by this feedback. Effective feedback, according to Hattie (2024), needs to be clear, actionable, and related to more general learning goals. A deeper layer of reporting that provides item analysis, question difficulty, and individual learning trends would improve the usefulness of Educulture's instant quizzes for teachers, even though they support superficial evaluation. Enhancing the infrastructure for assessments would enable teachers to make better decisions and give students more specialized assistance.

5.5.1. Areas for Improvement and Conclusion

Even though Educulture performed admirably, several things could be done better. While students want more gamification, teachers are calling for more customizable content. Headmaster 1 noted:

"It could be easier to manage users and track progress, among other administrative tasks."

These issues are in line with Siemens' (2024) connectivist tenets, which prioritized flexibility, customisation and student autonomy. While administrators need tools that streamline rather than complicate backend processes, educators must be able to customize learning materials to meet the needs of individuals or groups. The platform's scalability and sustainability might be constrained in the absence of these features. The Educulture platform is excellent in terms of learner autonomy, interactivity and visual design. Its educational value could be greatly increased, though, by improving its usability for less tech-savvy users, adding interactive features across subjects and improving assessment tools. These suggestions, which are backed by recent academic studies and user input, offer Educulture a path forward for developing into a more successful and inclusive e-learning platform.

5.4.7. Table 5.5: Summary of Key Themes

Theme	Strength	Areas for Improvement
Navigation and Usability	Most users find the dashboard and navigation to be intuitive.	Enhance user management tools, add tutorials and streamline navigation.
Engagement and interactivity	Learners are motivated by interactive slides, tests and animations.	Increase the number of games, gamified components and subject-specific activities.
Visual Design	Both teachers and students are drawn to bright, colourful designs.	Make sure the pace of the slides and other design elements are not overpowering.
Content Delivery	Understanding is aided by detailed explanations, real-world examples and illustrations.	Modify the pace, enlarge the text and vary the examples.
Assessment and Feedback	Quizzes are helpful for rapid assessments and offer instant feedback.	Include more adaptable tests and thorough feedback systems.
Areas for Improvement	platform for teaching and learning that is well-structured.	Enhance personalization, incorporate templates and offer users comprehensive training.

5.6. Chapter Summary

The Educulture e-learning platform is notable for its visually appealing design, interesting content and easy-to-use interface. However, there are still a number of usability issues, especially with regard to technical dependability, interactive content diversity and onboarding. If the platform wants to be as effective and reach as possible in a variety of educational contexts, these problems must be resolved. The encouraging comments from students and teachers point to a solid base upon which to build. When it comes to enhancements, the platform lies at the nexus of engagement and usability, offering chances to improve the user experience even more while promoting learning objectives. As Educulture develops, it will be crucial to maintain the focus on user-centred design principles.

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter summarises the study's main conclusions and offers a reflection on how the goals of the investigation were met. To arrive at significant conclusions, it integrates the knowledge gathered from data collection, analysis and prototype development. It also provides useful advice for those involved in creating, putting into practice and assessing e-learning user interfaces (UIs) for Zimbabwean primary school learners. Suggestions for future research directions are included at the end of the chapter.

6.2 Summary of Findings

6.2.1 Objective 1: Learning Preferences of Primary School Learners

According to the study interactive, multimedia-rich and culturally relevant e-learning platforms are preferred by primary school learners in Zimbabwe. Because they increase motivation and engagement, learners prefer platforms that include videos, animations, quizzes and gamified elements. The widespread usage of Google and WhatsApp by students suggests a desire for well-known, easily accessible and cooperative tools. Conversely, obstacles like expensive data plans and erratic internet connectivity restrict regular access. The demographic analysis highlighted the significance of flexible and age-appropriate interface designs by demonstrating how age, gender and grade level affect learning needs and technology interaction patterns. The results show that visual, easy-to-use interfaces that encourage independence are the most effective for young learners.

6.2.2 Objective 2: Features and Design Principles for Engagement

The information brought to light a number of important characteristics that support student engagement. Clear navigation, large buttons and uncomplicated instructions that allow for independent use are crucial for simplicity and intuitiveness. Bright colours, kid-friendly graphics and animations all contribute to visual appeal which is important because they draw and hold learners' attention. Another important consideration is accessibility, offline features, low-bandwidth support, multilingual choices and cultural relevance guarantee inclusivity for students in isolated and underdeveloped regions. In addition, learners are motivated and

learning is reinforced by interactive and gamified content such as quizzes, badges, levels and instant feedback. A supportive learning environment is promoted by parental and teacher support tools like communication channels, resource libraries and dashboards for tracking progress. Together, these observations shaped the design principles which placed a strong emphasis on user-centred, culturally aware, accessible and captivating interfaces.

6.2.3 Objective 3: Evaluation and feedback

Educulture a medium-fidelity e-learning platform that integrates the features found, is the product of the iterative prototyping process. Poppins typography and colour schemes (orange and blue) improve readability, trust and excitement while the platform uses semiotic principles to guarantee sign systems have meaning in the Zimbabwean cultural context. High levels of usability, engagement and satisfaction were found during user testing, confirming that the design principles successfully satisfy the needs of both teachers and students. The significance of offline functionality, cultural relevance, onboarding tutorials and adaptive assessment tools was emphasised in the feedback and will now be improved in the future.

6.3 Conclusion

In Zimbabwe cultural relevance, aesthetic appeal, interactivity and the platform's general usability all have a significant impact on learners' engagement with e-learning platforms. The efficacy and participation of these platforms are on the other hand severely hampered by technological and infrastructure issues such as inadequate internet connectivity, expensive data plans and restricted device availability. In order to overcome these obstacles user interfaces must be made inclusive, straightforward and flexible in order to satisfy the various needs of students while taking into account the particular contextual realities of the area. The effective execution and long-term viability of e-learning projects depend heavily on the participation of important stakeholders such as educators, students and legislators. Their suggestions can assist in customising platforms to successfully meet cultural and educational needs. Adopting iterative user-centered design approaches, guided by semiotic and cognitive theories can lead to the development of interfaces that are not only functional but also culturally resonant and engaging for learners. This highlights the importance of integrating cultural, infrastructural, pedagogical and technological considerations into the design of e-learning platforms. By doing so, it is possible to create solutions that enhance engagement and learning outcomes for primary

education in Zimbabwe ensuring that e-learning becomes a viable and impactful tool for all learners

6.4 Recommendations

6.4.1 For Policymakers and Educational Authorities

6.4.1.1. Enhancing Infrastructure and Resource Allocation

Investing in infrastructure to address existing resource and technology disparities, especially in underserved and rural schools, is a crucial first step in advancing e-learning. The success of digital learning depends on dependable internet connectivity, so efforts must be made to extend broadband access to more remote locations. To make sure that students have the resources they need to interact with e-learning platforms, it is also essential to expand the availability of learning devices like tablets, laptops and smartphones. Electricity stability is equally important because frequent power outages can interfere with learning and make digital tools less effective. Governments and stakeholders can establish an environment where educators and students alike have the resources they need to thrive in a competitive educational environment by giving priority to investments in these areas.

6.4.1.2. Promoting Teacher Training

For e-learning to be successfully incorporated into education teachers are essential. Programs for ongoing professional development that emphasise digital literacy and e-learning facilitation are therefore crucial. Teachers should graduate from these training programs with the abilities to use e-learning platforms, produce interesting digital content and assist students in a virtual setting. Training programs can assist teachers in modifying their pedagogical approaches to integrate technology in ways that enhance conventional classroom procedures. Schools can guarantee that teachers are not only comfortable utilising e-learning resources but also capable of optimising their potential to improve student learning outcomes by equipping them with the required knowledge and abilities.

6.4.1.3. Fostering Stakeholder Collaboration

Teachers, students, parents and community leaders must all actively participate in order for e-learning platforms to be implemented successfully and remain sustainable. These groups are

involved in collaborative policymaking and platform design processes that guarantee that the final solutions are applicable, workable and generally accepted. While parents and community leaders can offer viewpoints on accessibility and cultural appropriateness, teachers can offer insights on how to match digital tools with curriculum goals. Engaging and user-friendly platforms can also be ensured by involving students in the design process. E-learning projects can more effectively meet the particular requirements and expectations of communities by encouraging cooperation and making sure that a range of opinions are heard.

6.4.1.4. Establishing Standards for Inclusive and Culturally Relevant Content

Developing and implementing standards for inclusive and culturally relevant content is essential to guaranteeing that e-learning platforms are usable and effective for every student. In order to serve a variety of demographics, guidelines should be set for both designing interfaces that are considerate of cultural norms and preferences and producing content in multiple languages. To make sure that no student is left behind these standards should also give priority to accessibility features like offline capabilities and support for students with disabilities. Designers can produce solutions that appeal to students and promote fair access to education by incorporating these ideas into the creation of e-learning platforms.

6.4.2 For UI/UX Designers and Developers

6.4.2.1. Prioritizing Simplicity and Intuitiveness

Designing interfaces for e-learning platforms that are easy to use and intuitive so that students can navigate them with little guidance is one of the main objectives. Users should be guided through the platform with ease by clear layouts, visual cues and recognisable symbols, which will lessen cognitive load and confusion. By keeping design simple students can concentrate on interacting with the material rather than figuring out how to use the platform. Younger users, who might have less digital literacy, are also empowered to explore and learn on their own when designs are simple.

6.4.2.2. Incorporating Cultural Relevance

Fostering a sense of connection and engagement with e-learning resources requires cultural relevance. Learners are more likely to find platforms appealing and relatable if they incorporate

local symbols, languages and culturally relevant examples. For example, the learning process can be made more accessible and meaningful by utilising context-specific scenarios, regional dialects or familiar imagery. By honoring the cultural diversity of students this method not only improves understanding but also fosters inclusivity.

6.4.2.3. Ensuring Accessibility and Offline Functionality

Effective e-learning relies heavily on accessibility, especially when there are limited technological resources and internet connectivity. For users in remote or under-resourced locations to be able to access content without any disruptions, lightweight platforms with low bandwidth requirements are essential. Learners who might not always have access to the internet are further supported by offline features like preloaded modules or downloadable lessons. E-learning platforms can close the digital divide and give all students equal opportunities by tackling these issues.

6.4.2.4. Embedding Gamification and Interactive Features

Another important factor in e-learning design is motivating students and sustaining their interest. Badges, levels, quizzes and immediate feedback are examples of gamification components that can produce an exciting and dynamic learning environment. By rewarding progress and creating a sense of accomplishment, these features promote active participation. Drag-and-drop exercises, simulations and real-time feedback are examples of interactive components that enhance learning and effectively and entertainingly reinforce important ideas.

6.4.2.5. Including Support Tools for Users

Ultimately, strong support resources are essential for boosting user confidence and guaranteeing a seamless educational process. New users can rapidly learn how to use the platform and take advantage of its features with the aid of onboarding tutorials. While parental dashboards allow carers to track progress and offer assistance when required, help icons and tooltips offer extra direction for users who run into difficulties. Students, parents and teachers all gain from the supportive learning environment that these resources foster.

6.4.3 Areas for Further Studies

The study suggests that future research examine the ways in which new technologies, like augmented reality and artificial intelligence can affect the efficacy and design of e-learning platforms in elementary school. In order to fully address the issue, future research should be expanded to include additional provinces, districts, clusters and schools as this study was limited to just two in the Zvimba District of the Nyabira Cluster.

6.5 Final Reflection

This study confirms that Zimbabwean primary school learners' engagement and learning outcomes can be greatly improved by an e-learning interface that is thoughtfully created, culturally aware and contextually flexible. Realising inclusive and successful digital education in underserved areas requires addressing infrastructure issues and incorporating stakeholders at every stage of the design and implementation process.

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APPENDICES

APPENDIX A: ETHICAL CLEARANCE LETTER

CHINHOYI UNIVERSITY OF TECHNOLOGY	
RESEARCH ETHICS CLEARANCE LETTER	
NAME OF RESERCHER: - Dagious Masveta.	
STUDENT ID NUMBER: C23156631S ID Number: 27-176426-S-27	
SCHOOL OF ART AND DESIGN	
APPROVED RESEARCH TITLE: Designing an Engaging E-Learning User Interface for Primary School Learners in Zimbabwe	
I hereby confirm that the above mentioned Researcher is a Postgraduate Researcher at Chinhoyi University of Technology. The proposed study met all the requirements as stipulated in the University Policies and Guidelines and has been approved by the relevant committees. The proposal adheres to ethical principles as outlined by the University. Permission is hereby granted to carry out the research as described in the attached approved proposal.	
The main objective of the research is: To design an engaging E-learning User Interface for Primary School learners in Zimbabwe.	
Expected Outcome: - An e-learning user interface that will enhance the quality of education at the primary level for Grade 4-7 learners in Zimbabwe..	
In addition, the Researcher is urged to adhere to international and national ethical guidelines and all requirements by Chinhoyi University of Technology.	
Best Regards	CHINHOYI UNIVERSITY OF TECHNOLOGY DIRECTORATE OF RESEARCH AND GRADUATE STUDIES 24 FEB 2025 PRIVATE BAG 7724 CHINHOYI, ZIMBABWE
Yours Faithfully	
	
Dr. M. C. Mwando	
Chairperson, University Research Committee - Research Ethics	
Tel: +263 6721 22203-5	
E-mail: - researchandgraduatestudies@cut.ac.zw	

APPENDIX B: RESEARCH PERMISSION LETTER (ARMY EDUCATION DIRECTORATE)

<u>PERMISSION TO CARRY OUT RESEARCH IN ZIMBABWE NATIONAL ARMY SCHOOLS, ZVIMBA DISTRICT, NYABIRA CLUSTER</u> 05 February 2025 Directorate of Army Education Corps Army Headquarters Harare Dear Sir/Madam <i>Permission Granted 05/02/25</i> <u>RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT 1 PARACHUTE PRIMARY SCHOOL AND INKOMO PRIMARY SCHOOL-NYABIRA CLUSTER, ZVIMBA DISTRICT IN MASHONALAND WEST PROVINCE</u> Title of the research: Designing an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe. I am Daglous Masveta, currently pursuing research under the supervision of Dr. B. Chivhanga, a senior lecturer in the Department of Creative Art and Design at Chinhoyi University of Technology, towards a Master of Philosophy (MPhil) degree. I am writing to request permission to conduct research in the schools. The aim of the study is: To design an engaging e-learning user interface (UI) for primary school learners in Zimbabwe. The chosen schools were selected based on the following criteria: • Proximity to the researcher • Availability of ICT infrastructure, e-learning technologies and platforms The study will involve interviews with heads of schools, ICT teachers and Teachers. Additionally, questionnaires will be distributed to selected teachers and learners from Grades 4-7. Benefits of the Study: The findings from this research will contribute to designing an engaging e-learning UI for primary school learners in Zimbabwe. The results will aid policymakers and curriculum developers in making informed decisions when reviewing policies and delivery systems in schools. There are no anticipated risks as the study does not address sensitive topics nor directly collect data from individuals under 18 years of age.	
Dissemination Details: • There will be no reimbursement or incentives for participating in the research. • Feedback will be provided through a dissemination workshop, and a simplified version of the findings will be made available for participants to review. Thank you in advance for your cooperation and support. Yours Faithfully Signature:	

APPENDIX B1: REQUEST TO CARRY OUT RESEARCH IN SCHOOL A

REQUESTS FOR PERMISSION TO CARRY OUT RESEARCH IN SCHOOLS

153 White City
Chinhoyi
Mashonaland West

05 February 2025

The Head
A Primary School
P.O. Box
Tel: + ...



Dear Madam

RE: REQUEST FOR PERMISSION TO CARRY OUT RESEARCH IN YOUR SCHOOL

Title of the research: Designing an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe.

I am Daglous Masveta, conducting research under the supervision of Dr. B. Chivhanga at Chinhoyi University of Technology, towards a Master of Philosophy (MPhil) degree. I am writing to request permission to conduct research in your school.

Research Aim: To design an engaging e-learning UI for primary school learners in Zimbabwe. Your school was selected for its proximity and availability of ICT infrastructure.

Study Details:

- Interviews with heads of schools, ICT teachers, and other teachers
- Questionnaires for selected teachers and learners from Grades 4-7

Benefits:

- Contributing to the design of an engaging e-learning UI for primary school learners
- Assisting policymakers and curriculum developers in informed decision-making

Participation:

- No reimbursement or incentives

- Feedback via a dissemination workshop and a simplified findings report

Thank you for your cooperation and support.

Yours faithfully

Signature

Daglous Masveta Researcher: (+263 715 961 823)

APPENDIX B2: REQUEST TO CARRY OUT RESEARCH IN SCHOOL B


REQUESTS FOR PERMISSION TO CARRY OUT RESEARCH IN SCHOOLS

153 White City
Chinhoyi
Mashonaland West

05 February 2025

The Head
A Primary School
P.O. Box
Tel: + ...

DEPUTY HEAD
INDEPENDENT PRIMARY SCHOOL
05 MAR 2025
P. BAG 2186, HARARE
TEL: 0288-2192197
Email: hwanengprimschool@gmail.com

Permission granted

Dear Madam

RE: REQUEST FOR PERMISSION TO CARRY OUT RESEARCH IN YOUR SCHOOL

Title of the research: Designing an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe.

I am Daglous Masveta, conducting research under the supervision of Dr. B. Chivhanga at Chinhoyi University of Technology, towards a Master of Philosophy (MPhil) degree. I am writing to request permission to conduct research in your school.

Research Aim: To design an engaging e-learning UI for primary school learners in Zimbabwe. Your school was selected for its proximity and availability of ICT infrastructure.

Study Details:

- Interviews with heads of schools, ICT teachers, and other teachers
- Questionnaires for selected teachers and learners from Grades 4-7

Benefits:

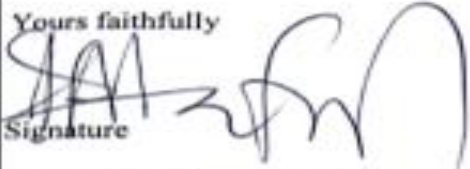
- Contributing to the design of an engaging e-learning UI for primary school learners
- Assisting policymakers and curriculum developers in informed decision-making

Participation:

- No reimbursement or incentives

Feedback via a dissemination workshop and a simplified findings report

Thank you for your cooperation and support.

Yours faithfully

Signature

Daglous Masveta Researcher: (+263 715 961 823)

APPENDIX C1: DOCUMENT ANALYSIS

SER	DOCUMENTS	DATA ANALYSED
01	ICT POLICY FOR MoPSE (2022 – 2027)	Government's vision, goals and strategies for ICT Integration
02	HERITAGE BASED CURRICULUM	Curriculum focus on Zimbabwe's cultural heritage, values and traditions and how can those be incorporated into the UI
03	SYLLABI	Examine the detailed outline of topics and skills to be covered in each area for Grade 4-7
04	SCHMES OF WORK	Long term plans outlining the topics and skills to be covered over a specific period.

APPENDIX C2: OBSERVATION CHECK LIST ON ICT INFRASTRUCTURE, EQUIPMENT AND E-LEARNING SOFTWARES IN SCHOOL A AND B

SER	lab	Internet	Computers	Tablets	Electricity	I/Boards	D/platforms
School A							
Comments							
School B							
Comments							

[illegible]

APPENDIX C3: Interview Guide for ICT Teachers and Headmasters (School A and B)

1. How do your students typically prefer to engage with e-learning content (videos, interactive quizzes, games)?
2. What features do your students find most engaging in the current e-learning tools they use?
3. What elements do you believe are essential for an engaging e-learning interface for primary school students?
4. Can you share any specific examples of e-learning tools that have been particularly successful or popular with your students?
5. How do you currently gather feedback from students about the e-learning tools they use?
6. What methods do you think are most effective for testing and refining e-learning interfaces based on student feedback?
7. What challenges have you faced when implementing e-learning tools in your school?
8. How do you think the e-learning experience for primary school students could be improved overall?

APPENDIX C4: Open Ended Questionnaire for Teachers (School A and B)

Dear respondent

The researcher is a MPhil Student at CUT conducting a study titled “***Designing an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe***”. Your participation in this research is greatly appreciated, and you are invited to answer the questions on this form. There is no requirement for you to disclose your identity. Your responses will be compiled as collective group data and treated confidentially to help design to design an engaging e-learning UI for primary school learners in Zimbabwe. Please provide your answers in the spaces provided below, or indicate your choices by ticking the boxes available.

Questionnaire for Teachers

SECTION A: Demography

1. Gender

Male	
Female	
Other	

2. Age

20-25	
26-30	
31-35	
36-40	
41-45	
46-50	
51+	

3. Qualifications.

Certificate	
Diploma	
Degree	
Master's Degree	
PhD	
Student Teacher	
Other	

4. How many years of teaching experience do you have?

0 – 5	
6 – 10	
11 - 15	
16 - 20	
21 - 25	
26 - 30	
31+	

5. What is your area of specialty or main subject? _____

Section b: Learning preferences of primary school learners in relation to e-learning interfaces in Zimbabwe.

5. (a) **Do you have access to computers, projectors, or interactive whiteboards in your classroom? (*Tick one*)** ☐ Yes ☐ No
- b) **If yes, how often do you use them for teaching? (*Tick one*)** ☐ Daily ☐ Several times a week ☐ Once a week ☐ Less than once a week
- (b.) How do your students typically prefer to learn using technology? (***Tick all that apply***) ☐ Videos ☐ Interactive Games ☐ Quizzes ☐ Other (Please specify: _____)
6. What features do your students find most engaging e-learning tools they currently use? List up to three and explain your responses:

Section c: E-learning user interface that maximizes engagement for primary school learners in Zimbabwe.

7. What elements do you think are essential for an engaging e-learning interface for primary school students? Explain your response.

8. Can you describe any specific examples of e-learning tools that your students have found particularly effective or enjoyable?

Section d: Enhancement and designing of e-learning UI

9. Does your school have a website? ☐ Yes ☐ No

10. What is the biggest challenge you face when using e-learning in your classroom? _____

11. How confident are you in using computers and other technology for teaching? Explain your response.

12. Do you have any training in the use of ICTs? ☐ Yes ☐ No. If yes give detail of levels acquired. _____

b. Briefly describe the training

13. Which local elearning platforms approved by the MoPSE are you using?

(b) Explain your experience when using them:

(c) If not using them, give a reason

APPENDIX C5: Open Ended Questionnaire for Learners (School A and B)

Dear respondent

The researcher is a MPhil Student at CUT conducting a study titled “***Designing an engaging e-learning User Interface (UI) for primary School learners in Zimbabwe***”. Your participation in this research is greatly appreciated, and you are invited to answer the questions on this form. There is no requirement for you to disclose your identity. Your responses will be compiled as collective group data and treated confidentially to help design to design an engaging e-learning UI for primary school learners in Zimbabwe. Please provide your answers in the spaces provided below, or indicate your choices by ticking the boxes available.

Questionnaire for Learners

Section A. Demography

1. Gender

Boy	
Girl	
Other	

2. Age range

6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 +	

3. What grade are you in?

Grade 4	
Grade 5	
Grade 6	
Grade 7	

4. a. Do you use computers or tablets for learning?

Yes	
No	

5.

6. b. If yes, which e-learning platform or websites do you use?

Ruzivo	
Zim e-learning passport	
Whatsapp	
Other (specify)	

7. How often do you use the above e-learning tools at school or at home?

8. _____

Section B: Learning preferences of primary school learners in relation to e-learning interfaces

9. What features do you like the most in the e-learning tools you have used?

10. _____

11. How do you prefer to receive instructions and content in e-learning tools (e.g., videos, games, interactive quizzes)? Explain your response.

Section B: Designing an e-learning user interface for primary school learners

12. What makes you enjoy using an e-learning tool, and what makes you want to use it more often?

13. _____

14. What kind of activities or content would you like to see in an e-learning tool to make learning fun and engaging?

Section C: Implementing user testing and feedback mechanisms to design effective UI

15. Can you describe your experience with the current e-learning tools?

16.

17. What do you like or dislike about them?

18. What do you think can be improved on the e-learning tools you have used to make them better for learning?

APPENDIX C6: USABILITY TESTING (LEARNERS, TEACHERS AND HEADMASTERS)

Final stage: Usability Testing Protocol

1. Test environment:

- Computer lab
- Device for accessing online platform (Desktop, laptop, tablet,)
- User sessions recorded and observed

2. Participants:

- Learners and teachers from School A
- Learners and teachers from School B
- Headmasters School (School A and B)

3. Platform to be tested:

- **Educulture UI Designed by the researcher**

4. Tasks:

- Find a specific learning area/lesson (navigation)
- Take quiz (for pupils)
- Submit assignment (for pupils)
- Provide feedback (for teachers)

19. Evaluation and feedback (learners, teachers and headmasters) interview guide.

1. What do you like the most about using the platform?
2. What do you find difficult or confusing to use on the platform?
3. How do the colors and pictures make you feel when using the platform?
4. What do you think about how easy it is to move from one section to another?
5. How does the platform help you understand your lessons better?
6. Are there any games or activities you enjoy on the platform? Why?

7. What do you think about the examples and stories used in the lessons?
8. How does the platform make learning fun for you?
9. What do you think can be added or improved to make the platform better?
10. If a friend asked you about the platform, what would you tell them?

APPENDIX E1: SIMILARITY INDEX REPORT

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Daglous Masveta

Daglous Masveta Mphil Chapter 1-6.docx

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APPENDIX E2: SIMILARITY INDEX REPORT



Page 2 of 112 - Integrity Overview

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