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'We think in isiXhosa first': Medium of instruction preferences in Rural Eastern Cape mathematics classrooms

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Abstract

This study investigates the medium of instruction preferences in mathematics classroom discourses among rural secondary school learners in the Eastern Cape Province, South Africa, where isiXhosa is widely spoken as a home language and English is the official medium of instruction. Anchored in Vygotsky's sociocultural theory, the research explores how language influences learners' engagement, comprehension, and achievement in mathematics, particularly within under-resourced rural contexts. Using a qualitative case study design, data were collected through semi-structured interviews with 15 Grades 10–12 learners from three high schools. Thematic analysis revealed that learners overwhelmingly prefer a bilingual approach that integrates both isiXhosa and English. While English is valued for assessments and future academic opportunities, learners reported enhanced understanding, participation, and confidence when instruction included their home language. Challenges identified include limited English proficiency, reduced classroom participation, and increased cognitive load when mathematics is taught solely in English. The study highlighted a critical tension between policy and practice in South Africa's rural mathematics classrooms. While English serves as the official medium of instruction, learners' voices point towards the necessity of isiXhosa for achieving real understanding, equity, and participation in mathematics education. It recommends the adoption of bilingual pedagogical strategies, development of isiXhosa-English mathematics support materials, and further research into long-term academic outcomes of dual-medium instruction. This research contributes to the discourse on language policy in education and offers practical insights for fostering equitable and linguistically inclusive mathematics teaching in rural South African schools.

Keywords: *bilingual teaching, code-switching, isiXhosa, language policy, medium of instruction, translanguaging*

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1. Introduction

Language plays a crucial role in shaping learners' understanding, participation, and academic success, particularly in content-heavy subjects such as mathematics. In multilingual countries like South Africa, where only 7% of learners speak English as their home language, yet the majority are taught in English from Grade 4 onwards, the medium of instruction (MoI) has emerged as both a pedagogical and political issue (Blocks & Moncada-Comas, 2022; Spaull, 2016). The South African Department of Basic Education's language-in-education policy mandates instruction in learners' home languages during the Foundation Phase (Grades R–3), followed by a switch to English as the primary language of learning and teaching (LoLT) from Grade 4 (Sibanda & Tshehla, 2025). While intended to promote access and equity, this policy often results in cognitive overload and reduced learning outcomes, especially in rural areas where learners' exposure to English is minimal. Despite policy commitments to multilingualism, classroom practices often reflect English-dominant instruction, with limited scaffolding in indigenous languages (Cekiso et al., 2019). Previous research has documented the challenges of English medium instruction (EMI) in mathematics classrooms, including reduced learner participation, surface-level understanding, and increased anxiety. However, few studies have centered the voices of learners themselves particularly those in the further education and training (FET) phase to understand how they perceive and experience language use in their daily mathematics lessons.

The linguistic nature of mathematics makes the subject especially challenging for rural learners who are taught in English as a second language. Mathematics relies on specialised vocabulary, dense academic language, and complex word-problem structures, all of which add linguistic load before learners even engage with concepts. Research shows that when learners lack proficiency in the language of instruction, they struggle to interpret tasks, leading to superficial procedural learning rather than deep understanding (Robertson & Graven, 2020; Mbatha et al., 2025). In rural settings, where English exposure outside school is minimal, learners face a "double burden" of learning both mathematics and academic English simultaneously (Mncwango & Makhathini, 2021). Studies argue that English-only instruction amplifies inequalities by privileging those with stronger English skills while marginalising the majority (Meeran & Biccard, 2025). Recent work supports structured bilingual or translanguaging approaches, which reduce linguistic barriers while still building the English register needed for assessments (Ngubane & Ngwenya, 2025).

To guide the investigation, the following research questions were posed:

1. How do secondary school learners in rural Eastern Cape classrooms experience and perceive the use of English as the medium of instruction in mathematics classroom discourses?
2. What are the challenges of the use of English only medium of instruction in bilingual rural secondary school mathematics classrooms in the Eastern Cape?
3. What medium of instruction do FET mathematics learners in bilingual rural high schools prefer during classroom mathematics discourses?

2. Literature Review

2.1. Theoretical Framework

This study is underpinned by Vygotsky's Sociocultural Theory which was developed in 1931 by a Russian psychologist, Lev Vygotsky. The theory posits that learning is fundamentally a socially mediated process, with language serving as a primary tool for cognitive development. The theory's key constructs - Zone of Proximal Development (ZPD), scaffolding, and mediation; align closely with the study's focus on how learners use language to construct mathematical understanding. In this framework, bilingual and translanguaging practices are not simply linguistic accommodations but are essential tools for co-constructing meaning within learners' cultural and linguistic contexts. At the core of Sociocultural Theory is the idea that learning is a socially mediated process, and language is the most essential cultural tool through which learners engage in thinking, reasoning, and meaning making (Vygotsky, 1978). In mathematics classrooms, this mediation is critical: learners do not merely absorb mathematical concepts but actively construct understanding through dialogue, discussion, and interaction with teachers, peers, and texts.

Vygotsky's concept of the ZPD refers to the distance between what a learner can do independently and what they can achieve with the guidance of a more knowledgeable other (e.g., teacher or peer). Effective teaching occurs within this zone, through the use of scaffolding strategies that provide temporary support until learners can function independently. In multilingual mathematics classrooms, bilingual scaffolding (e.g., code-switching or translanguaging) serves as a critical support mechanism, allowing learners to access mathematical ideas. Sociocultural Theory also emphasises that knowledge is co-constructed

through interaction. In the context of this study, learners' collaborative engagements highlight how language shapes the learning environment. According to Vygotsky, learning cannot be separated from the cultural and historical context in which it occurs. In the rural Eastern Cape, where isiXhosa is the dominant language of learners' homes and communities, English medium instruction often fails to reflect learners' cultural and linguistic realities. This dissonance can lead to learner disengagement and cognitive dissonance. By framing the study within a sociocultural perspective, the research situates language not only as a cognitive tool but also as a reflection of learners' identity, agency, and epistemological access.

Using Sociocultural Theory as a theoretical lens enables this study to move beyond viewing language of instruction as a neutral policy choice. Instead, it positions language as a central determinant of cognitive access, emotional security, and pedagogical inclusion. This framework helps interpret learners' expressed preferences for a bilingual medium of instruction as evidence of their desire for meaningful participation, equitable learning, and culturally grounded mathematical engagement.

2.2 Monolingual Language of Instruction and Its Consequences

The dominant language-in-education policy in South Africa supports home language instruction only in the early grades, after which English becomes the official medium of instruction. This shift creates significant pedagogical challenges, particularly in mathematics, which is a linguistically demanding subject requiring the comprehension of abstract concepts. Ester et al., (2021) argue that a monolingual approach in mathematics education especially in rural schools where English is often an additional language impedes learners' ability to engage meaningfully with mathematical ideas. Similarly, Chiphambo and Feza (2022) emphasise that the use of unfamiliar instructional languages limits conceptual clarity and results in rote learning rather than deep understanding.

2.3 Empirical review on Perception of school learners on using English to teach mathematics

School learners in South African rural schools generally perceive English as a preferred language for mathematics instruction, despite significant linguistic challenges. The evidence reveals a complex landscape. Makupe and Machaba (2024) found that high school mathematics learners in Township schools prefer English due to pedagogical, social, and economic

considerations. However, Robertson and Graven (2020) highlighted that most children learn mathematics in a language they lack proficiency in, with English being the dominant instruction language despite being the home language for less than 10% of the population. Setati (2008) further observed that learners positioning themselves around English are more concerned with accessing social goods than epistemological understanding. Empirical evidence suggests a need for more systematic language support and potentially bilingual approaches in mathematics education.

Additionally, South African research indicates that learners in bilingual rural mathematics classrooms often benefit from and prefer bilingual instructional discourse (home language + English) over English-only instruction. Seabela and Ncanywa (2024) report that teachers in senior-phase rural schools regularly code-switch between isiXhosa and English to clarify complex subject content, creating more inclusive and effective learning environments. Mpalami (2022) argue that translanguaging supports meaning-making in mathematics by positioning home languages as resources rather than obstacles.

2.4 Challenges of the use of English only medium of instruction in bilingual rural secondary school mathematics classrooms

In a rural South African context, poor mastery of English makes the language of instruction into a "key barrier" to learning. Rural learners have very limited contact with English outside the classroom, so they must simultaneously decode the language and the content, which undermines comprehension and confidence across subjects (including mathematics) (Mncwango & Makhathini, 2021). Learners in such settings are expected to handle cognitively demanding word problems and abstract mathematical explanations in a language they have not fully acquired, which inevitably pushes many towards rote procedures rather than conceptual understanding.

Evidence from senior-phase and secondary mathematics also shows that English-only instruction amplifies comprehension difficulties and weakens participation. Seabela and Ncanywa (2024) reports that teachers unanimously felt that learners "do not comprehend" content taught through English and that teaching non-English-home-language learners through English is "more challenging" than teaching them through their mother tongue. Classroom observations revealed that learners frequently slipped back into isiXhosa to participate, and many appeared confused or disengaged when questions were posed in English. Teachers linked

poor academic performance in mathematics directly to the abrupt shift from home-language instruction in the earlier grades to English-only in the intermediate and senior phases, highlighting the "major setback" this transition creates for rural learners who rarely hear or use English at home (Seabela & Ncanywa, 2024). Similarly, Meeran and Biccard (2025) in a study conducted with teachers in rural Limpopo province found that when mathematics switches from Sepedi to English in Grade 4, teachers perceive an immediate drop in learner understanding and participation and attribute it to learners' limited English exposure and the mismatch between LoLT and learners' linguistic repertoires.

At a system level, empirical research shows that English-only medium of instruction exacerbates inequities in mathematics achievement. Mbatha et al. (2025) found a strong positive correlation between English L2 proficiency and mathematical understanding, and then demonstrated that plurilingual pedagogical strategies (drawing on multiple languages) helped synchronise development of both skills. The implication for rural secondary schools is clear: where English proficiency is uneven and generally low, English-only mathematics teaching structurally advantages the minority whose English is relatively strong and systematically disadvantages the majority, turning language into a gatekeeper for success in a key high-stakes subject. Essien and Adler (2025) reinforces this view, as they noted that across the continent, when the LoLT is not the learners' home language, research consistently reports superficial learning, heavy reliance on memorisation, and persistent underperformance in mathematics.

Moreover, empirical work also shows that English-only medium of instruction is not just a pedagogical problem but a sociolinguistic and ideological one. The language-barriers study notes the "hegemony" of English in education and its symbolic association with upward mobility (Mncwango & Makhathini, 2021). Makupe and Machaba (2024) observed that many learners explicitly prefer English as the language for mathematics, citing pedagogical, social and economic reasons and seeing indigenous languages as "inadequate" for high-level mathematical talk.

2.5 Language of Instruction and Mathematics Performance

There is growing empirical evidence linking the language of instruction to learners' mathematics performance. Ester et al. (2021) demonstrate that learners taught in languages they understand exhibit stronger problem-solving skills and conceptual understanding. Conversely, those instructed in unfamiliar languages, such as English in rural contexts, often

misinterpret mathematical symbols and processes. Insufficient academic English language proficiency significantly restricts learners' ability to process and retain complex mathematical information. Several studies provide strong evidence for this claim. Xu et al. (2021) found that second-language learners scored lower on language-intensive mathematical tasks, with mathematical vocabulary and receptive vocabulary directly contributing to word-problem solving success. King and Powell (2023) demonstrated that students' academic English proficiency in reading and writing positively correlated with word-problem solving performance. Legarde (2022) further emphasised that mathematical disability often stems from language comprehension challenges, with students struggling to understand mathematical terminologies.

The evidence from literature consistently shows that language proficiency is not peripheral, but central to mathematical learning and comprehension. Sekuba et al. (2024) found that learners who receive instruction in their mother tongue struggle substantially when mathematics is taught in English, with preliminary findings showing a significant decline in mathematical comprehension. Ndhlovana and Charamba (2023) confirmed this, noting that language misalignment directly contributes to underachievement in mathematics, with proficiency in the language of instruction playing a crucial role in concept comprehension. In a related study Wilson and Mavuru (2023) further substantiated these findings, highlighting that scientific and mathematical language creates significant learning barriers for students whose home languages differ from English.

2.6 Learners' Voices: Experiences and Preferences in EMI Classrooms

Recent studies have begun to foreground the voices of learners themselves, revealing their nuanced perspectives on language use in mathematics classrooms. Learners in rural contexts frequently report feeling excluded and anxious when taught exclusively in English. They resort to informal code-switching and peer translation to bridge the comprehension gap (Malindi et al., 2014; Maluleke, 2019). Robertson and Graven (2020) found that learners generally preferred dual-medium instruction, describing bilingual teaching as less intimidating and more accessible. These findings resonate with Bowden et al. (2024), whose work in Rwanda illustrates that although EMI reduced student verbal engagement, learners used non-verbal and bilingual strategies to make sense of mathematical content.

2.7 Methods of Instruction and the Most Preferred One in Bilingual Rural Schools

In bilingual rural schools, mathematics is typically taught through a mix of methods that sit on a continuum from monolingual, teacher-centred English instruction to deliberately planned bilingual/translanguaging pedagogies that draw systematically on learners' home languages (Essien & Adler, 2025; McLachlan & Essien, 2022). In many rural classrooms, the default method is still teacher-centred exposition in English**,** often with rote practice of procedures. Studies synthesised in Essien and Adler's (2025) review of language in mathematics education in Africa indicate that where the LoLT is not learners' home language, English-only transmission tends to produce shallow procedural learning, high anxiety and limited participation, particularly in under-resourced rural schools. Kaziya's (2025) mixed-methods study in Kalomo District, rural Zambia, similarly documents how the policy shift to English as LoLT by Grade 5 leads to decreased performance and reliance on memorisation, as learners struggle to follow teacher explanations and word problems in a language they do not fully command. These findings suggest that traditional English-only teaching, although institutionally dominant, is not the method learners experience as most supportive in bilingual rural settings.

In contrast, code-switching and translanguaging teachers and learners flexibly using both the home language and English during lessons emerge across multiple studies as both widely practised and highly valued in rural mathematics classrooms. Robertson and Graven (2020) shows how a rural Eastern Cape mathematics teacher initially mandated to "teach them in English" gradually adopts an additive bilingual approach, systematically drawing on learners' home language to clarify concepts and then re-introducing English terms. Learners' participation and sense-making improve markedly, and the teacher herself comes to view bilingual explanation as essential rather than remedial. In a rural Limpopo context, Ramothwala et al. (2025) demonstrates that when teachers legitimise a local dialect and allow learners to move fluidly between Khelovedu dialect and standard Sepedi/English, learners engage more, ask questions more freely and display deeper conceptual grasp than in tightly policed monolingual lessons. Seabela and Ncanywa's (2024) seminal work in semi-rural Eastern Cape senior-phase classrooms similarly finds that planned code-switching is perceived by both teachers and learners as a powerful method for making content accessible without abandoning the development of English mathematical terminology.

Generally, the empirical evidence indicates that in bilingual rural schools, the most preferred and educationally productive method of mathematics instruction is additive bilingual/translanguaging pedagogy (Ngubane & Ngwenya, 2025; Robertson & Graven, 2020). Bilingual mathematics instruction in rural schools most effectively uses a combination of peer learning, group work, and code-switching between local and English languages. Fidele et al. (2019) found peer learning and group work to be the most applied teaching methods in selected schools. Chikodzi and Kaino (2020) emphasised the importance of code-switching between English and local languages, recommending a bilingual model that creates an engaging learning environment. Oluwaniyi et al. (2024) further supported this approach, noting that multilingual instruction can improve students' mathematical productivity, creativity, and problem-solving skills. The evidence suggests that using local language alongside English, incorporating students' cultural context, and employing interactive learning methods are key to effective mathematics instruction in bilingual rural classrooms. By adopting additive bilingual pedagogy in mathematics lessons the teacher actively uses learners' home language alongside English to explain, question, scaffold problem-solving and build confidence, while gradually developing competence in the official LoLT and its mathematical register (Kaziya, 2025). Learners consistently report greater understanding and comfort under these approaches, and teachers in rural contexts often gravitate towards them in practice because they see clearer learner progress than under monolingual, teacher-centred methods (Ramothwala et al., 2025; Robertson & Graven, 2020).

3. Methodology

This study employed a qualitative methodological approach to explore the medium of instruction preferences among rural FET mathematics learners in the Eastern Cape, South Africa. The focus was on understanding learners' lived experiences, perceptions, and language choices during mathematics classroom discourses.

3.1. Research Design

The study adopted a case study design, which is particularly suitable for examining phenomena within their real-life context (Yin, 2018). The case study focused on three rural high schools in the Eastern Cape Province, where isiXhosa is the primary home language and English is the official medium of instruction for mathematics. This design facilitated an in-

depth exploration of the linguistic and pedagogical challenges specific to these educational settings.

3.2. Participants of the Study

Non-probability purposive sampling was employed to select both the schools and the participants for this study. This sampling technique was chosen to ensure that information-rich cases relevant to the research objectives were included. The selection of schools was guided by three key criteria: firstly, English had to be the official medium of instruction for mathematics; secondly, the majority of learners needed to speak isiXhosa as their home language; and thirdly, the schools had to be situated in rural and socioeconomically disadvantaged communities within the Eastern Cape Province. These criteria ensured that the sample was contextually aligned with the linguistic and educational challenges under investigation. Fifteen learners participated in the study, comprising nine females and six males from Grades 10 to 12. Five learners were selected from each of the three schools. All participating learners were between the ages of 15 and 18 years. This approach enabled the researchers to capture a diverse range of learner voices while ensuring depth and relevance in the data collected.

3.3. Instrumentation and Data Gathering Process

Data collection was carried out through semi-structured, in-depth interviews**,** which allowed for a balance between consistency and flexibility. This method enabled the researchers to explore core themes across all participants while allowing room to probe further based on individual responses. Interviews were conducted in isiXhosa, English, or a combination of both, depending on the learners' language preferences. This multilingual approach was critical for creating a comfortable environment and ensuring that learners could express themselves authentically and without linguistic constraints. Each interview session lasted approximately 30 to 45 minutes and was conducted in a quiet, private setting within the school premises, after regular teaching hours. All interviews were audio-recorded with participants' consent to ensure accurate data capture. The recordings were then transcribed verbatim, and where necessary, responses given in isiXhosa were carefully translated into English to maintain meaning and context. This process ensured the reliability and richness of the qualitative data collected.

3.4. Data Analysis

Data were analysed using thematic analysis**,** a flexible and widely used method in qualitative research. The process followed the six-phase model outlined by Braun and Clarke (2021), allowing for a rigorous and systematic interpretation of learners' responses. The first phase involved becoming thoroughly familiar with the data through repeated readings of the interview transcripts. This immersion helped the researchers to gain a deep understanding of the content and context of participants' narratives.

To enhance the trustworthiness of the study, several strategies were employed to ensure the rigor and quality of the research process and findings. Credibility was strengthened through prolonged engagement with the participants and the use of language-congruent interviews. Transferability was ensured through the use of thick description, providing detailed accounts of the research setting, participant demographics, and contextual factors. To establish dependability, the researchers maintained a clear audit trail that documented the entire research process, including interview transcripts, translations, coding decisions, and theme development. This methodological transparency enhances the study's consistency and makes the process replicable. Confirmability was addressed through the use of reflexive journaling and peer debriefing**.** These strategies helped the researchers to remain critically aware of their own assumptions and biases, ensuring that the analysis and interpretations were grounded in the participants' perspectives rather than influenced by personal preconceptions.

3.5. Research Ethics

This study adhered to strict ethical protocols to safeguard the rights and well-being of all participants. Ethical clearance was obtained from the University of South Africa's College of Education Research Ethics Committee (CEDU-REC) prior to the commencement of the research. In addition, formal permission was secured from the Eastern Cape Department of Education and from the principals of the participating schools. Written informed consent was obtained from parents or legal guardians, and assent was obtained from the learners themselves. Voluntary participation was emphasised, and learners were assured of their right to withdraw from the study at any stage without facing any consequences. Confidentiality and anonymity were rigorously maintained by assigning pseudonyms to all participants and removing any identifying details from the data. All data collected were stored in secure, password-protected files, and transcripts were anonymised to uphold participant privacy.

4. Findings

The findings of the study are presented according to the three themes that emerged from the thematic analysis: (1) Learners' perceptions of using English as the medium of instruction in mathematics learning; (2) Challenges experienced due to English medium of instruction; and (3) The medium of instruction preferred in mathematics classroom discourses.

4.1 Learners' Perceptions of Using English Medium of Instruction in Mathematics Learning

The study establishes that mathematics learners in rural schools perceive English medium of instruction as a necessary linguistic tool for effective mathematics learning even though they have difficulties in understanding mathematical terminology in English. The study establishes the rural learners' position regarding the medium of instruction preference. The learners in this study expressed a preference for the integration of isiXhosa and English medium of instruction. This suggests that the learners prefer strategies such as codeswitching and translanguaging to be used in the teaching and learning of mathematics in rural secondary schools' classroom discourses, in order to eliminate the hegemony of English which does not cater for the linguistic deficiencies of the learners.

The learners' views highlighted that adopting English medium of instruction holistically is ideal in townships and other multilingual lingual environments. The adoption of English medium of instruction in multilingual classrooms is ideal in order to address the language problems without overlooking the cultural and multilingual diversity of the learners. In response to the question: "How do you feel about learning mathematics in English? Bekithemba (pseudonym) explained that:

> *Kunzima ukufunda izibalo ngesiNgesi kuba sihlala sithetha isiXhosa kakhulu ekhaya nasemhlabeni nabahlobo. Xa utitshala esebenzisa isiNgesi eklasini ngamanye amaxesha ndidideka ndingakwazi ukuqonda kakuhle incazelo. Ndiyaqonda ngcono xa utitshala esebenzisa isiXhosa kuphela. IsiNgesi siyamkeleka kodwa senza izibalo zibe nzima.* [It is difficult to learn mathematics in English because we speak isiXhosa most of the time at home and with friends. When the teacher uses English in class at times I get confused and fail to understand the explanation. I understand better if the teacher uses isiXhosa only. English is okay but it makes mathematics difficult] (Male, Grade 11 learner).

In addition, the study establishes that learning mathematics in English seems to be a double burden for rural learners, however, they do not have an option but to succumb to the dictates of the medium of instruction policy. In response to the question: "Do you think using English helps or makes learning more difficult? Nomaphelo explained that:

> *"Kulungile ukufunda iMathematika ngesiNgesi kuba iimviwo zibhala ngesiNgesi. Kodwa kunzima kuba kufuneka ndicinge ngesiXhosa kuqala, emva koko nditshintshe iingcinga zam zibe sisiNgesi."* (Intombazana, uMfumakazi weBanga le-12) [It is good to learn mathematics in English because exams are written in English. However, it is hard because I am forced to think in isiXhosa first then I will change my thoughts to English] (Female, Grade 12 learner).

Sizwe argued that:

> *"Andithandi ukufunda iMathematika ngesiNgesi, ndiyaqonda ngcono xa kufundiswa ngesiXhosa. Nangona ndinesiingxaki, thina bafundi kufuneka sisebenzise isiNgesi kuba zonke iincwadi zokufundisa kunye neemviwo zibhalwe ngesiNgesi." (Intombazana, uMfumakazi weBanga le-11)* [I don't like to learn mathematics in English, I understand better in isiXhosa. Even though I have these difficulties as learners we do have to use English because all the textbooks and exams are written in English] (Female, Grade 11 learner).

From the study, it emerged that the learners believe that code switching is essential in mathematics classrooms especially when the teacher is introducing or explaining complex concepts. These findings indicate that rural learners prefer bilingual scaffolding which accommodates learners' home languages and the English medium of instruction. Sivhiwe explained that:

> *"Ndiyathanda ukuba utitshala atshintshe phakathi kwesiNgesi nesiXhosa. Oku kungandinceda ndiqonde iikhonsephtini zeMathematika ezingekho kulwimi lwethu." (Intombazana, uMfumakazi weBanga le-10)* [I prefer the teacher to switch between English and isiXhosa. This will help me to understand mathematics concepts which are not in our language] (Female, Grade 10 learner).

In addition, Zimukhita argued that:

> "*Ndinqwenela ukuba kungangenzeka ukuba iinkcazo ezininzi ziqale ngolwimi lwethu lwasemakhaya, emva koko sitshintshele kwisiNgesi emva kokuba siwuqondile umxholo kunye neenkcazo." (Inkwenkwe, uMfumakazi weBanga le-*

> *12).* [I just wish if it is possible to have most explanations in our home language first, then we switch to English after understanding the concepts and explanations] (Male, Grade 12 learner).

Abongile succinctly observes:

> **"***Siyawufuna umhlalutyo ongaphezulu ngesiXhosa nangesiNgesi. Utitshala makasivumele sibuze imibuzo ngesiXhosa xa sididekile." (Intombazana, uMfumakazi weBanga le-11).* We need more explanations in both isiXhosa and English. The teacher should allow us to ask questions in isiXhosa if we are confused] (Female, Grade 11 learner).

In this study, it emerged that lack of English language proficiency appears to be detrimental for learners' mathematics learning and achievement. According to the learners, the English hegemony in mathematics classrooms reduces learner participation. Such a phenomenon has reduced learners' zeal to participate during the lesson. Andile explained that:

> *"Rhoqo ndiyathandabuza ukuthatha inxaxheba kwiingxoxo zeklasi kuba ndicinga ukuba mhlawumbi isiNgesi sam asilunganga kwaye abanye abafundi baza kundihleka. Ke ndingcono ndihlale cwaka eklasini nokuba andiqondi nto, kuba andifuni ukudana."* (USello, inkwenkwe, uMfumakazi weBanga le-10). Most of the time I feel shy to participate in class discussion because I think that maybe my English is not good and other learners will laugh at me. So I just keep quiet in class even I don't understand anything because I don't want to be embarrassed] (Sello, male, Grade 10 learner).

4.2 Challenges Experienced Due to English Medium of Instruction

One of the key themes emerging from the findings is the challenges experienced by rural secondary school mathematics learners is the challenges experienced by the learners due to the use of English medium of instruction. Vocabulary comprehension barriers emerged as the major challenge experienced by the learners. The following excerpts captures the linguistic challenges faced by the learners. Buleka indicated that:

> *"Kunzima ukuqonda eminye imibuzo kuba isiNgesi esisetyenziswa sinzima kakhulu."* [It is hard to understand some questions because the English used is too much complicated]

In agreement, Sizwe said that:

> "*Uninzi lwamaxesha utitshala uthetha ngokukhawuleza kakhulu aze asebenzise amagama endingawaziyo*." [Most of the time my teacher speaks too fast and use words I don't know].

4.3 The Medium of Instruction Preferred in Classroom Mathematics Discourses

Mathematics learners in rural secondary schools have a strong preference for bilingual medium of instruction. The participants indicated that they prefer to learn mathematics in English language as stated below:

> "*Ndiyawuthanda umthetho wokufundisa oxubayo — phakathi kwesiXhosa nesiNgesi-kuba isiXhosa sindinceda ndiqonde umxholo." (Intombazana, uMfumakazi weBangale 11).* I prefer a medium of instruction which combines isiXhosa and English because isiXhosa helps me to understand the content] (Female, Grade 11 learner).

> "*Andiwuthandi umthetho wokufundisa usebenzise isiXhosa sodwa kuba iimviwo zibhalwa ngesiNgesi. Zombini iilwimi ziyanceda, ngoko kungcono zixutywe eklasini." (Inkwenkwe, uMfumakazi weBanga le-12).* [I do not prefer a complete medium of instruction in isiXhosa because exams are written in English. Both languages help so it is better to mix them in class] (Male, Grade 12 learner).

The findings also indicate that, isiXhosa home language is beneficial for explanation, while English medium of instruction is preferred for assessment.

> "*Ndikhetha isiXhosa ukuze ndiqonde." (Intombazana, uMfumakazi weBanga le-10).* [I prefer isiXhosa for understanding] (Female, Grade 10 learner).

> *"IsiNgesi sibalulekile kwimviwo naseyunivesithi... ngoko ke, ndikhetha zombini… isiXhosa ukufundisa kunye nesiNgesi sokubhala." (Inkwenkwe, uMfumakazi weBanga le-10).* [English is important for the exam and university … so, I prefer both … isiXhosa for teaching and English for writing] (Male, Grade 10 learner).

The findings also highlight that a blend of isiXhosa and English medium of instruction enhances the learners' comfort and confidence when learning mathematics. Learning in isiXhosa reduces fear and stress. Such a language practice encourages more learner participation and engagement.

> "*Xa ootitshala bethetha ngesiXhosa, asoyiki ukubuza imibuzo*." *(Intombazana, uMfumakazi weBanga le-11)*. When the teachers in isiXhosa, we are not scared to ask questions] (Female, Grade 11 learner).

All in all, the findings indicate that the rural learners prefer practical bilingualism over English hegemony or isiXhosa hegemony. The use of one language is seen as limiting hence the rural learners want both for different teaching and learning functions.

Table 1 below summarises the major themes, analytic subthemes, codes/descriptive labels, and brief meanings emerging from the findings.

Table 1

Summary of major themes and subthemes

Theme	Analytic subtheme	Code (descriptive label)	Brief meaning/focus
1. Learners' Perceptions of Using English Medium of Instruction in Mathematics	English as necessary but challenging	*"English is needed for exams"*	Learners recognise the academic and future value of English but struggle with comprehension.
	Preference for bilingual support	*"Mix isiXhosa and English"*	Learners favour bilingual explanations to improve understanding of mathematical concept
	Mental translation burden	*"Think in isiXhosa first"*	English-only teaching forces learners to translate mentally, increasing cognitive load.
	Learners' anxiety due to English	*"Fear of embarrassment"*	Poor English proficiency reduces participation as learners fear making mistakes in English.
2. Challenges Experienced Due to English Medium of Instruction	Vocabulary and terminology difficulty	*"English too complicated"*	Complex mathematical vocabulary in English limits comprehension of questions and instructions.
	Teacher-related linguistic challenges	*"Teacher speaks too fast"*	Teachers' speed, accent, or English register makes content difficult to follow.
	Reduced participation and confidence	*"I keep quiet in class"*	Learners withdraw from participation due to limited English proficiency and fear of ridicule.
	Double burden of language and content	*"Two tasks: language + maths"*	Learners must simultaneously decode English and learn mathematics, creating a dual learning strain.

Theme	Analytic subtheme	Code (descriptive label)	Brief meaning/focus
3. Preferred Medium of Instruction in Mathematics Classroom Discourses	Strong preference for bilingualism	*"Use both isiXhosa and English"*	Learners see value in using isiXhosa for explanations and English for assessment purposes.
	Home language for conceptual clarity	*"IsiXhosa for understanding"*	IsiXhosa helps unpack difficult concepts and reduces stress and confusion.
	English for formal learning demands	*"English for exams/university"*	Learners acknowledge English as essential for tests, textbooks, and future academic pathways.
	Increased confidence through bilingual pedagogy	*"Not scared to ask questions"*	Using isiXhosa in class fosters participation, comfort, and emotional safety.

5. Discussion

This study examined rural secondary school learners' preferences regarding the medium of instruction in FET mathematics classrooms in the Eastern Cape. The findings strongly confirm the central role of language in shaping learners' mathematical comprehension, participation, and confidence. Consistent with Robertson and Graven's (2020) observation that most South African learners study mathematics in a language they do not speak at home, participants in this study expressed discomfort with English-only instruction and demonstrated a clear preference for a bilingual approach. Similar to the empirical patterns identified by Makupe and Machaba (2024) and Sepeng et al. (2014), learners recognised English as valuable for assessment and mobility but relied heavily on isiXhosa during sense-making, problem-solving, and peer discussion. This dual preference reflects what Setati (2008) describes as the tension between epistemological access and access to social goods.

Learners' reports of mental translation and increased cognitive load echo research showing that English-only instruction imposes a structural barrier to conceptual understanding in rural contexts (Mncwango & Makhathini, 2021; Seabela & Ncanywa, 2024). The present study's findings reinforce these concerns. Mathematics learners felt anxious, confused, and disengaged when instruction occurred exclusively in English. This observation aligns with Meeran and Biccard's (2025) who concluded that abrupt language shifts undermine mathematical comprehension and participation. Similar to evidence from Wilson and Mavuru (2023) and Legarde (2022), this study demonstrates that inadequate academic English

proficiency directly constrains learners' ability to engage with abstract mathematical vocabulary and word problems, leading to superficial learning and reliance on rote procedures.

The findings that learners feel more confident and less anxious when isiXhosa is used to explain complex mathematical concepts align directly with Vygotsky's Sociocultural Theory, which positions language as a central tool for cognitive development. When learners mentally translate from English to isiXhosa, they add unnecessary cognitive load, limiting their ability to work effectively within their Zone of Proximal Development (ZPD). Using isiXhosa for explanation therefore acts as scaffolding or temporary support that helps learners bridge the gap between what they can understand independently and what they can grasp with guidance.

A recurrent theme was that learners associate isiXhosa with understanding and English with performance in assessments. They prefer isiXhosa for learning and classroom engagement but recognise the necessity of English for examinations and further academic opportunities, particularly at tertiary level. This supports prior by Setati (2008) who argue for the legitimacy and effectiveness of code-switching as a pedagogical resource in multilingual classrooms. Learners' suggestions for alternating between isiXhosa and English reflect a practical awareness of their linguistic realities and educational aspirations.

The preference for bilingual explanation and code-switching reflects broader empirical findings across rural African classrooms. Teachers and learners in the present study treated isiXhosa as a cognitive resource, not a deficiency. This is consistent with Mpalami (2022), Seabela and Ncanywa (2024), and Ngubane and Ngwenya (2025), who document how translanguaging enhances inclusivity and supports meaning-making. Learners' increased confidence when isiXhosa was used for complex concepts aligns with Vygotsky's Sociocultural Theory: isiXhosa functions as a mediating tool that enables scaffolding within the Zone of Proximal Development. This mirrors Robertson and Graven's (2020) finding that deliberate bilingual pedagogy significantly improves participation and conceptual grasp.

However, as Kaziya (2025) and Essien and Adler (2025) caution, bilingual strategies must be carefully planned to avoid shifting the pedagogical focus toward language at the expense of mathematics. The current study similarly found that although isiXhosa explanations supported comprehension, the absence of structured bilingual pedagogy risked inconsistent development of English mathematical terminology which is important for assessment and progression. Learners themselves recognised this tension, preferring isiXhosa for

understanding but English for exams. This finding is consistent with findings by Makupe and Machaba (2024) and Setati (2008).

Challenges reported by learners such as unfamiliar terminology, fast-paced English explanations, and restricted opportunities to ask questions in isiXhosa mirror systemic issues raised across the literature, including poor alignment between LoLT and learners' linguistic repertoires (Mbatha et al., 2025; Ndhlovana & Charamba, 2023). These barriers deepen inequities, privileging a small subset of English-proficient learners while disadvantaging the majority.

Overall, these findings reinforce a consensus emerging from the literature that rigid English-only approaches marginalise rural learners and impede deeper mathematical understanding. On the other hand, structured bilingual or translanguaging pedagogies promote conceptual clarity, learner confidence, and increased participation (Ramothwala et al., 2025; Chikodzi & Kaino, 2020; Oluwaniyi et al., 2024). The study highlighted that mathematics language policy in rural contexts must be flexible, responsive, and aligned with both learners' linguistic realities and pedagogical needs. An additive bilingual approach which draws systematically on isiXhosa while developing English mathematical literacy emerges as the most contextually appropriate and educationally productive strategy.

6. Conclusion

This study investigated the medium of instruction preferences in classroom mathematics discourses among rural FET phase learners in three high schools in the Eastern Cape, South Africa. Learners reported that isiXhosa enhances conceptual understanding, especially during initial instruction, while English remains essential for assessment and alignment with national curricula. Despite English being the language of textbooks and examinations, it is often perceived as a barrier to participation and comprehension, particularly when teachers speak rapidly or use complex terminology without translation. Learners feel more confident, engaged, and willing to ask questions when isiXhosa is used during instruction. In conclusion, the findings highlight a critical tension between policy and practice in South Africa's rural mathematics classrooms. While English serves as the official medium of instruction, learners' voices point towards the value and necessity of isiXhosa for achieving real understanding, equity, and participation in mathematics education. Addressing this

linguistic mismatch is essential not only for improving learner performance but also for advancing social justice and educational transformation in post-apartheid South Africa.

The findings challenge the rigid implementation of English-only medium of instruction in mathematics. Education authorities should consider revising language-in-education policy frameworks to explicitly endorse dual-medium approaches in linguistically homogeneous rural areas. IsiXhosa should be recognised not merely as a subject but as a medium of instruction, especially in mathematics education, in order to bridge linguistic inequities and promote deeper learning. Pedagogically, mathematics teachers should create safe linguistic spaces where learners feel free to engaged using their home language for clarification and discussion, thereby fostering confidence and critical thinking. There is a clear need to develop mathematics glossaries, workbooks, and explanatory materials in both isiXhosa and English to aid understanding and reduce cognitive overload caused by language barriers. Future studies should examine the long-term academic performance effects of bilingual medium of instruction in rural mathematics classrooms. Further comparative research is needed across other provinces and rural contexts to understand the intersection of language, pedagogy, and mathematics achievement in multilingual South Africa.

Based on the findings and implications, the following recommendations are proposed: The Department of Basic Education should review the Language-in-Education Policy to allow for context-specific bilingual instruction, particularly in rural and linguistically homogeneous schools.

Teacher training and support: Teacher training programmes should integrate bilingual teaching strategies, including code-switching, translanguaging, and additive bilingualism.

Development of bilingual teaching resources: The Department of Education, in collaboration with curriculum developers, should invest in producing mathematics materials in both English and isiXhosa, including learner-friendly glossaries, translated textbooks, and audio-visual resources to support bilingual instruction.

Classroom language practices: School leadership should encourage flexible and inclusive language practices in the classroom that allow learners to use their home language without stigma, particularly when engaging with difficult content.

Further research: Longitudinal studies should be conducted to examine the impact of bilingual instruction on learner performance in mathematics over time. Comparative research

across different provinces and language groups is also needed to inform a national bilingual education strategy.

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Institutional Review Board Statement

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