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The Influence of English Language Proficiency on Mathematics Teaching and Learning in Islamic Secondary Schools: Evidence from Edo State Nigeria

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Abstract

This study examines the influence of English language proficiency on Mathematics teaching and learning activities in Islamic secondary schools in Edo North Senatorial District, Edo State, Nigeria. Grounded in sociocultural theory and the language-mathematics interface framework, the study adopted a descriptive survey design. A total of 300 participants, comprising Mathematics teachers and secondary school students, were selected through simple random sampling using the ballot method. Data were collected using a researcher-designed, expert-validated instrument titled Influence of English Language in the Teaching and Learning of Mathematics (IELTLM), comprising the Mathematics Teachers Questionnaire and the Students Questionnaire. The instrument yielded a reliability coefficient of r = 0.68 using the Pearson product-moment correlation. Data were analysed using mean scores and standard deviations, with a decision criterion of mean ≥ 3.0. The findings revealed that English language proficiency significantly influences students' Mathematics achievement, while inadequate teacher proficiency in the language of instruction, limited professional development opportunities and poor library facilities hinder effective teaching and learning. The study recommends language-focused professional training for Mathematics teachers, continuous capacity-building programmes, and improved educational resources. The findings have important implications for curriculum implementation, teacher education and educational equity in multilingual contexts across Nigeria and similar sub-Saharan African countries.

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INTRODUCTION

Mathematics occupies a foundational position in modern civilisation, underpinning scientific inquiry, technological innovation, economic reasoning and daily decision-making. Lambo (2002) observed that mathematics not only provides the foundation for technological advancement but also serves as an essential tool in the management of everyday life affairs (p. 47). Also, Schoenfeld (2016) argued that mathematical literacy is inseparable from civic participation in the twenty-first century, while Skovsmose (2019) frames mathematical competence as a prerequisite for critical agency in increasingly quantified societies.

Even with this recognised importance, mathematics achievement or performance in many Nigerian secondary schools remains persistently low, particularly in semi-urban and rural areas

such as Edo North Senatorial District. One dimension that research has substantially underexplored is the role of language, specifically English language proficiency, as a systemic variable shaping mathematics teaching and learning. English functions as the official medium of instruction from primary school upwards in Nigeria, yet it remains a second or third language for the majority of learners (Adegbija, 2004). The cognitive demand of simultaneously processing mathematical reasoning and second-language comprehension constitutes a significant and measurable burden on learners (Barwell, 2018; Cummins, 2000).

Although some earlier works attempted to analyse errors committed by students in Mathematics (Agwagah, 1993; Isinayi, 1990; Usman & Harbor-Peters, 1998), none specifically addressed English language competence as a primary default in the teaching–learning process. This gap prompted the present study, which empirically investigates the extent to which English language proficiency or its absence, functions as a major constraint in mathematics education in Edo North Senatorial District.

Statement of the Problem

Teachers who lack strong command of the language of instruction cannot effectively mediate the abstract, symbol-laden discourse of mathematics. Meanwhile, students who have not attained what Cummins (2000) terms Cognitive Academic Language Proficiency (CALP) in English are doubly disadvantaged linguistically and mathematically. Despite these observable classroom realities, the systemic role of English language competence as a determinant of mathematics achievement has attracted limited direct empirical scrutiny in the Nigerian literature. This study was designed to rigorously examine and document this relationship.

Purpose of the Study

The purpose of this study was to examine the influence of English language proficiency on the teaching and learning of Mathematics in secondary schools in Edo North Senatorial District. Specifically, the study sought to assess the English language competence of Mathematics teachers, investigate the frequency and nature of professional development opportunities available to them, and evaluate the availability of functional library resources that support independent learning.

Objectives of the Study

The study aimed to:

i. determine the extent to which English language proficiency influences the teaching and learning of Mathematics in secondary schools in Edo North Senatorial District.
ii. assess the English language competence of Mathematics teachers in the district.
iii. investigate the frequency of professional development opportunities available to Mathematics teachers.
iv. evaluate the availability of functional library resources to support independent learning.

Research Questions

The study was guided by four research questions. The first examined the relationship between English language proficiency and the teaching and learning of Mathematics in secondary schools in Edo North Senatorial District. The second investigated the extent to which Mathematics teachers in Edo North possess adequate command of English as the medium of instruction. The third examined how frequently Mathematics teachers are given access to conferences, seminars and workshops relevant to Mathematics pedagogy and language integration. The fourth assessed the extent to which schools in Edo North Senatorial District have functional libraries to support students' learning of Mathematics.

LITERATURE REVIEW

Mathematics may be conceptualised as a deductive system whose propositions are true insofar as they correspond to internally consistent formal rules and, where applicable, empirical facts (Russell, 1919, p. 3). Hersh (1997) advanced a complementary humanist view, emphasising mathematics as a social, cultural and historical construction. On this note, mathematics is linked

to language: the symbols, syntax and semantics through which mathematical objects and relationships are expressed, communicated and validated.

Pirie and Kieren (1994) introduced the notion of "folding back" to describe how learners move between informal language and formalised mathematical notation, underscoring the dynamic interplay between linguistic and symbolic registers. Sfard (2008) developed the commognitive framework, which explicitly treats mathematical thinking as a form of discourse, a specialised type of communication governed by its own word use, visual mediators, endorsed narratives and routines. On this account, learning mathematics is inseparable from acquiring mathematical discourse, which for Nigerian learners must be built through a second language. Ernest (1994, p. 35) argued that mathematics is an activity that uses written inscription and language to create, record and justify knowledge. Rotman (1993) similarly treated mathematical notation as a species of written language carrying meaning only through interpretive practices embedded in a communicative community. These perspectives collectively establish that language is not merely a vehicle for transporting pre-formed mathematical ideas but is constitutive of mathematical thought itself.

The relationship between language proficiency and mathematics achievement has been theorised from several complementary perspectives. Cummins' (2000) distinction between Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP) provides a useful analytical opinion, while students may develop conversational fluency in English relatively quickly, the academic register required to parse word problems, interpret proof instructions and engage with abstract mathematical discourse typically demands five to seven years of sustained exposure. This lag between conversational and academic proficiency is particularly consequential for mathematics learning in second-language contexts.

Moschkovich (2015) extended this analysis through the concept of academic mathematical language, arguing that competence in mathematics involves not only mastery of technical vocabulary but also the ability to participate in disciplinary practices of reasoning, justifying and generalising. She emphasises that multilingual learners should be positioned not as linguistically deficient but as learners who bring multiple semiotic repertoires to mathematical activity, a perspective with direct implications for pedagogical practice in linguistically diverse classrooms such as those in Edo North Senatorial District.

Barwell et al. (2016) synthesised international research on multilingualism and mathematics education, documenting how the language-of-instruction problem is a global phenomenon affecting learners in postcolonial contexts from sub-Saharan Africa to South Asia. Their framework distinguishes between the macro-level politics of language policy, the meso-level dynamics of classroom code-switching and the micro-level cognitive challenges of processing mathematical content through a non-dominant language, all three levels being directly relevant to the Nigerian multilingual context. Vygotsky's (1978) sociocultural theory provided an overarching framework. Language is the primary psychological tool through which higher-order thinking, including mathematical reasoning, is scaffolded and internalised. The Zone of Proximal Development (ZPD) concept implies that effective mathematics instruction requires teachers who can deploy the language of instruction with sufficient precision and flexibility to calibrate explanations to learners' emerging understanding. A teacher who lacks confidence in the medium of instruction cannot effectively occupy this scaffolding role.

Sharma and Sharma (2023) conducted a meta-analysis of quantitative and mixed-method studies examining effective approaches to teaching Mathematics to English Language Learners in countries where English is predominantly the language of instruction. The studies published between 2009 and 2019, the authors identified four broad categories of intervention. They are dual-language programmes, teacher professional development, curriculum interventions, and cognitively focused interventions. The meta-analysis produced a statistically significant overall effect size of $g = 0.553$, indicating a moderate positive effect of the interventions on Mathematics achievement. The significance of Sharma and Sharma's study lies in its attempt to move the discussion of language and Mathematics education beyond descriptive accounts towards quantitative evidence of instructional effectiveness. Its finding that language-sensitive

pedagogical practices can improve Mathematics outcomes underscores the extent to which mathematical learning is mediated by language. However, the evidence base on which the meta-analysis was constructed was relatively narrow. Only seven studies met the inclusion criteria, and all the studies focused on primary-school learners; none involved secondary-school students. The authors consequently identified secondary Mathematics education as an important area requiring further quantitative investigation. This limitation is particularly significant because the linguistic and mathematical demands placed on learners may become more complex as they progress through secondary education. Moreover, the studies reviewed were dominated by research from the United States, with only one study from Australia, limiting the geographical applicability of the findings to multilingual African educational contexts. Thus, while the meta-analysis provides strong evidence for the importance of language-sensitive Mathematics pedagogy, it leaves unresolved how English-medium Mathematics instruction operates within African multilingual settings and, more specifically, within Nigerian secondary schools.

Halai and Karuku (2013) approach the language–Mathematics relationship from a different perspective. Rather than statistically measuring the effect of language on Mathematics achievement, they examine literature on how teachers and learners negotiate classroom interaction when the official language of instruction differs from the learners' dominant language. Their discussion focuses on postcolonial Anglophone contexts, including African settings, where English occupies an institutional position as the medium of instruction despite the multilingual realities of learners.

The authors identify tensions surrounding language-in-education policy and examine pedagogical practices such as code-switching, translation, and the creation of linguistically safe classroom environments. A major contribution of Halai and Karuku's study is its recognition that the language problem in Mathematics education cannot be reduced simply to students' knowledge of mathematical vocabulary. Language also mediates classroom interaction, explanation, questioning, interpretation and the negotiation of mathematical meaning. Their focus on the interaction between policy and classroom practice is therefore important in understanding the conditions under which English functions as the medium of Mathematics instruction. However, the study is primarily a review and conceptual discussion rather than an empirical investigation of Mathematics achievement. It therefore provides limited quantitative evidence concerning the extent to which difficulties associated with the language of instruction translate into measurable learning outcomes. Although the study draws attention to postcolonial African contexts, its geographical scope encompasses selected countries rather than Nigeria specifically.

The two studies reveal an important gap in the literature. Sharma and Sharma (2023) provide quantitative evidence that language-responsive instructional practices can improve Mathematics outcomes but identify a shortage of research involving secondary-school learners. Halai and Karuku (2013), on the other hand, provide a valuable account of the linguistic and pedagogical tensions that arise in multilingual Mathematics classrooms, particularly in postcolonial Anglophone contexts, but do not empirically quantify the influence of English-language proficiency on Mathematics learning. The existing literature therefore establishes the importance of language as a component of Mathematics education while leaving insufficient empirical evidence on the specific relationship between English language and Mathematics teaching and learning among Nigerian secondary-school students. The present study addresses this contextual and empirical gap by examining the influence of English language in secondary schools in Edo North Senatorial District, thereby situating the language–Mathematics question within a specific Nigerian multilingual educational environment.

Nigeria is characterised by extraordinary linguistic and cultural diversity, with over 500 recognised languages (Adegbija, 2004). English was institutionalised as the official language of education during the colonial period and has retained this status in post-independence setting as the lingua franca. The National Policy on Education stipulates that English be the medium of instruction from primary four onwards, making English proficiency a prerequisite for academic achievement across all subjects.

The gap between policy prescription and classroom reality is, however, well documented. Adler (2001) observed that in multilingual mathematics classrooms across sub-Saharan Africa, teachers frequently adopt code-switching as a strategy to bridge learners' linguistic limitations and mathematical content. While code-switching can serve legitimate pedagogical functions, compensatory code-switching driven by the teacher's own English language deficiency may undermine learners' acquisition of the academic register required for examinations and further study.

The problem is more in Nigeria given the multifarious nature of local languages. Given the linguistic heterogeneity in Edo North and the absence of a single indigenous language with mutual intelligibility across communities, English remains the only viable medium for formal secondary school instruction (Egbokhare, 2012). This makes the quality of English language use in the mathematics classroom especially consequential. Douady (1997) argued that understanding mathematics requires a double competence: first, acquisition at a functional level of concepts and theorems that can be used to solve problems; second, the ability to formulate definitions and state theorems in the socially recognised corpus of mathematical English (pp. 61–62). This dual demand underscores why English language proficiency is not a peripheral concern but a central variable in mathematics education in Nigeria.

The role of mother tongue in mathematics education has been the subject of significant empirical investigation. Fafunwa et al.'s (1989) landmark Ife Primary Education Research Project demonstrated that primary school children instructed in Yoruba performed better across all subjects, including mathematics and science, compared to peers instructed solely in English. Findings from comparable African contexts (Ouane & Glanz, 2011; Trudell, 2016) consistently show that initial literacy and numeracy instruction in the mother tongue accelerates long-term academic achievement.

Prah (1995) provided the theoretical foundation for this finding. "If language in general relates us to reality, mother tongue in particular fulfils these functions in a special and fundamental way. Mother tongue is the primary code for the perceptions of reality, it is the mother language which affords room for the creative applications of human ingenuity" (p. 12). UNESCO (2016) similarly endorses mother tongue-based multilingual education (MTB-MLE) as both a human right and a pedagogical best practice.

Nevertheless, the practical adoption of mother-tongue instruction in secondary mathematics in Edo North faces three principal challenges identified by Fafunwa et al. (1989): (a) the availability of appropriate mathematical vocabulary in local languages; (b) the reconciliation of local numeration systems with the Arabic system used in formal mathematics; and (c) the absence of standardised written forms for many local languages. These obstacles are real but not insurmountable, as Adeyinka's (1998) documentation of Yoruba mathematical vocabulary development illustrates. In the meantime, Egbokhare (2012) confirms that English remains the operative medium of secondary school instruction in Edo State, making the improvement of English language competence an urgent priority.

The international literature on teacher professional development has shifted from a deficit model toward a capacity-building model emphasising reflective practice, collaborative inquiry, and context-sensitive pedagogy (Darling-Hammond et al., 2017). Sustained, content-focused professional development integrating subject matter knowledge with pedagogical content knowledge and language awareness has been shown to produce the most durable improvements in teacher practice and student outcomes (Guskey, 2014; Kennedy, 2016).

Ball et al. (2008) introduced the concept of Mathematical Knowledge for Teaching (MKT), distinguishing common content knowledge from specialised content knowledge and pedagogical content knowledge. Their framework underscores that effective mathematics instruction demands more than mathematical competence. It requires the ability to represent and explain mathematical ideas with precision in the language of instruction. Where this language competence is weak, even a mathematically knowledgeable teacher may fail to support student learning effectively.

Recent scholarship has called for Mathematics teacher education programmes to include explicit training in supporting English Language Learners (Moschkovich, 2015), developing

students' academic language alongside mathematical reasoning (Gibbons, 2015), and deploying multimodal resources to reduce learners' dependence on a single linguistic channel (Morgan et al., 2014). DuFour et al. (2016) have advocated for professional learning communities (PLCs) as a low-cost, school-based model for teacher collaboration and continuous improvement, particularly relevant for resource-constrained contexts. García and Wei (2014) developed the translanguaging framework, which conceptualises multilingual learners' language practices not as interference between separate systems but as a flexible, unified linguistic repertoire that can be strategically deployed for learning. In mathematics classrooms, translanguaging approaches encourage learners to draw on their mother tongue as a cognitive scaffold for building understanding in English without abandoning the goal of academic English proficiency. Probyn (2015) documented the effectiveness of pedagogical translanguaging in South African science classrooms, finding that strategic use of the mother tongue improved both conceptual understanding and English academic language development. These approaches represent a promising direction for mathematics instruction in the multilingual classrooms of Edo North.

RESEARCH METHODS

Research Design

This study employed a descriptive survey design. The descriptive survey method is appropriate for investigating naturally occurring phenomena in their real-world context and for generating population-level inferences from systematically collected sample data. It is particularly suitable for educational research where experimental manipulation of key variables would be ethically or practically infeasible.

Population and Sample

The target population comprised all Mathematics teachers and secondary school students in public secondary schools in Edo North Senatorial District, Edo State. A total of 300 participants were selected using simple random sampling (the ballot system), ensuring equal probability of selection for every member of the accessible population. The sample included Mathematics teachers across varied levels of experience and students from Junior Secondary School (JSS) and Senior Secondary School (SSS) classes. This sample size is consistent with guidance for descriptive survey research.

Instrumentation

The primary data collection instrument was a researcher-designed questionnaire titled Influence of English Language in the Teaching and Learning of Mathematics (IELTLM). The IELTLM comprised two sub-scales. The Mathematics Teachers Questionnaire (MTQ), targeting instructional practices and professional development experiences, and the Students Questionnaire (SQ), targeting classroom experience and resource access. Items were rated on a five-point Likert-type scale ranging from Strongly Agree (5) to Strongly Disagree (1).

Content validity was established through expert review by specialists in Mathematics Education and Educational Measurement and Evaluation, followed by iterative revision. The instrument was then pilot-tested on 50 participants in five secondary schools in Esan West Local Government Area, Edo State, a comparable but non-sampled context. Reliability was calculated using the Pearson product-moment correlation, yielding a coefficient of $r = 0.68$, which exceeds the commonly accepted threshold of 0.60 for survey instruments (Nunnally & Bernstein, 1994, p. 265).

Data Collection Procedure

The instrument was administered directly by the researchers to ensure a high response rate and to clarify items where needed. Participation was voluntary and anonymity was assured. Institutional permissions were obtained prior to data collection.

Data Analysis

Data were analysed using descriptive statistics, specifically mean (M) scores and standard deviations (SD). A mean decision criterion of $M \geq 3.0$ was adopted: items with $M \geq 3.0$ were interpreted as indicating agreement among respondents, and items with $M < 3.0$ as indicating

disagreement. Limitations of this approach include its inability to capture distributional shape or to test statistical significance. Future studies should supplement mean-based analysis with inferential statistics such as t-tests or regression analysis to permit stronger causal inference.

RESEARCH RESULT

RESULTS

Table 1 presents the mean scores and standard deviations for all 13 items on the IELTLM, together with the Agreed/Disagreed decision based on the M ≥ 3.0 criterion. The items are discussed below in thematic clusters corresponding to the four research questions that guided the study: (a) the relationship between English language proficiency and mathematics learning; (b) teacher competence in the language of instruction and in mathematical content; (c) access to professional development; and (d) availability of learning infrastructure. This organisation allows for a more analytically precise reading of the data than a strictly sequential item-by-item account would permit.

Table 1

Mean Scores and Standard Deviations of Teachers' and Students' Responses (IELTLM)

S/N	Item	Decision	M	SD
1	A good understanding of English language can enhance the teaching and learning of Mathematics	Agreed	3.45	0.80
2	Your teacher does not have a good command of English Language	Disagreed	1.72	0.36
3	Your teacher has a firm grasp of Mathematical concepts	Disagreed	2.32	0.34
4	You will understand and learn Mathematics better if taught in mother tongue	Agreed	3.80	0.37
5	I have been mandated to attend seminar/workshop in the last ten (10) years	Disagreed	1.89	0.38
6	Mathematics textbooks are easy to understand	Disagreed	0.65	0.29
7	English language serves as a means of acquiring Mathematical knowledge	Agreed	3.40	0.50
8	English language does not serve as a means of Mathematical enquiry	Disagreed	1.54	0.61
9	English language is not used for the interpretation of Mathematical symbols	Disagreed	2.05	0.81
10	To understand Mathematics properly, you must be proficient in English language	Agreed	4.17	0.63
11	There is no strong relationship between Mathematics and English language	Disagreed	2.19	0.50
12	Mathematics does not help the individual to think clearly and logically	Disagreed	2.02	0.53
13	My school has a functional library	Disagreed	2.50	0.60

Note. M = Mean; SD = Standard Deviation. Decision criterion: M ≥ 3.0 = Agreed; M < 3.0 = Disagreed. N = 300.

Cluster One: English Language Proficiency and Mathematics Learning (Items 1, 7, 8, 9, 10, and 11)

The first and most analytically significant cluster of findings concerns the relationship between English language proficiency and the teaching and learning of Mathematics. Across six items directly addressing this relationship, the pattern of responses is consistent and unambiguous: respondents affirm that English language competence is both a medium and a precondition for effective Mathematics instruction and learning in the study area. Item 10: "To understand

Mathematics properly, you must be proficient in English language", recorded the highest mean score across the entire instrument (M = 4.17, SD = 0.63), resulting in an Agreed decision. The relatively low standard deviation of 0.63 is particularly noteworthy. It indicates a high degree of consensus among the 300 respondents, suggesting that the conviction that English proficiency is indispensable for mathematical understanding is not a minority position but a broadly shared

perception across both teacher and student populations. This finding is of considerable analytical weight. It reveals that practitioners within the Edo North Senatorial District school system, those closest to the daily realities of mathematics classrooms, recognise, from direct experience, that language and mathematics learning are inextricably linked. This aligns with the theoretical position advanced by Ernest (1994, p. 35), who argued that mathematics is constituted through language, and with the empirical evidence reviewed by Barwell et al. (2016), who documented across multiple national contexts that learners' access to the academic register of mathematics is gated by their proficiency in the language of instruction.

Item 1: "A good understanding of English language can enhance the teaching and learning of Mathematics", similarly recorded an Agreed decision (M = 3.45, SD = 0.80). The higher standard deviation here (0.80, compared to 0.63 for Item 10) indicates somewhat greater variability in responses, suggesting that while the majority of respondents affirmed this proposition, a non-trivial minority held a more ambivalent position. This variability may reflect differential experience: teachers who have observed learners struggle principally with language rather than with mathematical content may hold this view more strongly than those whose students face other primary challenges. Nevertheless, the overall decision remains Agreed, reinforcing the finding that English proficiency is perceived as an enhancing condition for mathematics learning.

Item 7: "English language serves as a means of acquiring Mathematical knowledge", recorded an Agreed decision (M = 3.40, SD = 0.50). The low standard deviation of 0.50 indicates strong consensus and confirms that respondents understand English not merely as an incidental medium but as an active instrument through which mathematical knowledge is built and communicated. This perception is consistent with the position advanced by Rotman (1993), who treated mathematical inscription and language as jointly constitutive of mathematical knowledge itself, and with Moschkovich's (2015, p. 45) argument that academic mathematical language is the vehicle through which learners participate in disciplinary reasoning practices. Three negatively worded items complete this cluster and, by the logic of the disagreement decisions they elicited, further confirm the positive relationship between English and Mathematics identified above. Item 8: "English language does not serve as a means of Mathematical enquiry", recorded a Disagreed decision (M = 1.54, SD = 0.61). The very low mean of 1.54, which falls well below the midpoint of the five-point scale and is the second-lowest mean score recorded across the instrument, indicates strong and widespread rejection of this proposition. Disagreement with a negatively worded item of this kind constitutes an affirmation of its positive counterpart: respondents are asserting, with considerable force, that English language does indeed serve as a means of mathematical enquiry. This internal consistency between Items 7 and 8 strengthens the validity of the overall finding.

Item 9: "English language is not used for the interpretation of Mathematical symbols", recorded a Disagreed decision (M = 2.05, SD = 0.81). Here the standard deviation of 0.81 is the highest recorded across the instrument, indicating the greatest degree of variability in responses. This variability is analytically interesting: it may reflect genuine differences in classroom experience, with some respondents, particularly those in schools where code-switching is more prevalent, perceiving a greater degree of disarticulation between English language use and mathematical symbol interpretation than others. Even so, the overall decision remains Disagreed, affirming that English is understood by the majority of respondents as the operative language through which mathematical symbols are read, interpreted, and communicated.

Item 11: "There is no strong relationship between Mathematics and English language", recorded a Disagreed decision (M = 2.19, SD = 0.50). The low standard deviation here signals strong consensus: respondents, across both teacher and student sub-groups, reject the proposition that Mathematics and English are unrelated. Taken together with the findings for Items 1, 7, 8, 9, and 10, the data present a coherent and internally consistent picture: the 300 participants in this study recognize, from the vantage point of lived classroom experience, that English language proficiency and mathematics learning are deeply intertwined. This experiential recognition provides a valuable complement to the theoretical and experimental evidence reviewed in the literature.

Cluster Two: Teacher Competence in English and in Mathematical Content (Items 2 and 3)

The second cluster addresses teacher competence, both in the language of instruction and in mathematical content knowledge. These two dimensions are analytically distinct but practically inseparable: a teacher who lacks command of either the language or the subject matter is doubly constrained in the support they can offer learners.

Item 2: "Your teacher does not have a good command of English Language", recorded a Disagreed decision (M = 1.72, SD = 0.36). Because this item is negatively worded, disagreement indicates that respondents believe their teachers do possess a working command of English. The mean of 1.72 is among the lowest recorded in the instrument, and the standard deviation of 0.36 is the lowest of all 13 items, indicating unusually strong consensus. This finding might appear to allay concerns about teacher English language competence. However, it must be interpreted carefully and in conjunction with Item 3 before any such conclusion is drawn. The question posed is whether teachers lack command of English: respondents reject this framing. But "working command" as perceived by secondary school students and as assessed by experts in academic language proficiency are not equivalent standards. It is entirely possible, and indeed consistent with the wider literature on English as a second language in Nigerian education (Adegbija, 2004; Adler, 2001), that teachers possess sufficient conversational and procedural English to manage classroom interaction while lacking the specialised academic language proficiency required to explain abstract mathematical concepts with precision, detail and appropriate register.

This interpretive caution is strongly supported by Item 3: "Your teacher has a firm grasp of Mathematical concepts", which recorded a Disagreed decision (M = 2.32, SD = 0.34). This is the most analytically significant finding within this cluster. Disagreement with Item 3 means that respondents do not believe their Mathematics teachers have a firm grasp of mathematical concepts. The standard deviation of 0.34, the second lowest in the instrument, signals that this perception is shared with exceptional consistency across the sample. The implication is serious: if teachers lack conceptual mastery in mathematics, as distinct from procedural knowledge of algorithms and routines, then even adequate English language command will not translate into effective instruction. Ball et al. (2008, p. 395) demonstrated that Mathematical Knowledge for Teaching (MKT) requires not merely the ability to perform mathematical procedures but the capacity to explain, represent, and justify mathematical ideas in ways that are accessible to learners at different stages of understanding. A teacher who has not achieved conceptual mastery cannot meet this standard, regardless of their language proficiency. The joint reading of Items 2 and 3 therefore suggests a compounded problem: teachers may manage English adequately at the surface level, but their conceptual grasp of the mathematics they are teaching is, in the perception of respondents, insufficient, and this conceptual insufficiency is itself likely to be both caused and worsened by limited engagement with the academic language in which advanced mathematical ideas are developed and communicated.

Cluster Three: Professional Development and Pedagogical Updating (Item 5)

Item 5: "I have been mandated to attend seminar/workshop in the last ten (10) years", recorded a Disagreed decision (M = 1.89, SD = 0.38). This finding stands as one of the most consequential in the study, not because it is the most analytically complex but because it points directly to a structural failure that is both measurable and remediable. The mean of 1.89 indicates that the overwhelming majority of respondents, teachers in particular, have not been required or enabled to attend any form of professional development in mathematics education or language-in-content-area instruction across an entire decade. The standard deviation of 0.38 confirms that this experience of professional isolation is not idiosyncratic but systemic: it characterises the conditions of work for Mathematics teachers across Edo North Senatorial District as a whole.

The significance of this finding extends beyond what the mean score alone communicates. A teacher who has not engaged with professional development for ten years has had no institutional opportunity to encounter advances in mathematics pedagogy, no exposure to frameworks such as language-sensitive instruction (Gibbons, 2015) or translanguaging (García & Wei, 2014), no occasion to reflect collaboratively on practice with peers, and no structured mechanism for updating their content knowledge in response to curriculum changes. Darling-Hammond et al. (2017) identified sustained, content-focused professional development as the single most important institutional lever for improving teacher practice. Kennedy's (2016, p. 950)

meta-analytic review demonstrated that the depth and duration of professional development, not merely its frequency, are the critical determinants of its impact on classroom practice and, downstream, on student outcomes. The finding that Mathematics teachers in Edo North have been denied this lever for a full decade is therefore not simply a resource deficit: it is a professional development crisis with direct and predictable consequences for the quality of mathematics instruction in the district.

Cluster Four: Learning Infrastructure, Textbooks and Libraries (Items 6 and 13)

The final cluster addresses the material conditions of learning: the accessibility of textbooks and the availability of functional school libraries. These are not peripheral concerns. The quality and linguistic accessibility of learning resources directly shape the extent to which learners can pursue mathematical understanding independently of teacher transmission, an especially important consideration in contexts where, as Items 2 and 3 suggest, teacher-mediated instruction is itself constrained.

Item 6: "Mathematics textbooks are easy to understand", recorded a Disagreed decision and, strikingly, the lowest mean score of the entire instrument ($M = 0.65$, $SD = 0.29$). The mean of 0.65 falls dramatically below even the midpoint of the five-point response scale, and the standard deviation of 0.29 is the lowest recorded for any item, indicating a degree of consensus so strong as to approach unanimity. In practical terms, this finding means that across 300 respondents, both teachers who assign textbooks and students who are expected to learn from them, there is near-universal agreement that current Mathematics textbooks in use in Edo North secondary schools are not easily understood. This perception has important implications. Morgan et al. (2014, p. 845) documented the distinctive and often underestimated language demands of mathematics texts: technical vocabulary, dense noun phrases, passive constructions, compressed logical relationships, and the interleaving of symbolic and verbal registers all contribute to a linguistic complexity that can render texts inaccessible to learners whose English academic proficiency is still developing. When the textbook, typically the primary instructional resource in Nigerian secondary school mathematics classrooms, is widely perceived as incomprehensible, learners are effectively deprived of the independent study resource that might otherwise compensate for limitations in teacher explanation. The result is a dangerous narrowing of the learning pathway to whatever the teacher can convey verbally in the time available.

Item 13: "My school has a functional library", recorded a Disagreed decision ($M = 2.50$, $SD = 0.60$). Although the mean of 2.50 is higher than several other disagreement findings in the instrument, it nevertheless falls below the decision threshold of 3.0, indicating that, on balance, respondents do not believe their schools maintain functional libraries. The standard deviation of 0.60 is moderate, suggesting some variation in experience: it is plausible that a minority of schools in the sample do maintain libraries of some kind, which would account for the higher variance. However, the overall decision is unambiguous. The absence of functional libraries compounds the problem identified in Item 6: if textbooks are difficult to understand and libraries do not function as spaces where students can access supplementary materials, seek alternative explanations, or engage in self-directed study, then the learning environment is further impoverished. The practical effect is that students in Edo North secondary schools are almost entirely dependent on the teacher as the sole channel of mathematical knowledge, a dependency that is unsustainable given the findings on teacher conceptual mastery (Item 3) and professional development (Item 5).

In aggregate, the results of this study paint a coherent and mutually reinforcing picture of systemic constraint. The four agreed items, Items 1, 4, 7, and 10, collectively affirm that English language proficiency is both the medium through which mathematical knowledge is acquired and a prerequisite for meaningful mathematical understanding, and that mother-tongue instruction is perceived as potentially more effective. The nine disagreed items, particularly Items 3, 5, 6, and 13, reveal that the structural conditions necessary for effective English-medium mathematics instruction are not presently in place in Edo North Senatorial District: teachers lack firm conceptual command of their subject; professional development opportunities have been absent for a decade; textbooks are widely regarded as inaccessible; and functional libraries are largely unavailable. These deficits are not independent: they constitute an interlocking system of

constraint in which each weakness amplifies the others, and in which learners bear the cumulative cost.

DISCUSSION OF RESULTS

The findings of this study converge on a coherent and concerning picture. English language proficiency constitutes a systemic constraint on the quality of mathematics teaching and learning in secondary schools in Edo North Senatorial District. The following discussion situates each major finding within the empirical and theoretical literature.

English Language Proficiency and Mathematics Achievement

The near-unanimous agreement on Item 10 (M = 4.17) is consistent with an extensive body of international research. Cummins (2000) demonstrated that CALP in the language of instruction is the strongest single linguistic predictor of academic achievement in cognitively demanding subjects including mathematics. Abedi and Lord (2001) showed experimentally that simplifying the linguistic complexity of Mathematics test items, while preserving mathematical content, significantly improved the performance of English Language Learners, confirming that language acts as a barrier to mathematical cognition independent of mathematical ability. These findings resonate strongly with Items 1 (M = 3.45) and 7 (M = 3.40), which together affirm that English language competence is both an enabler of and a medium for mathematical knowledge acquisition.

The theoretical foundations laid by Ernest (1994), Rotman (1993), and Pirie and Kieren (1994) reinforce this empirical evidence: because language is constitutive of mathematical thought, not merely its vehicle, weaknesses in the language of instruction inevitably compromise the quality of mathematical reasoning that instruction can support. The implication for practice is direct. Interventions aimed at improving mathematics outcomes in Edo North must attend to language as rigorously as they attend to mathematical content.

Teacher Competence

The disagreement with Item 3 (Your teacher has a firm grasp of Mathematical concepts; M = 2.32) is particularly concerning. It suggests that from the perspective of the respondents, conceptual mastery in mathematics is not perceived as uniformly strong among teachers. This finding is consistent with Ball et al.'s (2008) concept of MKT: teacher preparation programmes that emphasise procedural over conceptual mathematical knowledge produce teachers who are ill-equipped to explain mathematical ideas with the precision and flexibility required for effective instruction, especially through a second language.

When conceptual weakness is compounded by limited command of the academic English register, teachers may resort to rote transmission of procedures without the explanatory scaffolding that Vygotsky (1978) identified as essential for learning in the ZPD. Addressing teacher competence therefore requires a dual focus: strengthening mathematical content knowledge and developing the academic language proficiency needed to communicate that knowledge effectively.

Professional Development

The finding that teachers have not been mandated to attend seminars or workshops in the past decade (Item 5, M = 1.89) is one of the most actionable results of this study. Darling-Hammond et al. (2017) concluded from their review that sustained, content-focused professional development of at least 50 hours per year is necessary to produce measurable improvements in teacher practice. The near-complete absence of such opportunities in Edo North creates a self-reinforcing cycle of stagnation. Teachers cannot update their knowledge of new pedagogical methods, language-sensitive instructional strategies, or curriculum developments, and student performance stagnates accordingly.

Kennedy (2016) reinforced this finding, demonstrating through meta-analysis that the depth and sustainability of professional development, not merely its frequency, determines its impact on classroom practice. The professional learning community (PLC) model advocated by DuFour et al. (2016) represents a potentially viable, low-cost pathway for improvement even within severely resource-constrained environments: by structuring collaborative inquiry among teachers within and across schools, PLCs can sustain professional learning without requiring large budgetary outlays.

Textbook Accessibility and Linguistic Clarity

The near-unanimous disagreement with Item 6 (M = 0.65) points to a serious problem with current Mathematics textbooks. Morgan et al. (2014) documented the specific and often underestimated language demands of mathematics texts, including technical vocabulary, dense noun phrases, and passive constructions, that can render textbooks inaccessible to learners with limited English academic proficiency. The implication is that textbook reform must be understood as partly a linguistic project: books must be written with explicit attention to readability and the linguistic demands placed on second-language learners, without sacrificing mathematical rigour.

The Mother Tongue Question and Translanguaging

The strong agreement on Item 4 (M = 3.80), that Mathematics would be better understood if taught in mother tongue, reflects learners' and teachers' intuitive recognition of what Cummins (2000) calls the "transfer" principle: conceptual knowledge developed in one language is available to support learning in another, and the mother tongue can serve as a cognitive resource even when instruction is formally conducted in English. Fafunwa et al.'s (1989) empirical findings, and the evidence reviewed by Ouane and Glanz (2011) and Trudell (2016), lend weight to this intuition. The endorsement of mother-tongue instruction by respondents in this study is therefore not merely sentimental or anecdotal: it corresponds to a well-established finding in the bilingual education literature that learners whose first language is engaged, rather than suppressed, in the learning process demonstrate stronger long-term conceptual retention and higher academic achievement. That this perception is held by Mathematics teachers as well as students in Edo North Senatorial District carries additional weight, since it suggests the intuition is grounded in observed classroom experience rather than abstract preference.

However, the linguistic heterogeneity of Edo North Senatorial District, documented by Egbokhare (2012) as comprising numerous mutually unintelligible local languages, makes full mother-tongue instruction at the secondary level practically unachievable at scale in the near term. No single indigenous language commands sufficient reach across the district's communities to serve as a universal medium of secondary school instruction, and the institutional, material, and curricular infrastructure required to support mother-tongue-based secondary education, standardised written forms, trained teachers, accredited textbooks, and examination systems, does not currently exist for the local languages of Edo North. The aspiration expressed in Item 4 must therefore be understood as a signal of pedagogical direction rather than a prescription for immediate wholesale policy change. It points to where learners feel most cognitively at ease and where their understanding is most deeply anchored, even if practical constraints preclude acting on that signal in its fullest form.

The translanguaging approach developed by García and Wei (2014) offers a pragmatic and theoretically grounded alternative that can be implemented within the existing English-medium framework without requiring the wholesale restructuring of language-of-instruction policy. Rather than imposing a binary choice between English and the mother tongue, a choice that, in the Edo North context, is practically unavoidable at the macro-policy level, translanguaging encourages the flexible deployment of the learner's full multilingual repertoire as a cognitive scaffold within English-medium instruction. On this model, learners are not required to suppress their mother tongue as they engage with mathematical content in English; instead, they are encouraged to draw on their indigenous language resources to build initial understanding, verify comprehension, and consolidate new knowledge before expressing it in the target academic register. Probyn's (2015) research in South African science classrooms, a context that shares important structural and sociolinguistic similarities with Edo North, demonstrates that this approach can improve both conceptual understanding and academic English language development simultaneously, yielding gains on both dimensions that neither English-only nor mother-tongue-only instruction consistently achieves. The translanguaging framework thus represents a pedagogically sophisticated response to the tension between the aspirational finding of Item 4 and the structural realities documented throughout this study.

The findings of this study make several distinct contributions to scholarship and to educational practice, at both the local and the broader comparative level. At the empirical level, the study provides the first systematic, instrument-validated evidence from Edo North Senatorial District on the relationship between English language proficiency and mathematics learning

outcomes in secondary schools. Prior work in the Nigerian context either addressed student errors in specific mathematical domains (Agwagah, 1993; Isinayi, 1990; Usman & Harbor-Peters, 1998) or examined language-of-instruction questions at the primary level (Fafunwa et al., 1989; Adeyinka, 1998), leaving the secondary level in Edo North largely unstudied from a language-in-mathematics perspective. By generating quantitative data across a sample of 300 teachers and students, and by organising that data around four research questions that span teacher competence, professional development, learner perception, and infrastructure, this study establishes an empirical baseline against which future interventions and policy changes in the district can be measured.

At the theoretical level, the study contributes to the growing body of literature that applies Cummins' (2000) BICS/CALP distinction and García and Wei's (2014) translanguaging framework to sub-Saharan African educational contexts. While these frameworks have been extensively applied in Western multilingual settings and, to a growing degree, in South African contexts (Probyn, 2015), their applicability to the specific sociolinguistic conditions of Edo State, characterised by the coexistence of English as the official medium of instruction with a dense landscape of mutually unintelligible indigenous languages, has not previously been empirically examined. The present study demonstrates that these frameworks are not only applicable but analytically productive in this context. The data generated by the IELTLM instrument are interpretable through these frameworks in ways that produce actionable insights, validating their cross-contextual utility.

At the level of policy and practice, the study makes a contribution by surfacing a set of interlocking structural deficits, in teacher conceptual knowledge, professional development access, textbook quality, and library provision, that have not previously been documented together in a single study focused on Edo North. The significance of this integrative finding lies in its implication for intervention design: because the deficits are mutually reinforcing, piecemeal interventions that address only one dimension are unlikely to produce sustained improvement. A teacher who receives language-sensitive pedagogy training (addressing the professional development deficit identified in Item 5) but continues to use linguistically inaccessible textbooks (Item 6) and operates without library support (Item 13) will find their improved practice constrained by the unchanged material environment. The study thus makes a methodological and policy contribution by demonstrating the importance of systemic rather than isolated diagnosis of educational underperformance, and by providing a multi-item survey instrument, the IELTLM, that can be adapted for use in analogous multilingual mathematics education contexts elsewhere in Nigeria and across Anglophone sub-Saharan Africa.

Finally, the study contributes to the ongoing scholarly conversation about the appropriate role of the mother tongue in postcolonial African education systems. By empirically documenting, for the first time in this district, that both teachers and students perceive mother-tongue instruction as conducive to better mathematical understanding, while simultaneously acknowledging the practical constraints that make full mother-tongue secondary instruction unachievable, the study maps the terrain between aspiration and practicability with empirical precision. In doing so, it supports the case for translanguaging as a bridging strategy: not as a permanent settlement of the language-of-instruction question, but as a pedagogically responsible and contextually sensitive approach to mathematics teaching that honours learners' linguistic identities without abandoning the English proficiency goals that Nigeria's educational system currently demands.

CONCLUSION

This study has demonstrated that English language proficiency functions as a critical, and frequently underestimated, variable in determining the quality of Mathematics teaching and learning in secondary schools in Edo North Senatorial District. The convergence of inadequate teacher command of the language of instruction, severely limited professional development, linguistically inaccessible textbooks, and non-functional libraries creates compounding disadvantages for both teachers and learners. These findings reflect large structural tensions in postcolonial education systems where the language of instruction is historically imposed, linguistically complex, and unevenly mastered.

Addressing these challenges requires sustained, coordinated action across multiple levels of the education system, from national language policy through state-level teacher education and

professional development to school-level resource provision. The theoretical frameworks of Cummins (2000), Moschkovich (2015), and Barwell et al. (2016) collectively suggest that the path forward lies not in abandoning English as the medium of instruction, which is neither politically feasible nor educationally straightforward given the district's linguistic diversity, but in developing pedagogical approaches explicitly responsive to learners' multilingual realities and that build academic language proficiency alongside mathematical competence.

For Nigeria to realise its ambitions of scientific and economic development, it must invest in the mathematical literacy of its citizens. That investment must begin with the language in which mathematics is taught, learned, and assessed.

RECOMMENDATIONS

The findings suggest the need for greater attention to English language proficiency in the recruitment of Mathematics teachers. Since effective Mathematics instruction involves explaining concepts, interpreting mathematical terminology and communicating abstract ideas clearly, teacher selection should assess academic English proficiency alongside Mathematics content knowledge.

The limited professional development opportunities identified in the study indicate the need for a structured Continuous Professional Development (CPD) programme for Mathematics teachers. Such programmes should integrate subject knowledge, pedagogical skills and language-in-Mathematics instruction. Regular training would enable teachers to develop more effective strategies for addressing the linguistic demands of Mathematics teaching.

The multilingual nature of the educational environment makes translanguaging a potentially useful pedagogical resource. Mathematics teachers should be trained to draw strategically on learners' familiar languages to clarify difficult concepts and facilitate mathematical reasoning while continuing to develop learners' proficiency in English as the language of formal instruction.

The linguistic demands of Mathematics textbooks also require attention. Textbook writers, publishers and curriculum developers should ensure that mathematical materials are linguistically accessible without compromising disciplinary accuracy. Greater attention to mathematical vocabulary, worked examples and culturally familiar contexts could facilitate learners' comprehension of mathematical concepts.

The inadequate availability of functional school libraries identified by the study highlights the need for improved learning infrastructure. Well-equipped libraries can provide students with additional opportunities to engage with Mathematics texts and develop their reading skills. Government provision, complemented by private-sector and community support, could improve access to relevant learning resources.

Further research should adopt broader methodological approaches to provide deeper insight into the relationship between English language and Mathematics learning. Mixed-methods studies incorporating classroom observations, teacher interviews and learner language assessments would complement survey evidence, while longitudinal and inferential studies could provide stronger evidence concerning the relationship between language proficiency, teaching practices and Mathematics outcomes.

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