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Design, Validation, and Effectiveness of an Offline Mobile Digital Learning Model for Enhancing Early Grade Reading and Literacy Skills among Out-of-School Children in Bauchi State

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ABSTRACT
This proposed study focuses on the development of an offline remote learning package designed to address the persistent challenge of out-of-school children in Bauchi State, Nigeria. Bauchi State is estimated to have over 1.37 million out-of-school children, largely due to socio-economic hardship, inadequate educational infrastructure, cultural practices, and limited access to digital connectivity, particularly in rural communities. These conditions make conventional online learning approaches unsuitable for the target population and necessitate alternative, context-appropriate solutions. The main objective of the study is to design, validate, and evaluate an offline remote learning package that responds directly to the educational needs of out-of-school children in Bauchi State. The proposed intervention aligns with national education priorities and global commitments to inclusive and equitable education, particularly the goal of ensuring access to quality basic education for all children. The research is structured into two phases. The first phase involves the development of the learning package using the CommCare application, which allows educational content to be delivered without internet access. Locally relevant early grade reading materials will be developed through collaboration with education specialists and informed by a comprehensive mapping of out-of-school children in the state. The second phase evaluates the effectiveness of the package using a quasi-experimental design involving 360 children aged six to twelve years, divided into experimental and control groups. Learning outcomes will be assessed through pre-test and post-test measures of early grade reading skills. Data will be analysed using descriptive and inferential statistics. The study aims to improve short-term access to quality education and to propose a scalable, sustainable model for wider application. A clear research gap exists in the limited availability of empirically tested offline learning interventions tailored to out-of-school children in low-resource settings.

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INTRODUCTION

Education is a fundamental driver of national development, and its importance cannot be overstated. Globally, the educational sector has faced unprecedented challenges, especially during and post-COVID-19 pandemic, which left over 1.37 billion students out of school by March 2020 (UNESCO, 2020a, 2020b). The aftermath

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issues such as rising Out-Of-School Children (OOSC), dropout rates, social isolation, unaccredited home learning, and heightened pressure on schools from authorities emerged as significant challenges to the global education system (Ali, 2020; Ochor, 2024).

Interestingly, the most recent data from the United Nations Educational, Scientific and Cultural Organisation indicates that an estimated 244 million children and youth aged between six and eighteen years were out of school, of which 118.5 million were girls and 125.5 million were boys, with sub-Saharan Africa alone accounting for approximately 98 million and 20 million from Nigeria, of these out-of-school children, thereby, making this region the largest contributor to the global figure and highlighting a persistent challenge in education access in low-income contexts (UNESCO, 2024). Other reports also note that progress in reducing global out-of-school numbers has been slow over the last decade, despite longstanding international development goals to expand access to education (UNESCO, 2024). Within sub-Saharan Africa, structural barriers such as poverty, gender inequality, and insufficient education financing contribute significantly to the high prevalence of out-of-school children.

In the Nigerian context, the United Nations Children's Fund reported that approximately 18.3 million children were out of school in 2024, comprising about 10.2 million primary school-age children and 8.1 million at the junior secondary level, positioning Nigeria among the countries with the highest out-of-school populations globally (United Nations Children's Fund, 2024). In Bauchi State, various reports suggest that the state historically had approximately 1.37 million out-of-school children, placing it among the highest within Nigeria, although efforts by the state government and partners have reportedly reduced this figure to around 521,000 as part of targeted mobilisation and education sector interventions (Owolabi, 2024; Usman, & Emmanuel, 2025). These figures demonstrate the scale of educational exclusion at national and sub-national levels and the ongoing efforts to address barriers to schooling. This situation demonstrated the unsustainability of conventional classroom-based education to cater for OOSC during and after the COVID-19 pandemic in Nigeria and other parts of the world.

The OOSC are the marginalised and vulnerable children who are not attending formal education due to several reasons ranging from natural causes to human-related factors. Consequently, Nigeria has over 11 million OOSC between the ages of 6 and 15, representing the largest number of OOSC globally (UNICEF, 2024; Ogwo, 2022). The negative impact was even more severe, particularly in Bauchi State, which recorded 1.37 million OOSC, the highest in the country according to the Ministry of Education's 2022 report (Owolabi, 2024; Usman, & Emmanuel, 2025).

The menace of the OOSC crisis stems from poverty, conflicts, natural disasters, socio-economic challenges, cultural norms, and inadequate educational infrastructure (Verlumun et al., 2024; Ochor, 2024). This crisis presents major barriers to the country's socio-economic development, Nigeria's education challenges that undermine both the United Nations' Sustainable Development Goal 4 (SDG-4), aiming for inclusive, equitable, and quality education, and the country's Medium-Term National Development Plan (Nigeria-MTNP, 2021-2025), which prioritizes improved access to quality education for all children. This calls for the need to carry the OOSC along while considering their educational needs and skills to meet the national and international goals of inclusive, equitable, and quality education for every child.

The OOSC need literacy skills, including arithmetic skills, phonological skills, letter knowledge, oral comprehension, and vocabulary to meet up with the UN SDG-4 and the country's Medium-Term National Development Plan (Nigeria-MTNP, 2021-2025), which both focused on inclusive, equitable, and quality education for all citizens. These skills are essential for their development and future opportunities through the use of modern remote learning tools. These remote learning tools include online tools like Google Classroom, and Zoom or offline tools such as interactive radio instruction (IRI) which was

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found to significantly improve the literacy skills of OOSC compared to traditional face-to-face learning environments (Verlumun et al., 2024). It can also be a full local content offline learning package as proposed by Saidu, Dahiru, Aliyu, Abubakar, and Jaja (2021) as adopted in the current study.

While many regions worldwide turned to online remote learning as an emergency solution during the pandemic (Asanov et al., 2020) and after the pandemic, the limitations of this online approach became evident in areas with inadequate internet access and technological infrastructure in developing countries like Nigeria. Bauchi State's limited internet connectivity, particularly in public primary schools, exacerbates the challenges faced by lower-level educational institutions, which often lack trained staff and digital resources, rendering online learning largely ineffective (Abubakar et al., 2024; Saidu et al., 2021).

Consequently, alternative offline remote learning packages that do not rely on internet access are necessary to bridge the educational gap for vulnerable OOSC populations. This is in line with the limited internet connectivity and resource deficits in Bauchi State's public primary schools that hinder online learning, especially in lower-level institutions and that warrants the need to develop an offline remote learning package that suits the local need for the OOSC. In contrast to prior studies, which have focused primarily on online solutions during the pandemic (Lemmetty, 2024; Prasad, Singh, & Srinivas, 2024), this research highlights the need for offline remote learning packages in the post-pandemic era in Nigeria.

The offline intervention will address the critical gaps in digital access and help mitigate educational inequities across different socio-economic groups in the state and beyond. This study also seeks to fill the gap in the literature regarding the development, validation, and testing of instructional packages that do not rely on internet infrastructure as suggested by prior researchers (Abubakar et al., 2024; Saidu et al., 2021). With Nigeria's developmental needs hinging on educating its young population, addressing the learning needs of marginalized OOSC is essential to ensuring long-term economic growth, social stability, and the reduction of poverty.

The justification for this research further lies in the need to bridge the educational gap for OOSC, a population that risks being left behind as digital solutions are prioritized without considering offline digital alternatives. This research aims to develop and evaluate an offline remote learning package personalized to the needs of OOSC in Bauchi State. Unlike the previous online methods that depended on digital devices and internet connections (Alade, 2020; Skog, Pettersson, & From, 2024), this offline solution seeks to provide equitable access to learning by utilising local content tools that do not require constant connectivity.

This study will create a sustainable educational solution that is accessible to marginalized communities, which aligns with the UN SDG-4 and the country's Medium-Term National Development Plan (Nigeria-MTNP, 2021-2025), which both focuses on inclusive, equitable, and quality education for all citizens of Nigeria, both the adult and the young pupils. Ultimately, this study proposes a unique conceptual framework for developing, validating, and testing the effectiveness of offline remote learning packages on OOSC educational achievements in Early Grade Reading (EGR) in Bauchi state and will serve as a model for similar interventions across other states with limited digital infrastructure for enhanced education access for OOSC.

STATEMENT OF THE PROBLEM

The case of OOSC at the lower educational levels in Nigeria and around the world is becoming a critical issue for the government, parents and other educational stakeholders in the country. The Nigerian government recognizes the issue and has plans to address it, but the problem persists, indicating challenges in implementation and resource allocation. Similarly, Verlumun et al. (2024) noted that Nigeria is still struggling to address the lingering problem of OOSC. For instance, Agwam (2024) reported that Nigeria now

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has 18.3 million OOSC, the highest number globally. UNICEF (2024) further reported that 26% of primary school-aged children and 25% of lower secondary school-aged children are out of school, with 3 out of 4 children aged 7–14 years not being able to read a simple sentence, understand a passage or solve simple math problems.

In Bauchi state specifically, the concern is a little bit worse. As evidence, according to the Ministry of Education's 2022 records, Bauchi State has the highest number of OOSCs in Nigeria, totalling 1,239,759 (Ogwo, 2022). This has led Nigeria to account for one in every five OOSC globally. Yet statistics indicate that the Nigerian government allocates only 2.4% of its GDP to both health and education (Ogwo, 2022; UNICEF, 2024), despite the worrisome records and reports of OOSC in the country. These existing challenges are obstructing the United Nations Sustainable Development Goal 4 (SDG-4), which focuses on achieving inclusive, equitable, and quality education for all children while promoting lifelong learning opportunities. Specifically, SDG-4 aims to ensure that by 2030, all girls and boys complete free, equitable, and quality primary and secondary education, leading to relevant and effective learning outcomes (United Nations, 2024). Moreover, in Nigeria, these challenges also hinder the country's Medium-Term National Development Plan (Nigeria-MTNP) for 2021-2025, which emphasizes improving access to quality education.

To address the mentioned issues at stake, Nigeria needs innovative educational solutions to enhance learning outcomes for its citizens. This includes increasing access to early childhood education, reducing out-of-school rates, and promoting gender equality in education (Federal Government of Nigeria, 2021) through remote learning (Abubakar et al., 2024; Safi, Wenzel & Lee-Anne, 2020). Unfortunately, the lack of preparedness and infrastructure for remote learning in Nigeria further exacerbated the situation. While some few private institutions managed to implement online remoted learning at the tertiary institutions level, public institutions at higher and lower levels were largely unable to implement it due to inadequate digital resources, poor internet connectivity, and the socio-economic challenges faced by students and their families (Abubakar et al., 2024; Saidu et al., 2021). As a result, there is a need to devise other means that will carry along all children's educational needs by developing offline remote learning packages as suggested by Abubakar et al. (2024); Hossain, Kong, and Malik (2023); Saidu et al. (2021). The urgent need to develop an offline remote learning package for teaching OOSC in Bauchi will incorporate technology and innovative pedagogy to address these challenges and enhance the quality of education for marginalised children.

Furthermore, efforts to test the effectiveness of remote learning globally have largely focused on online solutions, especially in developed countries and higher education institutions (Alade, 2020; Ali, 2020). Studies from the primary school level are limited and often focus on online methods (Asanov et al., 2020; Chandler, 2020), overlooking offline alternatives. In Nigeria, this gap is further pronounced due to the absence of affordable and accessible offline learning packages, which could serve as an alternative to digital solutions for students in low-resource settings. The lack of digital infrastructure, including devices, internet access, and trained educators, has created a significant barrier for students in rural and underserved communities (Abubakar et al., 2024; Saidu et al., 2021; Sufian & Rahman, 2024), particularly in Bauchi State, where the number of OOSC is alarmingly high. This educational disparity is further widened by socioeconomic inequalities that limit students' ability to access remote learning tools.

Given the challenges associated with online learning in Nigeria, there is a pressing need to develop and evaluate offline remote learning solutions that can be used in low-resource environments. Offline remote learning packages can bridge the gap in educational access for children who lack internet connectivity and digital devices. However, there is limited research on the development, validation, and efficacy of these offline instructional packages, especially in the context of primary school education in post-pandemic Nigeria. This research aims to fill this gap by aligning it with the goals of UN SDG-4 and

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Nigeria's MTNP 2021-2025, especially in the lower educational level. This study further seeks to address the knowledge gaps by developing, validating, and testing the effectiveness of offline remote learning packages for OOSC in Nigeria.

The study also aims at enhancing educational equity and ensure that vulnerable and marginalized students are not left behind in the post-COVID-19 recovery phase. This research also responds to the broader need for locally relevant and sustainable educational interventions that can address the unique challenges faced by OOSC in Nigeria. The scope of the research is limited to Bauchi State but can serve as a model for future interventions in similar regions across the country. Specifically, the research aims to answer the following key questions as follows:

1. What are the locations and distribution of OOSC in Bauchi State?
2. What are the content areas of Early Grade Reading (EGR) to be incorporated into the offline remote learning package for teaching OOSC in Bauchi state?
3. What is the nature of the offline remote learning package development using the *CommCare App*?
4. What is the validity of the offline remote learning package for teaching OOSC in Bauchi state?
5. What is the reliability of the developed offline remote learning package for teaching OOSC in Bauchi state?
6. What is the effect of an offline remote learning package on OOSC's achievement in EGR in Bauchi state?

LITERATURE REVIEW

Out-of-School Children (OOSC)

Out-of-school children (OOSC) are those who are not attending formal education due to various reasons, such as displacement from conflicts or natural disasters (Verlumun et al., 2024). They are aged 5-14 years and are not enrolled in or regularly attending school, despite the policy of free and compulsory primary education in Nigeria (Ochor, 2024). These are children who often lack the basic literacy skills, which are essential for functioning effectively in society. Most of the preservice teachers (PST) favoured OOSC during the pandemic period but paid less attention to them after the pandemic (Oktay, 2024).

The OOSC need the intervention and active roles of students, family, teachers, the school, official guides, and learners, especially through remote learning. Involving the OOSC in active learning can provide opportunities for them to engage in social justice development in supportive environments (Greer, Fosl, & Mitchell, 2024). Empirically, Verlumun et al. (2024) examine the impact of interactive radio instruction (IRI) on improving literacy skills among OOSC in IDP camps in Nigeria. Results show that IRI significantly enhances literacy skills, with sustained improvements over time compared to traditional face-to-face learning.

Causes and Challenges of Out-of-School Children

Nigeria has a significant problem with a large number of OOSC. The high number of OOSC also leads to increased child labour, early marriage, and societal instability, and limits future economic independence. Verlumun et al. (2024) further state that Nigeria has a significant problem with a large number of OOSC, and many not having attended school at all. Other causes and impacts of OOSC in Nigeria, include socio-economic factors and cultural norms. Particularly, Nigeria has approximately 10.5 million children aged 5-14 not attend school regularly due to socioeconomic challenges, cultural norms, and inadequate educational infrastructure (Ochor, 2024).

According to Verlumun et al. (2024), in Nigeria, many children are out of school due to poverty, conflicts such as those between farmers and herders, ethnoreligious conflicts, Boko Haram insurgency, and natural disasters like floods, leading to internal displacement. Other related causes include socio-economic challenges, cultural norms, and inadequate educational infrastructure as the primary causes of OOSC in Nigeria (Ochor, 2024). These OOSC have high

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Vulnerability and Future Risks. For instance, Verlumun et al. (2024) noted that OOSC in IDP camps are at risk of growing up without the necessary literacy skills to function effectively in society, potentially becoming a problem for the same society that neglected their education. They also face significant socio-economic challenges, including poverty, crime, and gender disparities, which perpetuate a cycle of educational deprivation and hinder national development (Ochor, 2024).

Remote Learning Overview

Nigeria's northern states, particularly Bauchi, face a pressing issue of OOSC, with UNICEF (2024) reporting Bauchi as one of the highest concentrations in the country. This calls for the need to identify and carry along the vulnerable and marginalised OOSC using offline remote learning technology in a country with challenges of power and internet connectivity. Offline remote learning is an individualistic performance orientation with a shift in learning responsibility from the organization to the individual, thereby emphasizing performance over genuine learning (Lemmetty, 2024). It also refers to the shift from traditional in-person schooling to home-based, online education due to school closures (Johnson, Castle, Partika, Martin, & Tulsa, 2024).

However, Remote learning introduces new educational conditions and challenges, such as maintaining student engagement and managing classroom dynamics without physical presence. It also presents unique challenges, including maintaining student engagement and managing classroom order, but also offers opportunities for innovative teaching practices (Skog, Pettersson, & From, 2024). They further note that teachers at K-12 primary school remote teaching contexts serve as practical, pedagogical, and social resources, with their roles varying based on classroom size and student age.

The COVID-19 pandemic has accelerated the adoption of remote learning globally, highlighting the critical role of technology in education. Researchers have emphasized the importance of internet infrastructure and teacher training for effective online remote learning (Johnson et al., 2024; Prasad et al., 2024; Skog et al., 2024). However, in low-resource settings like Nigeria, many schools and homes lack access to necessary online remote learning technology, excluding numerous children from online education (Abubakar et al., 2024; Saidu et al., 2021). However, traditional online platforms, radio, and television have failed to reach rural areas due to limited internet connectivity, electricity, and digital literacy (Chandler, 2020). Offline learning solutions offer a promising alternative. Studies by Safi et al. (2020) and Alade (2020) suggest that localized, structured offline learning packages can mitigate the digital divide in low-internet regions.

Empirically, Prasad et al. (2024) found some predictors of adoption of remote learning in school which include institutional support, environmental acceptance, habit formation, and social influence. Attitude towards conference apps mediates the relationship between adoption intentions and performance expectancy. They further highlight the need for better internet access, intuitive applications, and infrastructure to support remote learning. Additionally, Skog et al. (2024) explore how frame factors condition remote teaching and influence the facilitator's role, highlighting the importance of digital infrastructure and strong teacher-facilitator relationships.

The study aims to understand how frame factors condition remote teaching and influence the facilitator's role. They found that different frame factors, such as group size and digital infrastructure, create distinct classroom contexts that influence the facilitator's responsibilities and interactions. Moreover, Johnson et al. (2024) investigates the predictors of young students' participation in remote learning during the early days of COVID-19, particularly among low-income families in Tulsa, OK. They found that Family characteristics (e.g., parental depression, household chaos) and logistical barriers (e.g., internet access, device availability) were significant predictors of remote learning participation.

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Conceptual Framework of the Study

The conceptual framework of this study is informed by two key theories: Interaction Multimedia Computer-Assisted Instruction (IMMCAI) and Transactional Distance Theory (TDT). The IMMCAI theory, developed by Trirathanakul et al. (2008), provides essential guidance for developing, testing, and evaluating computer-based instructional applications. These applications incorporate elements such as graphic displays, imaging, animation, audio, sequential instruction, logical judgment, questions, and assessments. Trirathanakul et al. (2008) outline five stages for developing Computer-Assisted Instruction (CAI) packages: Analysis, Design, Development, Implementation, and Evaluation. The arrangement of subjects and topics must align with curriculum content and behavioural objectives, following the principles of IMMCAI. This theory enhances learners' participation, promotes independent learning, reduces teacher intervention, and supplements traditional face-to-face instruction (Saidu, Dahiru, & Muhammad, 2019).

The second and supportive theory is the TDT theory, established by Michael Grahame Moore in 1972, addresses the increasing number of students unable to participate in conventional classrooms, opting for learning with minimal teacher intervention (Moore & Diehl, 2019). TDT advocates for highly structured instruction with limited teacher-student interaction (Moore & Diehl, 2019). The distance between student and teacher, according to this theory, is psychological rather than geographical, varying in terms of three key constructs: Dialogue, Structure, and Autonomy. Dialogue refers to the extent to which students and instructors can engage with the educational content. Structure represents how flexible the educational program is in meeting students' needs, while autonomy refers to the degree of control students have over what, how, and when they learn. Autonomous learners set their own goals and pursue them independently, both emotionally (self-driven, without seeking validation) and instrumentally (learning without external help) (Moore & Diehl, 2019).

Both theories are critical to this proposed framework. IMMCAI provides the necessary steps for preparing, designing, developing, and evaluating computer-based instructional packages. TDT, on the other hand, offers guidance for students to use these packages independently, with minimal or no teacher involvement. The combination of these theories informs the development, validation, and testing of an effective remote learning package, enabling students to learn independently at their own pace as presented in Figure 1 and 2.

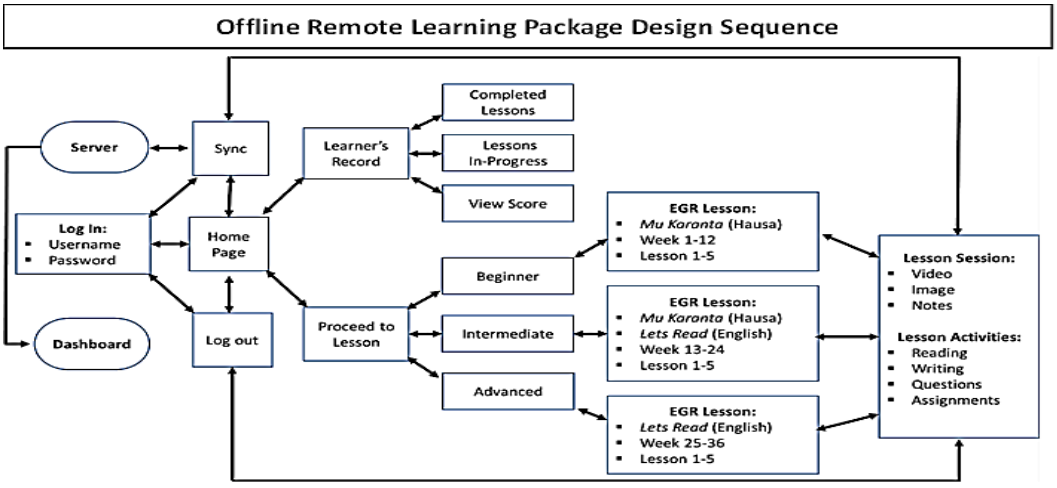

Figure 1: Proposed Offline Remote learning package Design Sequence
Source: Developed by the research team in consideration of work of Saidu et al. (2021)

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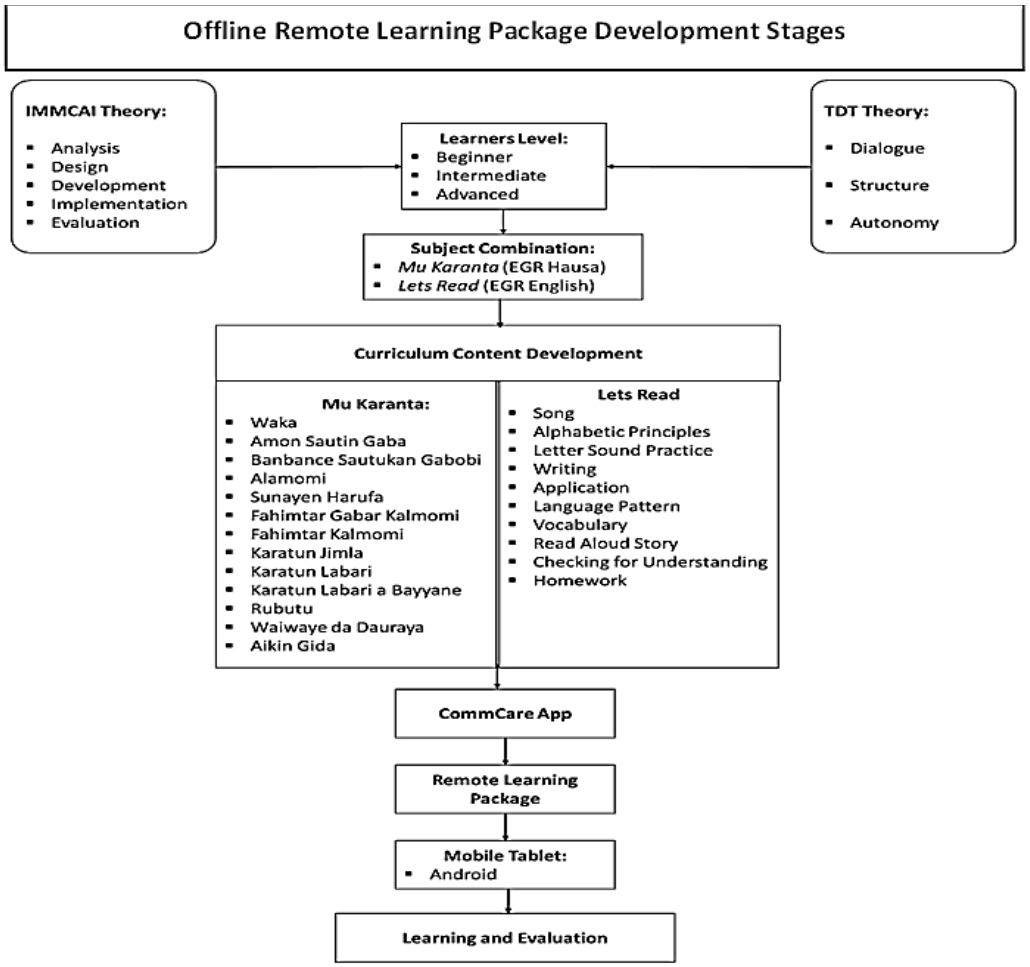

Figure 2: Offline Remote Learning Package Development Stages
Source: Developed by the research team in consideration of some theories from Moore and Diehl (2019); Trirathanakul, Sombunsukho, Lertkulvanich, and Buranajant (2008).

METHODOLOGY

Research design

The study will adopt two types of research designs including the Research and Development for the package development the Quasi-experimental design for OOSC EGR achievement test measurement. The R&D design will be used to develop an offline remote learning package for out-of-school children (OOSC) in Bauchi State. The R&D approach is suitable for creating educational packages that involve designing, testing, and validating instructional tools. The study will follow a systematic procedure to develop the learning package and evaluate its effectiveness in enhancing Early Grade Reading (EGR) achievement among OOSC in Bauchi State. Secondly, the proposed study will adopt a quasi-experimental design to test the effectiveness of an offline remote learning package for Early Grade Reading (EGR) among out-of-school children (OOSC) in Bauchi State, Nigeria. The quasi-experimental design is appropriate in this study for comparing the achievement of the experimental and control groups before and after the intervention.

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Study Area

The proposed research will be conducted within Bauchi State, North-East Nigeria, one of the six states comprising the region (Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe). Bauchi State was selected as the focus due to its significant population of OOSC and the need for educational offline digital interventions in the remote areas.

The Pilot Study

The sample for the pilot study will be comprised of 4 computer programmers, 4 early grade reading (EGR) specialists, and 12 out-of-school children that will be selected from within each senatorial zone within Gombe State. These participants will be integral to the package's development and validation processes. The computer programmers from ATBU will be responsible for rating the technical aspects of developing the offline remote learning package using the *CommCare* app, while the course specialists from SUBEC will focus on content development related to EGR. The OOSC from Gombe, outside the study area, will be involved in testing its effectiveness in learning EGR.

Population and Sample of the Main Study

The target population for this research comprises 1,370,000 OOSC, with a sample size of 360 OOSC, aged six to twelve, from Bauchi State. Out of the sample size, 180 will be randomly assigned to the experimental group, while the remaining 180 will be assigned to the control group. A multistage sampling approach will be employed to effectively study this population. This will result in the selection of 120 OOSC from each of the three senatorial zones in the state, providing a total of 360 participants, evenly divided between males and females. To ensure diverse representation, purposive sampling will be used to select male and female OOSC from urban, semi-urban, and rural areas within each zone. Convenience sampling will then be applied to target locations with the highest incidence of OOSC in each zone.

Instrumentation

Two instruments will be used for data collection for the proposed study. The first data collection instrument to be used in this study is a questionnaire titled the Offline Remote Learning Package Validation Questionnaire (ORLPVQ). The questionnaire items for the ORLPVQ instrument will be adapted from Saidu, Babawuro and Magnus (2019). The ORLPVQ is a structured, closed-ended questionnaire designed to evaluate various aspects of the offline learning package.

The instrument will consist of four sections:

1. Section A: It will focus on assessing the Early Grade Reading content areas, rated by the EGR specialists.
2. Section B: It will be concerned with the stages followed in the development of the offline remote learning package, and will be rated by all participants (computer programmers, content specialists, and students).
3. Section C: It will assess the technical aspects of the package, and will be rated by computer programmers.
4. Section D: It will focus on content validation and field testing, and to be rated by content specialists and the OOSC who participated in the experimental group.
5. Each section of the questionnaire will be rated on a five-point Likert scale, with response options ranging from Strongly Agree (5 points) to Strongly Disagree (1 point).

The second data collection instrument to be used in this study is the Early Grade Reading Achievement Test (EGRAT), which will be adopted from the existing curriculum of the EGR as currently used, to assess the participants' proficiency in EGR. The EGRAT will be divided into two components:

1. **EGRAT I:** This version will be used to obtain the pre-test scores for both the experimental and control groups.
2. **EGRAT II:** This version will be used to obtain the post-test scores for both

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groups by reshuffling the pre-test items. The same content will be tested to ensure consistency and to minimise any testing bias.

Validation and Reliability of the Instruments

The ORLPVQ will be subjected to face and content validation by three experts from the field of educational technology and early grade reading. These validators, will be professionals from the Department of Vocational and Technology Educational at Abubakar Tafawa Balewa University (ATBU), that will review the instrument to ensure its suitability for assessing the development and effectiveness of the offline remote learning package. The reliability of the ORLPVQ will be determined using inter-rater reliability. This method will be employed to assess the consistency of ratings among different raters (computer programmers, content specialists, and students).

Data Management and Analysis:

Data collection will be done in two phases. The first phase of data collection will be done through the administration of the ORLPVQ to the participants. The second phase of data collection process will involve the administering the EGRAT as follows:

1. **Pre-test (EGRAT I):** The pre-test will be administered to both the experimental and control groups to determine their initial EGR proficiency. For the experimental group, the pre-test will be conducted using the developed offline remote learning package, while the control group took the test using paper and pencil method.
2. **Intervention:** The experimental group will be engaged with the offline remote learning package designed specifically for OOSC as the intervention, which will be delivered using the *CommCare* app. The package will include the instructional content in EGR, and the children will interact with the learning materials and completed exercises directly within the app. The control group will receive the traditional instruction on the same content, to be delivered through the non-digital means.
3. **Post-test (EGRAT II):** After the intervention, the post-test will be administered to both groups using the reshuffled test items. For the experimental group, all test items will be completed and submitted through the offline learning package within the *CommCare* app, and the children's scores will automatically be stored in the software. In contrast, the control group will complete the post-test manually using paper and pencil, and the results will be collected and scored by the researchers.

The research team will train six research assistants to help in administering the pre-test and post-test in both the experimental and control groups. These assistants will ensure that the tests are conducted uniformly across the two groups and helped in gathering and returning the test scores for analysis. The responses collected will be analysed using descriptive statistics, including mean and standard deviation, to address the research questions related to the package's development, content validation, technical reliability and its effect on the OOSC's achievement in EGR will be analysed using inferential statistical tools of t-test. These statistical measures will provide more analytical information into how the validators perceived the offline remote learning package and its potential for teaching OOSC in Bauchi State.

The benefits of the New Research Framework

Short-Term Benefits of the Study

In the short term, the study will improve access to education by providing out-of-school children with structured and personalised digital learning materials that do not require internet connectivity. The use of the offline remote learning package is expected to lead to measurable improvements in learning outcomes, particularly in basic literacy and early learning competencies

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among the target population in Bauchi State. Additionally, the study will generate evidence-based insights that can inform educational policy and practice, offering practical recommendations to local and national education authorities on the implementation of offline learning solutions for marginalised children within Bauchi State and similar contexts.

Long-Term Benefits of the Study

The long-term benefits of the study include the establishment of a sustainable and scalable offline learning model that can significantly reduce the number of out-of-school children by overcoming barriers related to poverty, insecurity, and limited digital infrastructure. By strengthening foundational literacy and learning skills, the intervention is expected to improve learners' progression into formal or non-formal education pathways, thereby enhancing future employability and economic participation. The study will also provide robust empirical evidence to guide educational planning and policy formulation at state and national levels, supporting more inclusive and equitable education systems. Additionally, the adoption of locally developed offline learning technologies will promote innovation, local content development, and capacity building within the education sector.

Study Impact

The long-term impact of the study is expected to be multidimensional. From a technological perspective, the study will pioneer an innovative offline learning package that can serve as a replicable model for other regions facing similar infrastructural and connectivity challenges, thereby advancing offline educational technologies and delivery strategies. Socially, the study will promote the inclusion of out-of-school children by expanding access to education and reducing educational inequality in Bauchi State and Nigeria more broadly. Economically, by strengthening basic literacy and foundational skills, the study will enhance the prospects of further education, employability, and meaningful economic participation, contributing over time to smart education initiatives, local content development, and sustainable economic growth.

Direct Beneficiaries of the Study

The primary beneficiaries of the study will be out-of-school children in Bauchi State, who will gain access to quality educational opportunities without reliance on internet connectivity. Teachers and caregivers will also benefit from the availability of structured offline learning resources, which will reduce dependence on advanced digital technologies and enhance their capacity to support children's learning effectively. In addition, educational authorities and policymakers will benefit from access to reliable data and empirical evidence that can guide future strategies and policies aimed at promoting inclusive education, particularly in remote and underserved communities.

CONCLUSION

In conclusion, this study proposes a contextually appropriate and innovative response to the persistent challenge of out-of-school children in Bauchi State by developing and evaluating an offline remote learning package that addresses barriers related to poverty, infrastructure, and limited internet connectivity. By combining systematic mapping, locally relevant content development, and rigorous quasi-experimental evaluation, the study is expected to generate empirical evidence on the effectiveness of offline learning solutions for marginalised children. The anticipated outcomes will contribute to improved educational access, enhanced learning achievements, and informed educational policy at both state and national levels. More broadly, the study offers a scalable and sustainable model that can be adapted to similar low-resource settings, thereby contributing to social inclusion, human capital development, and long-term socio-economic advancement, while addressing the existing gap in evidence-based offline education interventions for out-of-school children.

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RECOMMENDATIONS

1. State and National Educational Authorities should institutionalise offline remote learning solutions within basic education policies to ensure sustained access to quality education for out-of-school children in rural and underserved communities.
2. Curriculum Developers and Educational Technology Experts should collaborate to design and regularly update locally relevant offline digital content that aligns with national curriculum standards and the specific learning needs of out-of-school children.
3. Schools, Community Learning Centres, and Non-Governmental Organisations should adopt and implement the offline learning package through structured learning schedules supported by trained facilitators and caregivers.
4. Teachers and Caregivers should receive continuous capacity-building programmes to effectively utilise offline learning tools and provide guided support to learners with limited formal schooling experience.
5. Development Partners and Policy Makers should invest in monitoring, evaluation, and scaling mechanisms to replicate and sustain effective offline learning interventions across Bauchi State and similar low-resource settings, addressing the gap in long-term evidence on scalable offline education models.

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