**Utilising AI-powered Chatbots for Learning Endangered Nigerian Languages and Considerations for Their Development**

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**Abstract**

Younger generations in Nigeria increasingly use English over their native languages, leading to a decline in indigenous language use in public and professional settings and risking language loss. Consequently, this study explores the potential of AI-powered chatbots in aiding the learning of endangered Nigerian languages. The objectives are to determine how chatbots can support language learning, identify the essential functionalities required for effective learning, and outline design considerations to address the specific challenges faced by these languages. The research employs a qualitative approach, using secondary data from existing literature on language revitalisation, AI chatbots, and Nigerian languages. The analysis reveals that AI chatbots can significantly enhance language learning through features such as handling tonal distinctions and syntactic operations present or allowed in the languages, providing feedback, and engaging learners. Practical design considerations for developers include integrating these functionalities to create effective language-learning tools. These findings suggest that integrating AI technology into language preservation efforts can offer an innovative solution to revitalise endangered Nigerian languages and ensure their continued use among future generations.

**Keywords:** Endangered Nigerian languages; AI-powered chatbot; language learning; language revitalisation; learner autonomy

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**Introduction**

What characterises our world today is by no means slow technological progress; instead, ingenious implementation of artificial intelligence (Belda-Medina & Calvo-Ferrer, 2022; Sanusi et al., 2023) has led to revolutionary changes in the field of human activities, including language learning (Annamalai et al., 2023) and preservation. Artificial intelligence for machines is a term that refers to the application of techniques that allow machines to imitate human intelligence (Azan et al., 2018). AI-driven chatbots, as highly complex advanced systems that can replicate human-like conversation using natural language processing and machine learning algorithms (Haristiani, 2019; Hallal et al., 2023), are a type of artificial intelligence that uses these techniques to grasp and respond to user inputs in a more intelligent and context-aware manner. These chatbots allow users to converse with AI, receive personalised feedback, and access relevant information on various topics (Fryer & Carpenter, 2006). Chatbots are used across diverse domains: customer service, virtual assistants, and educational applications (Liebrecht, 2020; Keykubat, 2022). Most chatbots were made to act as general-purpose ones (Fryer et al., 2020), while some were purposefully made for language learning (Alm & Nkomo, 2020).

According to Maikanti et al. (2021), Nigerian languages are endangered by urbanisation, globalisation, and the shift from using various languages to dominant ones such as English. Endangerment implies that the threatened languages could be lost soon entirely. Thus, it can be presumed that if a more arduous push is not made to record, preserve, and revitalise them by teaching them to children, many will shortly be wiped out in under 100 years. Chatbots converse with learners (Hussain et al., 2023), which makes learning a language interesting and enjoyable (Eisenring et al., 2024). As a result, learners gain confidence and develop fluency in the language they are learning (Li et al., 2022). Incorporating AI-powered chatbots for language learning is one of the innovative steps to ensure the vitality of Nigerian indigenous languages in this digital age. These chatbots can make language learning more accessible and interesting to the younger generation, who are more inclined to digital gadgets and tools. This research, therefore, aims to discuss the potential of Artificial intelligence-powered chatbots for learning endangered Nigerian languages and the factors to be considered when it comes to their development. These research questions are put in place:

1. In what way can AI chatbots help the effort of learning endangered Nigerian languages?
2. What capabilities and functionalities of AI-based chatbots would be needed?
3. Taking into consideration the problems associated with endangered Nigerian languages, how can the AI-powered chatbots be designed?

**Literature Review**

Nigeria is a linguistically diverse country with over 500 languages (Udoh & Emmanuel, 2020), and the official language is English, spoken by 195.9 million people (Eberhard et al., 2020). The language has descended from the rule of British colonisation and serves as the language of delivery between the ethnic groups that live together. English is also heavily used in government, education, media, and commerce. Hausa, Igbo, and Yoruba have national status, and these languages are predominant among the northern, southeast, and southwest ethnic groups, respectively (Eberhard et al., 2020). They assume responsibilities for local administration and media in their respective territories. In addition to the national language, many other indigenous languages are spoken in the country, some of which have millions of speakers while others have small communities. Nigerian languages are threatened with various degrees of endangerment, with some considered endangered and others already extinct (Udoh & Emmanuel, 2019; Ikoro, 2019). Of the three national languages of Hausa, Igbo, and Yoruba, Igbo and Yoruba are now considered endangered. Endangerment reports related to the Yoruba and Igbo languages are common in various treatises. Aremu (2024) reports that a high percentage of Yoruba-English bilingual youths have a moderate ability in Yoruba, as their performance in various tasks was not satisfactory. The study indicates that many participants lack competence in Yoruba idioms, the counting system, days of the week, and months of the year. Also, many lexical and grammatical words are falling out of use. Similar to Aremu (2024), Adeniyi and Olaogun (2020) state that much of the language's vocabulary is lost due to a lack of usage. Idioms are rarely used, and the young are not conversant with them (Oyinloye, 2016). Fabunmi and Salawu (2005) argue that the high number of Yoruba speakers cannot save it from death and attribute the factors to language shift, rural-urban migration, globalisation, and the official language – English in Nigeria. The educated and elites among the Yoruba would switch to English for economic prospects, social elevation, and disgust for the language they now see as local. The Igbo language is dominated by problems such as a rapid decline in child competence, language shift towards pidgins, depletion of elderly monolingual speakers, marginalisation of dialects, and loss of idiomatic expressions and oral literary forms (Azuonye, 2002; Johnmary, 2012). Azuonye (2002) claims that with the widespread use of English among Igbo speakers, the language will likely become Creole or vanish entirely. Using an example from Onyemelukwe (2019), we see young people speaking Igbo less and not having it as a mother tongue. As Onyemelukwe reported, among them are negative attitudes, marginalisation, and disloyalty towards the Igbo, and the long-term effects are so devastating – they include extinction within 40-50 years and cultural loss. Hausa is the only national language among the three that has not yet been listed among those endangered. Spoken in the north, Hausa is another language like English: the language is adapting. The aspiration for a "one north" unified view makes Hausa the lingua franca of the northern region, eclipsing over 200 indigenous languages (Igboanusi & Peter, 2004, p. 131). However, for Yoruba and Igbo, except Hausa, it is a fact that languages with a low number of speakers or poor institutional support are most likely to be endangered; languages without writing systems may face even more difficulties.

The measures used to conserve and enhance a language sometimes involve usage by speakers, documentation, description, archiving, revitalisation, media production, technology implementation, and other efforts (Udoh, 2022). The recommendatory suggestion of Udoh (2022) is the production of language apps that will facilitate learners to interact with different Nigerian indigenous languages. Udoh (2022) states that these language apps create a very accessible and easy-to-reach medium for learners to enrich their indigenous language skills; people can use the apps to learn indigenous languages more efficiently, and the younger generations, who are more familiar with technology, can familiarise themselves with these languages. Similarly, Galla (2018) states that digital technologies, through virtual modes of connection, can be powerful tools that bind and connect both speakers and learners from local and urban places, as well as rural villages, providing them with opportunities to be directly involved in local language revitalisation and education initiatives. Language apps can be a very effective alternative for people who want to learn languages (Kohnke et al., 2023; Karasimos, 2022) while attracting various communities in the process of reviving languages.

Chatbots are communicators (Mohamed & Alian, 2023; Li et al., 2022; Ruan et al., 2021), which make them a suitable choice as a language learning medium in two ways: as an aid to mastering a language and as an independent learning tool (Haristiani, 2019). They could be effective tools since their users will likely welcome them because of their convenience and the high level of confidence they inspire (Li et al., 2022; Ruan et al., 2021; AbuShawar, 2015; Haristiani, 2019; Kim et al., 2019). Fryer and Carpenter (2006) and Sarosa et al. (2020) observed that chatbots improve participants' understanding of what they are learning and, unlike humans, perform these functions unobjectionably without any growing impatience over repeated materials. Along with these authors, others describe the same effects on reading and listening skills (Kim, 2019) and the knowledge of grammar (Kim, 2018). In research by Belda-Medina and Calvo-Ferrer (2022) on chatbot usage to support language learning, chatbots demonstrated efficiency.

**Theoretical Framework**

The theoretical framework for this study is Crystal's theory of language revitalisation. Language revitalisation focuses on returning a threatened language to use (Comajoan-Colomé & Coronel-Molina, 2020). According to Crystal (2000), an endangered language undergoes three stages, the first of which is when pressure from political, social, or economic sources forces people to adopt the dominant language. This pressure can come from top-down measures like government laws, incentives, and recommendations or bottom-up influences, like social trends. The culmination of the first stage is emerging bilingualism. This second stage (i.e., emerging bilingualism) means that language speakers become increasingly proficient in the new language while maintaining some competence in their native language. The decline of this bilingualism leads to the third stage, in which the younger generation becomes more proficient and identifies more with the dominant language. The old language becomes less relevant as parents do not actively use it, and children do not communicate using that language. Over time, this brings about semilingualism and eventually monolingualism, pushing the language towards extinction.

Crystal (2000) notes that it is impossible to influence the factors driving the first stage of language endangerment, and intervening in the third stage is too late for most languages. Revitalisation efforts should focus on the second stage, where emergent bilingualism offers a genuine opportunity for progress. Nigerian youths who are bilingual in English can be considered in the stage of emergent bilingualism. They are becoming increasingly proficient in English while retaining competence or a moderate ability in their native languages (Aremu, 2024; Azuonye, 2002; Adeniyi & Olaogun, 2020; Onyemelukwe, 2019). Crystal (2000) identified electronic technology as one of the six key factors necessary for revitalising endangered languages based on his evaluation of successful language maintenance projects (Crystal, 2000, pp. 141-143). Using AI-powered chatbots for learning endangered languages can be considered among the electronic technologies that support language revitalisation, given that they can enhance the public profile of endangered languages and facilitate communication and learning among speakers, which aligns with the goals of language revitalisation efforts.

**Methodology**

**Research Design**

The study utilises secondary data to investigate the potential and requirements for AI chatbots in learning endangered Nigerian languages. According to Vartanian (2010), secondary data consists of previously collected information being reused to address new research questions. The secondary data is derived from existing literature on language learning, AI-powered chatbots, and efforts to revitalise endangered languages.

**Research Instrument**

Secondary data was used in this study. This includes a comprehensive review of existing studies and literature relevant to language revitalisation, AI-powered chatbots, and the challenges that endangered Nigerian languages face.

**Data Collection Procedures**

Relevant secondary data was extracted from their sources. Existing studies and literature on language revitalisation, AI-powered chatbots, and the specific challenges faced by endangered Nigerian languages were collected for review, analysis, and discussion.

 **Data Analysis Procedure**

The information gathered from the literature was analysed to identify the necessary capabilities and functionalities of AI-powered chatbots for learning endangered Nigerian languages, such as handling tonal distinctions and complex syntactic operations present or allowed in the languages, providing feedback, and maintaining user engagement. In addition to this, a hypothetical learner interaction with a chatbot, which was used as an illustrative example in the study, to demonstrate the potential chatbot responses and feedback mechanisms based on the findings from previous studies, was discussed under the discussion section.

**Way In Which AI Chatbots Can Help the Effort of Learning Endangered Nigerian Languages**

First, for a language to be preserved from danger, it must be actively spoken. However, when a language is endangered, the only way it can be revived is with the help of a more knowledgeable individual teaching the language. This is so given that linguists' efforts in archiving, recording, and documenting a language provide an avenue for an endangered or a dead language to be revived; thus, such a revival necessitates teaching and learning. For one who is learning a language as a beginner, the teaching begins with knowing the sounds that are obtainable from the language, the vocabulary, conversational phrases, how meanings are derived, how words are created, the culture, and all the things that are unique to it.

Chatbots can assist in language preservation by serving as language learning and practice tools, maintaining and promoting language use through features like text, audio input and output, and visual aids. In fact, when multimedia resources are incorporated, a language and its culture are brought to life. Audio recordings featuring native speakers allow learners to hear the language being naturally spoken, enabling them to develop listening comprehension skills and acquire pronunciation and intonation patterns appropriately. Similarly, videos depict visual representations of cultural practices, traditions, and societal norms. It can be traditional celebrations, everyday interactions, or historical events, as can be seen in the case of the Memrise language learning app, which incorporates video clips of native speakers where learners observe how native speakers articulate utterances, their intonation, and the emotion associated with each word (Kyung, 2019).As Mohamed and Alian (2023) noted, chatbots track learners’ progress, identify areas for improvement and offer appropriate feedback to help them. All these are what each learner needs; they help learners advance their proficiency levels (Kwon et al., 2023; Galla, 2018).The following is an illustrative example of a hypothetical learner interaction with an AI chatbot for language learning. The chosen Nigerian language here is Yoruba.

**Note:** A learner named Fadekemi, with a basic understanding of Yoruba, is using an AI chatbot named ORO for language learning. The chatbot is designed to teach different times of the day in Yoruba, how to greet accordingly, and quiz learners based on what they have learned (See table 1 and 2). The chatbot also teaches conversational Yoruba (See Table 3). The learner can read, listen to, speak and/or write her messages.

**Table 1**

 *Timing of a Day*

|  |  |
| --- | --- |
| Interaction in Yoruba | English Translation |
| ORO: Ǹlẹ́ o Fadekemi! Emi ni ORO, olùrànlọ́wọ́ ẹ̀kọ́ Yorùbá rẹ. Lónìí, jẹ́ kí á kọ́ nípa àwọn àsìkò tí ó wà nínú ọjọ́.  | ORO: Hi Fadekemi! I'm ORO, your Yoruba learning assistant. Today, let's learn how to greet people in Yoruba.  |
| Fadekemi: Ǹlẹ́ o ORO!  | Fadekemi: Hi ORO!  |
| ORO: Ó dára! Yoruba pín àsìkò tó wà nínú ọjọ́ sí ìpín méje: (1) Àárọ̀/Òwúrò(2) Ìyálẹ̀ta(3) Ọ̀sán(4) Ìrọ̀lẹ́(5) Alẹ́(6) Àfẹ̀júmọ́(7) Àjìn/Òru | ORO: Great! Yoruba categorises the day into seven periods:(1) Morning(2) Noon(3) Afternoon(4) Sunset(5) Early night (6) Dawn(7) Midnight |
| Fadekemi: Ó dára! Sugbon eléyìí jẹ́ àjòjì. Àárọ̀, ọ̀san, àti alẹ́ nìkan ni mo mọ̀.  | Fadekemi: Great! But this is strange! I've always known morning, afternoon and night.  |
| ORO: Wọ́n lè jẹ́ àjòjì nítorí i àìsàmulò wọn. Dájúdájú o nífẹ̀ẹ́ láti kọ́ ohun tuntun.  | ORO: They may be strange because they are rarely used. Knowing and using them will give you an edge. You definitely like to learn new things.  |
| Fadekemi: Bẹ́ẹ̀ ni!  | Fadekemi: Yes!  |
| ORO: Ó dára! Ìwọ̀nyíí ni bí o ṣe lè lo ọ ìkọ̀ọ̀kan àwọn ọ̀rọ̀ náà ní àsìkò tí ó tọ́:1. Ẹ kàárọ̀ (Lọ́gán tí òòrùn bá tí yọ). 2. Ẹ kú ìyálẹ̀ta (Ní déédéé aago méjìlá ọ̀sán).3. Ẹ káàsán (Ago kan sí ago mẹ́rin ọ̀sán). 4. Ẹ kú ìrọ̀lẹ̀ (Ago méje alẹ́). 5. Ẹ káalẹ́ (Ìkíni lẹ́yìn ago méje alẹ́).6. Ẹ kú àfẹ̀júmọ́ (Ago márùn-ún sí àgó mẹ́fà àárọ̀) 7. Ẹ kú àjìn (Àárín òru)  | ORO: Great! Here is how you can use each word in greeting at a specific time:1. Ẹ kàárọ̀ (Greting after early sunrise). 2. Ẹ kú ìyálẹ̀ta (Greeting during the noon “12pm”).3. Ẹ káàsán (Greeting from 1pm to 4pm)4. Ẹ kú ìrọ̀lẹ̀ (Greeting at 7pm).5. Ẹ káalẹ́ (Greeting after 7pm).6. Ẹ kú àfẹ̀júmọ́ (Greeting at 5 to 6 am).7. Ẹ kú àjìn (Greeting at midnight). |
| Fadekemi: Ó dára!  | Fadekemi: Okay!  |
| ORO: Ríi dájú wípé o kò si Ẹ kú ìrọ̀lẹ̀ àti Ẹ káalẹ́ gbé sí ara wọn.  | ORO: Make sure you don't confuse greeting at 7 pm with greeting after 7 pm.  |
| Fadekemi: Tí n kò bá fẹ́ dárúkọ àsìkò ń kọ́? O jọ wípé kò sí ìkíni irú u rẹ̀.  | Fadekemi: What if I don't want to mention time? It seems there's no general greeting.  |
| ORO: Rárá, ìkíni irú rẹ̀ wà. Sọ pé "Ẹ kú déédéé ìwòyí" tí o kò bá fẹ́ dárúkọ àsìkò. Ìkíni tí ó ṣe é lò ní àsìkò yòówù ni.  | ORO: No, there is. Say “Ẹ kú déédéé ìwòyí” if you don't want to mention the time. It is a versatile greeting that can be used throughout the day.  |

**Table 2**

*Practicing with Quizzes*

|  |  |
| --- | --- |
| Interaction in Yoruba | English Translation |
| ORO: Ní sìn ín, jẹ́ kí á ṣàgbéyẹ̀wò ìmọ̀ rẹ. Báwo ni a ṣe ń kíni ní déédéé aago méjìlá ọ̀sán?  | Chatbot: "Now, let's test your knowledge! Which greeting would you use at 12pm?" |
| Fadekemi: (Mú “Ẹ kú ìyálẹ̀ta” nínú àwọn ìdáhùn).  | Fadekemi: (Selects “Ẹ kú ìyálẹ̀ta” from a multiple-choice quiz) |
| ORO: Ìyẹn tọ̀nà. Ọlọ́pọlọ pípé ni ẹ́, Fadekemi. Tó bá jẹ́ àjìn ńkọ́?  | ORO: "Correct! You're a fast learner, Fadekemi. How would you greet if it is midnight?" |
|  |  |
| Fadekemi: (Mú “Ẹ kú àjìn” nínú àwọn ìdáhùn).  | Fadekemi: (Selects “Ẹ kú àjìn” from a multiple-choice quiz) |
| ORO: O káre, Fadekemi! Báwo la ṣe ń kí ni lẹ́yìn ago méje alẹ́?  | ORO: "Fantastic job, Fadekemi! How do you greet after 7pm? |
|  |  |
| Fadekemi: (...). | Fadekemi: (...).  |

**Table 3**

*Conversational Yoruba*

|  |  |
| --- | --- |
| Interaction in Yoruba | English Translation |
| ORO: Kú ìṣe, Fadekemi! Ní sí-ín yìí, o lè kí àwọn àníyàn ní èdè Yorùbá. Tá ni o máa fẹ́ láti kọ́kọ́ kí?  | ORO: Great work, Fadekemi! Now you can greet people in Yoruba. Who would you like to say hello to first? |
| Fadekemi: Máa fẹ́ láti kí ọ̀rẹ́ mi Daniel. | Fadekemi: I'd like to greet my friend Daniel. |
| ORO: Ìyanu ńlá lèyí! Ǹjẹ́ kí á ṣàgbéyẹ̀wò ìtàkurọ̀sọ kékeré? Àpẹrẹ nìyí: "Inú mi dùn láti rí ẹ, Daniel! Báwo ni? | ORO: That's wonderful! How about we practise a short conversation? Here's an example: 'I am happy to see you, Daniel! How are you? |
| Fadekemi: Inú mi dùn láti rí ẹ, Daniel! Báwo ni? | Fadekeni: 'I am happy to see you, Daniel! How are you?'"  |
| ORO: Ó dára gan-an. Nísin yí, ìwọ lo kàn láti bèrè ìbéèrè lọ́wọ́ Daniel. Kí ni o wù ọ́ láti mọ̀?  | ORO: Very good! Now, it's your turn to ask Daniel a question. What would you like to know? |
| Fadekemi: Báwo ni ojú ọjọ́ lónìí?  | Fadekemi: "How is the weather today?" |
| ORO: ìbéèrè ńlá nìyẹn, Fadekemi! A kò tíì kọ́ nípa ojú ọjọ́. Ṣùgbọ́n mo lè sọ fún ẹ pé òrùn mú lónìí. Bóyá a máa nípa àwọn ọ̀rọ̀ tó jẹ́ mọ́ ojú ọjọ́ lọ́jọ́ iwájú.  | ORO: "That's a great question, Fadekemi! While we haven't learned about weather phrases yet, I can tell you it's a sunny day. Perhaps we can learn some weather vocabulary next time?" |

Note: Table 3 is a continuation of a conversation between ORO and Fadekemi. The interaction starts like the opening of Table 1. A similar opening is not provided in Table 3 to avoid the repetition of similar information ad nauseam – the opening is actually predictable for and in various contexts and can be taken as a template.

**Specific Needed Capabilities and Functionalities of AI-powered Chatbots for Learning Endangered Nigerian Languages**

AI-powered chatbots can enhance language learning by being responsive, secure, and culturally sensitive while also serving as effective language learning tools (Abdulquadri et al., 2021; Teibowei & Agbai, 2023; Haristiani, 2019; Kim et al., 2019). As far as Nigerian languages are concerned, chatbots designed for language learning must be able to handle language-specific features. For instance, Nigerian languages are largely tonal (Crystal, 1987). Tone is a suprasegmental feature where identical words could be differed by contrast in the pitch of the voice (Uba & Eme, 2019). Consequently, a chatbot designed for learning a tonal language must be able to handle tonality as it lexically and grammatically marks contrast between words, interrogative, and declarative expressions (Okoye & Osuagwu, 2017; Uba & Eme, 2019). A learner who encounters words of the same form being pronounced differently and having different interpretations without any physical marks distinguishing them would undoubtedly be confused. Tone marks are necessary to prevent such confusion (Alake, 2000). The following examples from various Nigerian languages illustrate how words of the same form differ in meaning because of the difference in the pattern of tone attached to them.

Yoruba

|  |  |  |  |
| --- | --- | --- | --- |
| a | Word  | Tone | Gloss |
|  | Ìgbà  | LL | time |
|  | Igbá | MH | calabash |
|  | Ìgbá | LH | Mature pod of *parkia biglobosa* tree |
|  | Igba | MM | 200 |
|  | Igbà | ML | Rope for climbing palm tree |
|  |  |  |  |
| b | Ajá  | MH | Dog |
|  | Àjà | LL | Roof |
|  |  |  |  |
| c | Agbon | MH | Insect  |
|  | Agbon | ML | Basket |
|  | Agbon | LM | Coconut  |

Nyifon

|  |  |  |  |
| --- | --- | --- | --- |
| a | Word  | Tone | Gloss |
|  | Achi | MM | Poison  |
|  | Àchi | LM | Medicine |
|  |  |  |  |
| b | Ùkè | LL | Song  |
|  | Ùke | LM | Door |
|  |  |  |  |
| c | Ba | M | Draw |
|  | Bà  | L | Wait |
|  |  |  |  |
| d | Teme  | MM | Remove  |
|  | Tème  | LM | Wrap up |
|  |  |  |  |
| e | Iji  | MM | Food |
|  | Ìji  | LM | Vein  |

(Uba & Eme, 2019)

Igbo

|  |  |  |  |
| --- | --- | --- | --- |
| a | Word  | Tone | Gloss |
|  | Àkwa  | LM | Egg  |
|  | Akwa  | MM | Cry  |
|  | Àkwà  | LL | Bed  |
|  | Akwà  | ML | Cloth  |
|  |  |  |  |
| b | Aka  | MM | Hand  |
|  | Akà  | ML | Bead |
|  |  |  |  |
| c | Òkè  | LL | Share |
|  | Okè  | ML | Boundary  |
|  | Oke | MM | Male |
|  | Òke  | LM | Rat |
|  |  |  |  |
| d | Enyi  | MM | Elephant |
|  | Enyì  | ML | Friend |

(Okoye & Osuagwu, 2017; Uba & Eme, 2019)

Etulo

|  |  |  |  |
| --- | --- | --- | --- |
| a | Word  | Tone | Gloss |
|  | Gbò  | L | Fail |
|  | Gbo | M | Beat |
|  |  |  |  |
| b  | Atse  | MM | Comb  |
|  | Àtse  | LM | Mate |
|  |  |  |  |
| c | àbê | L, Falling tone | Breast  |
|  | Àbè  | LL | Name |

(Okoye & Osuagwu, 2017)

While Nigerian languages use SVO word order like English, several specific aspects are unique to these languages. A typical example is Yoruba, in which adjectives mostly post-modify nouns (Adelabu, 2014), as shown below:

 a. Omobinrin dudu kan

 Lady dark one

 (A dark lady)

 b. Ile giga

 House tall

 (A tall house)

There are a few exceptional cases where adjectives come before the nouns they modify. These cases include:

1. When stating a special feature of a person or thing (Adelabu, 2014):

 a. Arugbo Okunrin

 Old Man

 (An old man)

 b. Ajoji eniyan

 Strange person

 (A strange person)

2. When expressing a fraction (Adelabu, 2014):

 a. idaji apo iresi

 Half bag rice

 (A half bag of rice)

 b. Ilata igo epo

 1/3 bottle oil

 (One third bottle of oil)

Within these exceptions, it is allowed for some adjectives to come after the nouns they modify:

 1a. Idaji apo iresi 1b. iresi idaji apo

 Half bag rice rice half bag

 (A half bag of rice) (A half bag of rice)

 (Both ‘a’ and ‘b’ are the same)

The 2a below is an example from exceptional cases. However, unlike 1a, adjectives cannot come after the nouns they modify:

 2a. Obun omo 2b. \*omo obun

 Dirty child child dirty

 (A dirty child) \*(A Dirty’s child)

Unlike 1a and 1b, which both mean the same thing, 2a and 2b do not. In 2b, the adjective 'dirty' becomes a noun that functions as possessive when it switches position with or crosses over 'omo’. This is not allowed in the grammar of the language. It is more of a matter of syntax and semantics.

**How AI-powered Chatbots Can Be Designed Taking into Consideration the Problem Associated with Endangered Nigerian Languages**

Many Nigerian indigenous languages are not codified (Owojecho, 2020). Despite these languages' abilities to foster unity, cultural identity, and national pride (Ayakoroma, 2017), their role in national development is hindered by a lack of orthography (Olaoye, 2013). This makes preserving linguistic knowledge and cultural heritage challenging for future generations. Even among languages that have a writing system, a lack of standard dialect is another problem; this is true of a language like Igbo where, essentially, the idea of a standard Igbo dialect exists, but its concrete existence or specific characteristics are not easily identifiable with within the diverse Igbo community (Anyanwu, 2013).

To design a chatbot that can address the lack of orthography or description of many Nigerian indigenous languages, insights can be drawn from studies by Chiaráin and Chasaide (2016) and Paul et al. (2018). Chiaráin and Chasaide note that a speech-enabled chatbot is a powerful tool for dealing with the challenges of teaching and/or learning an endangered language where learners have limited access to native speaker models of the language and limited exposure to the language in a truly communicative setting. In their study, the chatbot uses synthetic voices developed for the dialects of Irish and aims to provide a learning environment that incorporates speech. The chatbot platform was evaluated in 13 schools, where the learners' opinions of the platform “as a learning environment” and the quality and attractiveness of the synthetic voices were assessed (Chiaráin & Chasaide, 2016, p. 3432). The quality of the synthetic voices had 73% positive rating, whereas the attractiveness of the voices received 57% rating. Paul et al. (2018) proposed a semi-supervised AI chatbot for automating interaction to generate contextualised responses in any language without relying heavily on rich NLP background, or extensive prior datasets. Practically, they created a chatbot framework suitable for resource-poor language like Bangla and found that using N-Gram stemming alone maintained performance without heavy NLP methods, while a convolutional neural network improved query identification. Context tracking using LCA was reported to be excellent in maintaining the flow of conversation. Although a chatbot with an architecture like this cannot handle features such as tone, intonation, and complex grammatical rules, it can be considered a good start, considering its suitability for basic language learning or use (such as vocabulary and other simple conversation skills, particularly for beginners).

**Discussion**

It has been established that chatbots can assist in language preservation efforts by serving as tools for language learning and practice, maintaining and promoting language use through features like text, audio input and output, and visual aids. An example is given in Tables 1, 2, and 3 to illustrate this. The example is the hypothetical interaction of a learner with an AI-powered chatbot. It is a fictional situation demonstrating a learner's and a chatbot's interaction. This demonstrative part shows how the chatbot reacts to the trainee's contribution, provides the expected feedback, and how they all lead to curiosity. In Table 1, Fadekemi learns about the different times of the day in Yoruba and how to greet accordingly. The quizzes in the second interaction (Table 2) reinforce the learning. Positive reinforcement through praise motivates Fadekemi to continue because it builds confidence in what she has learned. Fadekemi practised what she had learned in Table 3. Her question about the weather is outside the learning objectives, but the chatbot effectively handles it by responding to it and letting her know she is going out of the scope of learning and that the topic can be learned next time. In these interactions, it can be seen that the chatbot personalises language learning. That is, it provides the feedback that the learner needs, and there is room for exercises, opportunities for the practical application of what a learner has learned, and absolute control over what they are learning.

Regarding the capabilities and functionalities of AI chatbots that would be needed, Nigerian languages are syntactically rich and largely tonal. Any chatbots designed for learning the languages should be able to handle tonal distinctions and complex syntactic operations that are present or allowed in the languages. If the syntax is poor, the chatbot cannot serve its purpose. In the same way, the tonal aspect has to be perfectly fixed to avoid mistaking one word for another, which can lead to misinterpretation, as shown in the given examples. In other words, the chatbots should be able to handle tonal distinctions and complex syntactic operations, and this is essential because tonal distinctions and complex syntactic operations are critical components of Nigerian languages. Properly managing these features ensures accurate communication, comprehension, and effective learning.

Taking into consideration the problem associated with endangered Nigerian languages, which is lack of codification or description, Chiaráin and Chasaide (2016) and Paul et al. (2018) show that undocumented languages can incorporate a speech-enabled feature to provide access to native speaker models or utilise a semi-supervised AI chatbot which generates contextualised responses in any language without relying heavily on rich NLP background, or extensive prior datasets. While the latter may not be a comprehensive solution due to its inability to handle sophisticated language features, it certainly offers a meaningful contribution to language learning. It should be noted, however, that while chatbots may not possess human-like intelligence (Chomsky et al., 2023), they can guide learners in these activities through the training they have received from their developer(s).

**Conclusion**

Using AI-powered chatbots to learn endangered Nigerian languages is an innovative approach to addressing Nigeria's critical issue of language preservation. Chatbots can support this effort by acting as tools for language learning and practice, offering functionalities such as text and audio input/output and visual aids. These chatbots must be capable of managing language-specific features, including handling tonal distinctions and complex syntactic operations, which are crucial for accurate communication and comprehension. A major problem with many Nigerian languages is the lack of documentation. However, speech-enabled chatbots can be valuable in contexts with limited access to native speakers. Semi-supervised AI chatbots can generate contextualised responses in any language without heavily relying on an extensive NLP background. The limitation of this study is that language learning through chatbots is restricted to educated individuals with access to technology. Despite this, integrating AI-powered chatbots into language learning initiatives can offer practical solutions for revitalising endangered Nigerian languages. These chatbots can facilitate language learning and potentially preserve and promote these languages among current and future generations. Stakeholders involved in language preservation efforts should consider incorporating AI chatbots with features that address endangered Nigerian languages' unique linguistic characteristics and challenges. Future research should focus on developing systems equipped with the functionalities and considerations discussed in this study.

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**References**

Abdulquadri, A., Mogaji, E., Kieu, T., Nguyen, N. (2021). Digital transformation in financial Services Provision: A Nigerian perspective to the adoption of chatbot. Journal of Enterprising Communities: People and Places in the Global Economy. https://doi.org/10.1108/JEC-06-2020-0126

AbuShawar, B. & Atwell, E. (2015). ALICE Chatbot: Trials and Outputs. Computación y Sistemas. 19(4), 625–632. doi: 10.13053/CyS-19-4-2326

Alake CA (2000). Early Descriptions of the Yoruba Language: The Work of Samuel Ajayi Crowther. In: D. P., J. L., S. P., S. P., eds., The History of Linguistic and Grammatic Praxis. Proceedings of the XIth International Colloquium of the Studienkris "Geschichte der Sprachwissenschaft". 427–443.

Alm, A., & Nkomo, L. (2020). Chatbot experiences of informal language learners: a sentiment analysis. International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT), 10(4), 51-65. https://ideas.repec.org/a/igg/jcallt/v10y2020i4p51-65.html

Annamalai, N., Rashid, R. A., Hashmi, U. M., Mohamed, M., Alqaryouti, M. H. & Sadeq, A. E. (2023). Using chatbots for English language learning in higher education. Computers and Education: Artificial Intelligence (5, 100153). 1–9.

Anyanwu, O. (2013). Igbo Language and its Dialects: A Challenge for an Igbo Language Teacher. Annals of Modern Education, 2(1)

Aremu, A. O. (2024). Assessing L1 Competence Decline Among Yoruba-English Bilingual Undergraduates at Usmanu Danfodiyo University, Sokoto. TRANS-KATA: Journal of Language, Literature, Culture, and Education. 4(2), 117–131. DOI: https://doi.org/10.54923/jllce.v4i2.77

Ayakoroma, B. F. (2017). Reviving the Use of Indigenous Languages in the Contemporary Nigerian Society: The National Institute for Cultural Orientation (NICO) Initiative. International Journal of Language and Linguistics. 4(4), 182-188

Azan B, Y., Estrada S, V., Martinez S, N. (2018). Artificial intelligence techniques for information security risk assessment". IEEE Latin America Transactions, 6(3) 897–901

Azuonye, C. (2022). Igbo as an Endangered Language. Africana Studies Faculty Publication Series. 41-49

Belda-Medina, J. & Calvo-Ferrer, J. M. (2022). Using Chatbots as AI Conversational Partners in

Language Learning. Applied Sciences. https://doi.org/10.3390/app12178427. 1-16.

Brinegar, M. (2023). Chatbots as a Supplementary Language Learning Tool: Advantages, Concerns, and Implementation. International Journal of Education and Social Science Research, 6(6), 223–230, doi: 10.37500/IJESSR.2023.6615

Chiaráin, N. N. & Chasaide, A. N. (2016). Chatbot Technology with Synthetic Voices in the Acquisition of an Endangered Language: Motivation, Development and Evaluation of a Platform for Irish. International Conference on Language Resources and Evaluation. 3429-3435

Chomsky, N., Roberts, I. & Watumull J. (2023). The False Promise of CHATGPT. New York Times. https://www.nytimes.com/2023/03/08/opinion/noam-chomsky-chatgpt-ai.html?fbclid=IwAR34S5ryZj9oeh2zw2YQWadm8yUUtuafPp7YGSTZ4XgMKy7uxu7dV4IMFfg

Comajoan-Colomé, L., & Coronel-Molina, S., (2021). What Does Language Revitalization in the Twenty-first Century Look Like? New Trends andFrameworks. JOURNAL OF MULTILINGUAL AND MULTICULTURAL Development. Vol, 42. No, 10. 897-904, DOI: 10.1080/01434632.2020.1827643

Crystal, D. 2000. Language Death. Cambridge: Cambridge University Press.

Eberhard, David M., Gary F. Simons, and Charles D. Fennig (eds.). (2020). Ethnologue: Languages of the World. Twenty-third edition. Dallas, Texas: SIL International. Online version: http://www.ethnologue.com

Eisenring, M. A. A., Jamiluddin, J., Hairul, M. A. & Putri, D. (2024). The Use of Chatbots in the English Language Teaching to Promote Modern Language Learning: A Literature Review. International Journal of Indonesian Education and Teaching. https://doi.org/10.24071/ijiet.v8i1.7321. 8(1). 127-139.

Fryer, L., & Carpenter, R. (2006). Emerging technologies bots as language learning tools. Language Learning and Technology, 10(3), 8–14.

Fryer, L., Coniam, D., Carpenter, R., & Lăpușneanu, D. (2020). Bots for language learning now: current and future directions. Language Learning & Technology, 24(2), 8–22. https://www. lltjournal.org/item/10125-44719/

Galla, C. K. (2018). Digital Realities of Indigenous Language Revitalization: A Look at Hawaiian Language Technology in the Modern World. Language and Literacy. 20(3), 100-120

Hallal, K., Hamdan, R. & Tlais, S. (2023). Exploring the potential of AI-Chatbots in organic chemistry: An assessment of ChatGPT and Bard. Computers and Education: Artificial Intelligence (5, 100170). 1-8.

Haristiani, N. (2019). Artificial Intelligence (AI) Chatbot as Language Learning Medium: An inquiry. Journal of Physics: Conference Series. doi:10.1088/1742-6596/1387/1/012020. (1387, 012020), 1–6.

Holec, H. (1981). Autonomy and foreign language learning. Oxford: Pergamon/ Council of Europe

Hussain, S., Al-Hashmi, S. H., Malik, M. H. & Kazmi S. I. A. (2023). Chatbot in E-learning. SHS Web of Conferences (156, 01002), 1–5.

Igboanusi, H. & Peter, L. (2004). Oppressing the oppressed: the threats of Hausa and English to Nigeria’s Minority Languages. Int’l. J. Soc. Lang, 131–140

Ikoro, F. M. (2019). Development and Sustenance of Indigenous Languages in Nigeria: The Role of Ninlan and Its Library. International Conference on Social and Education Sciences. 45-52

Johnmary, A. K. (2012). UNESCO Prediction on the Extinction of Igbo Language in 2025: Analysing Societal Violence and New Transformative Strategies. Developing Country Studies. 2(8), 110-118

Karasimos A. (2022). The battle of language learning apps: a cross-platform overview. Research Papers in Language Teaching and Learning, 12(1), 150-166

Keykubat, A. A. (2022). Chatbot-Human Interaction and Its Effects on EFL Students’ L2 Speaking Performance and Anxiety. Novitas-ROYAL (Research on Youth and Language. 16(2), 113–131

Kim, N., Chad, Y. & Kim, H. (2019). Future English Learning: Chatbots and Artificial Intelligence. Multimedia-Assisted Language Learning, 22(3), doi:10.15702/mall.2019.22.3.32

Kim, N., Y. (2019). A study on the Use of Artificial Intelligence Chatbots for Improving English Grammar Skills. Journal of Digital Convergence, 17(8), 37–46. https://doi.org/10.14400/JDC.2019.17.8.037.

Kim NY (2018). A study on chatbots for developing Korean college students' English listening and reading skills. Journal of Digital Convergence 16(8): 19–26.

Kohnke, L., Moorhouse, B. K. & Zou, D. (2023). ChatGPT for Language Teaching and Learning. RELC Journal 1–14. DOI: 10.1177/00336882231162868

Kwon, S. K., Shin, D., & Lee, Y. (2023). The application of chatbot as an L2 writing practice tool. Language Learning & Technology, 27(1), 1–19. https://doi.org/10125/73541

Kyung, J. S. (2019). Introduction to Popular Mobile Chatbot Platforms for English Learning: Trends and Issues. STEM Journal. 20(2). doi: 10.16875/stem.2019.20.2.67

Li, Y., Chen, C., Yu, D., Davidson, S., Hou, R., Yuan, X., Tan, Y., Pham, D. & Yu, Z. (2022). Using Chatbots to Teach Languages. In Proceedings of the Ninth ACM Conference on Learning. https://doi.org/10.1145/3491140.3528329

Liebrecht, C., Sander, L. & Hooijdonk, C. V. (2020). Too informal? How a chatbot’s communication style affects brand attitude and quality of interaction. 4th International Workshop on Chatbot Research. 1-17

Maikanti, S., Chukwu, A., Odibah, M. G, & Ogu, M. V. (2021). Globalisation as a Factor for Language Endangerment: Nigerian Indigenous Languages in Focus. Malaysian Journal of Social Sciences and Humanities (MJSSH), 6(9), 521 - 527). DOI: https://doi.org/10.47405/mjssh.v6i9.1055

Mohamed, S. S. A. & Alian, E. M. I. (2023). Students’ Attitudes toward Using Chatbot in EFL Learning. Arab World English Journal (AWEJ), 14(3), 15-27, DOI: https://dx.doi.org/10.24093/awej/vol14no3.2

Okoye, A. N. & Osuagwu, E. C. (2017). Tone in Igbo and Etulo: A Comparison. Igbo Language Studies. Vol. 2. Pp 99-112.

Olaoye, A. A. (2013). The Role of Indigenous Languages in National Development: A Case Study of Nigerian Linguistic Situation. International Journal of Applied Linguistics & English Literature. 2(3), 29-34

Onyemelukwe, I. M. (2019). Language Endangerment: The Case of the Igbo Language. IMPACT: International Journal of Research in Humanities, Arts and Literature (IMPACT: IJRHAL). 7(1), 213-224

Owojecho, F. A. (2020). Implementation Challenges of National Language Policy in Nigeria: The Roles of the Indigenous Languages. International Journal of Language and Literary Studies. 2(1), 270-279, DOI: https://doi.org/10.36892/ijlls.v2i1.183

Paul, A., Latif, A. H., Adnan, F. A. & Rahman, R. M. (2018). Focused domain contextual AI chatbot framework for resource-poor languages. Journal of Information and Telecommunication, 1-22, DOI: 10.1080/24751839.2018.1558378

Ruan, S., Jiang, L., Xu, Q., Davis, G. M., Liu, Z., Brunskill, E. & Landay, J. A. (2021). English Bot: An AI-Powered Conversational System for Second Language Learning.

Ryan, R. M. & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. American Psychologist. 55(1), 68-78, DOI: 10.1037110003-066X.55.1.68

Sanusi, I. T., Oyelere, S. S., Vartiainen, H., Suhonen, J. & Tukiainen M. (2023). Developing middle school students’ understanding of machine learning in an African school. Computers and Education: Artificial Intelligence 1-11.

Sarosa, M., Kusumawardani, M., Suyono, A. & Wijaya, M. H. (2020). Developing a social media-based Chatbot for English learning. IOP Conf. Series: Materials Science and Engineering. 1-6, doi:10.1088/1757-899X/732/1/012074

Teibowei, M. T. & Agbai, E. (2023). Awareness and Utilisation of Artificial Intelligence-Based Systems in Biomedical Translation in Nigeria. International Journal of Medical Evaluation and Physical Report. 7(3), 72-81.

Uba, E.D. & Eme, C. A. (2019). Tone in the Nyifon and Igbo Languages: A Preliminary Comparative Study. International Journal of Current Research in the Humanities. No (23) pp. 34-47.

Udoh, I. (2022). Preservation and Development of Nigerian Indigenous Languages. 2022 International Mother Language Day Celebration, Federal Ministry of Information and Culture. 65-73

Udoh, I. & Emmanuel, I. (2020). Nigerian Languages and Identity Crises. Language and Semiotic Studies. 6(3), 96-111

Vartanian, T. P. (2010). Secondary data analysis. Oxford University Press.

Vygotsky, L. S. (1962). Thought and language. MIT Press, Massachusetts Institute of Technology.