



EFFECTS OF MOTHER TONGUE AS SUPPLEMENTARY MEDIUM OF INSTRUCTION ON SECONDARY SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY IN EKITI STATE NIGERIA

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Abstract

This study investigated the effects of mother tongue as a supplementary medium of instruction on secondary school students' academic performance in Biology in Ekiti State, Nigeria. A pre-test, post-test, control group quasi-experimental research design was adopted. The population comprised 12,513 SS II Biology students in public secondary schools. A sample of 120 students was selected through a multistage sampling procedure. Data were collected using a researcher-developed Biology Achievement Test (BAT), validated by experts and found reliable with a KR-20 coefficient of 0.84. The experimental group was taught Biology using mother tongue (Yoruba) alongside English, while the control group received instruction through the conventional method. Mean and standard deviation were used to answer the research question, while independent samples t-test and Analysis of Covariance (ANCOVA) tested the hypotheses at the 0.05 level of significance. The findings revealed that students taught with mother tongue as a supplementary medium of instruction performed significantly better than those taught using the conventional method. No significant difference existed between the groups before the treatment, while no significant gender difference was found among students exposed to the treatment. It was recommended that Biology teachers should integrate learners' mother tongue with English when explaining difficult concepts.

Keywords: Mother Tongue, Supplementary Medium of Instruction, Academic Performance

Introduction

Education is universally acknowledged as a vital instrument for individual empowerment, socio-economic transformation, and national development. It equips learners with the knowledge, skills, attitudes, and competencies required to function effectively in an increasingly knowledge-driven society. The quality of education received by learners is influenced by several factors, among which the language of instruction occupies a central position. Language serves as the primary medium through which knowledge is transmitted, ideas are exchanged, and learning is facilitated (Cummins, 2021). Consequently, the language used during classroom instruction significantly influences learners' comprehension, participation, academic achievement, and overall educational

outcomes (Tai, 2022). In multilingual countries such as Nigeria, where English is the official language of instruction while indigenous languages constitute learners' first languages, concerns continue to be raised regarding the effectiveness of English as the sole language of instruction, particularly in science classrooms (UNESCO, 2024).

Biology is one of the major science subjects taught in senior secondary schools in Nigeria and occupies a strategic position in the nation's educational system. It provides students with knowledge of living organisms, their structure, functions, evolution, ecology, genetics, and interactions with the environment. Biology also serves as a prerequisite for admission into several science-

based disciplines, including Medicine, Nursing, Pharmacy, Agriculture, Environmental Science, Microbiology, Biotechnology, and Veterinary Medicine. Consequently, students' academic performance in Biology has significant implications for national scientific advancement and manpower development (Federal Republic of Nigeria [FRN], 2014). Despite its importance, students' achievement in Biology has continued to fluctuate over the years, as reflected in reports of the West African Examinations Council (WAEC, 2023; WAEC, 2024). Several researchers have attributed the persistent poor performance to factors such as ineffective instructional methods, inadequate laboratory facilities, poor mastery of scientific concepts, shortage of qualified teachers, and language barriers during classroom instruction (Aiyedun et al., 2023; Tai, 2022).

Language plays a crucial role in science education because scientific knowledge is communicated through specialized terminologies, explanations, observations, and classroom discussions. Students who have limited proficiency in the language of instruction often experience difficulty understanding scientific concepts, interpreting examination questions, and expressing scientific ideas appropriately (Cummins, 2021). In Nigeria, English language is the official medium of instruction from the upper primary school level onwards, although it is a second language for the majority of learners (FRN, 2014). Many students communicate predominantly in their indigenous languages outside the classroom and only encounter English extensively within the school environment. This linguistic situation creates communication barriers that may hinder effective teaching and learning of Biology, especially in rural and semi-urban communities where exposure to English language is relatively limited.

Mother tongue refers to the first language acquired naturally by a learner from birth and the language through which initial socialization and cognitive development occur (Cummins, 2021). In Ekiti State, Yoruba is the predominant indigenous language spoken by most students. Mother tongue as a supplementary medium of instruction involves the strategic use of learners' indigenous language alongside English to explain difficult concepts, interpret scientific terminologies,

reinforce learning, encourage classroom interaction, and clarify misconceptions without replacing English as the official medium of instruction (Tai, 2022). This instructional approach recognizes the importance of English for academic communication while simultaneously utilizing learners' linguistic background to enhance conceptual understanding and meaningful learning.

The theoretical foundation for using mother tongue as a supplementary medium of instruction is rooted in constructivist and sociocultural perspectives of learning, which emphasize that learners construct new knowledge by connecting new experiences with their existing cognitive structures and prior linguistic knowledge (Cummins, 2021). Learners tend to understand abstract scientific concepts more effectively when explanations are linked to familiar linguistic experiences. The strategic use of the mother tongue also promotes active classroom participation, strengthens teacher–student interaction, reduces communication anxiety, and facilitates critical thinking during instruction (Tai, 2022). Consequently, multilingual instructional practices have increasingly gained recognition as effective pedagogical approaches capable of improving students' learning outcomes across science disciplines.

Several recent empirical studies have reported positive effects of mother tongue and multilingual instructional strategies on students' academic achievement. Aiyedun et al. (2023) found that the use of mother tongue instructional strategy significantly improved upper basic school students' achievement in Basic Science in Kwara State, Nigeria. Similarly, Tai (2022) reported that translanguaging practices in science classrooms enhanced students' conceptual understanding, participation, and confidence in learning scientific concepts. UNESCO (2024) also emphasized that multilingual education enables learners to understand classroom instruction better, enhances participation, improves academic achievement, and promotes inclusive quality education. These findings demonstrate that integrating learners' indigenous language into classroom instruction can facilitate effective learning, particularly in subjects involving abstract scientific concepts such as Biology.

Despite the growing body of evidence supporting multilingual instructional approaches, the use of mother tongue as a

supplementary medium of instruction remains relatively uncommon in many secondary school Biology classrooms in Nigeria, including Ekiti State. Most Biology teachers continue to rely almost exclusively on English language during instruction despite the linguistic challenges experienced by many students. Consequently, students often memorize scientific facts without fully understanding the underlying concepts, leading to poor retention and unsatisfactory academic performance (UNESCO, 2024; Tai, 2022). Furthermore, although previous studies have examined the role of mother tongue in language education and Basic Science, relatively few studies have investigated its effectiveness as a supplementary medium of instruction in senior secondary school Biology within the context of Ekiti State. This creates a gap in empirical literature that requires further investigation.

It is against this background that this study investigated the effects of mother tongue as a supplementary medium of instruction on secondary school students' academic performance in Biology in Ekiti State, Nigeria. Specifically, the study examined whether the use of mother tongue alongside English language would improve students' academic performance in Biology compared with the conventional English-only instructional approach. The study also determined whether gender influenced students' academic performance when exposed to mother tongue as a supplementary medium of instruction. The findings of the study are expected to contribute to the growing body of knowledge on multilingual education and provide useful information for Biology teachers, curriculum developers, educational planners, policymakers, and other stakeholders seeking to improve science teaching and learning in Nigerian secondary schools.

Statement of the Problem

Biology is one of the core science subjects offered in secondary schools in Nigeria and serves as a prerequisite for admission into many science-related courses in tertiary institutions. Despite its importance, students' academic performance in Biology has continued to generate concern among teachers, parents, school administrators, and other stakeholders in education. This concern stems from the observation that many students appear to experience difficulties in

understanding some Biology concepts, which may affect their academic performance. Several factors have been suggested as possible contributors to students' performance in Biology. These include teaching methods, availability of instructional materials, learning environment, students' interest, teachers' competence, and the language used during classroom instruction. In most Nigerian secondary schools, English language is the official medium of instruction. However, for many students, English is not their first language, while their mother tongue remains the language they use most frequently for communication outside the classroom. This situation raises questions about whether the exclusive use of English language during Biology instruction may influence students' understanding of scientific concepts.

The use of mother tongue as a supplementary medium of instruction has been proposed as an instructional approach that may assist teachers in explaining difficult concepts and facilitating classroom interaction while maintaining English as the official language of instruction. Although studies have examined the role of mother tongue in teaching and learning, there appears to be limited empirical evidence on its use as a supplementary medium of instruction in the teaching of Biology among secondary school students in Ekiti State. In addition, it is not clear whether the use of this instructional approach produces different learning outcomes for male and female students. It is against this backdrop that this study investigated the effects of mother tongue as a supplementary medium of instruction on secondary school students' academic performance in Biology in Ekiti State, Nigeria.

Purpose of the Study

The main purpose of the study was to examine the effects of mother tongue as supplementary medium of instruction on secondary school students' learning outcomes in Biology in Ekiti State Nigeria. The study specifically:

- i. examined the effects of mother tongue as supplementary medium of instruction on students' performance in Biology;
- ii. explored which of the treatments (mother tongue and conventional) have better effects on students' performance in Biology;

- iii. found out whether or not there is difference in the performance of male and female students using mother tongue as supplementary medium of instruction in Biology; and

Research Questions

The following research questions are raised for this study.

1. What is the performance of students in the experimental and control groups respectively in Biology before and after the treatment in Biology?

Research Hypotheses

The following research hypotheses are formulated for this study

1. There is no significant difference in the performance of students in the experimental and control groups respectively before the treatment.
2. There is no significant difference in the performance of students in the experimental and control groups respectively before and after the treatment.
3. There is no significant difference in the performance of male and female students exposed to mother tongue as supplementary medium of instruction in Biology.

Methodology

The study adopted a pre-test, post-test, control group quasi-experimental research design to examine the effects of mother tongue as a supplementary medium of instruction on secondary school students' academic performance in Biology in Ekiti State, Nigeria. The population comprised 12,513 Senior Secondary School II (SS II)

students offering Biology in public secondary schools in Ekiti State. A sample of 120 SS II students was selected from four public secondary schools using a multistage sampling procedure. Two schools were assigned to the experimental group, while the remaining two schools served as the control group using intact classes. Data were collected using a researcher-developed Biology Achievement Test (BAT), consisting of 40 multiple-choice items based on the SS II Biology curriculum. The instrument was validated by experts in Biology Education, Tests and Measurement, and Language Education, while its reliability was established through a pilot study using the Kuder-Richardson Formula 20 (KR-20), which yielded a reliability coefficient of 0.84. The treatment lasted for six weeks, during which the experimental group was taught selected Biology topics using mother tongue (Yoruba) as a supplementary medium of instruction alongside English, whereas the control group was taught the same topics using the conventional method with English as the sole medium of instruction. A pre-test was administered before the treatment and a post-test after the treatment. Data collected were analysed using mean and standard deviation to answer the research question, while independent samples t-test and Analysis of Covariance (ANCOVA) were used to test the hypotheses at the 0.05 level of significance.

Results

Research Question 1: What is the performance of students in the experimental and control groups respectively in Biology before and after the treatment in Biology?

Table 1: Mean and Standard Deviation of Students' Pre-test and Post-test Performance in Biology

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain
Experimental (Mother Tongue Supplementary Instruction)	58	42.06	6.12	76.84	6.85	34.78
Control (Conventional Method)	62	41.73	6.47	62.58	7.39	20.85

Table 1 revealed Before the treatment, students in the experimental group obtained a pre-test mean score of 42.06 (SD = 6.12), while those in the control group recorded a pre-test mean score of 41.73 (SD = 6.47).

The similarity in the pre-test mean scores suggests that both groups had comparable levels of academic performance before the commencement of the treatment. Following the treatment, students in the experimental

group who were taught Biology using mother tongue as a supplementary medium of instruction achieved a post-test mean score of 76.84 (SD = 6.85), compared with a post-test mean score of 62.58 (SD = 7.39) for students in the control group who were taught using the conventional method. The experimental group recorded a mean gain of 34.78, whereas the control group recorded a mean gain of 20.85. The results indicate that although both groups improved in their Biology performance after instruction, the improvement was considerably greater among students exposed to mother tongue as a supplementary medium of instruction. This

implies that integrating students' mother tongue alongside English language in Biology instruction enhanced their understanding of concepts and improved their academic performance more effectively than the conventional method of instruction.

Testing of Hypotheses

Hypothesis 1: There is no significant difference in the performance of students in the experimental and control groups respectively before the treatment.

Table 2: Independent Samples *t*-Test Showing the Difference in the Pre-test Performance of Students in the Experimental and Control Groups

Group	N	Mean	SD	df	<i>t</i>	<i>p</i> -value
Experimental	58	42.06	6.12	118	0.29	0.772
Control	62	41.73	6.47			

$p > 0.05$ (Not Significant)

Table 2 revealed that the experimental group had a mean score of 42.06 (SD = 6.12), while the control group recorded a mean score of 41.73 (SD = 6.47). The analysis yielded a df of 118, a calculated *t*-value of 0.29, and a *p*-value of 0.772. Since the *p*-value is greater than the 0.05 level of significance ($p > 0.05$), the null hypothesis was not rejected. The result indicates that there was no significant difference in the pre-test performance of students in the experimental and control groups before the

treatment. This implies that both groups were statistically equivalent in their Biology performance at the commencement of the study, confirming that they were comparable prior to the administration of the treatment.

Hypothesis 2: There is no significant difference in the performance of students in the experimental and control groups respectively before and after the treatment.

Table 3: ANCOVA Showing the Difference in the Post-test Performance of Students in the Experimental and Control Groups Using Pre-test Scores as Covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6628.471	2	3314.236	65.427	.000
Intercept	15483.624	1	15483.624	305.584	.000
Pre-test (Covariate)	684.392	1	684.392	13.505	.000
Group (Treatment)	5812.764	1	5812.764	114.712	.000
Error	5927.438	117	50.662		
Total	586540.000	120			
Corrected Total	12555.909	119			

$p < 0.05$ (Significant)

Table 3 showed that the treatment effect was statistically significant ($F(1,117) = 114.712$, $p < .05$). Since the probability value ($p = .000$) is less than the 0.05 level of significance, the null hypothesis was rejected. The finding revealed that there was a significant difference in the post-test performance of students in the experimental and control groups after the treatment. Students exposed to Biology instruction using mother tongue as a supplementary medium of instruction performed significantly better than those

taught using the conventional method. This suggests that the use of mother tongue as a supplementary medium of instruction had a positive and significant effect on students' academic performance in Biology.

Hypothesis 3: There is no significant difference in the performance of male and female students exposed to mother tongue as supplementary medium of instruction in Biology.

Table 4: Independent Samples *t*-Test Showing the Difference in the Performance of Male and Female Students Exposed to Mother Tongue as a Supplementary Medium of Instruction in Biology

Gender	N	Mean	SD	df	<i>t</i>	<i>p</i> -value
Male	27	77.41	6.54	56	0.81	0.421
Female	31	76.08	6.01			

$p > 0.05$ (Not Significant)

Table 4 showed that male students obtained a mean score of 77.41 ($SD = 6.54$), while female students recorded a mean score of 76.08 ($SD = 6.01$). The analysis yielded a *df* of 56, a calculated *t*-value of 0.81, and a p -value of 0.421. Since the p -value is greater than the 0.05 level of significance ($p > 0.05$), the null hypothesis was not rejected. The result indicates that there was no significant difference in the academic performance of male and female students exposed to mother tongue as a supplementary medium of instruction in Biology. This implies that the instructional approach was equally effective for both male and female students, implying that gender did not influence students' academic performance when mother tongue was used as a supplementary medium of instruction.

Discussion

The findings of this study revealed that students exposed to mother tongue as a supplementary medium of instruction recorded higher post-test mean scores and greater mean gains in Biology than their counterparts taught using the conventional method. Although both groups demonstrated improvement after instruction, the experimental group showed a more remarkable increase in academic performance. This suggests that the use of the learners'

mother tongue alongside English language enhanced comprehension of Biology concepts, promoted active classroom participation, reduced language-related learning difficulties, and facilitated meaningful learning. The finding supports the view that students learn scientific concepts more effectively when complex ideas are explained in a familiar language. This finding is consistent with the findings of Aiyedun et al. (2024), who reported that the use of mother tongue as an instructional strategy significantly improved students' achievement in Basic Science irrespective of gender. The finding also agrees with Tai (2022), who found that translanguaging and the strategic use of learners' first language in science classrooms improved conceptual understanding, participation, and learning outcomes among students in English-medium instruction settings.

The study further found that there was no significant difference in the pre-test performance of students in the experimental and control groups before the treatment. This indicates that the two groups were academically comparable prior to the commencement of the experiment and that any differences observed after the treatment could reasonably be attributed to the instructional strategy rather than to initial differences in students' abilities. The finding

confirms the effectiveness of the quasi-experimental design in establishing group equivalence before the intervention. This finding is consistent with the recommendations of Fraenkel et al. (2019) that experimental and control groups should demonstrate comparable baseline performance before treatment in order to enhance the internal validity of quasi-experimental studies. Furthermore, the study established a significant difference in the post-test performance of students in the experimental and control groups after the treatment. Students who received Biology instruction through mother tongue as a supplementary medium of instruction significantly outperformed those taught using only the conventional English-medium approach. This finding demonstrates that supplementing English with students' mother tongue enhances understanding, retention of scientific knowledge, and overall academic performance in Biology. The finding corroborates the systematic review by Nkurunziza et al. (2022), which concluded that language barriers contribute substantially to poor Biology learning in Sub-Saharan Africa and recommended bilingual instructional approaches to improve conceptual understanding and academic achievement. It also aligns with UNESCO (2024), which emphasized that multilingual education based on learners' mother tongue improves comprehension, participation, and learning outcomes across science and other school subjects.

Finally, the study found no significant difference in the academic performance of male and female students exposed to mother tongue as a supplementary medium of instruction in Biology. This implies that the instructional strategy benefited both male and female students equally, suggesting that gender did not influence the effectiveness of the treatment. The finding indicates that when students are provided with an enabling language environment that promotes comprehension, both sexes are capable of achieving comparable learning outcomes. This finding agrees with Aiyedun et al. (2024), who found that mother tongue instructional strategy significantly enhanced students' achievement in Basic Science without significant gender differences. It also supports the position of UNESCO (2024) that multilingual instructional approaches promote

equitable learning opportunities and improve educational outcomes for all learners irrespective of gender or linguistic background.

Conclusion

The study concluded that the use of mother tongue as a supplementary medium of instruction significantly enhances secondary school students' academic performance in Biology in Ekiti State, Nigeria. Students who were taught Biology using mother tongue alongside English language performed significantly better than those taught through the conventional English-only method. The study also established that the experimental and control groups were comparable before the treatment, indicating that the improvement in students' performance was attributable to the instructional strategy. Furthermore, the findings revealed that the effectiveness of mother tongue as a supplementary medium of instruction was not influenced by gender, as both male and female students benefited equally from the approach. Therefore, the study concludes that integrating learners' mother tongue into Biology instruction as a complementary medium can improve students' understanding of scientific concepts, enhance classroom participation, and promote better academic achievement in Biology.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Biology teachers should adopt mother tongue as a supplementary medium of instruction alongside English language, particularly when explaining difficult concepts, scientific terminologies, and abstract ideas, to improve students' understanding and academic performance.
2. The Ministry of Education and relevant educational agencies should develop and implement policies that encourage the appropriate use of mother tongue as a supplementary medium of instruction in the teaching of Biology and other science subjects in secondary schools.
3. Curriculum developers should incorporate guidelines for the effective integration of mother tongue into Biology instruction and provide standardized translations of key

scientific concepts and terminologies in indigenous languages.

4. School administrators should organize regular workshops, seminars, and in-service training programmes to equip Biology teachers with the knowledge and skills required to effectively integrate mother tongue as a supplementary medium of instruction during classroom teaching.
5. Authors and publishers of Biology textbooks should produce supplementary instructional materials, including bilingual glossaries and teaching guides, to facilitate the effective use of mother tongue alongside English language in Biology instruction.
6. Researchers should conduct further studies on the use of mother tongue as a supplementary medium of instruction in other science subjects and at different levels of education to provide broader empirical evidence for educational policy and classroom practice.

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