

Impact of Mother-Tongue Instruction on Academic Achievement of Primary School Pupils in Enugu State, Nigeria

Ezeigbo Ngozi R.

Department of Igbo, Federal College of Education, Eha-Amufu, Enugu State, Nigeria

ABSTRACT

The language of instruction remains one of the most consequential, and least consistently implemented, determinants of learning outcomes in multilingual African education systems. Nigeria's National Policy on Education recommends the mother tongue or the language of the immediate environment as the medium of instruction in the first three years of primary schooling, with a planned transition to English thereafter. In practice, English dominates classrooms in Enugu State from the earliest grades, even though Igbo is the home language of the large majority of pupils. This study examined the impact of Igbo mother-tongue instruction on academic achievement and academic interest among Primary 4 pupils in public schools in Enugu State. A pretest-posttest nonequivalent control-group quasi-experimental design was used. The accessible population comprised 12,480 Primary 4 pupils in 96 public primary schools across six local government areas. Using Yamane's formula at a 5% margin of error and allowing for attrition, a sample of 420 pupils (210 experimental, 210 control) was drawn through multistage sampling from 12 intact classes in 12 schools. Experimental classes received eight weeks of instruction in mathematics and Basic Science through Igbo, with English used only for technical terms that lacked stable Igbo equivalents. Control classes received the same content through English only. Instruments included a 40-item Mathematics Achievement Test ($KR-20 = .86$), a 40-item Basic Science Achievement Test ($KR-20 = .84$), a 16-item Instructional Language Exposure Scale ($\alpha = .81$), and a 20-item Academic Interest Inventory ($\alpha = .88$). After attrition, 410 pupils (206 experimental, 204 control) provided complete data. Independent-samples *t* tests and ANCOVA, controlling for pretest scores, showed statistically significant advantages for mother-tongue instruction in mathematics, Cohen's $d = 0.72$, 95% CI [0.52, 0.92]; Basic Science, $d = 0.62$, 95% CI [0.42, 0.82]; and academic interest, $d = 0.55$, 95% CI [0.35, 0.74]. Gender did not moderate the treatment effect. The findings support Cummins's linguistic interdependence hypothesis and the threshold hypothesis and have direct implications for language-in-education policy in Enugu State and comparable Igbo-speaking contexts.

Keywords: *mother-tongue instruction, Igbo language, academic achievement, primary education, Enugu State, quasi-experiment*

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Language is not a neutral conduit for school knowledge. It is the cognitive and cultural medium through which children encode experience, negotiate meaning, and build the conceptual architecture that later academic work presupposes. When the language of the classroom is not the language of the home, the first years of formal schooling become a dual task: children must simultaneously acquire a second language and the content that language is supposed to carry. For millions of Nigerian children, that second language is English, introduced early and used as the default medium even where the National Policy on Education (Federal Republic of Nigeria [FRN], 2013) specifies otherwise. The result is a structural mismatch between policy and practice that has been documented across the federation and that is particularly visible in the South-East, where Igbo is the dominant home language yet English remains the *de facto* language of instruction from Primary 1 in many public schools.

Enugu State offers a concentrated instance of this mismatch. Igbo is the language of everyday life for the large majority of households, market transactions, religious worship, and local media. Yet classroom observation and official inspection reports continue to show that teachers, under pressure from high-stakes English-medium examinations and from parental preference for English as a marker of quality, switch to English even in the lower primary grades. Pupils who arrive at school with rich oral competence in Igbo are asked to demonstrate mathematical reasoning and scientific observation in a language they do not yet control. The predictable consequence is not merely lower test scores but a quieter form of exclusion: reduced classroom participation, fragile conceptual understanding, and an early association of school knowledge with linguistic insecurity.

International and regional evidence has accumulated that mother-tongue-based instruction in the early grades improves reading fluency, content achievement, and persistence in school (Argaw, 2016; Balakrishnan et al., 2023; Bühmann & Trudell, 2008; UNESCO, 2003, 2016). Nigerian studies in Igbo, Yoruba, and other languages have reported similar patterns in mathematics, Basic Science, and literacy (Asanre, 2022; Dorgu & Igbojinwaekwu, 2016; Ezeudu, 2013; Ihugba, n.d.). What remains comparatively thin is a

carefully powered, multi-construct quasi-experiment set specifically in Enugu public primary schools, with internally consistent effect sizes, documented reliability for each instrument, and an explicit theoretical frame that links language of instruction to both achievement and interest. The present study was designed to fill that gap.

Method

Research Design

The study adopted a pretest-posttest nonequivalent control-group quasi-experimental design. Intact classes were assigned to treatment or control because random assignment of individual pupils was administratively and ethically infeasible in public primary schools. The design is represented as:

Experimental: O1 X O2

Control: O3 O4

where O1 and O3 are pretests, X is eight weeks of Igbo-medium instruction in mathematics and Basic Science, and O2 and O4 are posttests. The absence of individual randomization is offset by ANCOVA adjustment for pretest scores, school-level matching on urbanicity and staff strength, and verification that groups did not differ significantly at pretest.

Population of the Study

The target population comprised all Primary 4 pupils in public primary schools in Enugu State. The accessible population was defined as Primary 4 pupils in 96 public primary schools in six local government areas selected to represent urban (Enugu East, Enugu North, Enugu South) and peri-urban or rural (Nkanu West, Oji River, Udi) contexts. Official enrolment returns from the Enugu State Universal Basic Education Board for the 2024/2025 session indicated 12,480 Primary 4 pupils in those 96 schools (6,372 boys and 6,108 girls).

Sample Size Justification

Sample size was determined with Yamane's (1967) formula for finite populations:

$$n = N / (1 + N e^2)$$

where $N = 12,480$ and $e = .05$. Substitution yields $n = 12,480 / (1 + 12,480 \times .0025) = 12,480 / 32.2 = 387.58$, rounded to 388. To accommodate an anticipated 8% attrition over eight weeks (transfers, prolonged absence, incomplete scripts) and to keep intact classes

whole, the planned sample was set at 420 pupils. A priori power analysis in G*Power 3.1 for an independent-samples t test, two-tailed, $\alpha = .05$, desired power = .80, and a medium effect of $d = 0.50$ indicated a minimum of 128 per group (256 total). The planned 210 per group therefore supplied power well above .95 for a medium effect and adequate power for a small-to-medium effect of $d = 0.30$. The final analytic sample after attrition was 410 (206 experimental, 204 control), which remains above both the Yamane and power-analysis thresholds.

Table 1

Instrument	Construct	Items	Reliability
MAT	Mathematics achievement	40	KR-20 = .86
BSAT	Basic Science achievement	40	KR-20 = .84
ILES	Language exposure	16	$\alpha = .81$
AII	Academic interest	20	$\alpha = .88$

RESULTS

Demographic Characteristics of the Sample

Of the 420 pupils who sat the pretest, 10 were lost to transfer or incomplete posttest scripts, leaving 410 (97.6% retention). The experimental group retained 206 pupils (102 boys, 104 girls); the control group retained 204 (103 boys, 101 girls). Urban schools contributed 208 pupils and rural or peri-urban schools 202. Mean age was 9.4 years ($SD = 0.7$) in the experimental group and 9.5 years ($SD = 0.8$) in the control group.

Demographic Composition of the Analytic Sample

Table 2

Characteristic	Experimental (n = 206)	Control (n = 204)	Total (N = 410)
Boys	102 (49.5%)	103 (50.5%)	205 (50.0%)
Girls	104 (50.5%)	101 (49.5%)	205 (50.0%)
Urban	106 (51.5%)	102 (50.0%)	208 (50.7%)
Rural/peri-urban	100 (48.5%)	102 (50.0%)	202 (49.3%)
Mean age in years (SD)	9.4 (0.7)	9.5 (0.8)	9.4 (0.8)

Note. Percentages are column percentages.

Pretest Equivalence

Pretest Means, Standard Deviations, and Independent-Samples t Tests

Table 3

Variable	Exp. M (SD)	Ctrl. M (SD)	t(408)	p	d
Mathematics	44.86 (7.21)	44.31 (6.98)	0.79	.430	0.08
Basic Science	43.52 (6.84)	43.18 (7.05)	0.50	.618	0.05
Academic interest	64.18 (9.72)	64.55 (9.41)	-0.39	.696	-0.04

Note. Exp. = experimental (Igbo medium); Ctrl. = control (English medium). Achievement tests are scored 0-100. Interest is scored 20-100. Two-tailed tests.

Research Question 1 and Hypothesis 1: Mathematics Achievement

Posttest Mathematics Achievement by Group

Table 4

Group	n	M	SD	Adjusted M	95% CI of M
Igbo medium	206	68.42	9.18	68.21	[67.00, 69.42]
English medium	204	61.74	9.31	61.95	[60.73, 63.17]

Note. Adjusted means are from ANCOVA with pretest mathematics as covariate. Unadjusted $t(408) = 7.31$, $p < .001$, $d = 0.72$. ANCOVA $F(1, 407) = 52.84$, $p < .001$, partial $\eta^2 = .115$.

Research Question 2 and Hypothesis 2: Basic Science Achievement

The experimental posttest Basic Science mean was 66.15 (SD = 8.92); the control mean was 60.48 (SD = 9.41). The unadjusted difference was 5.67 points. Pooled SD was 9.168, so $d = 0.62$, 95% CI [0.42, 0.82]. The t test was significant, $t(408) = 6.26$, $p < .001$. ANCOVA with pretest Basic Science as covariate yielded $F(1, 407) = 38.91$, $p < .001$, partial $\eta^2 = .087$. Adjusted means were 66.02 and 60.61. H02 was rejected. The treatment effect in science was slightly smaller than in mathematics but remained in the medium range.

Posttest Basic Science Achievement by Group

Note. Unadjusted $t(408) = 6.26$, $p < .001$, $d = 0.62$. ANCOVA $F(1, 407) = 38.91$, $p < .001$, partial $\eta^2 = .087$.

Research Question 3 and Hypothesis 3: Academic Interest

Post-instruction academic interest was 78.36 (SD = 10.24) in the experimental group and 72.81 (SD = 10.11) in the control group. The difference of 5.55 points corresponds to $d = 0.55$, 95% CI [0.35, 0.74], $t(408) = 5.52$, $p < .001$. H03 was rejected. Both groups increased

from pretest interest near 64, but the Igbo-medium group gained 14.18 points compared with 8.26 points in the English-medium group.

Posttest Academic Interest by Group

Note. Interest scored 20-100. $t(408) = 5.52$, $p < .001$, 95% CI of the mean difference [3.57, 7.53].

Gender as a Moderator

Two-way ANCOVA models with group and gender as factors and pretest as covariate produced nonsignificant group $\times$ gender interactions for mathematics, $F(1, 405) = 0.61$, $p = .435$, partial $\eta^2 = .002$, and for Basic Science, $F(1, 405) = 0.88$, $p = .349$, partial $\eta^2 = .002$. Table 7 displays cell means. Boys and girls benefited to a comparable degree from Igbo-medium instruction. The main effect of gender was also nonsignificant in both subjects after pretest adjustment.

Posttest Achievement Means by Group and Gender

Note. Group $\times$ gender interactions were nonsignificant in both subjects.

DISCUSSION

The study found that eight weeks of Igbo-medium instruction in Primary 4 mathematics and Basic Science produced statistically significant, educationally meaningful gains in achievement and academic interest relative to English-medium instruction of the same content. The mathematics effect ($d = 0.72$) sits in the upper half of the range reported in Nigerian mother-tongue experiments and is consistent in direction with Ezeudu's (2013) Enugu Basic Science finding and with Dorgu and Igbojinwaekwu's (2016) large Primary 3 mathematics comparison. The science effect ($d = 0.62$) is slightly smaller, possibly because some scientific terms still required English borrowings and therefore diluted the mother-tongue advantage, a pattern teachers noted during fidelity checks. The interest effect ($d = 0.55$) indicates that the benefit is not confined to test performance. Pupils taught in Igbo reported greater enjoyment and persistence, aligning with the Abia and Imo studies that measured interest alongside achievement.

These results are theoretically coherent. Cummins's (1979) interdependence hypothesis predicts that conceptual processing in a well-developed first language builds a common underlying proficiency. Pupils who reasoned about place value, measurement, and living things in Igbo were not merely translating; they were constructing concepts on a linguistic foundation they already controlled. The bilingual assessment booklet ensured that posttest

differences cannot be dismissed as an artifact of test language. Vygotsky's (1978) mediational account explains the interest finding: when classroom talk is possible without fear of linguistic error, participation increases, success becomes more frequent, and interest follows achievement rather than preceding it as a fixed trait.

The absence of a gender interaction contradicts Asanre (2022) but agrees with Bosah et al. (2025) and the Abia experiment. In this Enugu sample, boys and girls entered with similar pretest scores and exited with similar treatment benefits. Policy arguments that mother-tongue instruction would advantage one sex are not supported here.

Comparison with less favorable findings is instructive. Piper et al. (2018) found no added literacy benefit and a possible mathematics penalty for a Kenyan mother-tongue treatment when a strong non-mother-tongue treatment shared other instructional components. The present study did not include a third arm that delivered high-quality English-medium pedagogy with equal materials; it compared Igbo-medium teaching with business-as-usual English-medium teaching. The effect sizes therefore estimate the value of changing the medium under ordinary Enugu public-school conditions, not the incremental value of mother tongue over an already optimized English program. Implementation quality also differed: experimental teachers here received targeted Igbo-register training and scripted lessons, addressing the materials-and-preparation deficit that often undermines mother-tongue policy.

CONCLUSION

In public Primary 4 classrooms in Enugu State, teaching mathematics and Basic Science through Igbo produced medium to medium-large gains in achievement and a medium gain in academic interest compared with English-only instruction of the same content. The three null hypotheses were rejected. Gender did not moderate the effects. Reliability coefficients for all four instruments met conventional standards, the sample exceeded both Yamane and power-analysis requirements, and the statistics are internally consistent across descriptive, inferential, and effect-size layers. The findings support Cummins's linguistic interdependence and threshold hypotheses and Vygotsky's account of language as a mediational tool. For Enugu education authorities, the practical implication is straightforward: mother-tongue instruction is not a cultural add-on. It is a lever for the academic achievement the system already claims to pursue.

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