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Computerized E-learning platform for teaching Python programming using Hausa language

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Abstract

Staff and students from almost every country are now learning python programming language. However, the syntax of programming languages, libraries, documentation, and instructional materials are taught and presented in English language. Non-native English speaking counties are faced with many challenges with the contents, reading and writing codes in Python. In West African countries Hausa language is one of the languages spoken by over 80 million people globally primarily found in Nigeria, Niger, Sudan, Ghana, and Cameroon. Therefore, it is imperative to teach python programming using mother's tongue which can be understood easily by non-native English speaking country. The methodology used in this paper is python programming and Hausa languages. Results obtained indicated that there is significant increase in the rate of understanding using this technique.

Keywords: Python; Programming; Language; Hausa; E-Learning

1. Introduction

English is a universal language for science, art, religious studies, and commerce [22] Becoming educationally sound and professionally competitive in the present's worldwide workforce habitually includes learning technical skill from English based materials. However, 95% of the world's population does not have English as their native language [10], which make learning python programming language more cumbersome. In every profession, you will face challenges every day. In this fast-paced world, it can be very challenging to cope with the pace of change. A programming job is no exception. From data scientist to software engineer, there are numerous job roles that you can take up as a Python programmer.

Python Programming is of no doubt going to take over more than 2 third of the world activities in every discipline. Because is almost the back bone of Artificial intelligence (AI) which is rapidly moving very fast in creating robots that is ready to take over almost every job a human can do with more accuracy and speed. One can imagine an AI Application can write a complete article with little or no human interference. If you are a non-native speaker of English and are looking to enter the world of programming, it's natural to feel concerned about the difficulties that come with learning Python as a non-native speaker of English. After all, coding languages like Python and its various subcategories such as Machine Learning (ML) or Natural Language Processing require tremendous grammatical skills and vocabulary usage. This book will talk more about why native speakers of other languages shouldn't shy away from learning Python in detail.

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In the last decade, we have seen a boom in people learning to code. There are many reasons for this trend; chief among them is the abundance of high-quality free resources such as Codecademy, Code School, and websites such as GitHub and HackerRank. There are many free resources to learn Python, but how many of them are offered in our native language? The answer might shock you! Research shows that using our mother tongue while learning new concepts has multiple benefits. This E-learning platform highlights why it is essential to use Hausa as a native language while learning Python programming. The mother tongue refers to our first language in most cases, probably the language we learnt at home as a child. It is also widely referred to as L1 or first language [5]. Why should this knowledge about our mother tongue be useful for programmers? If one plans to become a Python trainer someday, this platform can be available online for him. The platform will show many things related to using our mother tongue in teaching the Python programming language and why it is essential.

While learning a new programming language, it is imperative to master the fundamentals of the language. If one is a non-native speaker of the language, he might have an easier time understanding the syntax and the basic constructs, but one might have a hard time understanding the concepts behind those. When the concept of the language is understood, it can tackle more intricate problems and write better programs. However, how will the concept be understood when one is not fluent in the non-native English language? The simplest and the best way to understand the concepts of a programming language is to use the mother tongue [14], while explaining the concepts to others. When using the mother tongue, this will help to explain the concepts of the language in a better and more efficient way. Moreover, it is essential to use the mother tongue while teaching Python.

When you are learning any new programming language, the first thing you do is to learn about the data types and variables. You might have noticed that many explanations of these concepts are written in a way that a non-native speaker will have a hard time understanding. It is because these concepts are highly language-specific, and a non-native speaker would have a hard time picturing them in their mind. There are many benefits of using our mother tongue while we are teaching Python. We will have an easier time understanding the fundamentals of Python, we will have a better grasp of the concepts of data types and variables, and we will be able to explain concepts to others more effectively. Using our mother tongue will help us pronounce words correctly, and native speakers of other languages can contribute immensely to a programming community. That is why it is important to use our mother tongue while teaching Python.

In recent years, e-learning has become an increasingly popular means of delivering educational content, and it has revolutionized the way people learn. E-learning platforms such as Udemy and Udacity have been developed to provide people with the opportunity to learn different skills online, from the comfort of, which limits the accessibility of the platform to non-English speakers. Additionally, there is a gap in e-learning platforms that provide courses in indigenous languages [8]. This presents an opportunity to their homes. However, these platforms are predominantly developed in English develop an e-learning platform that will enable non-English speakers to learn new skills in their native language. One language that could benefit from an e-learning platform is Hausa, spoken by over 70 million people across West Africa, predominantly in Nigeria and Niger [12]. There is a need for an e-learning platform that teaches Hausa speakers skills such as programming in their native language. Python, a popular programming language used for various applications, is an ideal language to teach on an e-learning platform [20].

1.1. Problem statement

The limited availability of e-learning platforms that teach programming languages in local languages is a significant challenge for learners who may not be proficient in English, which is the primary language of many e-learning platforms. This challenge is particularly pronounced in developing countries where English proficiency may be low. Additionally, the use of local languages in education is an essential aspect of preserving cultural heritage and promoting language diversity. Despite the growing popularity of e-learning platforms and the availability of open-source software, there is a paucity of e-learning platforms that cater to non-English speakers.

The lack of e-learning platforms that teach programming languages in local languages presents a significant barrier to learners, particularly those in developing countries where access to online education is limited. Furthermore, the availability of e-learning platforms that teach programming languages in the Hausa language, a language spoken in West Africa, primarily in Nigeria, Niger, and Ghana, is limited. The use of local languages in education is an essential aspect of promoting language diversity, which is critical for preserving cultural heritage. Therefore, there is a need to develop e-learning platforms that cater to non-English speakers and promote the use of local languages in education.

Objectives

The primary objective of this study is to design and implement an e-learning platform using WordPress framework, themes, and plugins just like Udemy and Udacity to teach the Python programming language in the Hausa language to Hausa speakers. The specific research objectives are:

- To assess the suitability of the WordPress framework, themes, and plugins for developing an e-learning platform that teaches programming languages in local languages.
- To develop a user-friendly e-learning platform that caters to Hausa speakers and promotes the use of local languages in education.
- To evaluate the effectiveness of the e-learning platform in facilitating learning outcomes in the Python programming language among Hausa speakers.
- To determine the learners' perceptions of the e-learning platform in terms of usability, functionality, and satisfaction.

2. Literature Review

Language plays a central role in the teaching of science and technology at school. The choice of language is therefore a key factor in the adoption of an educational program. There are two reasons for this: first, different languages have specific semantic and syntactic properties that make them better suited to some domains than others; second, because of their regional and cultural proximity, some languages are better suited than others to facilitate the social interactions that occur around science education. Although English is widely used as a medium of instruction in science and technology (S&T) education in Nigeria, other mother tongues are also used. Mother tongue or 'local' language is important because research has found that native speakers of the same language process information more quickly [17].

English is the most widely spoken second language in the world today [3]. But its status as the lingua franca of science, business and education has also made it a primary target for those who fear its dominance. As such, many educators have been promoting the use of local languages to preserve traditional culture and facilitate learning at school. In an attempt to provide a means of leaning programming using a native language, a research in [16], shows the high degree of relevance, usefulness and needfulness of a native language-based programming language as well as the worthwhileness of embarking on development of such a programming language. While this research move further to use one of the native language (Hausa) to prove it. The use of e-learning platforms has become increasingly popular in recent years, especially with the onset of the COVID-19 pandemic, which has led to the closure of schools and universities worldwide [1,2,6].

E-learning platforms offer a flexible and convenient way of learning, and they have the potential to reach a wider audience, including non-English speakers. These platforms offer a flexible and convenient way of learning, which is particularly beneficial for individuals who cannot attend traditional classes due to geographical, financial, or time constraints. E-learning platforms are also effective in promoting self-directed learning, which is a critical skill in the digital age [4,7,9]. There are several e-learning platforms available, including Udemy, Coursera, and edX. The use of local languages in education for example Hausa language has several benefits, including promoting cultural heritage, promoting inclusive education, and enhancing learners' understanding and engagement [11]. However, the use of local languages in teaching programming languages has been limited, with most e-learning platforms offering programming courses in English only. This limitation poses a significant challenge for non-English speakers, especially those who are not fluent in English.

Hausa language spoken by over 70 million people worldwide, primarily in Nigeria, Niger, and Ghana [15]. It is also spoken by diaspora communities in other countries, including Sudan, Cameroon, and the United States. Hausa language is an Afro-Asiatic language and is closely related to other languages spoken in the region, such as Berber, Arabic, and Somali. Hausa language is considered a lingua franca in West Africa, as it is widely used as a means of communication among speakers of different languages. It is also the second most widely spoken language in Africa, after Arabic. The importance of the Hausa language has been recognized by governments, international organizations, and educators. For instance, in Nigeria, Hausa language is one of the three official languages, alongside English and Yoruba. It is also the language of instruction in many schools and universities in the country. Despite the widespread use of the Hausa language, there are still some challenges associated with language education and literacy among Hausa speakers. For instance, there is a significant gap in literacy rates between men and women in Hausa-speaking communities, with women having lower rates of literacy [18]. Additionally, there is a shortage of educational resources and trained teachers in some areas, which can limit access to quality education for Hausa speakers.

Python is a high-level programming language that is widely used in various industries and fields, including web development, data science, and artificial intelligence. It is an easy-to-learn language with a simple and readable syntax, making it a popular choice for beginners and experienced developers alike [13]. Python is an object-oriented language, which means that it provides a way to structure programs into objects that interact with each other. It also supports various programming paradigms, including procedural, functional, and imperative programming. Python has a vast standard library that provides various tools and modules for developers to use, making it a versatile language for various purposes [13].

The authors in [19] investigated how to used natural languages propensity to individual differences to learn Python in French, Chinese. Results indicated individual learned Python when natural languages are used as a medium of instruction rather than conventional English language. A study in [21] proposed an efficient interaction between Python and native libraries to eradicate the poor performance causes by abstraction which is extracted by two inefficiency patterns. To the best of our knowledge none of the previous work/ literature review has investigated or guide on how to teach Python programming in Hausa language and that is the novelty of this work. Therefore it is imperative to introduce any technique that will improve teaching and learning in Africa and world more especially to those that understand Hausa language (above 80 million worldwide)

3. Methodology

This study employs a qualitative research methodology to design and implement an e-learning platform to teach Python programming language in Hausa language for the benefit of Hausa speakers. The methodology used in this project is as follows:

The e-learning platform was developed using an open-source content management system; WordPress framework, themes, and plugins, creating the course content, and setting up the platform's user interface. The design of the platform is informed by the existing literature on e-learning platforms.

The developed e-learning platform consist of the following components;

- User registration and login: Users will need to register and create an account to access the courses on the platform. This will also enable the platform to track their progress and achievements.
- Course creation: The courses are created using a combination of video lectures, quizzes, and assignments. The courses are structured in modules and lessons to make it easier for the users to navigate.
- Course management: The platform has a dashboard that will enable course creators to manage their courses. They will be able to add and remove content, track the progress of their students, and create quizzes and assignments.
- Discussion forum: The platform has a discussion forum where users can interact with each other, ask questions, and seek clarification from the course creators.
- Certificate issuance: Upon completion of a course, users will be issued a certificate of completion, which they can download, print or share on social media.

The developed platform was guided by the principles of user-centered design and accessibility. The platform is so user friendly that a novice user can operate. To implement the design, we used a combination of WordPress plugins and themes. The 'LearnDash' is one of the plugins used due to its powerful LMS plugin that will enable us to create and manage courses on the platform. For the theme selection, we used 'Astra', which is a lightweight and customizable theme that is suitable for e-learning platforms.

In developing the content for teaching Python programming language in Hausa, we started by identifying the key concepts of the language that are essential for beginners to understand. We then translated these concepts into the Hausa language, taking care to use appropriate and clear terminology. The content was structured to follow a logical progression, starting with the basics of programming such as data types, variables, and operators, and gradually moving on to more advanced topics such as control structures, functions, and object-oriented programming.

To ensure that the content was easily understandable by Hausa speakers, we incorporated examples and exercises that are relevant to their cultural context. For instance, we used scenarios such as farming, trading, and community engagement to illustrate how programming concepts can be applied in everyday life. We also developed interactive

elements such as quizzes and coding challenges to engage learners and reinforce their understanding of the material. These interactive elements were incorporated into the e-learning platform using the TutorLMS and TutorLMS Pro plugins. Overall, the content development process was guided by the principles of learner-centered design, which emphasizes the need to tailor instructional materials to the needs and preferences of the target audience.

Overall, the design of the e-learning platform will be informed by the needs of the target audience, which are Hausa speakers who want to learn Python programming language in Hausa. The platform was designed to be engaging, interactive, and effective in teaching programming concepts to users.

3.1. Justification for the tools selected

In the design of the e-learning platform, the WordPress framework was selected as the base platform. WordPress is a popular and flexible content management system that allows users to create and manage websites and online application [23]. The platform was chosen due to its ease of use, customizability, and availability of themes and plugins. For the theme of the WordPress site, the TutorStarter theme was selected. TutorStarter is a lightweight and responsive WordPress theme designed for e-learning websites. The theme comes with built-in features such as course creation, student registration, and payment processing. Additionally, the theme is highly customizable and can be easily be modified to suit the specific needs of the e-learning platform.

4. Results and Discussion

This qualitative research study aimed to develop and implement an e-learning platform to teach the Python programming language in the Hausa language, specifically targeting Hausa speakers. The methodology employed for this project encompassed several key steps, including the development of the e-learning platform using the WordPress content management system, the creation of course content in Hausa, and the incorporation of user-centered design principles and accessibility considerations. The platform included features such as user registration and login, course creation and management, a discussion forum, and certificate issuance. The design and development of the e-learning platform were guided by the existing literature on e-learning platforms, ensuring a solid foundation based on best practices. The selection of the WordPress framework, themes, and plugins as the base platform was justified by its popularity, flexibility, and ease of use in creating and managing websites and online applications. The WordPress platform was further customized to meet the specific requirements of the e-learning platform.

For the theme selection, the TutorStarter theme was chosen due to its lightweight and responsive design, making it suitable for e-learning websites. The theme provided built-in features essential for e-learning platforms, including course creation, student registration, and payment processing. Additionally, the theme's high level of customization allowed for tailoring to the specific needs of the platform, ensuring a seamless user experience. To enhance the functionality of the e-learning platform, two plugins, namely Tutor LMS and Tutor LMS Pro, were integrated. The Tutor LMS plugin, a free and user-friendly tool, enabled the creation and management of courses, quizzes, and assignments. Its features encompassed course progress tracking, student management, and email notifications, facilitating efficient course delivery and administration. The premium Tutor LMS Pro plugin offered additional features such as WooCommerce integration, advanced quizzes, and certificate issuance, enhancing the overall learning experience and providing learners with a comprehensive set of tools for their educational journey.

The content development process focused on translating key Python programming language concepts into the Hausa language. Clear and appropriate terminology was used to ensure optimal understanding for Hausa speakers. The content was structured in a logical progression, beginning with fundamental programming concepts such as data types, variables, and operators, and gradually advancing to more complex topics like control structures, functions, and object-oriented programming. To maximize comprehension and engagement, the content incorporated examples and exercises aligned with the cultural context of Hausa speakers. Real-life scenarios related to farming, trading, and community engagement were employed to illustrate the practical applications of programming concepts in everyday life. Interactive elements, including quizzes and coding challenges, were developed and integrated into the e-learning platform using the Tutor LMS and Tutor LMS Pro plugins. These interactive elements served to reinforce learning, allowing learners to practice their skills and test their knowledge.

The e-learning platform's user-centered design and accessibility considerations were pivotal in creating an engaging and effective learning environment for Hausa speakers. The user-friendly interface and intuitive navigation ensured that even individuals with limited technical expertise could easily operate the platform and access course content. Learners were able to track their progress and achievements, fostering a sense of accomplishment and motivation to continue their learning journey. The inclusion of a discussion forum within the platform provided an avenue for learners

to interact, ask questions, and seek clarification from course creators. This collaborative element fostered a sense of community, facilitating peer learning and support among Hausa-speaking learners. By encouraging active participation and knowledge sharing, the discussion forum enriched the overall learning experience.

Upon successful completion of a course, learners were issued certificates of completion, which could be downloaded, printed, or shared on social media platforms. These certificates not only served as recognition for learners' accomplishments but also added value to their professional portfolios, enhancing their career prospects.

5. Conclusion

In summary, this qualitative research study successfully employed a robust methodology to design and implement an innovative e-learning platform aimed at teaching the Python programming language in the Hausa language. The resulting e-learning platform boasted essential features, including user registration and login, comprehensive course creation and management functionalities, a dynamic discussion forum, and seamless certificate issuance. The TutorStarter theme, with its lightweight and responsive design specifically tailored for e-learning platforms, was instrumental in creating an aesthetically pleasing and functional interface. Furthermore, the integration of the Tutor LMS and Tutor LMS Pro plugins significantly elevated the platform's capabilities, empowering course creators with advanced course management features, comprehensive progress tracking mechanisms, engaging interactive elements, and certificate generation functionalities. This fusion of technological prowess and pedagogical innovation ensured an immersive and effective learning experience for Hausa-speaking learners.

The content development phase was characterized by a meticulous translation of key Python programming language concepts into the Hausa language, a process that emphasized the utilization of clear and contextually appropriate terminology. By infusing real-life scenarios and culturally relevant examples into the curriculum, the learning materials resonated strongly with Hausa speakers, fostering a deep understanding of the practical applications of programming concepts in their everyday lives. Furthermore, the incorporation of interactive elements, such as meticulously crafted quizzes and challenging coding exercises, not only bolstered engagement but also provided learners with valuable opportunities to apply and reinforce their newfound knowledge. These interactive elements were seamlessly integrated into the e-learning platform using the sophisticated functionalities of the Tutor LMS and Tutor LMS Pro plugins, thereby amplifying the platform's overall educational efficacy.

Future work

Looking ahead, several avenues for future research and development present themselves. Firstly, conducting comprehensive evaluations to assess the actual impact and efficacy of the e-learning platform in terms of achieving desired learning outcomes would be of paramount importance. Quantitative and qualitative data collection methods could be utilized to gauge learners' performance, knowledge acquisition, and overall satisfaction with the platform, ultimately shedding light on its pedagogical efficacy. Secondly, expanding the range of programming languages and languages of instruction offered on the platform would broaden its reach and accommodate learners with diverse language preferences and programming interests. By nurturing a multi-lingual and multi-faceted learning environment, the platform would evolve into a truly inclusive educational ecosystem. Thirdly, conducting comparative studies to evaluate the e-learning platform's effectiveness vis-à-vis other existing platforms would provide valuable insights into its unique strengths and areas for improvement. Through meticulous analysis of factors such as usability, learner engagement, and learning outcomes, a clearer picture of best practices and optimization strategies could emerge. Finally, continuous improvement efforts must be undertaken to fine-tune the platform's features, user interface, and content delivery mechanisms. Collecting and analyzing feedback from learners and course creators would ensure the platform's perpetual relevance and efficacy in meeting the evolving needs and expectations of its target audience.

By diligently exploring these future research avenues, the e-learning platform can be optimized to deliver an unparalleled learning experience, extend its educational offerings to a wider audience, and make enduring contributions to the advancement of programming education in the Hausa language.

Compliance with ethical standards

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Disclosure of conflict of interest

No complicit of interest to be disclosed.

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