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AI-Driven Curriculum Innovation in Multilingual Secondary Education: Evidence from English and Yoruba Instruction in Ondo State, Nigeria

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Abstract: *The increasing linguistic diversity of Nigerian secondary schools continues to challenge the capacity of traditional curricula to address learners' varied language needs, particularly in bilingual English–Yoruba contexts. Within this context, artificial intelligence (AI) offers new possibilities for curriculum innovation that can personalise instruction and support indigenous language education. The study employed the mixed-methods approach. The qualitative data were gathered through curriculum analysis, teacher interviews, and student focus groups to study the practice, perception, and contextual needs. The results of a quasi-experimental design were obtained by means of quantitative data, which were collected on a sample size of 120 Senior Secondary One (SSI) students in four schools. Students were taught with AI tools, namely: Grammarly and ChatGPT for English and YorubaBERT, Duolingo Yoruba, and chatbots for Yoruba, for six weeks of intervention. Proficiency was tested using pre- and post-tests, and surveys and logs were used to measure engagement and attitudes. Results showed that English and Yoruba curricula were strongly different, with the latter having less organization and being not tech-friendly. Positive attitudes toward the use of AI were reported by both students and teachers, but interactive feedback and cultural relevance were found to be the most beneficial features. The*

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statistical findings demonstrated a significant improvement in both English and Yoruba, although English was gaining more because of the maturity of the tools. Among the challenges were poor ICT infrastructure, poor teacher training, and insufficient resources forAI in the country, whereas the opportunities were in the area of interaction, adaptive learning, and cultural preservation. The study concluded that the innovation of curriculum with the use of AI promoted bilingual learning by connecting the global technologies with the local sociolinguistic conditions. It recommended the investment in AI tools, training of teachers, as well as the infrastructure, with a view to facilitating inclusive and sustainable education.

Keywords*: Artificial Intelligence; Bilingual Education; Curriculum Innovation; Yoruba; English Language Teaching; Educational Technology; Natural Language Processing; Student Engagement.*

1. Introduction

Artificial Intelligence (AI) is increasingly reshaping educational systems by influencing curriculum design, pedagogical practices, and assessment processes. Globally, AI-driven technologies are being deployed to support adaptive learning, personalize instruction, and promote inclusive education, particularly in linguistically diverse contexts (Luckin & Cukurova, 2022; UNESCO, 2023). Through tools such as intelligent tutoring systems, automated feedback platforms, and natural language processing (NLP) applications, AI enables real-time diagnosis of learners' needs and supports differentiated instruction that would otherwise be difficult to achieve in large classrooms.

Language education occupies a critical position in this transformation. In multilingual societies, learners must negotiate linguistic, cultural, and cognitive demands simultaneously. AI-assisted language learning tools such as chatbots, automated writing evaluators, and speech recognition systems have been shown to enhance learner engagement, provide low-anxiety practice environments, and improve proficiency outcomes across languages (Feng et al., 2022; Wang et al., 2023). However, most empirical evidence and technological development remain concentrated in global languages, particularly English, leaving indigenous and minority languages underrepresented in AI-driven curriculum innovation.

In Nigeria, English functions as the official language of instruction, while indigenous languages such as Yoruba play a vital role in cultural transmission, identity formation, and early cognitive development. The National Policy on Education advocates bilingual proficiency through the combined use of English and the learner's mother tongue (Federal Republic of Nigeria, 2020). Despite this policy direction, classroom practice remains heavily skewed toward English, with Yoruba and other indigenous languages receiving limited instructional time, weak

curricular structuring, and minimal technological support (Adebayo & Adedokun, 2023). This imbalance has contributed to declining indigenous language competence among students, particularly at the secondary school level.

Curriculum innovation offers a strategic pathway for addressing these challenges. AI technologies provide opportunities to integrate culturally responsive pedagogy with adaptive learning systems, enabling bilingual instruction that is both globally relevant and locally grounded. For example, NLP-driven tools can facilitate bilingual interaction, automated feedback, and translanguaging practices, while learning analytics can inform curriculum adjustments based on learner performance patterns (Holmes & Tuomi, 2022; Wang et al., 2023). Nonetheless, the implementation of such innovations in sub-Saharan Africa remains uneven due to infrastructural constraints, limited teacher preparedness, and policy–practice gaps.

Ondo State presents a particularly relevant context for examining AI-driven curriculum innovation in bilingual education. Although Yoruba is the dominant indigenous language in the state, its instructional use in secondary schools is often marginalised and poorly supported compared to English. Existing curricula insufficiently reflect learners' sociolinguistic realities, resulting in reduced engagement and uneven achievement outcomes. Moreover, while global literature on AI in education is expanding, there is a notable scarcity of empirical studies focusing on AI-supported indigenous language instruction within African secondary school contexts.

Against this backdrop, this study investigates AI-driven curriculum innovation in the teaching of English and Yoruba in senior secondary schools in Ondo State, Nigeria. By combining curriculum analysis, stakeholder perceptions, and quasi-experimental evidence, the study contributes context-specific insights into how AI can support bilingual education while addressing cultural relevance, equity, and instructional effectiveness. The findings are intended to inform curriculum reform, guide policy implementation, and extend scholarly understanding of AI-enabled multilingual education in developing contexts.

The study attempted to examine AI-informed curriculum innovation for the instruction of English and Yoruba in senior secondary schools in Ondo State, Nigeria. In particular, the objectives of thisresearchwere to;

- examine the current curriculum for the instruction of English and Yoruba in senior secondary schools in Ondo State with respect to structure, content, and delivery.

- examine attitudes of teachers and students towards the use of AI-based tools and methods in teaching and learning English and Yoruba in the State:
- design an AI-based curriculum framework to enhance bilingual (English and Yoruba) education at senior secondary level in the State;
- assess the impact of AI-based learning methods on improved performance and achievement in English and Yoruba by children at senior secondary school level in the State; and
- identify challenges and opportunities for applying AI-driven curriculum innovation in a multilingual learning environment.

The following research questions were raised to guide the study:

- What is the structure of teaching English and Yoruba in senior secondary schools in Ondo State, the contents of teaching and their delivery method?
- How do teachers and students perceive the addition ofAI-based tools and strategiesinteaching and learning English and Yoruba?
- What are the key components that should involve a system of AI-inspired curriculum change to support the bilingual language teaching learning?
- To what extent do AI instructional interventions promote the knowledge of English and Yoruba in students?
- What are the challenges and the opportunities of implementing AI-based curriculum innovation in senior secondary classrooms (that are based on multilanguage)?

Moreover, according to the specific objectives of the current study, the following hypotheses were formulated and tested:

H_{01}: There is no significant difference between the English proficiency of the students taught through AI-based strategies and traditional instruction.

H_{02}: There is no significant difference between the Yoruba proficiency of the students taught using AI-based strategies and those taught with traditional instruction

H_{03}: There is no significant interaction effect of AI-driven strategies and demographic variables (gender, school type and location where students attend) on the students' English and Yoruba proficiency.

The study was significant because it explored the role of Artificial Intelligence (AI) to be used during curriculum development and instruction in teaching English and Yoruba within the senior secondary school curriculum and

how current gaps in the current teaching methods are likely to limit student engagement and language learning skills. The outcomes would be useful to the learners as they will offer them tailored and flexible learning activities that foster the development of bilingualism and equip the educators with research-supported practises of differentiated instructions and digital literacy. Its practical implication would be that the curriculum developers and policymakers would be better placed to redesign curriculum in Nigeria to address 21st-century skills and national development goals and that researchers would be able to base future research on the interaction of AI and development of the indigenous language and technology-enabling pedagogy.

2. Literature Review

2.1 Theoretical Framework

This paper is supported by four concepts that intersect with each other, and it is Construction Learning Theory, Technological Pedagogical Content Knowledge (TPACK) Framework, Diffusion of Innovation Theory and Translanguaging Theory. The combined theories are able to give a strong basis of investigating how curriculum innovation driven by artificial intelligence (AI) can revolutionise the teaching of English and Yoruba languages in senior secondary schools in Ondo State, Nigeria.

2.1.1 Constructivist Learning Theory

Constructivist Learning Theory As proposed by Piaget (1973) and Vygotsky (1978): A focus on constructive activities by learners in relation to their surrounding to construct knowledge, instead of passively receiving information. The theory emphasises the emphasis of student centred methods, participation and experiences in language learning. Adaptive language learning platforms, chatbots, and interactive translation systems are the type of AI-based tools that also tend to reduce constructivist principles of personalised feedback, real-life situations, and co-created knowledge (Sun et al., 2023). In terms of this research, constructivism promotes the inclusion of AI-centred approaches in the curriculum development, so that English and Yoruba classes become lively, culturally sensitive, and sensitive to the needs of students.

2.1.2 Technological Pedagogical Content Knowledge (TPACK) Framework.

The framework of TPACK (Mishra and Koehler, 2006) underlines that in order to teach effectively, there has to be a complex interaction of three forms of knowledge, content knowledge (CK), pedagogical knowledge (PK), and

technological knowledge (TK). Teaching in the context of AI-guided curriculum development, it is essential that not only to know what the English language or Yoruba language entails but also plan pedagogical methods that would incorporate AI resources in the learning process. The recent research has extended TPACK to encompass competencies of data-informed decision-making and the ethics of AI, emphasising the importance of teachers being critical about AI technologies and adapting them to their instructional use (Ifenthaler and Schumacher, 2024). This research paper is grounded in TPACK by exploring ways in which teachers can be empowered to incorporate AI in curriculum development to improve language teachings in the diverse classroom contexts.

2.1.3 Theory of Diffusion of Innovation

According to the Diffusion of Innovation Theory by Rogers (2003), new ideas and technologies spread in a community depending on relative advantage, compatibility, complexity, trialability and observability. Use of AI in Nigerian schools at secondary level is still in a little infancy and it is important to know what drives and suppresses innovation. This theory offers an understanding of the way that teachers, policy makers and school administrators can create an enabling environment to promote AI-industrialised curriculum change. Research suggests AI implementation in African education systems is impeded by the lack of infrastructure, readiness of teachers, and policy gaps, but these challenges can be addressed with the help of a repurposed plan and the promotion of professional growth (Afolabi and Oyelere, 2023). This theory, therefore, explains why it is important to look at the systemic factors that affect the integration of AI in schools in Ondo State.

2.1.4 Translanguaging Theory

Translanguaging Theory maintains that bilingual learners rely on the whole linguistic system in constructing meaning in order to break the strong divide between languages in classrooms(García and Li Wei, 2014). In the case of a study that examines English/Yoruba teaching, translanguaging offers a culturally sensitive basis of AI-based curriculum development. Fluid language practises can be encouraged through AI-based applications (including bilingual chatbots, natural language processing systems, and speech recognition applications), which provide support to code-switching, translation, and contextualised learning (Almutairi and Lee, 2022). This theory makes sure that AI creativities do not merely depend on technological advancement, but also on their cultural

foundation so that learners can use the linguistic identities inherent in their Yoruba community to harness the capabilities of acquiring English proficiency.

2.1.5 Synthesis of Theories

A combination of these theories is what offers this study a grand framework. Constructivism stresses on learning, TPACK on teacher knowledge integration, Diffusion of Innovation describes systemic patterns of adoption and Translanguaging stresses linguistic inclusivity. They are both in favour of the exploration of AI-fueled curriculum change in English and Yoruba secondary school learning in Ondo State, Nigeria, so that this research can cover pedagogical, technological, cultural, and systemic aspects of academic reform.

2.2 Conceptual Review

2.2.1 Artificial Intelligence as Education.

The concept of artificial intelligence (AI) has emerged as a model of radical change in the educational field, transforming the way the curriculum is formed, the way learning takes place, and the way the process of assessment is conducted in various learning settings. The use of AI tools, including adaptive learning platforms, intelligent tutoring systems, and natural language processing (NLP) applications, is becoming more widespread to support teaching and learning, both globally (Holmes and Tuomi, 2022; UNESCO, 2023). Within the language learning domain, AI-based systems can be used to support automatic scoring of essays, correct grammar, vocabulary development, and pronunciation feedback, thereby enhancing the limits of the teachers and offering real-time assistance to students (Chen et al., 2023). In addition to personalising the instruction process and spotting the at-risk learners in their early stages, AI-powered analytics enable the educator to monitor the learner engagement and performance, which makes it easier to use the information (Luckin et al., 2023).

AI can also be a strong solution to the gaps in education in Nigeria, where the teacher-student ratio is frequently high, and the resources are limited. The quality of its delivery of scalable and differentiated learning experiences is vital in multilingual classrooms where students usually have different degrees of mastery of the English language and native languages such as Yoruba. Nevertheless, to be adopted successfully, teacher training, digital infrastructure, and policies to tackle ethical issues, including the privacy of data, algorithm bias, and fair access are needed (UNESCO, 2023; Inegbedion and Ojo, 2024).

2.2.2. Curriculum Innovation in the Nigerian Secondary Schools.

The National Policy on Education informs curriculum innovation in Nigeria, focusing on functional literacy and bilingual proficiency and utilising technology in education and learning processes (Federal Ministry of Education, 2023). In spite of these dreams, numerous schools are facing old-fashioned curricula, shortage of teaching and learning resources, and inadequate training of teachers, and achievement disparities persist (Ogunyemi & Lawal, 2024). AI-based solutions promise to revolutionize the way in which teaching is conducted by introducing customized learning journeys and automated evaluations, as well as providing greater access to online materials (Okeke et al., 2023).

The transition to more student-centered and competency-based models of learning is also facilitated by the use of the AI application that enables tracking of the strengths and weaknesses of learners in real-time. AI-generated data can be used by curriculum designers to revise syllabi and modify their instructional speed and development of inclusive content that takes into account the cultural and linguistic backgrounds of learners (Akinbode & Fajobi, 2023). These innovations are paramount in a system where language teaching will be an important part of the literacy growth and in general capability of the students. Implementing AI into curriculum innovation is not only a way to align Nigeria with the Sustainable Development Goal 4 (quality education) but also makes the education system competitive on the international level.

2.2.3 Bilingual and Multilingual Education.

The linguistic diversity of Nigeria, as it has more than 500 indigenous languages, underscores the need to ensure that the country has bilingual education and multilingual education as a way of enhancing literacy, preserving its culture, and uniting the nation (Egunjobi, 2024). English is the language of instruction in most cases, and Yoruba and other indigenous languages are subject languages. Nevertheless, studies show that a large number of students cannot develop high proficiency in English and their native language because of not always using language policies, lack of training of teachers, and insufficient resources to learn the indigenous language (Ogunmodede, 2023).

These gaps can be bridged with the help of AI-driven solutions that can offer multilingual translation services, digital content creation, and speech recognition tools that can assist learners in comprehending both languages (Oladosu & Adebayo, 2024). Bilingual education with the help of AI also promotes translanguaging, in which students are able to use their full linguistic repertoire to learn successfully. The method is especially useful when it comes to

Yoruba-speaking students in secondary schools, as they can gain high levels of literacy while preserving their cultural identity. Addressing the language barriers, AI-based bilingual education is consistent with the world trends in inclusive education and makes Nigerian students ready to work in a globalized environment.

2.2.4. The Action of AI in Culturally Responsive Pedagogy

Culturally responsible pedagogy focuses on how cultural identities, values and languages of learners are incorporated into teaching. This strategy promotes student involvement and academic success in multilingual communities such as Nigeria (Gay, 2018; Adeyemi & Fajobi, 2023). AI has the opportunity to intensify the idea of culturally responsive teaching to create localized content, individualize learning resources by norms of different cultures, and personalize instruction with the help of algorithms, depending on the backgrounds and needs of students (Luckin et al., 2023). As an example, AI-based solutions can provide reading resources in Yoruba and English, create culturally sensitive examples, and create language-aware assessments.

This correspondence between AI and culturally responsive pedagogy provides a fair chance to all learners, especially the representatives of the marginalized language groups. Besides, AI technologies may facilitate the professional growth of teachers by examining classroom dynamics and proposing inclusive pedagogical techniques. With AI implemented into culturally responsive systems, schools can correct inequalities in access and performance, so that education innovation can support all students, irrespective of their socio-economic and language background (UNESCO, 2023; Oladosu & Adebayo, 2024).

2.3. Empirical Review

The use of artificial intelligence (AI) in education has seen a substantial increase in the last ten years, as researchers have examined the potential of artificial intelligence to alter the process of teaching, learning, and curriculum delivery. The latest research regularly underlines the opportunities of AI to assist in individualized learning, automate grading, and help students become more engaged in bi- or multilingual contexts. Li et al. (2023), as an example study, hypothesized that AI-driven adaptive learning tools can have an effect in secondary schools in China and discovered that the integration of AI-powered adaptive learning tools caused better language proficiency and self-directed learning in students. On the same note, Zawacki-Richter et al. (2022) asserted that

AI-based systems not only offer real-time feedback but also help teachers to create inclusive curricula that tend to meet the needs of learners.

In Africa, studies are also coming out on AI-based education innovations. Oladejo and Adeyemi (2024) studied the use of AI-assisted reading aids in Nigerian junior secondary schools and found that reading fluency and vocabulary growth in students who had been exposed to AI-powered reading practice aids were significantly higher than in those who had been trained using traditional methods. This observation shows how AI tools can help address the issue of literacy, especially in low-resource settings.

Moreover, the multilingual education studies emphasize the importance of AI in promoting the use of mother tongues in addition to the global languages. Oyeniran and Fagbohun (2023) researched the applicability of AI-based translanguaging technology in Yoruba-English bilingual classrooms in Lagos and found that comprehension and engagement among the learners were improved through the application of AI-based translation and speech recognition applications. According to their study, AI is able to assist culturally responsive pedagogy and solidify language equity. In the same vein, Adegbite and Balogun (2022) highlighted that AI applications such as ChatGPT and other large language models can be adapted to language promotion to encourage the teaching of indigenous languages in Nigerian schools and thus make bilingual education practices richer.

In addition to Nigeria, Huang and Chang (2023) studied AI chatbots in Taiwan, investigating how they enhanced writing fluency, accuracy, and confidence in high school students. Their results show that AI innovations do not only support traditional teaching, but also boost creativity and motivation. This is evidenced by such evidence globally that AI tools can be tailored to fit different linguistic and cultural settings such as the bilingual classrooms of Nigeria.

Nonetheless, certain empirical indicators point at implementation issues. In a study by Yusuf et al. (2024), the researchers found that even with the awareness of AI and the potential it can offer, there are infrastructural constraints, gaps in teacher training, and poor alignment of policies in most schools in Nigeria, which impede the use of AI in curriculum delivery. Likewise, Ojo and Ibrahim (2022) observed that digital literacy is an important challenge to both educators and learners, which restricts the expansion of AI-based curriculum innovations. These results highlight the necessity of specific interventions and planning the implementation of AI in bilingual education.

Although existing empirical studies consistently report positive effects of AI-supported instruction on learner engagement and language proficiency, several

limitations are evident across the literature. First, many studies prioritise dominant global languages, particularly English and Mandarin, thereby offering limited insights into the pedagogical and technological requirements of indigenous language instruction (Zawacki-Richter et al., 2022; Huang & Chang, 2023). Second, African-based studies, while emerging, often focus on tool adoption rather than curriculum-level integration, leaving questions about sustainability and alignment with national education policies insufficiently addressed (Yusuf et al., 2024). Third, few studies adopt mixed-method designs capable of capturing both learning outcomes and contextual classroom realities, particularly in bilingual secondary school settings.

Consequently, there remains a critical gap in understanding how AI-driven curriculum innovation can be systematically designed, implemented, and evaluated for bilingual instruction involving English and indigenous languages such as Yoruba. This study addresses this gap by moving beyond tool effectiveness to examine curriculum structure, stakeholder perceptions, learning outcomes, and implementation constraints within a single coherent framework.

2.4. Appraisal of Literature

The analysed literature shows that despite the fact that AI-based tools have a tremendous potential to transform the language teaching process and the process of curriculum design, local research should be conducted to investigate their effectiveness within the context of the Ondo State bilingual classrooms. There have been a slim number of studies that dealt specifically with developing AI-based curriculum in teaching English and Yoruba at the high school level, which globally has shown a significant research gap that this study would fill.

3. Methodology

3.1. Research Design

The research design used in this study was a mixed-method design because it utilized both qualitative and quantitative methods to come up with a holistic perspective of AI-based curriculum innovation to teach English and Yoruba in senior secondary schools in Ondo State, Nigeria. The population of this research included all the learners and teachers in English and Yoruba classes in Ondo State who attended senior secondary schools. The students of senior secondary schools were of different socio-economic, gender and types of schools and the teachers were both English and Yoruba language teachers with different experience in teaching. One hundred and twenty (120) students in senior secondary school one

(SS1) were selected purposely in four state-owned senior secondary schools to cover both rural and urban environments.

The schools provided thirty students each and were randomly divided into two groups. Group A was provided with English instruction enabled by AI-driven tools, like Grammarly, ChatGPT, and Quillbot, and Group B was provided with Yoruba instruction by YorubaBERT, Duolingo Yoruba, and Yoruba language chatbots. Purposive sampling was employed to select the teachers who participated in the study according to their experience level and their desire to implement AI-directed instructional practices. Sampling strategy made the qualitative and quantitative data representative of the various linguistic, cultural, and instructional conditions in the State.

3.2. Research Instruments

Several data collection tools were used to ensure that the objectives of the study were met. Document review guides were used to analyse the curriculum based on review guides that were used to assess the structure, content, and methods of delivery. Questionnaires and semi-structured interviews were used to gather data in the form of teacher and student perceptions that were validated by language educators and educational technologies specialists. The pre-test and post-test instruments were used to measure the success of the students in English and Yoruba, whereby they were developed according to the official curriculum and in relation to what they had been taught through AI-based instructional methods. Moreover, students kept their interaction with the AI tools as engagement logs that were prepared each week. These tools guaranteed triangulation and increased the trustworthiness and validity of the research results.

The content validity was determined by three language education experts and two educational technology experts, who analyzed the instruments regarding their relevance, clarity, and adherence to the research objective and questions. The reliability and clarity of the instruments were tested with 20 students in a non-participating school (pilot study). The Cronbach alpha was used to determine the internal consistency of the achievement tests, and it obtained a coefficient of 0.84 and 0.81 in English and Yoruba, respectively, which signifies high reliability. The questionnaires and interview guides were also developed relative to the pilot feedback to guarantee the proper measurement of the teacher and student perception of AI-driven teaching strategies.

3.3. Threats to Internal Validity

While the findings of this study demonstrate significant gains in English and Yoruba proficiency following AI-based instructional interventions, certain threats to internal validity must be acknowledged. One potential threat is the novelty effect, whereby students' increased motivation and engagement may be partly attributable to the introduction of new technologies rather than the instructional efficacy of AI itself. This possibility is particularly relevant given the limited prior exposure of participants to AI tools in classroom settings. A second concern relates to teacher-mediated variability. Although participating teachers received orientation on the use of AI tools, differences in technological confidence and pedagogical skill may have influenced instructional delivery across schools. Such variability could have affected student outcomes independently of the AI tools employed. Additionally, selection and maturation effects cannot be entirely ruled out, as the study focused on SS1 students who are at a developmental stage characterised by rapid cognitive and linguistic growth. Although the pre-test–post-test design mitigates this concern to some extent, future studies employing randomized controlled trials and longer intervention periods would strengthen causal claims. Recognising these limitations enhances the interpretive rigour of the findings and underscores the need for cautious generalisation, while still affirming the observed positive contribution of AI-driven curriculum innovation.

3.4. *Data Collection and Analysis*

The period of data collection was six weeks. First, the review of curriculum documents was performed, and the interview of the teachers was carried out to examine the current performance and the perceptions. This was followed by pre-tests of all the students who participated in this study to establish baseline proficiency in English and Yoruba. During the period of four weeks, AI-based instructional plans were introduced, whereby Group A was taught English using AI tools and Group B was also taught Yoruba using AI tools. The AI tools were incorporated by the teachers into the normal delivery of lessons and student interaction on weekly reports. Post-tests were taken at the end of the intervention and focus group interviews with students were carried out to get qualitative information on their learning experiences, engagement, and perceived difficulties.Paired-sample t-tests were used to analyze quantitative data of pre-tests and post-tests to find out the significance of learning gains in English and Yoruba. Mean scores, SDs and effect sizes were determined to present a thorough description of the effect of AI-based instruction strategies on student proficiency, which directly answered hypothesis H_{01} andH_{02}. Also, two-way ANOVA was used

to identify the interaction effect of AI-based instructional strategies and demographic factors (gender, school type, and location) on the performance of students, which was related to hypothesis H_{03}. Thematic analysis of qualitative data pertaining to questionnaires, interviews, and engagement logs were broken down into patterns that were based on the perceptions, challenges, and opportunities of students and teachers related to AI-driven tool integration. The results were compiled to give a comprehensive picture of both the quantitative and the qualitative findings, with the results being fully consistent with the objectives and the research questions developed in the study.

4. Results and Discussion

4.1 Results

This chapter reports the research on AI-based curriculum innovation in teaching English and Yoruba in senior secondary schools in the Ondo State, Nigeria. The findings are also formulated in such a way as to respond to the five specific objectives and research questions presented in Chapter One. Quantitative and qualitative data is being analyzed and statistical tests, descriptive analysis, and thematic insights are incorporated. All the findings adhere to the research hypothesis and are documented in a clear narrative with the help of tables.

Q1: What is the structure of teaching English and Yoruba in senior secondary schools in Ondo State, the contents of teaching and their delivery method?

In answering this research question generated for the study, the research examined the design, content and means of teaching the present curriculum in English and Yoruba in senior secondary. An analysis of documents and interviews with teachers showed that the English curriculum documents were more comprehensive and structured with grammar, reading comprehension, writing, and oral skills, whereas the Yoruba curriculum instructions were rather limited and oriented on reading and cultural texts. It was observed that English teaching was more content-oriented, and Yoruba teaching did not have an assessment standard in many instances. The teachers cited that their teaching curricula were adversely impacted by class sizes, inadequate teaching aids, and a lack of technology application.

The current English curriculum is extensive, but there are numerous challenges in the implementation process, including the large sizes of the classes and irregular evaluation. The Yoruba curriculum documents are not very

meticulous and systematic, which is the area where technological and pedagogical improvement is needed.

Q2: How do teachers and students perceive the addition ofAI-based tools and strategiesinteaching and learning English and Yoruba?

Perceptions were measured using quantitative survey data and qualitative interviews. Table1 shows the descriptive statistics of teacher and student survey regarding integration of AI.

Table .1.

Understandings of AI Use in English and Yoruba Teaching

Respondent Group	Mean	SD	Interpretation
Teachers (English)	4.25	0.52	Positive
Teachers (Yoruba)	3.78	0.68	Moderately Positive
Students (English)	4.3	0.49	Positive
Students (Yoruba)	3.91	0.61	Positive

Note: The ratios were given on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

Themes of enthusiasm, perceived ease of learning and cultural relevance were found in qualitative analysis of interview transcripts. Educators were optimistic that AI tools can improve the engagement, and students cited instant feedback and interactive material as the significant advantages. Nevertheless, issues on internet connectivity and availability of devices rose.

Teachers and students expressed positive views of AI-based instruction, although more positively about English than Yoruba, because of the sophistication of the tool. The barriers were observed to be the challenges in infrastructure and technological literacy.

Q3: What are the key components that should involve a system of AI-inspired curriculum change to support bilingual language teaching and learning?

The framework of AI-based curriculum innovation was guided by data regarding teacher workshop data, student feedback, and data analysis using documents. The model highlights five elements, including the integration of AI tools (Grammarly and ChatGPT in case of English; YorubaBERT and Duolingo Yoruba in case of Yoruba) according to learning goals; culturally responsive material (Yoruba folktales and proverbs to solidify identity and bilingual

competence) to support the use of AI; assessment modules facilitated by AI that will offer immediate feedback, progress tracking, and custom advice; teacher training to develop AI pedagogy capacity; and infrastructure support based on the availability of adequate devices and an uninter

Qualitative feedback revealed that it is crucial to integrate cultural context and adaptive AI functionality into the process of curriculum design to make it more engaging and to conserve cultural identity without neglecting the role of bilingual instruction. The suggested framework is a combination of AI-based strategies and cultural and contextual importance, where accessibility, teacher capacity building, and content relevance are presented as the pillars of sustainable curriculum innovation.

Q4: To what extent do AI instructions
Do interventions promote the knowledge of English and Yoruba in students?

- **Quantitative Analysis and Hypotheses Test**

The effect of AI-based teaching on the students' mastery of both English and Yoruba was measured by the pre-test score and the post-test score. To test the following hypotheses, paired-sample t -t-tests were employed:

H_{01}: There is no significant difference between the English proficiency of the students taught through AI-based strategies and traditional instruction.

H_{02}: There is no significant difference between the Yoruba proficiency of the students taught using AI-based strategies and those taught with traditional instruction

H_{03}: There is no significant interaction effect of AI-driven strategies and demographic variables (gender, school type, and location where students attend) on the students' English and Yoruba proficiency.

- **Paired-Sample t-Test Results**

Table 2.

Scores of Student Proficiency Paired-Sample t –test

Language	***Pre-test Mean***	***Post-test Mean***	***Mean Difference***	***t-value***	***p-value***
English	48.6	72.1	23.5	18.65	< 0.001*
Yoruba	46.2	63.4	17.2	13.72	< 0.001*

p=.05; significant

The findings indicated that the two languages have greatly improved, and the learners of the English language have higher mean gains. It is an indication of the relative maturity and strength of the tools of AI that exist in English in comparison with those that exist in Yoruba.

- **Qualitative Corroboration**

The qualitative findings supported the quantitative findings. According to reports from students and teachers, the students' writing, reading, and comprehension abilities were enhanced, and engagement and motivation increased among the teachers. Culturally relevant content within AI applications brought specific value to Yoruba learners, in particular, which improved the sense of affiliation towards language learning.

- **Hypothesis Decisions**

$H_{01}$is rejected: English learners who were taught using AI-driven strategies had significantly higher results in comparison to their baseline scores.

H_{02} is rejected: Yoruba learners also experienced a significant improvement compared to the pre-tests.

H_{03} is partially rejected: The results of ANOVA (not presented here due to brevity) showed that demographic variables like school type and location produced only minor but not significantly important effects on the gains of proficiency, and neither gender nor gender in combination with AI-led instruction showed any significant effects.

AI-based teaching methods improved student competence on English and Yoruba, but the positive effects were stronger in English when the groups studied English rather than Yoruba. Relevance to culture was seen as a determining factor to successful Yoruba teaching. These results prove the success of the intervention and help to implement AI in the curriculum designs of bilingual education.

Q5: What are the challenges and the opportunities of implementing AI-based curriculum innovation in senior secondary classrooms (that are based on multilanguage)?

The paper established major obstacles and opportunities that shape the application of AI-driven curriculum innovation. The first obstacles were the lack of ICT infrastructure, the lack of teacher training, and unreliable internet connectivity. On the other hand, new opportunities were found in such domains as

the increased engagement of students, individualized learning, building digital literacy, and the possibility of scalable bilingual education.

Table .3.

Thematic Analysis of Opportunities and Barriers

Theme	***Barriers***	***Opportunities***
Infrastructure	Limited devices, poor internet	Investment potential in school ICT
Teacher Capacity	Low AI literacy	Yoruba AI tools are underdeveloped
Student Engagement	Unequal access	Personalized and adaptive learning
Content	Yoruba AI tools are underdeveloped	Cultural integration enhances learning

Although the poor infrastructure, lack of teacher readiness, and the unavailable Yoruba AI tools are still noteworthy barriers, the results indicate great opportunities. Curriculum innovation that is AI-driven can encourage student engagement, individualised learning, digital literacy, and culturally responsive bilingual education.

4.2 . Discussion

4.2.1 Existing Curriculum Structure, Content, and Delivery

The research obtained substantial differences between the English and Yoruba curricula. English lessons were more content-filled, interactive, and sometimes included technology, whilst Yoruba lessons were teacher-led and based mostly on rote learning. These results correspond to the previous studies that show that native languages in Nigeria tend to be less focused on the content depth and innovative methods of learning (Ajayi, 2019; Oladunjoye and Adegbite, 2020). The case of inadequate use of technology in teaching Yoruba supports the infrastructural and resource disparities, which substantiate the fact that UNESCO (2022) reviewed that indigenous language education tends to be less digital. The results highlight the importance of innovative curriculum development in order to provide equitable high-quality access to bilingual education.

4.2.2 The Perception of AI Integration by Teachers and Students

The students and teachers positively viewed AI tools. Students also claimed more engagement and motivation with lessons that were interactive and provided instant feedback, which is in line with Luckin et al. (2016) and Olowo and Afolabi (2022). The teachers were moderately receptive, but emphasized the need to develop professionally in order to integrate AI effectively to teach the Yoruba language. The qualitative results placed emphasis on AI contextualized content. The importance of local proverbs, folk tales, and exercises that are sensitive to tones, as Yoruba learners are attracted to the culturally relevant pedagogy advocated by Salawu (2021). Such findings prove that AI applications should take into account the peculiarities of the local language and cultural context in order to be effective.

4.2.3 AI-Curriculum Innovation Framework

The suggested framework will incorporate the use of AI into English and Yoruba instruction, focused on interactive and student-centered learning and teacher professionalization. This is in line with constructivist and experiential learning principles, which support active learning on the part of the learner, scaffolding, and contextualized learning (Kolb, 1984; Vygotsky, 1978).

The framework addresses the research gap on important elements of AI-driven bilingual curriculum design to answer research question three. The structure balances bilingual instruction by adding culturally relevant material to the Yoruba population or technology-advanced resources to the English population to support inclusive education (Akinrinade and Salawu, 2022).

4.2.4 The efficacy of AI-Based Instruction

Quantitative measures revealed that English and Yoruba proficiency improved significantly in the group exposed to AI-driven instructional measures, so the rejection of H_{01} and H_{02} was confirmed. English learners had better gains, probably because the AI tools on English are more mature and advanced, as with Brown et al. (2020).

The qualitative information indicated that students enjoyed instant feedback, interactive games, and customised learning paths. Motivated, the Yoruba learners were constrained by their developing AI tools, which failed to capture tones and interactive richness. These results correspond to those of Adebara and Abdul-Mageed (2022), who state the importance of the further development of indigenous language AI.

The partial rejection of H_{03} showed that there are few interaction effects of

demographic variables, implying that AI-oriented policies are universal in their application (between gender, school type, and location) but may be moderated by disparities in infrastructures.

4.2.5 Barriers and Opportunities of Implementation

The challenges identified, particularly inadequate infrastructure, limited teacher preparedness, and underdeveloped Yoruba-language AI tools, should not be viewed merely as logistical constraints but as structural issues embedded within broader policy and funding frameworks. Without deliberate investment in indigenous language technologies, AI risks reinforcing existing linguistic hierarchies rather than promoting equity. Conversely, the opportunities presented by AI extend beyond improved engagement and achievement; they include the potential for long-term language revitalisation, curriculum localisation, and the repositioning of indigenous languages within formal education systems. Harnessing these opportunities requires coordinated policy action, sustained professional development, and collaboration between educators, linguists, and AI developers.

5. Conclusion and Recommendations.

This paper has analysed AI-based curriculum development in bilingual education in senior secondary schools of Ondo State in Nigeria. It was found that although the English instructional system is rather developed and has the help of mature AI tools, Yoruba needs specific innovations in terms of depth and integration of technologies. Teachers and students had affirmative views about AI, pointing to its ability to engage, personalize, and be culturally relevant. A model was created to help direct implementation, focusing on AI tools, culturally responsive content, adaptive assessments, professional development by teachers, and infrastructure support. The experiment confirmed the substantial increases in proficiency in both English and Yoruba and better results in English. These issues include: poor ICT infrastructures, poor teacher training, and poor indigenous AI tools and barriers continue to exist; however, the prospects of engagement, digital literacy, and cultural preservation are immense. All in all, AI is a promising avenue to match international technological development with the multilingual education interests of Nigeria. Based on the findings of this study, the following recommendations are made:

- Invest in the ICT infrastructure through decent internet coverage and provision of sufficient digital devices to schools.

- Empower teacher growth through ongoing education in AI pedagogy and curriculum implementation.
- Create native AI-based applications that use Yoruba as well as other Nigerian languages to make them culturally and linguistically relevant.
- Make AI apps culturally responsive (e.g., use folktales, proverbs, oral traditions) to make them more engaging and identity-forming.
- Enhance fairness of access by creating inclusive AI solutions that lessen differences between school types, schools, and socioeconomic lines.
- Foster governmental policy backing and collaborations with EdTech firms and international agencies to continue to be innovative and scalable.

6. Limitation to the Study

No matter how much this study has helped, some limitations are to be mentioned. First, a quasi-experimental design was used in the study and this restricts complete randomisation and can develop selection biasness. Second, six weeks might be insufficient to enthusiasm the long-term learning results and lasting effects of AI-inspired curriculum innovation. Third, mismatched maturity and access to the AI tools used in English over those used in Yoruba could have contributed to the extent of learning difference between the two languages. Moreover, infrastructure issues like the poor analysis of the internet connection and the insufficient availability of digital gadgets could have influenced the regularity of the use of AI tools. Such constraints imply that one should take the findings with caution especially when making a generalisation outside the study context.

7. Future Research Suggestions

The proposed study must be conducted using longitudinal designs to consider the long-term impacts of AI-based curriculum innovation on bilingual language growth in the long term. More research has the potential to broaden the research to encompass other native languages of Nigerians so as to bolster comparative knowledge on the AI-mediated multilingual education. There is also a need to conduct a research on how AI can be policy-level integrated in national curriculum frameworks and teacher education programmes. Also, further literature must explore the ethical implications of AI, including algorithm bias, information security, and fair usage of AI in education less developed settings.

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Authors' Contribution

Olagoke R. O. and Akande I. D. jointly conceptualised the study and contributed to the design of the methodology. Olagoke R. O. supervised the research process, while Akande I. D. led the literature review and data collection. Both authors contributed to drafting the manuscript and reviewing the final version for submission.

Disclaimer status on the use of Generative AI

The authors ensured that the entire research, analysis and conclusions in this manuscript belong to them. The idea, interpretations and findings were not developed with the help of generative AI tools, only wording suggestiongs were taken out and consulted very slightly. This piece of work indicates the autonomous scholarship and critically important thinking of the authors.

Declaration of conflicting interest

The authors declared no conflicts of interest with respect to the research, authorship, and/or publication of the article.

Ethical approval

Ethical approval for this study was obtained from the appropriate academic review committee. Permission was also secured from the participating schools.

Informed consent

Informed consent was obtained from the students' parents/guardians and assent was received from the students themselves prior to participation.