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Development of an Interactive Climate Change Education Platform for Rural Communities: Engaging Isoka, Zambia in Sustainable Environment Practices

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Abstract

Climate change poses significant threats to rural communities around the world. Climate education is crucial for building resilience and promoting sustainable livelihoods. This study aims to develop an interactive climate change educational platform to address the needs of communities in Zambia. The study will incorporate interactive features such as games and quizzes to enhance engagement and knowledge retention. Using participatory approach, we will engage local stake holders to identify knowledge gaps and develop relevant content. The project will seek to assess levels of climate awareness among Isoka residents. It will have a user-centered climate education platform. The study will evaluate the platforms effectiveness in enhancing climate knowledge and promoting behavioral change. The study will also identify the community's climate educational needs and gaps. The study will also engage the community in environment practices. A mixed method approach will employ combining participatory design, surveys and interviews to ensure platform' relevance and effectiveness.

Keywords: Climate Change, Zambia Statistical Agency report, UNESCO

1. Introduction

Climate change is a pressing global issue that requires immediate attention and action. To address this challenge effectively, it is essential to promote interactive climate change education platforms to raise awareness among individuals, communities, and societies in environment practices (Mpanza & Muluka, 2023) [25]. This project report outlines a comprehensive plan for conducting a climate education and awareness to empower people with knowledge and encourage sustainable actions to mitigate climate change.

1.1 Background of the Study

The population of Isoka District in Zambia was **111,599** as of the 2022 Zambia Statistical Agency report. The district has a sex ratio of approximately 49.3% males to 50.7% females. The table below shows the figures.

Table 1.1:

S. No	Males	Females	Total
1	55,054	56,545	111,599

There are over **12,000** small scale farmers in Isoka district, Zambia who are registered under the government's Farmer Input Support Program (FISP) as of **2023/2024** farming season. The number of farmers is bigger than this if we include even those not registered under FISP. All of the are severely affected by climate change.

As the impacts of climate change become increasingly evident, the urgency for effective climate change education has never been greater. Rising global temperatures, extreme weather events, and the depletion of natural resources pose significant challenges to current and future generations. In this context, equipping students with the knowledge and skills necessary to understand and address climate change is essential to fostering a sustainable future. This proposal aims to develop and

implement an interactive climate change education platform that engages rural communities in sustainable environment practices to instill a sense of environmental responsibility and empowering them to become proactive stewards of the planet.

Climate change represents one of the most critical challenges facing the global community today. Its impact is widespread, affecting ecosystems, livelihoods, and socio-economic structures—particularly in developing countries like Zambia, where a large portion of the population depends on natural resources for survival (IPCC, 2021) [20]. Rural communities such as those in Isoka District, located in Zambia's Muchinga Province, are especially vulnerable due to limited access to climate information, weak adaptive capacity, and low levels of climate change literacy (Chisanga, *et al*., 2022) [10].

Despite growing global awareness, climate change education in many rural areas remains insufficient or poorly structured. Formal education systems in Zambia have only recently begun integrating climate-related content, and informal community education efforts often lack accessibility, engagement, and contextual relevance. Rural learners often rely on traditional knowledge systems, which, while valuable, are no longer sufficient on their own to navigate the increasingly complex climate realities. There is therefore a pressing need for innovative educational tools that are culturally appropriate, accessible, and interactive to empower rural populations with the knowledge and skills necessary to adopt sustainable environmental practices.

Isoka District is predominantly agrarian, with a population highly dependent on subsistence farming. The area is witnessing the direct effects of climate change, including unpredictable rainfall patterns, soil degradation, deforestation, and reduced agricultural productivity (ZVAC, 2023) [47]. These environmental issues are exacerbated by a general lack of awareness and information dissemination mechanisms tailored to non-urban populations. Without targeted educational interventions, communities remain ill-equipped to participate in or lead sustainability initiatives.

Interactive educational platforms have emerged globally as transformative tools for climate change education. These platforms combine digital content, local context, and participatory learning models to engage users meaningfully. However, there is a noticeable gap in the development and implementation of such platforms in Zambia's rural settings. Most digital climate education tools are designed for urban or high-literacy audiences, overlooking the specific needs and limitations of rural communities such as language barriers, digital illiteracy, and limited internet access (Simu, *et al*., 2020) [37].

This study seeks to address these gaps by developing an interactive climate change education platform specifically tailored for the rural community of Isoka. The platform aims to enhance local understanding of climate change issues, promote sustainable environmental practices, and strengthen community participation in resilience-building. By integrating local languages, visual aids, and community engagement features, the platform will provide a relevant and user-friendly learning experience for rural users.

The proposed study is not only significant in contributing to Zambia's national climate education agenda but also aligns with global commitments such as the United Nations Sustainable Development Goal 13: Climate Action. It also supports Goal 4 on Quality Education, emphasizing inclusive and equitable education and the promotion of lifelong learning opportunities for all (UNESCO, 2021).

The proposed program will incorporate interdisciplinary approaches to teach rural communities and students about the science of climate change, its socio-economic impacts, and the critical role of individual and collective action. By integrating hands-on learning experiences, gamification, quizzes we aim to create an educational environment that not only informs but inspires students to contribute to sustainable efforts.

1.2 Motivation of the Study

I was motivated to carry out this research because of the lack of interactive climate change educational platforms which not only hinders individual understanding but also perpetuates a cycle of ignorance and inaction that affects society as a whole. When young people are not educated about the realities of climate change, they may develop a sense of apathy or helplessness regarding environmental issues, believing that the challenge is very difficult or that their actions will not make a difference. This gap in knowledge undermines the collective efforts of communities, policymakers, and organizations striving to create a sustainable future.

1.3 Significance of the Study

Climate change is a pressing global issue that requires immediate attention and decisive action. Education plays a critical role in raising awareness and promoting behavior change. However, traditional teaching methods often fail to engage learners and promote deep understanding of complex climate change concepts. This study aims to design and develop an interactive climate educational platform that uses interactive simulations and games to teach users about climate change, its causes, and potential solutions. The platform will tailor content for different age groups and educational levels, providing a comprehensive and inclusive learning experience.

The significance of this study lies in its potential to improve climate change education: By providing an interactive and engaging learning experience, the platform can improve learners' understanding of climate change concepts and promote behavior change.

Increase accessibility: The platform will be designed to be accessible to learners of different age groups and educational levels, educators, government officials and local communities promoting inclusivity and equity in climate change education. This will help engage people various sectors in sustainable environment practices.

Support sustainable development: By promoting education and awareness about climate change, the platform can contribute to the achievement of the United Nations' Sustainable Development Goals (SDGs).

1.4 Scope of the Study

The study will involve the development of an educational climate change platform that uses interactive simulations and games to teach users about climate change. This platform will be designed to tailor content for different age groups and educational levels, ensuring that the learning experience is comprehensive and inclusive. The study will also involve the evaluation of the platform's effectiveness in promoting communities understanding of climate change

concepts and promoting sustainable environment practices and behavior change.

1.5 Problem Statement

Climate change significantly affects Isoka's economy, primarily by disrupting the agriculture and natural resources sectors through increased temperatures, variable rainfall, and extreme weather events like droughts and floods. Agriculture is a dominant economic activity and a major source of livelihoods for rural households in Isoka, which is largely rain-fed, making it highly vulnerable to climate shocks.

1. **Reduced Crop Yields:** Higher temperatures and altered rainfall patterns lead to progressive declines in the yields of staple crops like maize, millet, and sorghum.
2. **Food Insecurity:** The frequent crop failures and reduced production increase the incidence of food shortages and malnutrition in households across the district as shown below.

Fig 1.1

3. **Livelihood Losses:** The vulnerability of rain-fed farming systems leads to livelihood losses for smallholder farmers who make up the majority of the agricultural workforce.
4. **Shifting Crop Production:** Changing conditions may lead to a shift in suitable agricultural areas, potentially creating new opportunities in northern regions like Isoka, but requiring adaptation measures and investment in new technologies like irrigation.
   The natural resource base that the local economy depends on is also under threat.
5. **Water Scarcity:** Decreased and more variable rainfall, combined with higher temperatures, reduces water availability in river basins and local sources, affecting both agriculture and household use.

The below table shows supply of water by utility companies in a month:

Table 1.2:

S. No	Number of Residential Areas	Days in a Month Water supplied	Days in a moth with no water supplied
1	3	NIL	30
2	12	15	15

6. **Deforestation:** There are ongoing issues with deforestation in Isoka, which contributes to greenhouse gas emissions and environmental degradation, further impacting the local ecosystem and the resources local communities rely on.
7. **Biodiversity Loss:** Loss of natural vegetation and lack of water due to drought can affect wildlife, impacting local ecosystems and potentially nature-based tourism activities.
8. The graph below shows evidence of the impact of climate change in Agricultural Sector country wide making this appropriate in teaching people about the causes and potential solutions.

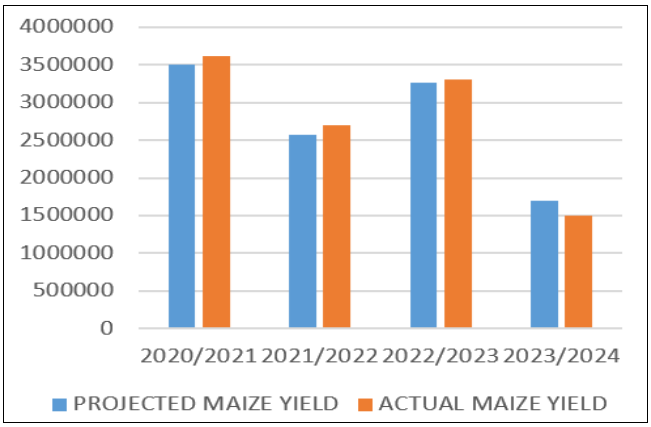


Fig 1.2:

1.6 Objectives

1.6.1 General Objective

The general objective of this study was to develop an interactive climate change education platform that uses interactive simulations and games to teach people about climate change, its causes and potential solutions.

1.6.2 Specific Objectives

1. To design and develop an interactive digital platform incorporating simulations and educational games tailored to the context of rural communities in Isoka Zambia.
2. To evaluate the effectiveness of the platform in enhancing knowledge and awareness of climate change causes, effects, and mitigation strategies among rural users.
3. To assess user engagement and adoption of sustainable environment practices as a result of interaction with the platform.

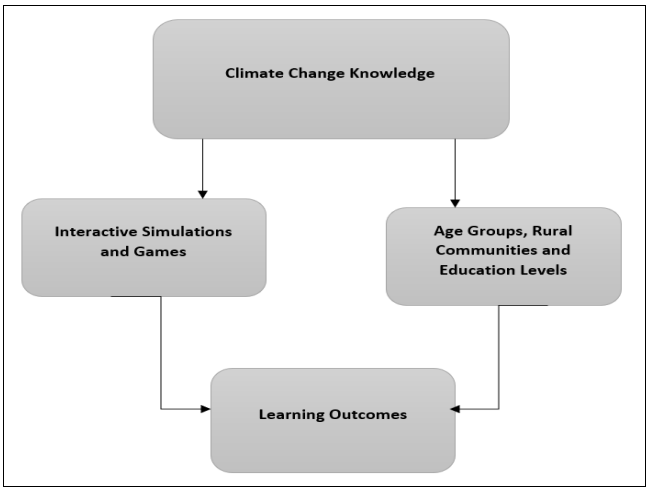
1.7 Research Questions

This research will seek to answer the following questions.

1. How can an interactive climate change educational platform be effectively designed to meet the educational and technology needs of rural communities in Isoka, Zambia?
2. What are the challenges and opportunities in implementing the platform in rural Isoka, and how do local stakeholders engage with it?
3. What impact does the use of the platform have on rural users' knowledge, attitudes, and behaviors regarding climate change and sustainable environment practices?

1.8 Conceptual/ Theoretical Framework

The study is grounded in teaching people about climate change using interactive means such as games and quizzes. The conceptual model for this research topic consists of the following components:



2. Literature Review

2.1 Overview

This chapter will focus on the review of literature, related works and gaps in the literature.

2.2 Review of the Literature

Climate change education has become increasingly vital, especially for rural communities that are often on the frontlines of its effects due to their dependence on agriculture and natural resources (UNESCO, 2024) [44]. Traditional environmental education methods, while effective in some contexts, often fail to engage rural populations due to factors like low literacy rates, lack of localized content, and limited access to educational infrastructure. The integration of digital technology particularly interactive platforms offers a promising solution to bridge this educational gap (Rajanen, 2021) [33].

Climate change poses significant challenges globally, with rural communities being particularly vulnerable due to their reliance on climate-sensitive sectors such as agriculture and natural resources. Effective education on climate change is crucial for these communities to develop adaptive strategies and mitigate adverse impacts. Interactive educational platforms have emerged as promising tools to enhance climate literacy, especially in underserved rural areas.

- Climate Change Education and the Rural Context: Climate change disproportionately affects rural communities through changing weather patterns, droughts, floods, and reduced agricultural productivity (FAO, 2021) [13]. However, these communities often lack adequate access to climate information and education. Rural populations in Sub-Saharan Africa exhibit low levels of climate change literacy, hindering their ability to adapt and respond effectively. Education platforms designed for these areas must therefore be inclusive, locally relevant, and accessible.
- Adapting Technology for Rural Communities: While interactive platforms hold great promise, their success in rural areas depends on contextual adaptation. Infrastructure limitations such as lack of internet connectivity, unreliable electricity, and low digital literacy levels must be considered. Mobile technologies especially offline-capable applications are the most practical delivery medium in rural Africa. Additionally, localized content, use of vernacular languages, and cultural relevance are critical to ensure engagement and comprehension. To address these issues, participatory design approaches are recommended. Involving community members, local educators, and youth in the development process ensures that the platform reflects local realities and values, increasing its usability and impact. Educational games and simulations foster problem-solving skills and critical thinking, which are essential for environmental decision-making. These tools are particularly effective in contexts where learners have limited formal education or prefer practical, hands-on learning.
- Interactive Platforms in Environmental Education: Interactive platforms, leveraging digital technologies, have shown potential in enhancing engagement and comprehension of climate change concepts. These platforms often utilize simulations, games, and virtual environments to provide experiential learning opportunities. A study conducted in Southeastern Ghana examined how climate change education influences grassroots engagement. The findings highlighted that interactive and participatory educational approaches significantly enhanced community members' understanding and proactive involvement in climate adaptation strategies (Hambulo Ngoma *et al*., 2021) [19]. This suggests that interactive platforms can be instrumental in translating climate knowledge into actionable community practices. Interactive learning platforms use features such as simulations, animations, gamified quizzes, and decision-making tools to actively engage users.

2.3 Related Works

In this section three digital systems or initiatives are reviewed that share similarities with an interactive climate change education platform. The focus is on their structure, strengths, gaps, and relevance to a possible design of a fully interactive, localized education tool.

2.3.1 Smart Climate Actions Zambia (SCAZ)

Smart Climate Actions Zambia (SCAZ) is a school-based climate education and hands-on resilience project implemented by the Wildlife and Environmental Conservation Society of Zambia (WECSZ). The project was developed to increase climate awareness among school children and to build capacity in practical climate-smart techniques (for example, conservation agriculture and cocoon tree-planting) through demonstration plots, club activities and teacher training (Smart Climate Actions Zambia, 2025) [38] SCAZ responds to Zambia's recognized need to strengthen local climate adaptation and mitigation actions particularly among youth who can influence household and community practices.

2.3.2 Digital Learning Platform and Learning Passport

The Learning Passport Zambia is a national digital teaching and learning platform launched by the Zambian Ministry of Education in November 2022, developed with support from UNICEF. The platform provides digital teaching and learning materials, including audio lessons, teacher guides, and resources for learners and educators. In 2024 UNICEF and Airtel formed a partnership to expand internet access for schools and ensure inclusivity for differently-abled learners (UNICEF, 2022) [46].

2.3.3 Kio Kit: Transforming Education in Kenya

The Kio Kit is an innovative digital education solution developed by BRCK, a Kenyan technology company. Launched in 2015, the Kio Kit aims to bridge the

educational divide in underserved regions by providing a portable, offline digital classroom (Engineering For Change, 2024) [12]. This initiative addresses challenges such as limited internet connectivity, electricity shortages, and inadequate educational resources in rural and peri-urban schools across Kenya.

2.4 Gaps in the Literature

While there are many studies on climate change education, few have focused specifically on the development and evaluation of interactive climate education platforms. The gaps in literature on the selected topic are listed below.

Interactive platforms have been used in various global contexts to educate people about climate change, with evidence showing increased knowledge and behavioral change (UNEP, 2022) [41]. However, most documented successes are in urban or well-connected settings. There is a limited body of work focused specifically on rural communities in developing countries, particularly in Sub-Saharan Africa. There is limited understanding of the effectiveness of gamification in climate education. Gamification is a key feature of many interactive climate education platforms, but there is a need for more research on its effectiveness in promoting climate literacy and behavior change. Limited understanding of the potential of technology-enhanced climate education to promote scalability and accessibility. Technology-enhanced climate education has the potential to promote scalability and accessibility, but there is a need for more research on its effectiveness in these areas.

Although these three systems show promising elements, none fully combine interactive digital simulations, local language support, offline functionality, and scenario-based learning tailored for rural communities. SCAZ emphasizes practical activities but lacks digital interactivity. The FACE-NDC curriculum sets the policy direction but does not provide delivery tools. The Learning Passport provides infrastructure but limited interactivity. Thus, a gap exists for an interactive climate change education platform that works offline, integrates local languages, and aligns with Zambia's curriculum.

This highlights a gap in the literature and a need for context-specific solutions tailored to underserved populations. These gaps in the literature review highlight the need for further research on the development and evaluation of interactive climate education platforms.

3. Methodology

3.1 Overview

This chapter comprises the research design or methods which will be used to collect data that is authentic and factual, baseline study, data collection, research approach, development of the application, system design, context diagram, system, software level architectural design, modular design of the system functions, system class diagram and system data model design.

3.2 Research Design

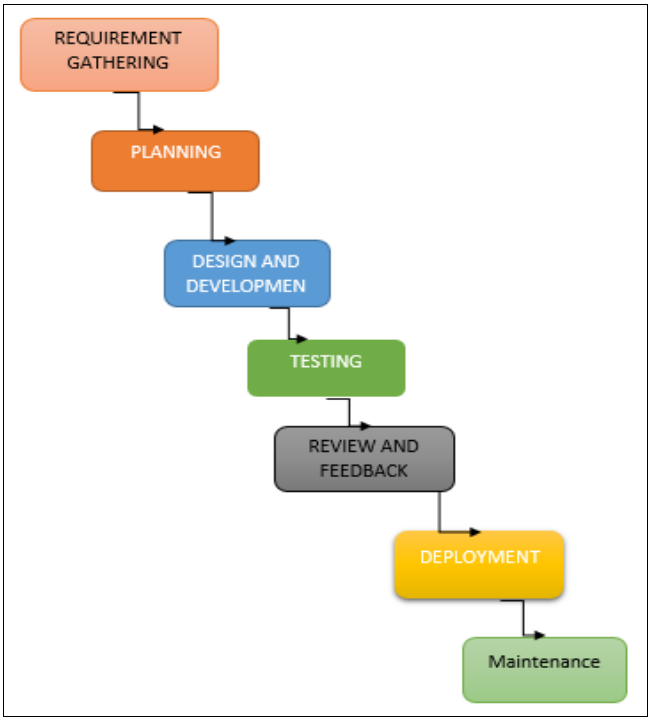
The project will employ a mixed-method design combining qualitative and quantitative approaches.

1. Qualitative approach: To understand user needs and engagement factors.
2. Quantitative methods: To measure performance, system effectiveness and learning outcomes.

Using these methods will help integrate the system evaluation by having a broad aspect of data from user engagement with the platform.

Project design and approach (e.g., system development, data analysis).

The project follows an agile development model for flexibility and continuous improvements.



Some phases include:

Requirement analysis: Identify key users (students, policy makers, environmentalists, general public). Define core features such as interactive simulations, quizzes, and real time climate data, gamification. Assess integration needs (APIs for real-world climate data).

System Design and Architecture: Modular design to ensure easy scalability for future features. Cloud-based infrastructure to allow real-time updates and multiplayer interactions. Data-driven insights to track user progress and environment impact.

System Architecture

Frontend (user interface)-client side. Technology: React.js, HTML, CSS, JavaScript (for web app).

Purpose: Handles user interactions, decision-based simulations, stores and processes climate-related data.

- Html- to create structure content.
- CSS- for styling the content.
- JS- to create the website to come live and interactive.
- Xamp was used to create database for back end.

Visual studio code was used for its greater versatility for debugging the codes.

3.3 Baseline Study

This study established the foundation for the platform by identifying knowledge gaps and disaster preparedness through user need assessment because it helped to gain better understanding and evaluation. The baseline study on this topic also involved teaching people about climate change, the causes, possible solutions and engagement in sustainable environment practices.

3.4 Data Collection

3.4.1 Survey method

Survey method will allow the researcher to collect data about opinions, behaviors, experiences and characteristics by asking people directly by means of questionnaires and interviews.

3.4.2 Questionnaire

Semi-structured Questionnaires will be used in order to gather large size of information in a short period of time which will help to provide answers to questions more objectively and subjectively.

3.4.3 Interviews

The researcher will use guided Interviews which will be conducted in order to reflect emotions and experiences, and explore issues with a greater focus. This will help the researcher to have face to face interactions with participants in which emotions, and other essential gestures attached to questions and answers will be deduced.

3.4.4 Secondary Data

Secondary data is the method of collecting data which other researchers have collected for example, previous studies conducted on the same topic.

3.4.5 Target Area

In picking the study area for the research, relevance to the objectives or research questions, easier accessibility and financial resources were considered. The research will be conducted in Isoka District of Muchinga Province of Zambia. The research will be conducted in the central Business District (CBD) of Isoka, rural communities. The target population includes students, teachers, and community members, especially those involved in environment or agricultural activities.

3.5 Research Approach

This research will use a mixed-method approach combining both quantitative and qualitative approaches to provide more comprehensive understanding of the research topic. The research design or methods which will be used to collect data that is authentic and factual, are survey method which are Questionnaires and interviews and secondary data. Purposive sampling technique will be used to select participants who have the potential to benefit from or contribute to the development of the platform. Approximately 30 -50 participants will be involved across various phases.

3.6 Sampling Techniques and Sample Size

The sample size for this research was fifty (50) respondents and the sampling techniques used were purposive sampling and random sampling. Random sampling allowed the researcher to collect factual and authentic information. Random sampling was also employed because climate change affects every Zambian the educated and uneducated.

Development of the Application

The platform is developed as a web-based application using the following stack.

Technology used:

- Html- to create structure content.
- CSS- for styling the content.
- JS- to create the website to come live and interactive.
- Xamp was used to create database for back end.

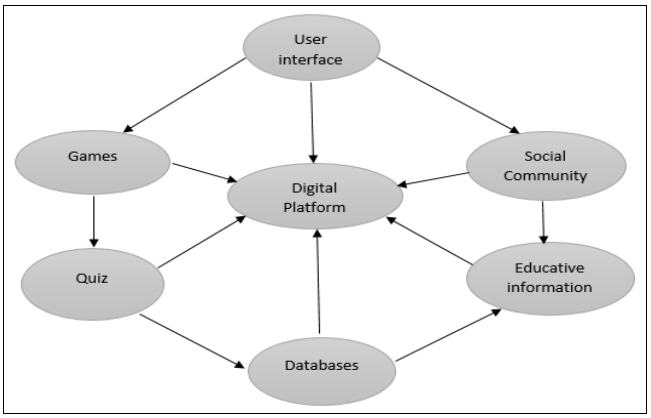
3.6.1 System Design

This is visual representation of a system's architecture and components. It shows how different parts interact and work together.

- The diagram helps plan and communicate system architecture.
- Identify potential bottlenecks and issues.
- Guide development and deployment.

Key elements

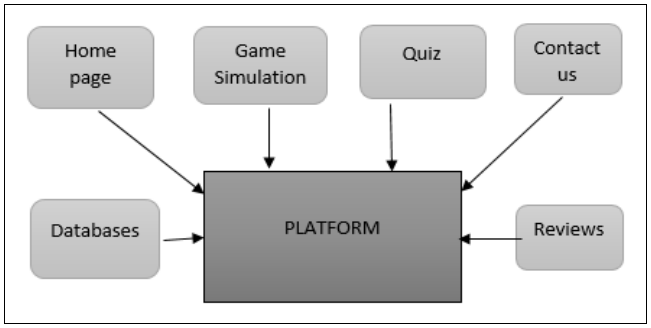
- **Components:** Modules, services, databases, interfaces.
- **Interactions:** Data flows, APIs, interfaces.
- **Data Storage:** Databases, file systems.
- **External Interfaces:** User interfaces, third-party services.



3.6.2 Context Diagram

Context Diagram for Climate Education Platform.

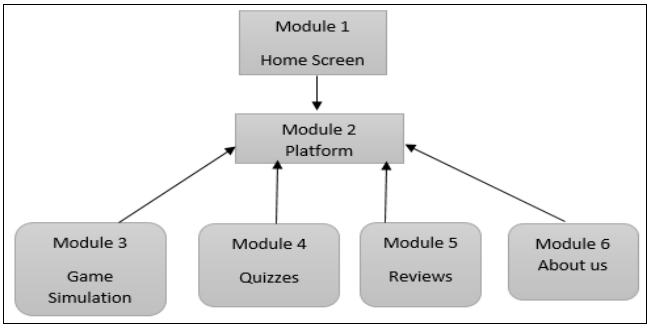
It visually represents the platform at the center and its interaction with key external entities.



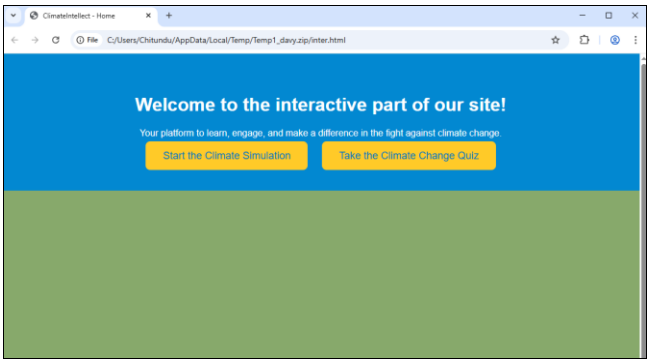
3.6.3 Modular Design of the System Functions

Below is a modular design of the system functions.

It breaks the system into independent modules, each handling specific functions. This makes the system scalable, maintainable and easy to update.



The screen below shows the interactive part of the digital platform where the user will play the game or answer the quiz.



This screen shows the gaming part of the platform that help users to make decisions that can positively impact the climate.

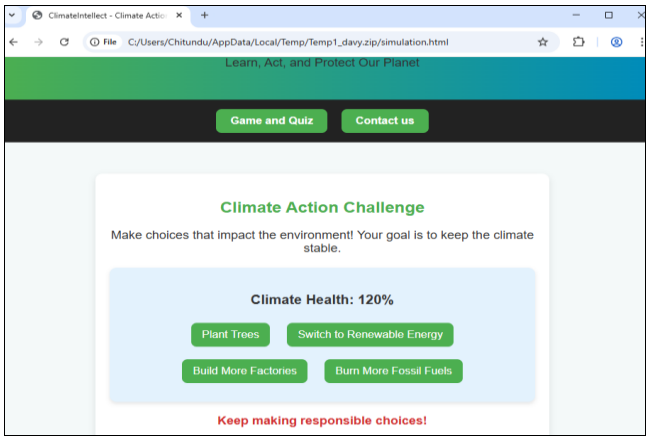
The Game Concept

The game will be a text-based adventure game where the player takes on the role of a climate change activist. The goal is to reduce carbon emissions and mitigate the effects of climate change.

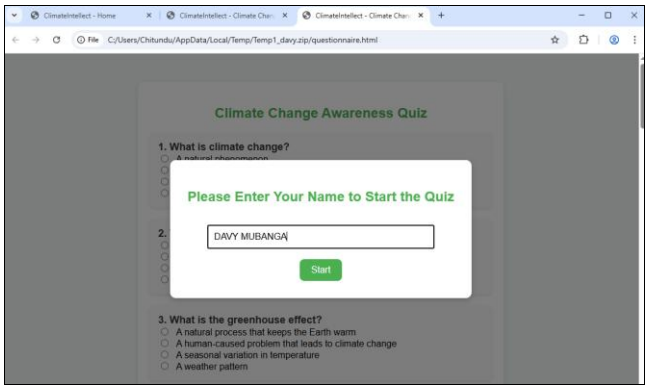
Gameplay

1. The player starts with a carbon footprint of 100 tons.
2. The player is presented with a series of choices that affect their carbon footprint.
3. Each choice has a positive or negative impact on the player's carbon footprint.
4. The player's goal is to reduce their carbon footprint to 0 tons.

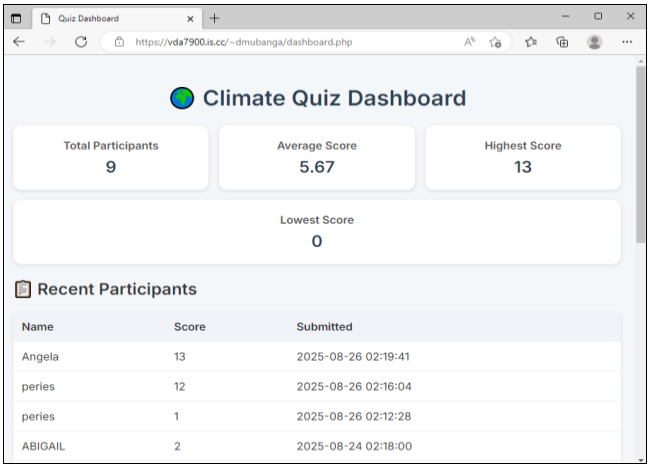
When the user plays planting more trees button the response from the platform is keep making responsible choices.



The screen below shows the platform requiring the user to enter the names before answering the quiz.



Below is the quiz dashboard showing the statistics when users answer the quiz. The dashboard will only be accessed by the platform administrator for security purposes.



4. Results

4.1 Overview

This chapter presents the results or findings of the study on the development of an interactive climate change education platform for rural communities: engaging Isoka, Zambia in sustainable environment practices. The findings are based on the research objectives of the study. The findings presented are based on the data that was collected through the guided interviews, questionnaires which were administered. The focus groups were as follows; educational institutions, Non-Governmental Organizations (NGOs), Government agencies and Local communities. This chapter also presents the baseline study results, survey results and discussion, system implementation results (Test results) and finally, the chapter closes with data analysis. The sample size for this research was fifty (50) respondents and the sampling techniques used were purposive sampling and random sampling. Random sampling allowed the researcher to collect factual and authentic information. Random sampling was also employed because climate change affects every Zambian the educated and uneducated.

4.2 Baseline Study Results

This study has established the foundation for the platform by identifying knowledge gaps and disaster preparedness through user need assessment for this helped to gain better understanding and evaluation. The baseline study on this topic also involved teaching people about climate change, the causes, possible solutions and engagement in sustainable environment practices.

4.3 Developing an interactive digital platform that incorporates quizzes, simulations and educational games tailored to the context of rural communities in Isoka-Zambia

Interactive climate change education platforms, are necessary because they help communities to learn about climate change, engage in sustainable environment practices and work to improve the health of the climate.

Digital platforms are very important because they bring about modern ways of learning about climate change, teaching about practices such as planting more trees, and protecting our planet by not burning more fossil fuels.

Digital platforms are very important because they have a larger coverage of people in real time regardless of where people stay they can still learn about climate change online.

Digital platforms are very ideal in teaching people about climate change because it caters for all ages young and old and especially that this is the digital age were technology has taken the center stage.

According to the study, it was found that many people appreciated the use of technology incorporating quizzes and game simulation in teaching people about climate change, its effects, sustainable environment practices and potential solution.

Digital platforms being interactive in nature, can easily be spread to larger sections of the population and can allow the young generations to be well equipped and fully trained to respond to the call and protect the health of our planet by engaging in sustainable environment practices such as using renewable energy, water conservation and protecting the trees.

The graph below shows different views from respondents as to why the platform is relevant and must be developed.

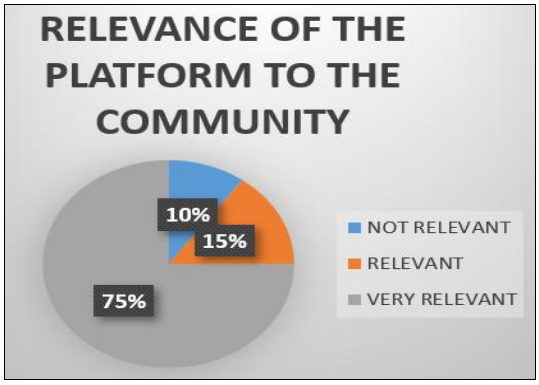


Fig 4.1

4.4 Evaluating the effectiveness of the platform in enhancing knowledge and awareness of climate change causes, effects, and mitigation strategies among rural users

The study sought to appreciate the effectiveness of the platform in enhancing knowledge and awareness of climate change causes, effects, and mitigation strategies among rural users. In evaluating the effectiveness of the platform, the following results were obtained. Positive behavioral change was observed especially from learners who were chosen as ambassadors of the platform in planting trees in the school yard.

This section presents the findings from the study on environmental sustainability practices within the community. The research focused on areas such as energy efficiency, sustainable transportation, waste reduction, afforestation, and climate advocacy as environment practices.

Table 4.1:

Category	Number/Extent
Shop Owners Reducing Single-use Plastics	25
Trees Planted in Schools	16
Learners Advocating for Climate Policies	20

Results indicate that a significant portion of the population is adopting sustainable practices. A large number of people are engaging in walking and cycling, while shop owners are reducing the use of single-use plastics. Additionally, schools are contributing to reforestation by planting trees, and learners are actively advocating for climate-friendly policies and sustainable practices. The platforms promote knowledge, awareness of climate change causes, effects and solution.

The study revealed that most respondents, such as educational institutions, Non-Governmental Organizations, government agencies and local communities who were interviewed indicated that the rural users have more challenges in accessing the digital platform because of lack of electronic devices like smart phones, computers, internet connectivity, low literacy levels among rural users, not enough sensitizations, negative attitudes among rural users.

of local communities who may not understand English.

Some local people had a negative attitude toward the idea of learning about climate change online because they do not have a technical expert on the use of modern technology.

The graph below shows the reasons for the challenges encountered in implementing the platform.

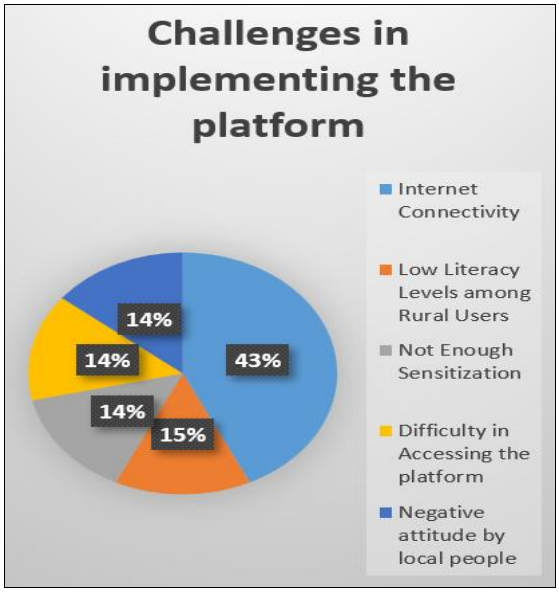


Fig 4.2:

5. Discussion and Conclusion

5.1 Overview

This chapter presents the discussion of findings and their implications on the development of an interactive climate change education platform for rural communities: Engaging Isoka, Zambia in sustainable environment practices. The findings of the study are discussed in relation to the research questions and the existing knowledge from related disciplines.

5.2 Developing climate change digital platforms in local languages

From the views of the participants it seemed to suggest that Isoka community including the Central Business District (CBD) has a mixture of people who can understand English well and those who cannot. Some participants asserted that some rural users can learn well about climate change in their own local languages and this can help to bridge the gap in the language barrier. Climate change education is a critical need in rural communities that are both highly vulnerable to climate impacts and often underserved by traditional educational systems. The integration of interactive digital platforms into environmental education—particularly those available in local languages—has been shown to significantly improve engagement, retention, and local relevance (UNESCO, 2021).

In regions like Isoka, Zambia, where literacy levels vary and digital access is limited, localized platforms that use audio-visual content, games, and simulations offer a practical solution for climate literacy. Digital tools that are offline-compatible, support Bemba Namwanga and Tumbuka, and include culturally contextual examples can bridge the gap between scientific knowledge and community practices.

Studies by (Ochieng, *et al*., 2020) [31] suggest that when communities are given tools in their native languages, their understanding of abstract environmental concepts such as greenhouse gas emissions or carbon sinks significantly improves. Furthermore, interactive methods such as storytelling, animations, and community simulations increase youth participation and foster behavioral change (UNEP, 2022) [41].

To ensure impact, such platforms must be developed with a bottom-up approach—involving local teachers, students, and leaders in content creation and deployment. Tools should also be adaptable across devices, use open-source formats, and align with national curriculum goals (UNESCO, 2021).

From the views of the participants, it was revealed that some rural users would prefer to have offline systems because communities lack electricity, others lack technology expertise to navigate online systems, their real challenges with internet connectivity.

Rural communities across sub-Saharan Africa face significant climate risks, yet they often lack access to effective climate education due to infrastructure, literacy, and technological barriers. An offline digital platform can bridge this gap by delivering interactive, localized climate change education content without requiring constant internet access (UNESCO, 2021).

Such platforms are especially crucial in areas with limited connectivity and electricity. By integrating content into solar-powered tablets, mobile apps with offline functionality, or preloaded SD cards, these tools provide equitable access to knowledge. The use of local languages and culturally relevant illustrations can help overcome literacy and language barriers, improving user comprehension and retention (Ochieng, *et al*., 2020) [31].

FAO (2020) highlights the importance of localized education tools in promoting climate-smart agriculture, while (UNEP, 2022) [41] emphasizes that adaptation starts with awareness. Offline platforms that include animations, community stories, and scenario-based games can engage rural populations in sustainable environmental practices. In addition, integrating tools into school curricullum and community centers ensures long-term sustainability and community ownership (UNFCCC, 2024) [45].

Design considerations must include simple interfaces, audio narration, and low-bandwidth data formats. Partnering with local teachers, NGOs, and agriculture officers in content creation and distribution is key to relevance and impact (FAO, 2021) [13]. Monitoring and evaluation can be conducted through built-in quizzes and user feedback mechanisms that synchronize with servers when connectivity is available.

5.3 Inclusion of climate change in school and university curriculum

Some teachers and standard officers who were interviewed indicated that there is need to include climate change in school and university curriculum just as always. Now the approach must be different, instead of teaching theories, learners and students must learn practical ways of mitigating climate using modern ways. For example, the modern ways should promote awareness among students, improve critical thinking, and the ability to mitigate climate change and protect our planet by engaging in responsible behavior.

Climate change is one of the most pressing global issues of the 21st century, and education plays a critical role in equipping future generations with the knowledge and skills to address it. Integrating climate change into educational curricula ensures that learners understand the science behind it, its effects, and strategies for mitigation and adaptation (Michelle, 2022).

Including climate change in school and university curricula raises awareness and promotes responsible behavior. It fosters critical thinking and empowers students to become environmentally conscious citizens (UNESCO, 2021). Education systems that incorporate climate topics tend to produce individuals who are more engaged in sustainable practices and civic action (Anderson, A, *et al*., 2021) [4].

Moreover, the inclusion of climate change education benefits societies by preparing a workforce skilled in green technologies and sustainable development. It also contributes to the broader goal of achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG 13: Climate Action (IPCC, 2021) [20].

5.4 The challenges the digital platform has provided

Digital climate change education platforms in Zambia face challenges including limited access to technology and internet, lack of digital literacy among educators and learners, and the need for localized, culturally relevant content (Anderson, A, *et al*., 2021) [4]. Further, integrating digital platforms into existing education systems and ensuring equitable access across different socioeconomic groups also pose significant hurdles.

Isoka, like many rural areas in Zambia, faces challenges such as Limited Digital Infrastructure, poor internet connectivity and limited access to digital devices. This

hampers the effective use of online platforms for education.
The primary languages spoken in Isoka are Namwanga, Bemba and other local dialects, while digital platforms operate primarily in English. This linguistic gap (language barriers) can hinder comprehension and engagement.
Climate change education materials may not always reflect local agricultural practices or environmental challenges, making them less relatable to the community.
Limited Access to Technology and Internet: A significant portion of the Zambian population, particularly in rural areas, lacks access to reliable internet and appropriate digital devices (computers, smartphones). This digital divide hinders the effective implementation of digital climate change education initiatives.
Digital Literacy Gap: Many teachers and students in Zambia lack the necessary digital literacy skills to effectively utilize and navigate digital platforms for learning. This includes basic computer skills, internet navigation, and the ability to critically evaluate online information (Chisanga, *et al*., 2022) [10].
Content Localization and Relevance: While global climate change information is readily available online, it often lacks the specific context and relevance to Zambia's unique climate challenges and local communities. Developing locally relevant digital content that addresses Zambia's specific vulnerabilities (e.g., droughts, floods, deforestation) is crucial for effective engagement.
Integration with Existing Systems: Integrating digital climate change education into the existing Zambian education system requires careful planning and coordination. (Chisanga, *et al*., 2022) [10]. This includes aligning digital resources with the curriculum, providing adequate teacher training on digital tools, and addressing potential disruptions to traditional learning methods.
Equity and Inclusion: Ensuring that digital climate change education reaches all learners, regardless of their socioeconomic background or geographical location, is essential. This requires addressing the digital divide and providing accessible and affordable digital solutions for all (Atta, M.H.R, 2025) [6].
Sustainability and Maintenance: Maintaining digital platforms, including hardware, software, and internet connectivity, requires ongoing financial and technical support. Ensuring the long-term sustainability of digital climate change education initiatives is crucial for their continued effectiveness.
Teacher Training and Support: Equipping teachers with the necessary skills and knowledge to effectively utilize digital platforms and integrate climate change into their lessons is vital. Providing ongoing professional development and support for teachers is essential for successful implementation.
Cost and Affordability: The cost of internet access, digital devices, and relevant online resources can be prohibitive for many schools and individuals in Zambia. Addressing these cost barriers is crucial for ensuring equitable access to digital climate change education.
Engaging Learners and Promoting Active Participation: Digital platforms need to be engaging and interactive to capture learners' attention and promote active participation in climate action. This requires designing user-friendly platforms with multimedia content, interactive activities, and opportunities for collaboration.
Monitoring and Evaluation: Establishing robust monitoring and evaluation mechanisms is crucial for tracking the effectiveness of digital climate change education initiatives and identifying areas for improvement. This includes collecting data on platform usage, learner engagement, and the impact of digital education on climate change awareness and action.

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