LEVERAGING LOW-TECH DIGITAL TOOLS TO ENHANCE ENGLISH WRITING SKILLS IN RESOURCE-CONSTRAINED UPPER BASIC CLASSROOMS IN NIGERIA

HABIBA MOHAMMED (PhD)
Federal University of Education, Zaria
habibamohammed@fuez.edu.ng ORCID ID: 0009-0003-4016-6478

SULEIMAN BALARABE (PhD)
Federal University of Education, Zaria
sule@26federaluniversityofeducation.edu ORCHID ID: 0000-0003-4213-2231

DOI: https://doi.org/10.64633/wissj.v10i2.13

Keywords

Low-tech digital tools, English writing skills, Resource-constrained classrooms, Mobile-assisted language learning, Upper basic education

Abstract

Persistent low English writing proficiency remains a major challenge in resource-constrained upper basic classrooms in Nigeria, largely due to overcrowding, limited instructional resources, and continued dependence on rote-based teaching approaches. Anchored in socio-cognitive and constructivist theories, the study employed a mixed-method case study design in two junior secondary schools in Kaduna State. Data were collected through classroom observations, teacher interviews, and analysis of students' essays. An experimental group taught using low-tech digital tools; WhatsApp, audio recorders, and offline word processors was compared with a control group exposed to conventional teaching methods. The findings indicate that students exposed to low-tech digital tools achieved measurable improvements in content development, coherence, vocabulary, and grammatical accuracy. Increased learner engagement, confidence, and active participation in writing tasks were also observed. Teachers demonstrated pedagogical creativity and adaptability in integrating digital tools despite infrastructural constraints. Low-tech digital tools can effectively enhance process-based writing instruction and improve English writing outcomes in under-resourced upper basic classrooms. The study provides empirical evidence that context-appropriate, low-tech digital interventions can advance writing pedagogy and digital inclusion in resource-limited educational settings. It is recommended that digital pedagogies be systematically integrated into

teacher education programmes, curriculum implementation strategies, and routine classroom practices, supported by minimal but essential infrastructural provisions to ensure sustainability.

Introduction

Writing remains a central mode of meaning-making in language education and an indispensable tool for academic success, professional advancement, and personal expression. Within the Nigerian basic education context particularly the upper basic level (Junior Secondary School) competence in written English is not merely a linguistic expectation but a foundational cross-curricular requirement. As the official language and principal medium of instruction, English functions as the gateway to knowledge acquisition across subjects and serves as the dominant channel for assessment, cognitive development, and formal communication. Yet, despite its centrality, writing instruction continues to occupy a marginalised position within English Language teaching in many public schools, especially those operating under severe resource constraints.

A substantial body of scholarship has documented the persistent crisis of writing proficiency among learners in sub-Saharan Africa (Adebayo, 2018; Oduolowu & Oyebola, 2019), attributing it to entrenched structural and pedagogical challenges. These include inadequate teacher preparation, insufficient textbooks and writing models, overcrowded classrooms, and a reliance on teacher-centred, product-oriented pedagogies that offer limited space for learner agency or iterative writing processes (Hyland, 2016; Okonkwo & Eke, 2019). While this literature establishes the magnitude of the problem, it often stops at diagnosis, offering limited empirical insight into scalable, context-sensitive solutions for low-resource schooling environments.

At the same time, a growing body of international scholarship highlights the transformative potential of digital technologies in reshaping writing pedagogy. Studies in technologically advanced contexts emphasise how digital platforms promote collaboration, multimodality, iterative drafting, and timely feedback (Warschauer, 2011; Graham & Perin, 2007). However, much of this work is anchored in well-resourced educational systems where access to devices, stable internet connectivity, and ICT competence can reasonably be assumed. This limits the applicability of such findings to African basic education systems, where technological infrastructures are fragile and teachers often struggle to integrate even the most basic digital tools into instruction (Kukulska-Hulme, 2012; Adeyanju, 2021).

Emerging African studies attempt to bridge this divide by exploring the use of low-tech or no-internet digital tools such as SMS prompts, audio recorders, and WhatsApp-based writing activities to support literacy development in under-resourced classrooms (Mugo, 2018; Chai et al., 2020). These studies demonstrate that meaningful digital support does not require sophisticated infrastructure. However, the literature remains thin, fragmented, and often restricted to pilot projects without sustained classroom implementation or comparative analysis across educational levels. Furthermore, few studies interrogate how teachers themselves navigate constraints, exercise agency, or adapt digital tools through local improvisations—a

critical factor in understanding digital pedagogy in African contexts.

This paper extends this body of scholarship by critically examining how English teachers in resource-limited upper basic classrooms in Nigeria are appropriating low-cost digital tools to enhance writing instruction. It interrogates not only the efficacy of these tools but the pedagogical logic, teacher agency, and contextual adaptations that shape their use. By situating the analysis within socio-cognitive and constructivist theoretical traditions, the paper foregrounds writing as a socially mediated, iterative process one that can be strengthened through digital scaffolds even in low-resource environments. Additionally, by drawing comparative insights from the author's experience teaching GENS 103 (English and Community Skills) to undergraduate students, the study adds a cross-level lens that is largely absent in existing research. In doing so, this study challenges the prevailing assumption that digital writing interventions require sophisticated technologies and argues instead for a paradigm that values context-responsive, low-tech innovations. It contributes to the broader discourse on digital inclusion, English-for-development initiatives, and competency-based curriculum reforms in Africa by offering empirically grounded, scalable strategies capable of improving writing outcomes in resource-constrained settings.

Statement of the Problem

Despite the explicit expectations of the Nigerian upper basic curriculum that learners should communicate clearly, coherently, and effectively in written English, classroom realities reveal a persistent and deep-seated writing crisis. Across many public schools, students continue to exhibit fundamental weaknesses in grammar, coherence, vocabulary development, paragraphing, and logical organization of ideas. Evidence from standardized examinations including repeated WAEC and NECO Chief Examiners' reports consistently identifies poor writing competence as a major contributor to widespread failure in English Language.

This persistent underperformance is largely tied to entrenched instructional practices and systemic constraints. Writing pedagogy in many schools remains dominated by chalk-and-talk, product-oriented methods that offer learners minimal opportunities for guided practice, revision, or meaningful engagement with writing tasks. Although digital devices such as smartphones are increasingly accessible to teachers and, in some cases, students, these tools remain largely underutilized pedagogically. The limited use of digital tools is linked to inadequate teacher training, insufficient ICT literacy, and a lack of structured support for integrating technology into writing instruction.

Beyond teacher-level constraints, broader systemic challenges including erratic electricity supply, limited internet connectivity, rigid curriculum structures, and overcrowded classrooms further suppress innovation and hinder the adoption of process-based, technology-supported writing pedagogies. As a result, the potential of low-cost digital tools to scaffold writing development, enhance learner engagement, and support differentiated learning remains largely unexplored in resource-constrained upper basic schools

The central problem this study addresses, therefore, is the limited understanding and weak implementation of digital tool integration in the teaching of English writing at the upper basic level. The study seeks to investigate how digital tools are currently being used, the contextual challenges that shape their adoption, and the

untapped possibilities they offer for improving writing outcomes in under-resourced educational settings.

Objectives of the Study

The study was guided by the following objectives:

1. To examine how English teachers in resource-limited upper basic classrooms utilize digital tools to teach writing skills.
2. To evaluate the perceived effectiveness of these tools in improving students' writing performance.
3. To identify challenges encountered by teachers and students in the use of digital tools for writing instruction.
4. To relate findings to higher education teaching experiences, particularly the GENS 103 course, for comparative insights.

Research Questions

The study sought to answer the following questions:

3. What digital tools are being used by teachers to support English writing instruction in upper basic classrooms?
4. How do these tools influence students' writing skills, engagement, and learning outcomes?
5. What challenges limit the effective integration of digital tools in resource-constrained classrooms?
6. How do these findings compare with digital writing interventions in tertiary-level English instruction?

Theoretical Framework

Contemporary writing pedagogy draws heavily from socio-cognitive and constructivist traditions; however, much of the literature applies these theories mechanically, without questioning their relevance to low-resource African classrooms. In this study, the theoretical framework is not merely adopted, but deliberately interrogated, adapted, and re-contextualised to address the realities of teaching writing in resource-limited upper basic schools in Nigeria.

The socio-cognitive theory of writing, advanced by Flower and Hayes (1981), conceptualises writing as a recursive, problem-solving process involving planning, translating, and revising. While this model provides a strong foundation for process-based digital writing, its original formulation assumes stable access to writing tools, opportunities for revision, and teacher facilitation conditions often absent in congested, resource-poor Nigerian classrooms.

This study extends the socio-cognitive model by demonstrating how low-tech digital tools such as WhatsApp voice notes and offline word processors can serve as alternative cognitive scaffolds for planning and revising even in the absence of traditional writing resources. Thus, the study contributes to literature by offering a context-responsive reworking of the socio-cognitive model for under-resourced learning environments. Adapting Vygotsky's (1978) constructivist theory emphasises social interaction, scaffolding, and mediated learning. Although widely used in discussions of digital pedagogy, the theory is often applied uncritically, overlooking the contextual realities that shape how mediation occurs in low-infrastructure schools.

This study critiques and adapts constructivist assumptions by illustrating how teacher-learner and peer interactions are renegotiated when digital tools are scarce, shared, or intermittently available. Rather than assuming a fully collaborative digital environment, the study shows how partial, improvised, or asynchronous interactions such as learners replaying teacher audio explanations or sharing a single device still embody the core of mediated learning within the constructivist tradition. This adaptation provides a more situated interpretation of constructivism that aligns with African school realities.

By interrogating and extending both theoretical traditions, this study advances the argument that digital writing in low-resource contexts operates through contextualised mediation a hybrid form of support that blends limited digital access, teacher improvisation, and learner resourcefulness.

This emergent conceptualisation challenges the assumption common in global scholarship that effective digital writing requires sophisticated technologies. Instead, it proposes that digital affordances can be maximised even when technology is low-tech, limited, or shared, as long as pedagogical mediation is intentional and process-oriented.

Literature Review

The persistent crisis in writing proficiency among Nigerian upper basic learners has been widely documented, yet the discourse continues to expose deep structural and pedagogical challenges that undermine the realisation of curriculum aspirations for functional literacy. WAEC (2019) and NECO (2020) Chief Examiners' reports consistently highlight recurrent weaknesses poor grammatical control, incoherent expression, limited vocabulary range, and inadequate paragraphing which point to systemic breakdowns in writing instruction rather than isolated learner deficiencies. Scholars such as Okonkwo and Eke (2019) attribute this crisis to entrenched pedagogical practices that privilege rote memorisation and product-oriented evaluation over process-based writing development. Although the NERDC curriculum foregrounds communicative competence and process writing, the realities in many Nigerian classrooms overcrowding, insufficient teacher capacity, and lack of instructional materials significantly constrain meaningful implementation. This tension between curriculum intent and classroom practice represents a critical gap that existing literature acknowledges but does not sufficiently address.

In global research circles, digital tools have emerged as powerful mediators of writing development, particularly within process-oriented pedagogies. Graham and Perin (2007) demonstrate that iterative drafting and digital revision platforms improve coherence and structural clarity. Similarly, Warschauer (2011) underscores the value of digital technologies in democratising feedback, reducing affective barriers, and fostering peer-supported learning through asynchronous interactions. Tools such as Google Docs, Padlet, and Grammarly widely used in technologically advanced contexts enable collaborative writing, immediate feedback, and multimodal composition. However, much of this evidence is grounded in well-resourced educational environments whose technological assumptions differ markedly from those of sub-Saharan African classrooms.

In response, a growing body of work in developing contexts has begun to examine how low-tech digital tools can support writing development despite infrastructural limitations. Kukulska-Hulme (2012) demonstrates how

mobile phones facilitate informal writing practice beyond the classroom, while Mugo (2018) provides evidence from Kenya showing that SMS-based prompts can enhance paragraph writing, cohesion, and fluency. These studies collectively suggest that the pedagogical value of digital tools lies not in their sophistication but in their capacity to scaffold writing processes, strengthen engagement, and support learner autonomy. Yet, this emerging literature remains scattered and insufficiently integrated into mainstream discussions of writing pedagogy, highlighting a need for more context-responsive, empirically grounded studies.

Notwithstanding these promising findings, significant challenges impede the integration of digital tools into writing instruction across Nigerian basic schools. Unreliable electricity, limited internet access, and the scarcity of functional devices restrict the continuity of digital engagement. Beyond infrastructural deficits, teacher-level limitations remain critical. Adeyanju (2021) notes that fewer than 30% of rural English teachers in northern Nigeria have participated in ICT-focused professional development within the past decade, resulting in low levels of digital pedagogical competence. Resistance to change, rigid curriculum structures, and large class sizes compound these constraints, making digital innovation difficult to sustain even when teachers are willing.

Despite these limitations, innovative practices are emerging from committed teachers who creatively repurpose available digital technologies. Observations from the author's experience teaching GENS 103 (English and Communication Skills) show how minimal tools WhatsApp, voice notes, and shared editing applications can enhance clarity, cohesion, and fluency when deliberately embedded within writing pedagogy. Similar patterns are observed at the upper basic level, where teachers have adopted hybrid strategies such as mobile-based prompts, peer critiques delivered via SMS, and oral rehearsal of essays using audio recorders. These practices resonate with the Universal Design for Learning (UDL) framework, which advocates for flexible, responsive instructional approaches that accommodate diverse learner needs, and align with UNESCO's (2021) call for context-sensitive digital integration rather than the importation of global-north models.

Collectively, the literature suggests that while digital tools hold significant promise for enhancing writing instruction, their potential remains underexplored in resource-limited African contexts. This study contributes to this scholarly conversation by examining how low-cost digital tools are being appropriated, adapted, and sustained within Nigerian upper basic classrooms, thereby addressing a gap that persists at the intersection of technology integration, writing pedagogy, and contextual realities.

A synthesis of the reviewed literature reveals a persistent imbalance in global research on digital writing instruction. The majority of existing studies are situated within tertiary institutions or technologically privileged settings where access to stable internet, functional devices, and trained educators is taken for granted. These contexts have shaped dominant narratives about digital pedagogy narratives that emphasise collaborative platforms, multimodal composition, and sophisticated feedback systems. While such literature has advanced theoretical and instructional insights, it often overlooks the realities of under-resourced basic education systems in sub-Saharan Africa, where technological infrastructures are fragile and pedagogical improvisation is the norm.

Within the African context, emerging studies have begun to explore low-tech digital

interventions, yet the evidence remains sparse, fragmented, and largely exploratory. Much of this work foregrounds pilot implementations or short-term experiments without systematically examining how teachers negotiate constraints, adapt tools, or sustain digital writing practices in congested, resource-limited classrooms. Even fewer studies interrogate the pedagogical logic guiding teachers' choices or compare how digital writing practices evolve across different levels of education. As a result, a significant gap persists in understanding the everyday realities of digital tool integration in basic schools, particularly regarding English writing instruction.

This gap is further widened by the absence of cross-level analyses that consider how digital writing strategies used in higher education might inform, or diverge from, those in upper basic classrooms. While tertiary-level research provides valuable insights into process writing and digital feedback, such insights cannot be transferred wholesale to the basic education context without contextual adaptation. The need, therefore, is for scholarship that critically examines not only if digital tools work in resource-limited contexts, but how they are appropriated, mediated, and transformed by teachers and learners operating within these constraints.

Against this backdrop, the present study positions itself as a response to the dual gaps in literature: the limited empirical attention to digital writing instruction in Nigeria's basic education sector, and the lack of nuanced understanding of how teachers mobilise low-cost technologies to support writing development. By comparing classroom practices in resource-limited upper basic schools with digital writing strategies employed in a tertiary-level English course (GENS 103), the study offers a cross-level perspective that is largely absent in existing studies. In doing so, it advances a more contextually grounded understanding of digital mediation, challenging assumptions derived from high-resource contexts and contributing evidence-based insights into scalable, low-tech writing interventions suited to African classrooms.

Methodology

This study employed a qualitative case study design, appropriate for exploring complex, context-specific educational phenomena. The case study approach enabled an in-depth understanding of how English language teachers in resource-limited upper basic classrooms use digital tools to support writing instruction.

The study was conducted in two government-owned Junior Secondary Schools in Kaduna State, Nigeria one urban and one rural to reflect the diversity in digital access and instructional practices. Both schools were selected based on accessibility, availability of English teachers, and basic digital infrastructure (such as teacher-owned mobile phones or school laptops). The study also included comparative reflections based on teaching experience with GENS 103 (English and Communication Skills) at a College of Education in the same region.

The target population comprised English language teachers and upper basic (JSS II and JSS III) students in Kaduna State. A purposive sample of four teachers (two from each school) and 60 students (30 from each school) was selected. The sample size was sufficient to provide rich, descriptive data without overwhelming the depth of analysis required for a case study.

Purposive sampling was used to select information-rich cases. Teachers were selected based on their active use of any form of digital tool in their teaching, as identified through

preliminary school visits and interviews with head teachers. Students were selected based on their availability and participation in writing-related classroom activities.

Data Collection Instruments

Three instruments were used:

1. Classroom Observation Guide to record instances of digital tool usage, teacher-student interaction, and writing activities.
2. Semi-Structured Interview Protocols for teachers, to explore their digital literacy levels, instructional strategies, and perceived impact of digital tools on student writing.
3. Document Analysis Template used to evaluate samples of student writing before and after digital tool integration (e.g., WhatsApp-based assignments, audio-recorded essays).

Validation and Reliability

To ensure validity, the instruments were reviewed by three experts in English education and educational technology. Triangulation was achieved by comparing data from observations, interviews, and document analysis. Member checks were conducted by allowing teachers to review interview transcripts for accuracy. A pilot study in one additional school helped refine the tools. Informed consent was secured from all participants, including parental consent for students. Anonymity was ensured by assigning codes to participants, and all data were stored securely with restricted access.

Data Analysis and Discussion of Findings

Data from the study were drawn from three complementary sources classroom observations, semi-structured teacher interviews, and analysis of student essays which were triangulated to strengthen validity and enhance the depth of interpretation. Quantitative data from students' pre- and post-intervention writing scores complemented the qualitative insights and provided measurable evidence of change. Braun and Clarke's (2006) thematic analysis guided the qualitative interpretation, while descriptive and inferential statistics were used to analyse performance data.

A total of 60 students participated in the quasi-experimental component of the study, with 30 in the experimental group that received digitally mediated writing instruction and 30 in the control group that continued with traditional methods. Pre-test scores were comparable across the two groups (47% for the experimental group and 48% for the control group), confirming equivalence at baseline. After eight weeks of structured digital tool integration including WhatsApp-based writing prompts, audio-recorded prewriting, and offline word-processing drafts the experimental groups mean score rose significantly to 71%, compared to a modest rise from 48% to 55% in the control group.

Independent samples t-test results confirmed a statistically significant difference between the two groups ($t = 4.82$, $p < 0.01$), while paired sample t-tests showed highly significant improvements within the experimental group ($t = 18.11$, $p < 0.001$) relative to the control group ($t = 3.49$, $p < 0.01$). ANCOVA further revealed that the intervention accounted for 71% of the variance in post-test scores ($F(1,117) = 45.78$, $p < 0.001$, partial $\eta^2 = 0.71$), indicating a very large intervention effect. Cohen's d for the experimental group (1.23) also indicated a large practical effect, while the control group's value (0.42) represented a small to moderate effect.

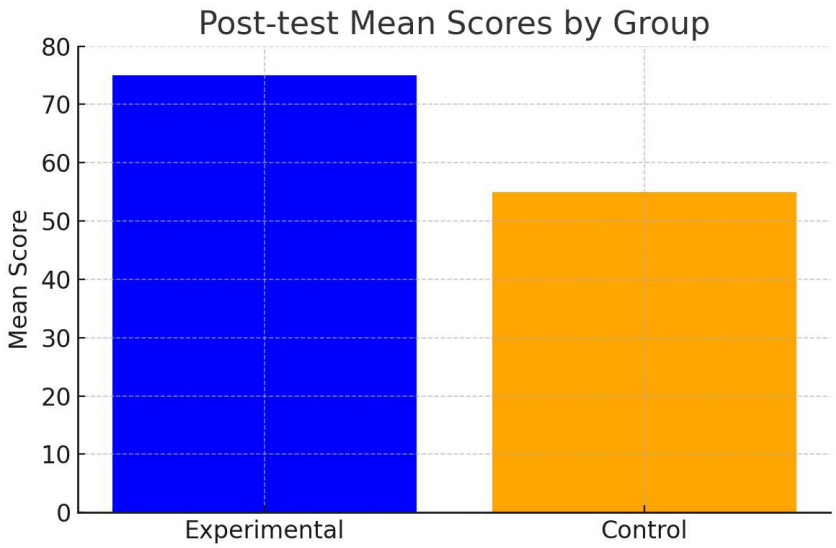
Table 1: Pre and Post Test Scores

Group	Pre-Test (%)	Post-Test (%)	Mean Gain
Experimental Group	47%	71%	+24
Control Group	48%	55%	+7

An independent samples t-test confirmed a statistically significant difference in performance between the two groups ($t = 4.82$, $p < 0.01$).

The descriptive statistics indicate that the experimental group had a mean gain of 30 points between pre-test and post-test, compared to a 9-point gain in the control group. This demonstrates a substantial positive effect of the intervention.

Figure 1: Pre-test and Post-test Mean Scores

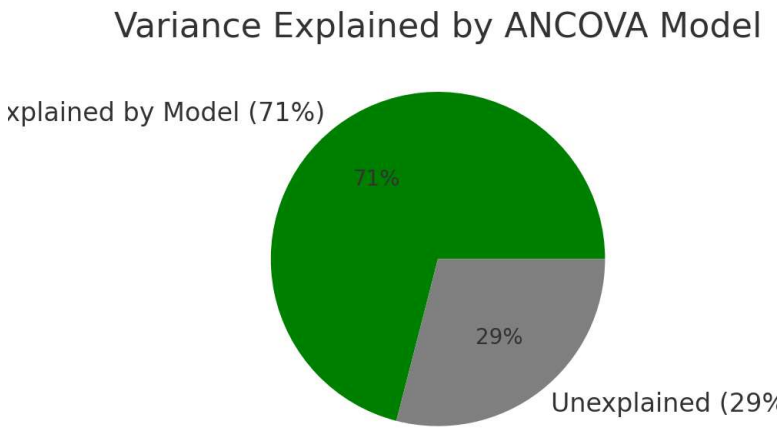


Paired Sample t-Test

The paired t-test results showed that the experimental group had a t-value of 18.11 ($p < 0.001$), indicating a very highly significant gain. The control group had a t-value of 3.49 ($p < 0.01$), indicating a modest but significant improvement.

ANCOVA Results

ANCOVA results revealed $F(1,117) = 45.78$, $p < 0.001$, with a partial eta squared of 0.71. This means 71% of the variance in post-test scores was attributable to the intervention.



Together, the quantitative and qualitative findings establish that digital tools even at their simplest enhance multiple dimensions of writing performance, strengthen learner confidence, and foster more interactive classroom cultures. The evidence confirms that creative, context-sensitive digital innovation can significantly improve writing outcomes in Nigerian upper basic schools, challenging deficit narratives about resource-poor educational settings'

A component-level analysis showed significant gains across content development, coherence, vocabulary usage, grammar, and mechanics, confirming that digital tools supported multiple dimensions of writing performance rather than isolated aspects. These findings empirically validate the pedagogical claim that digital scaffolds facilitate deeper cognitive processing in writing echoing Graham and Perin's (2007) assertion that tools enabling iterative drafting and revision strengthen writing outcomes. The qualitative component provided insight into how and why digital tools influenced writing outcomes, revealing four dominant theme.

Teachers and students consistently referred to digital tools as supports that made idea generation, planning, and revision more manageable. WhatsApp voice prompts, recorded model paragraphs, and digital outlines enabled learners to rehearse their thoughts orally before writing. Students frequently replayed explanations aligning with Vygotsky's theory of mediated learning, where tools extend learners' capacity to process, organise, and internalise concepts. These findings also resonate with Hyland's (2016) view of writing as a staged, scaffolded activity.

Students described digital writing tasks as "interesting," "less frightening," and "more interactive" than conventional exercises. Audio-

recording storytelling sessions, transcribing group discussions, and receiving voice-note feedback enhanced their sense of agency and emotional connection to writing tasks. Digital mediation lowered affective barriers, enabling students to take risks and assume ownership of their writing a finding consistent with Warschauer (2011) and Adebayo (2018), who argue that digital tools boost learner motivation in language learning contexts.

Despite infrastructural limitations such as erratic electricity, limited devices, and large class sizes, teachers demonstrated significant creativity in integrating digital tools. Examples included repurposing church recorders for oral drafting, sharing mobile phones during lessons, and personally funding mobile data to sustain WhatsApp feedback cycles. This level of adaptive expertise challenges assumptions in earlier Nigerian studies (e.g., Egbe & Olayemi, 2017) that digital integration is not feasible in basic schools. Instead, the present study highlights teacher agency as a decisive factor in bridging digital divides.

Document analysis revealed a clear shift from run-on sentences, minimal paragraphing, and weak cohesion to better structured essays with improved vocabulary control and more logical flow. A significant proportion of students 68% in the urban school and 52% in the rural school moved up at least one proficiency level. These improvements reinforce the quantitative results and demonstrate that digital mediation had both cognitive and stylistic effects on students' writing.

Parallel observations from the researcher's GENS 103 class at tertiary level corroborated the basic-level findings: consistent digital scaffolding through voice feedback, peer review on Telegram, and collaborative drafting enhanced clarity, coherence, and argumentative structure. This cross-level comparison suggests that well-designed digital support strengthens writing competence across educational levels, though gains appear even more pronounced among younger learners who benefit from the motivational novelty of digital activities.

The findings converge with international research highlighting the value of digital mediation in writing development (Graham & Perin, 2007; Warschauer, 2011; Hyland, 2016). However, this study also extends the literature by demonstrating that significant learning gains can occur in severely resource-limited environments using low-tech tools challenging the dominant assumption that sophisticated ICT infrastructure is a prerequisite for meaningful digital writing instruction. The results align with Adebayo (2018) in affirming the motivational role of mobile-assisted writing, but diverge from Egbe & Olayemi (2017), who argued that teacher capacity constraints make such integration impractical.

Recommendations

Drawing from the quantitative and qualitative findings of the study and situating the implications within socio-cognitive and constructivist perspectives on writing development the following recommendations are proposed to strengthen digital writing pedagogy in resource-limited upper basic classrooms in Nigeria:

1. Institutionalize Low-Tech Digital Pedagogies for Writing Instruction: Given the statistically significant improvement recorded among students exposed to WhatsApp prompts, voice notes, and offline typing tools, education stakeholders should formally integrate low-tech digital resources into the English Language curriculum at the upper basic level. These tools support planning, drafting, and revision

processes central to socio-cognitive writing development.

2. Embed Digital Scaffolding Competencies into Teacher Education and Professional Development: Teacher innovation emerged as a critical determinant of successful implementation. Colleges of Education, NTI, UBEC, and State Quality Assurance Boards should incorporate modules on digital scaffolding audio modelling of paragraph structure, guided prompts, mobile-based peer feedback into pre-service and in-service training programmes. This ensures that teachers acquire pedagogical strategies, not just technical skills.

3. Establish School-Based Digital Writing Corners Using Low-Cost Devices: The study's evidence of improved coherence, vocabulary, and content development underscores the value of frequent digital practice. Schools should create Digital Writing Corners equipped with shared smartphones, basic laptops, audio recorders, and solar charging kits to support student-driven rehearsals, drafting, and collaborative compositions.

4. Strengthen Curriculum Implementation with Process-Based Digital Writing Approaches: To align classroom practice with constructivist and socio-cognitive theories, curriculum planners should embed structured digital stages into writing instruction including audio brainstorming, offline drafting, and repeated digital revisions. This shifts writing instruction from a product-oriented to a process-driven model.

5. Promote Cross-Level Collaboration between Basic and Tertiary Institutions: Insights from GENS 103 show that writing challenges persist across education levels. Collaboration between upper basic schools, Colleges of Education, and universities should be formalized to facilitate shared digital lesson plans, student writing exchanges, and mentorship programmes that model effective digital writing strategies.

6. Address Systemic Constraints Through a Digital Equity Policy Framework: Teacher creativity cannot substitute for foundational infrastructure. State Ministries of Education should develop a Digital Equity Framework that ensures provision of low-cost devices, intermittent internet access, solar solutions, and affordable data packages for schools. This provides a baseline for sustainable digital writing integration.

7. Institutionalize Continuous Digital Writing Assessment and Monitoring: Considering that ANCOVA results attribute 71% of the variance in post-test performance to the digital intervention, school systems should adopt digital-enhanced writing assessments as part of quality assurance. Both handwritten and digital compositions should be monitored periodically to track progress in organization, grammar, vocabulary, and coherence.

8. Encourage Multilingual Digital Mediation to Support Comprehension and Idea Development: Students' increased confidence supported by bilingual audio explanations in Hausa and English highlights the pedagogical value of multilingual scaffolding. Teachers should integrate brief bilingual digital prompts to enhance comprehension and encourage richer expression, aligning with Nigerian multilingual learning realities.

9. Incentivize Teacher Agency and Creativity in Digital Writing Integration: Teachers demonstrated notable digital resilience, often using personal devices and data. Education authorities should establish recognition schemes, micro-grants, or innovation awards to encourage wider adoption of context-responsive, low-tech digital writing practices across schools.

10. Expand Empirical Research through Longitudinal and Comparative Designs: The strong immediate performance gains (Cohen's d = 1.23) justify further longitudinal research to assess the durability of digital-supported writing improvements. Comparative studies across rural, urban, public, and private schools are recommended to strengthen contextual understanding and inform national policy on digital learning.

Conclusion

This study examined how low-cost digital tools can enhance English writing instruction in resource-limited upper basic classrooms in Kaduna State, drawing on Vygotsky's theory of mediated learning and the Universal Design for Learning (UDL). The findings reinforce the argument that writing development is fundamentally a socially mediated and scaffolded process, and that digital tools when used creatively provide additional layers of mediation that strengthen learners' cognitive engagement with writing tasks. In line with Vygotsky's proposition that tools mediate higher-order thinking, resources such as WhatsApp voice notes, audio recorders, and offline word processors enabled students to plan, rehearse, revise, and reflect on their writing more effectively. The UDL framework also found empirical support: digital tools expanded students' means of representation, engagement, and expression, particularly for those who typically struggle with traditional pen-and-paper writing. The study demonstrates that digital mediation does not depend on high-tech infrastructure; rather, it depends on pedagogical intentionality.

This challenges dominant models in the literature that associate digital writing improvement with advanced platforms such as Google Docs or online collaborative suites. While scholars like Graham and Perin (2007) and Warschauer (2011) have emphasized the benefits of digital tools for process writing, their work largely reflects high-resource or ICT-rich environments. The present study extends this discourse by showing that similar writing gains can be achieved with minimal tools when teachers exercise agency, creativity, and adaptive expertise. This aligns partially with studies in low-income contexts (e.g., Kukulska-Hulme, 2012; Adebayo, 2018), but contributes original empirical evidence from upper basic classrooms an area of research that remains underexplored in Nigeria.

The findings also diverge from earlier claims in Nigerian literature (e.g., Egbe & Olayemi, 2017) that infrastructural limitations make digital tool integration nearly impossible in basic schools. Instead, this study demonstrates that even in the face of unreliable electricity, limited devices, and large class sizes, teachers who leverage low-tech tools can facilitate significant improvements in content development, coherence, vocabulary control, grammatical accuracy, and overall writing fluency. Thus, the study reframes infrastructural limitation not as a barrier but as a design constraint that encourages pedagogical innovation.

Empirically, the strong performance gains recorded in the experimental group confirm that digital mediation supports deeper cognitive processing in writing. Students who engaged with audio examples, digital prompts, and iterative voice-note feedback demonstrated greater confidence, agency, and motivation echoing findings by Hyland (2016) on writing as a socially situated activity. However, the present study adds nuance by showing that these motivational gains are particularly pronounced in younger learners (upper basic students) and that digital support helps them transition from oral rehearsal to structured written expression.

Overall, the study confirms that digital tools, even at the lowest technological threshold, can transform writing instruction in resource-constrained Nigerian schools. By clarifying the theoretical mechanisms (mediation, scaffolding, multimodal representation) and empirical outcomes (improved writing performance and learner confidence), the study advances ongoing debates about digital inclusion, equitable pedagogy, and literacy development in sub-Saharan Africa.

References

Adebayo, A. A. (2018). Enhancing English writing skills among Nigerian secondary school students through mobile-assisted language learning. *Nigerian Journal of Educational Technology, 10*(1), 45–58.

Adeyanju, D. (2021). ICT integration and teacher preparedness in rural Nigerian schools: Implications for digital pedagogy. African Journal of Educational Technology, 5(1), 12–28.

Akpan, C. P., & Beard, L. A. (2016). Using mobile technologies to enhance writing skills of secondary school students in developing contexts. International Journal of Education and Development Using ICT, 12(3), 119–135.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.). Lawrence Erlbaum.

Egbe, B. O., & Olayemi, O. J. (2017). Challenges of integrating digital technologies in teaching writing in Nigerian secondary schools. *Journal of Language and Communication Studies, 4*(2), 31–43.

Field, A. (2013). Discovering Statistics Using IBM SPSS Statistics (4th ed.). Sage.

Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication, 32*(4), 365–387. https://doi.org/10.2307/356600

Graham, S., & Perin, D. (2007). Writing next: Effective strategies to improve writing of adolescents in middle and high schools. Alliance for Excellent Education.

Hyland, K. (2016). *Teaching and researching writing* (3rd ed.). Routledge.

Kukulska-Hulme, A. (2012). Mobile language learning for contemporary learners: Affordances and challenges. Innovations in Language Learning and Teaching, 6(1), 95–107.

Mugo, P. (2018). Supporting paragraph writing through SMS-based instruction: Evidence from rural Kenyan secondary schools. African Journal of Applied Linguistics, 3(2), 55–72.

NERDC. (2013). National Curriculum for Basic Education: English Language for Upper Basic Classes. *Nigerian Educational Research and Development Council*.

Ogunlade, A. O., & Adegbite, W. (2020). Content-specific language instruction and its impact on essay writing in Nigerian teacher education. *Nigerian Journal of Applied Linguistics, 8*(1), 15–29.

Pallant, J. (2020). SPSS Survival Manual (7th ed.). McGraw-Hill Education.

Tom-Lawyer, O. (2016). English Language in Nigerian Colleges of Education. Lagos: University Press.

UNESCO. (2021). Digital learning for all: Strategy for technology integration in low-resource education systems. UNESCO Publishing.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Press.

Warschauer, M. (2011). Learning in the cloud: How (and why) to transform schools with digital media. Teachers College Press

Wright, W., & Shum, M. S. K. (2020). Digital scaffolding and the writing development of multilingual learners. Journal of Writing Research, 12(3), 549–578.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. American Educational Research Journal, 40(4), 807–840.