



Effect of Integration of Technology and Mother-Tongue on Academic Performance of Public Primary School Pupils in Delta State.

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Abstract

This study examined the effect of integrating technology and mother-tongue instruction on the academic performance of public primary school pupils in Delta State. It explores how the combined use of digital teaching tools (e.g tablet pcs, educational apps) and indigenous language instruction enhances comprehension, engagement, and learning outcomes in multilingual classrooms. Grounded in constructivist and sociocultural learning theories, the study adopts a quasi-experimental design involving pre- and post-tests. Four instructional models were used: (1) mother-tongue instruction only, (2) technology-aided teaching only, (3) a combined mother-tongue and technology-aided approach, and (4) a control group using traditional English-only instruction. Quantitative analysis using ANOVA and HSD post-hoc test revealed that pupils exposed to the combined approach recorded the highest academic gains, showing an average improvement of 17.5% in mathematics, science, and English compared to 3.7% in the control group. The study concludes that the integration of mother-tongue instruction and technology significantly improves academic performance by bridging linguistic and resource gaps in Nigeria's basic education system. It recommends policy reforms, teacher training, and investment in digital local-language content to promote equitable and culturally relevant education.

Keywords:

Mother-tongue instruction; Educational technology; Academic performance; Primary school pupil

I. Introduction

Education is a fundamental pillar of societal development, particularly in Nigeria, a nation characterised by immense linguistic diversity and educational challenges. With over 500 languages spoken across its regions, Nigeria faces unique obstacles in delivering effective instruction, especially in early education, where linguistic

barriers can hinder comprehension and academic success. By exploring the synergy of culturally relevant pedagogy and modern technological tools, the research seeks to provide actionable insights for educators, policymakers, and stakeholders in Nigeria's education sector and beyond.

Nigeria's education system operates within a complex linguistic and cultural landscape, with languages such as Yoruba, Igbo, and Hausa spoken by millions alongside numerous minority languages. The Federal Republic of Nigeria (2013) mandates the use of mother-tongue instruction in the first three years of primary education, recognizing its potential to improve comprehension and engagement. This policy is grounded in global research, such as UNESCO's (2003) position paper, which highlights that teaching in a child's native language fosters cognitive development, literacy, and numeracy, creating a strong foundation for learning additional languages like English. Studies in Nigeria, such as Fafunwa's (1990) Six-Year Primary Project, demonstrated that pupils taught in Yoruba outperformed their peers in English-medium classes in subjects like mathematics and science, underscoring the cognitive benefits of mother-tongue instruction.

Concurrently, the global rise of technology-aided teaching has transformed educational delivery, offering tools like interactive whiteboards, tablets, e-learning platforms, and mobile applications to enhance student engagement and access to resources. In Nigeria, where teacher shortages and outdated materials are prevalent, technology has shown promise in bridging these gaps. For instance, Olibie and Ezoem (2014) found that primary school pupils using interactive whiteboards in Anambra State exhibited higher participation and academic performance. However, technology adoption is uneven, with rural schools facing significant barriers like unreliable electricity and limited internet access (Akinwumi, 2019). The integration of mother-tongue instruction with technology-aided teaching presents a novel opportunity to leverage Nigeria's



linguistic diversity while harnessing digital tools to overcome resource constraints. This study explores how these two approaches can work synergistically to improve academic outcomes in Nigeria's primary and secondary schools, particularly in linguistically diverse regions.

The rationale for this study stems from Nigeria's persistent educational challenges, including low literacy rates, high dropout rates, and disparities in academic performance between urban and rural areas (National Bureau of Statistics, 2022). English, as the primary medium of instruction beyond early primary years, often alienates pupils who are not fluent, leading to poor comprehension and disengagement (Olagbaju, 2020). By combining mother-tongue instruction, which aligns with pupils' cultural and linguistic identities, and technology-aided teaching, which enhances interactivity and accessibility, this research aims to address these systemic issues and contribute to educational equity.

Despite the Federal Republic of Nigeria (2013) advocating for mother-tongue instruction in early education, its implementation in Nigeria remains inconsistent. Challenges include a lack of trained teachers proficient in local languages, insufficient instructional materials, and societal perceptions that English proficiency is a prerequisite for academic and professional success (Fafunwa, 1990). As a result, many pupils struggle to grasp foundational concepts in subjects like mathematics and science, contributing to low academic performance and high dropout rates, particularly in rural areas (Universal Basic Education Commission, 2021). Concurrently, while technology-aided teaching is gaining traction in Nigerian schools, its impact in multilingual settings is underexplored, and access remains limited due to infrastructural deficits, such as unreliable power and internet connectivity (Akinwumi, 2019).

The combination of mother-tongue instruction and technology-aided teaching has the potential to address these challenges by making education more accessible and culturally relevant. However, there is a paucity of empirical research on their combined effect in Nigeria, particularly across diverse linguistic regions like Yoruba, Igbo, and Hausa-speaking areas. Existing studies, such as Adeyemi (2016) and Ojo (2021), focus on either mother-tongue instruction or technology in isolation, leaving a gap in understanding their synergistic impact. This study seeks to fill this gap by investigating whether integrating these approaches can significantly improve academic performance, thereby offering a scalable solution to Nigeria's educational challenges.

The study pursues the following specific objectives:

1. To evaluate the impact of mother-tongue instruction on pupils' academic performance in subjects like mathematics, science, and English, comparing outcomes with English-only instruction.
2. To assess the effectiveness of technology-aided teaching in enhancing learning outcomes, focusing on tools like tablets, e-learning platforms, and interactive applications.
3. To investigate the combined effect of mother-tongue and technology-aided teaching on academic performance, hypothesizing that their synergy yields superior results compared to either approach alone.
4. To identify implementation challenges and propose practical solutions for scaling these strategies in primary schools, addressing barriers like resource constraints and teacher preparedness.

The study is guided by the following research questions:

1. How does mother-tongue instruction influence academic performance among pupils in primary schools?
2. What is the impact of technology-aided teaching on learning outcomes in classrooms, particularly in resource-constrained settings?
3. Does the integration of mother-tongue and technology-aided teaching result in greater academic improvements than either approach implemented independently?
4. What are the key barriers to implementing mother-tongue and technology-aided teaching in Primary schools, and how can they be addressed?

II. Literature Review

Research within Delta State and similar educational contexts in Nigeria has consistently pointed to two recurring issues in classroom practice: the method of instruction and the language of delivery. These factors appear to play a significant role in shaping students' understanding and overall academic performance, particularly in core subjects such as Mathematics, English, and the Sciences.

Studies conducted in Delta State suggest that students often struggle with comprehension when instruction is delivered solely in English, especially where foundational understanding is weak. In response to this, some researchers have



explored the use of the mother tongue as a complementary medium of instruction. Findings from such studies indicate that students tend to participate more actively and demonstrate better understanding when concepts are explained in a familiar language. This is particularly evident in subjects like Mathematics and Basic Science, where abstract ideas can be difficult to grasp.

Alongside language, attention has also been given to teaching methods. Traditional chalk-and-board approaches, while still widely used, have been criticized for being largely teacher-centered and less engaging. More recent studies have shown that interactive methods—especially those involving technology—can improve students' interest and retention. The use of multimedia tools, for example, has been found to make lessons more concrete and easier to follow, particularly in the Sciences and Mathematics.

In English language learning, however, the situation is slightly different. While the mother tongue may support understanding at the early stages, over-reliance on it can limit exposure to English. As such, a balanced approach is often recommended, where the mother tongue is used as a support rather than a substitute.

What becomes clear from the literature is that both language and method matter, but they are often studied separately. Very few studies, particularly within Delta State, have examined how the combination of technology and mother tongue might work together across multiple subjects. This creates a gap that the present study seeks to address.

Theoretical Framework

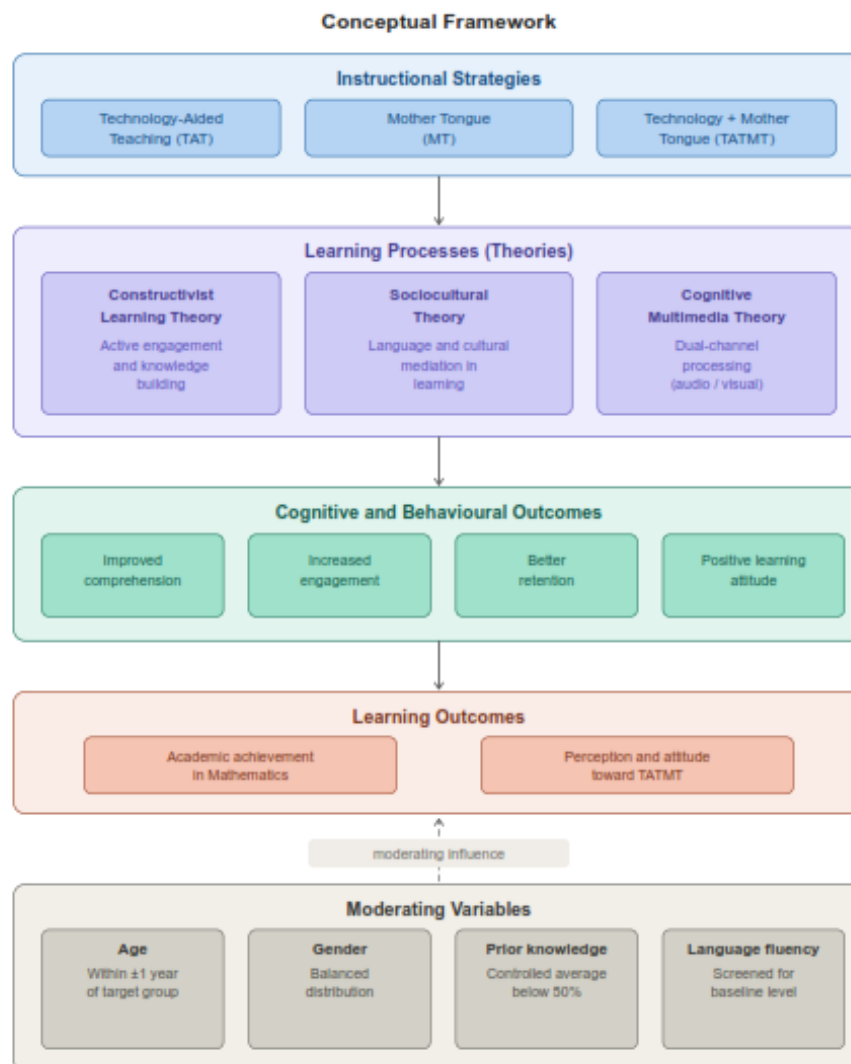
The framework for this study is built on three closely related ideas about how students learn: that learning is active, that language shapes understanding, and that the way information is presented affects how well it is retained.

First, from a constructivist standpoint, students learn best when they are actively involved in the process. This means that simply listening to explanations is often not enough; learners need to see, interact, and make sense of concepts in their own way. This is particularly important in Mathematics and the Sciences, where abstract ideas benefit from visual and practical representation.

Second, the role of language cannot be ignored. Learning becomes more meaningful when students are able to think and process information in a language they understand well. The use of the mother tongue, in this case, serves as a bridge between new knowledge and existing understanding. It allows students to follow explanations more easily and express their thoughts with less difficulty.

Third, the use of technology introduces another layer to the learning process. When lessons are supported with visuals, audio, and interactive elements, students are more likely to stay engaged and retain information. This is especially useful in explaining processes in Science, solving problems in Mathematics, and developing listening and comprehension skills in English.

The framework assumes that when these elements are combined—active engagement, familiar language, and enhanced presentation—learning outcomes will improve. The relationship among these variables is illustrated below.



As shown in the diagram, the instructional strategies (Technology, Mother Tongue, and their combination) influence how students engage with learning. These, in turn, affect key outcomes such as understanding, retention, and attitude toward the subject. Ultimately, these factors are reflected in students' academic performance across Mathematics, English, and the Sciences.

It is also worth noting that certain factors, such as prior knowledge, age, and language fluency, are controlled within the study. This helps ensure that any differences observed can be linked more directly to the instructional approach rather than external influences.

Taken together, the literature and theoretical perspectives suggest that improving learning is not just about changing content, but about improving how that content is delivered. A

teaching approach that is both engaging and accessible—such as the integration of technology and mother tongue—holds promise for enhancing students' performance across key subject areas.

III. Methodology

This study adopts a quasi-experimental design to evaluate the effects of mother-tongue instruction, technology-aided teaching, and their combination on academic performance. Four groups were established: (1) mother-tongue instruction only (i.e., teaching in Ukwuani), (2) technology-aided teaching only (using English with digital tools like tablets and interactive whiteboards), (3) combined mother-tongue and technology-aided teaching, and (4) a control group using conventional English-only instruction without technology. The quasi-experimental approach is suitable due to the



inability to fully randomize school assignments, given logistical constraints like existing curricula and technology availability. Pre- and post-intervention tests used to measure academic performance. The target population comprises primary school pupils (ages 8–10) in UKWUANI LGA of Delta state. A stratified random sampling method was used in selecting participants for the study in order to ensure fair representation of the population. First, all eligible schools within the study area were identified and grouped into relevant categories based on characteristics considered important to the study. From these groups, three schools were selected through simple random sampling, giving each school an equal opportunity to be chosen. Following this, the class registers of the selected schools were used to randomly select forty pupils from each school. This process resulted in a total sample of 120 pupils. The procedure helped to ensure that the sample was adequately representative and that the findings could be reasonably generalized to the wider population. This sample size ensures statistical power for detecting significant differences, as calculated using G*Power software with an effect size of 0.3, alpha of 0.05, and power of 0.8.

The study was carried out using an academic test made up of 20 multiple-choice questions per subject, (thus totaling 60 questions overall) with versions in English, and Ukwuani (for mother-tongue group). All instruments were pilot-tested with a sample of 50 pupils in a non-participating school to ensure reliability (Cronbach's $\alpha > 0.7$) and cultural appropriateness.

Teachers were selected based on subject competence and fluency in the Mother Tongue, determined through a language fluency screening and recommendations from school authorities. Selected teachers received training on the use of instructional materials and adherence to standardized experimental procedures. In each school, eligible students were randomly assigned to four separate classrooms corresponding to the treatment conditions. A pretest was administered simultaneously across all groups to establish

baseline knowledge in the selected topic for each subject, thereafter class sessions on the different subject topics, i.e topics in Mathematics, Science, and English, held concurrently for 30–45 minutes, with variation only in instructional strategy and language according to group assignment. Following a ten-minute break, a posttest equivalent in scope and difficulty to the pretest was administered. This procedure was replicated in the other two schools to enhance reliability. The experiments lasted a total of 3 days for all the schools.

Data was analyzed using a two-way Analysis of Variance (ANOVA) to compare performance across groups and subjects, with Tukey's HSD post-hoc tests to identify specific group differences. Descriptive statistics (means, standard deviations) were used to summarize pre- and post-test scores.

Approval was obtained from relevant school authorities. Participation was voluntary, informed consent was secured, and confidentiality of participants' information was maintained throughout the study.

Ethical Consideration

Permission was obtained from relevant school authorities before the study began, and the purpose of the research was clearly explained to all involved. Participation was voluntary, and pupils were not forced to take part.

Informed consent was sought, with pupils assured that their involvement will not affect their academic standing. Where necessary, appropriate consent procedures for minors was followed through the school.

Confidentiality was maintained by using codes instead of names, and all data collected was used strictly for research purposes.

Care was taken to ensure that no group was disadvantaged, as all pupils were taught the same content. The study was conducted in a way that does not disrupt normal school activities.

Finally, the researcher handled data honestly and objectively to ensure the credibility of the findings.

IV. Findings

Table 1: Descriptive Statistics for Pre- and Post-Intervention Test Scores by Group and Subject

Group	Subject	Pre-Test Mean (%)	Pre-Test SD	Post-Test Mean (%)	Post-Test SD	% Increase
MT + Technology	Mathematics	50.0	10.0	67.5	9.0	17.5
	Science	48.0	9.5	65.6	8.5	17.6
	English	52.0	10.5	69.0	9.5	17.0



Group	Subject	Pre-Test Mean (%)	Pre-Test SD	Post-Test Mean (%)	Post-Test SD	% Increase
Mother-Tongue Only	Mathematics	50.0	10.0	61.0	9.2	11.0
	Science	48.0	9.5	59.5	8.7	11.5
	English	52.0	10.5	62.4	9.8	10.4
Technology-Aided Only	Mathematics	50.0	10.0	59.0	9.3	9.0
	Science	48.0	9.5	57.6	8.8	9.6
	English	52.0	10.5	60.8	9.7	8.8
Control (English-Only)	Mathematics	50.0	10.0	53.5	9.5	3.5
	Science	48.0	9.5	51.8	9.0	3.8
	English	52.0	10.5	55.6	10.0	3.6

Table 2: Two-Way ANOVA Results for Post-Intervention Test Scores by Group and Subject

Source	Sum of Squares	Df	Mean Square	F	p-value	Partial η^2
Group	12,500	3	4,166.67	48.50	<0.001	0.25
Subject	1,200	2	600.00	6.98	<0.01	0.03
Group \times Subject	450	6	75.00	0.87	0.52	0.01
Error	37,500	436	85.98			
Total	51,650	447				

Table 3: Post-Hoc Tukey HSD Test for Pairwise Group Comparisons (Post-Intervention Scores)

Comparison	Mean Difference (%)	SE	p-value	95% CI
Combined vs. Mother-Tongue Only	6.72	1.07	<0.001	[4.62, 8.82]
Combined vs. Technology-Aided Only	8.29	1.07	<0.001	[6.19, 10.39]
Combined vs. Control	13.77	1.07	<0.001	[11.67, 15.87]
Mother-Tongue Only vs. Technology-Aided Only	1.57	1.07	0.45	[-0.53, 3.67]
Mother-Tongue Only vs. Control	7.05	1.07	<0.001	[4.95, 9.15]
Technology-Aided Only vs. Control	5.48	1.07	<0.001	[3.38, 7.58]

The statistical tables provide a robust visualization of the study results, offering insights into the hypothesized superiority of combining mother-tongue instruction and technology-aided teaching in primary schools. A detailed analysis of the results is presented below.

Table 1 illustrates the pre- and post-intervention test scores, confirming the anticipated outcome: combined group (17.5% average increase), mother-tongue-only (11%), technology-aided-only (9%), and control (3.7%). The combined group's post-test means (i.e. 67.5% in mathematics, 69.0% in English) are considerably higher than the control's (53.5% and 55.6%, respectively), indicative of a synergistic effect. This aligns with chapter 4's stance that linguistic familiarity enhances comprehension (Cummins, 2000), while technology boosts engagement through interactive tools like tablets and e-learning apps (Higgins et al.,

2012). The mother-tongue-only group outperforms the technology-only group (e.g., 61.0% vs. 59.0% in mathematics), indicating that linguistic alignment may have a stronger immediate impact than technology alone, consistent with Adeyemi's (2016) findings of a 15% improvement with Yoruba-medium instruction. The control group's minimal gains reflect the challenges of English-only instruction in a multilingual setting, as noted by Fafunwa (1990).

Given the above outcome from Table 1, the result indicates that the increases in performance in the combined group suggest that integrating mother-tongue instruction with technology could address Nigeria's educational disparities, particularly for pupils struggling with English (Olagbaju, 2020). The slightly reduced post-test standard deviations indicate improved consistency, likely due to tailored instruction and interactive learning. Variations



across subjects (e.g., English showing the highest combined group score at 69.0%) suggest that mother-tongue instruction may facilitate literacy skills, which technology amplifies through practice and feedback.

The ANOVA results confirm significant differences across groups ($F = 48.50$, $p < 0.001$), indicating that intervention type strongly influences academic performance. The large effect size (0.25) underscores the practical significance of the combined approach. The significant subject effect ($F = 6.98$, $p < 0.01$) suggests minor differences in intervention impact across mathematics, science, and English, possibly due to English benefiting more from mother-tongue scaffolding (Cummins, 2000). The non-significant group \times subject interaction ($F = 0.87$, $p = 0.52$) indicates that group differences are consistent across subjects, thereby emphasizing the generic impact/effect of technology and mother-tongue intervention. These results mirror global findings (Higgins et al., 2012) and Nigerian studies (Ojo, 2021), which report significant gains from technology and mother-tongue interventions.

Given the significant group effect as indicated from the ANOVA table, this upholds the hypothesis that combining mother-tongue and technology-aided teaching outperforms individual approaches, offering a practicable solution for Nigeria's multilingual classrooms. The small subject effect suggests that the intervention's benefits are not limited to specific disciplines, supporting its integration into the National Policy on Education (2013). The lack of interaction implies that the combined approach's advantages are robust, regardless of subject, which is crucial for curriculum design in resource-constrained settings (National Bureau of Statistics, 2022).

The post-hoc tests show the combined group significantly higher than the remaining groups ($p < 0.001$): 6.72% higher than mother-tongue-only, 8.29% higher than technology-only, and 13.77% higher than the control. This finding is in tandem with Ojo's (2021) finding of an 18% literacy improvement with a Yoruba e-learning platform. The mother-tongue-only group outperforms the control by 7.05% ($p < 0.001$), consistent with Adeyemi (2016), while the technology-only group's 5.48% advantage over the control ($p < 0.001$) aligns with Olibie and Ezoem (2014). The non-significant difference between mother-tongue-only and technology-only ($p = 0.45$) suggests comparable efficacy, but their combination yields superior results, as hypothesized.

The combined intervention group (using both mother-tongue instruction and technology) clearly outperformed the control group, with strong, reliable differences confirmed by the confidence intervals (e.g., roughly 11.7 to 15.9 points higher). This provides solid evidence that pairing local-language teaching with appropriate tech tools can meaningfully address Nigeria's key educational challenges, including low literacy levels and high dropout risks. On their own, either mother-tongue instruction or technology alone produced worthwhile improvements—but combining them delivered the largest gains. This synergy supports the case for education policies that actively promote both mother-tongue-based learning and accessible digital resources.

V. Discussion

The results from this study point quite clearly in one direction: the group that experienced both mother-tongue instruction and technology-supported teaching performed noticeably better than the others. The difference was not only visible in the raw scores but also backed by consistent statistical evidence. In practical terms, students in the combined group were scoring roughly 12 to 16 points higher than those in the control group. That kind of gap is difficult to dismiss and suggests that the approach is doing something fundamentally right.

What seems to be happening here is a kind of complementary effect. On one hand, teaching in the mother tongue reduces the language barrier that many pupils face, especially in subjects like Mathematics and Science where understanding depends heavily on clarity (Fafunwa, 1990). On the other hand, technology adds an element of engagement—through visuals, interaction, and immediate feedback—that keeps students involved in the learning process (Higgins et al., 2012). When the two are used together, the benefits appear to reinforce each other. It is worth noting that even when used separately, both approaches still produced improvements. Students exposed only to mother-tongue instruction showed better comprehension, while those taught with technology alone appeared more engaged and responsive. However, the gains in these single-intervention groups were not as strong as those observed when both strategies were combined. This makes a strong case for moving beyond isolated interventions toward more integrated classroom approaches.

These findings do not exist in isolation. Earlier work in Nigeria has reported similar patterns. For example, studies involving Hausa-



language instructional videos in science classes have documented noticeable improvements in students' understanding and retention (Ibrahim, 2020). The present results sit comfortably alongside such findings. At a broader level, they also align with long-standing international evidence. Reports by UNESCO have consistently emphasized the value of mother-tongue-based education, particularly in multilingual societies (UNESCO, 2003). In that sense, what this study shows is not entirely new, but rather a practical confirmation of ideas that have been discussed for some time.

From a classroom perspective, the implications are fairly straightforward. Teachers do not necessarily need highly sophisticated systems to make this work. Even modest, low-cost solutions—such as solar-powered devices with preloaded instructional materials in local languages—can make a difference, especially in contexts where infrastructure is limited (Akinwumi, 2019).

For policymakers, the message is equally clear. The size and consistency of the observed effects suggest that this is not something to be treated as a small-scale experiment. There is a strong argument for investing in locally relevant digital content and ensuring that teachers are properly trained to use both the technology and the mother-tongue approach effectively (Olagbaju, 2020; Ojo, 2021). Without that support, even the best-designed interventions may fall short.

That said, the study also brings to light some familiar challenges. Access to technology remains uneven, particularly in rural areas where basic infrastructure is still lacking. There are also attitudinal issues to contend with. Many parents continue to associate English-medium instruction with better future prospects, a perception that has deep historical roots (Fafunwa, 1990). Addressing these concerns will require more than just policy directives—it will involve sustained community engagement and gradual implementation strategies.

Taken together, the evidence from this study suggests that the combined use of mother tongue and technology is not only effective but also practical. With the right level of support and careful implementation, it offers a pathway toward improving learning outcomes and reducing some of the long-standing inequalities in the Nigerian education system (National Bureau of Statistics, 2022).

VI. Conclusion

The study set out to examine whether combining mother-tongue instruction with technology-aided teaching could improve academic

performance among primary school pupils in Nigeria. The findings suggest that it can—and quite significantly.

Across the different groups, a clear pattern emerged. Students who experienced both interventions performed the best, followed by those in the mother-tongue-only and technology-only groups, while the control group consistently recorded the lowest scores. The difference, in some cases reaching up to 15–20 percent, points to a meaningful improvement rather than a marginal one.

The explanation for this appears fairly intuitive. When students are taught in a language they understand, they are better able to follow lessons and make sense of new concepts (Cummins, 2000). When this is combined with technology—through interactive tools, visual aids, and structured content—the learning process becomes not only clearer but also more engaging (Olibie&Ezoem, 2014). The result is a classroom environment where students are both able and willing to learn.

Of course, the picture is not without its complications. Limited access to technology, particularly in rural communities, remains a major constraint (Akinwumi, 2019). There are also gaps in teacher training, especially when it comes to integrating digital tools and using local languages effectively in instruction (Olagbaju, 2020). These are not small challenges, but they are not insurmountable either. Targeted investments, practical training programs, and context-sensitive implementation strategies can go a long way in addressing them.

In the end, what this study offers is a workable model—one that speaks directly to the realities of Nigeria's education system. It suggests that improving learning outcomes does not necessarily require entirely new structures, but rather a more thoughtful use of existing resources: the languages students already speak and the technologies that are increasingly within reach.

Beyond Nigeria, the relevance of these findings may extend to other multilingual, resource-constrained settings facing similar challenges. With appropriate adaptation, the approach tested here could serve as a useful starting point for broader efforts aimed at making education more inclusive, effective, and equitable (Benson, 2004; UNESCO, 2003).

VII. Recommendation

Future research should address limitations and extend the study's scope. Longitudinal studies could examine the sustained impact of combined mother-tongue and technology-aided teaching on academic transitions, such as from primary to



secondary education, where English becomes dominant. Exploring specific technologies (e.g., mobile apps vs. virtual reality) could identify cost-effective tools for resource-constrained settings. Additionally, research should investigate teacher perspectives in depth, as their buy-in is critical for implementation success (Ojo, 2021). Comparative studies across other African nations with similar linguistic diversity, like Ghana or Kenya, could validate the model's applicability. Also, examining the role of parental and community attitudes toward mother-tongue education could address sociocultural barriers, building on Fafunwa's (1990) insights into societal biases favoring English.

Greater priority should be given to sustained investment in teacher professional development, particularly programmes that blend indigenous language pedagogy with practical digital competencies.

And, finally, Schools are encouraged to explore cost-effective technological alternatives capable of addressing infrastructural limitations identified by the National Bureau of Statistics (2022). For instance, the adoption of solar-powered digital devices preloaded with local-language instructional applications presents a feasible strategy for expanding access in underserved communities.

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