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Embracing Vernacular: Transformative Trends in Multilingual Grade 3 Mathematics Teaching

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Abstract: This study explored the instructional strategies used by Grade 3 teachers to develop number sense in Sepedi-medium multilingual classrooms in the Foundation Phase. Historically, mathematics instruction was often delivered through dominant or official languages, which could disadvantage learners whose home languages differed from the language of teaching and learning. Guided by Vygotsky's sociocultural theory, this qualitative study investigated how teachers employed vernacular-language-based pedagogical practices to support mathematical understanding in multilingual classrooms. Data was generated through classroom observations and teacher interviews involving two Grade 3 teachers from two schools. The findings revealed that teachers employed strategies such as code-switching, questioning, collaborative learning, and teacher-made resources to facilitate learners' participation and conceptual understanding of mathematics. The study found that purposeful questioning encouraged learners to explain and justify their mathematical thinking. At the same time, flexible language use, particularly the integration of Sepedi and English, helped bridge communication barriers and enhance learner engagement. Collaborative learning activities and locally developed teaching resources further supported the development of number sense. However, challenges related to limited mathematics resources in vernacular languages and insufficient teacher support constrained the effective implementation of multilingual pedagogies. The study highlights the important role of language, social interaction, and instructional tools in mediating mathematical learning and underscores the value of purposeful instructional practices in multilingual Foundation Phase classrooms. While the findings are context-specific and not intended for generalisation, they offer insights that may inform teacher professional development, resource provision, and the implementation of multilingual mathematics instruction in similar educational settings.

Keywords: Code-Switching, Culturally Relevant Pedagogy, Linguistic Diversity, Translanguaging, VernacularLlanguages, Sepedi.
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Introduction

South African classrooms are increasingly characterised by linguistic and cultural diversity, particularly in the Foundation Phase, where learners from different language backgrounds learn together. This diversity presents both opportunities and challenges for mathematics teaching, as language plays a crucial role in the development of mathematical understanding. In many Grade 3 classrooms, indigenous languages such as Sepedi are used as the language of learning and teaching (LoLT). At the same time, learners may speak a range of other South African languages, including Xitsonga, Tshivenda, isiZulu, Setswana, and Afrikaans, as well as languages from neighbouring African countries such as Zimbabwe and Mozambique. Consequently, teachers are often required to teach mathematics through Sepedi to learners with varying levels of proficiency in the language.

The use of indigenous languages in education has gained increasing attention due to their potential to improve learner participation, comprehension, and academic achievement. Research suggests that learners acquire mathematical concepts more effectively when instruction is provided in a familiar language, as it allows them to engage with the content without the additional burden of decoding an unfamiliar language (Edmonds-Wathen et al., 2019; UNESCO, 2020). In response to growing linguistic diversity, educational reforms have increasingly emphasised inclusive and culturally responsive pedagogies that recognise learners' linguistic resources as assets for learning rather than barriers.

Despite these potential benefits, teaching mathematics in a vernacular language within a multilingual classroom remains complex. Teachers are expected to support learners who may not speak or understand the LoLT while simultaneously ensuring meaningful engagement with mathematical concepts. This challenge is often compounded by limited access to culturally relevant teaching materials, insufficient professional development, and persistent perceptions that English is a more suitable language for mathematics learning (Robertson & Graven, 2020a; Bacan, 2025).

Existing studies tend to focus on the general benefits of home-language instruction, multilingual mathematics teaching, and language-related challenges in South African classrooms (McLachlan & Essien, 2022; Mpalami, 2022; Mulaudzi, 2024), with insufficient attention given to the specific instructional strategies teachers employ when teaching mathematics in Sepedi. Although some research has examined teacher practices for mediating the Sepedi mathematics register in Foundation Phase classrooms (Dlamini, 2022; Dlamini & Essien, 2023), these studies focused primarily on mathematical discourse and register development rather than on how teachers use Sepedi to scaffold number sense learning among Grade 3 learners in multilingual settings. Consequently, there is limited understanding of the pedagogical strategies teachers employ to promote participation, understanding, and inclusion within multilingual learning environments. This study seeks to address this gap by exploring the pedagogical strategies used by Grade 3 teachers when teaching mathematics through Sepedi in multilingual classrooms, with particular attention to how they support number sense development, navigate linguistic diversity, and assist learners who do not speak Sepedi as a home language. Furthermore, the study examines how teachers implement practices associated with transformative trends in multilingual mathematics education and how these practices influence learners' participation and understanding. By investigating these strategies, the study aims to deepen understanding of how to promote equitable, inclusive, and effective mathematics teaching in multilingual Foundation Phase classrooms.

Theoretical Lens

This study is grounded in Vygotsky's (1978) Sociocultural Theory of Cognitive Development, particularly the concepts of the Zone of Proximal Development (ZPD) and scaffolding. Vygotsky argues that learning occurs through social interaction and is mediated by language, culture, and other symbolic tools. He further posits that cognitive development occurs when learners interact with more knowledgeable others, such as teachers and peers, who provide support that enables them to perform tasks beyond their independent capabilities (Vygotsky, 1978; Shabani, 2010). Within the ZPD, learners gradually develop higher-order thinking through guidance and collaborative engagement.
The theory is particularly relevant to this study because the participating Grade 3 classrooms are linguistically diverse. Although Sepedi is the Language of Learning and Teaching (LoLT) for mathematics, many learners speak other South African languages such as Xitsonga, Tshivenda, isiNdebele, Setswana, and Afrikaans, while others come from countries such as Zimbabwe, Mozambique, and Ethiopia. In such contexts, language becomes both a resource and a potential barrier to learning mathematics. According to Kinard and Kozulin (2008) and McLeod (2026), Vygotsky's sociocultural perspective recognises that learners draw on their existing linguistic and cultural knowledge to construct new understanding through interaction with others.

In this study, instructional strategies such as code-switching, translanguaging, questioning, group work, and the use of concrete resources can be understood as forms of scaffolding. Through code-switching and translanguaging, teachers mediate mathematical concepts using languages that learners understand, thereby connecting new mathematical knowledge to learners' prior linguistic experiences. Mpalami (2022) has shown that using home languages can enhance learners' understanding of mathematical concepts, although challenges may arise when mathematical terminology is translated directly across languages.

The concept of scaffolding is evident in teachers' use of questioning, language mediation, and instructional resources to support learners' mathematical understanding. Effective questioning guides learners from their current level of understanding towards more advanced mathematical thinking by encouraging explanation, reasoning, and justification. Similarly, teacher-made resources such as number charts, number cards, word cards, and six bricks function as mediational tools that help learners construct mathematical meaning by linking concrete experiences to abstract concepts (Kinard & Kozulin, 2008; Wright, 2018). In multilingual classrooms, scaffolding also occurs when teachers use a language familiar to learners to explain mathematical concepts that may be difficult to understand in the Language of Learning and Teaching (LoLT). This temporary linguistic support enables learners to access new knowledge, connect it to their prior experiences, and gradually develop independent understanding. As learners become more confident, the support can be reduced. Consistent with translanguaging research, this approach allows learners to draw on their full linguistic repertoire to make sense of mathematical concepts without the additional cognitive demands of an unfamiliar language (Bouzid & Javier, 2024). Furthermore, recognising and utilising learners' home languages affirms their cultural identities, promotes positive learner participation, and reduces mathematics anxiety. Such practices represent a transformative shift from a deficit view of vernacular languages to an additive and inclusive approach that positions learners' linguistic resources as valuable tools for mathematical learning (Baker, 2011).

Furthermore, Vygotsky emphasises that learning occurs at a social level before becoming internalised by the individual. This principle highlights the importance of learner-learner and teacher-learner interaction in multilingual mathematics classrooms. Group work provides opportunities for learners to collaborate, explain ideas, negotiate meaning, and support each other's learning. Through these social interactions, learners can access knowledge that may be beyond their individual capabilities, thereby operating within their ZPD (Shabani, 2010; Wright, 2018).
Therefore, Vygotsky's Sociocultural Theory provides an appropriate lens for examining how Grade 3 teachers use Sepedi and other linguistic resources to scaffold mathematical learning in multilingual classrooms. The theory helps explain how social interaction, language mediation, and instructional support contribute to the development of number sense among learners from diverse linguistic backgrounds

Literature Review

Research on mathematics teaching in multilingual Grade 3 classrooms highlights the important relationship between language, pedagogy, and learner participation. In this study, multilingual classrooms are learning environments where Sepedi is used as the language of learning and teaching (LoLT), and learners come from diverse linguistic backgrounds, including Xitsonga, Tshivenda, Setswana, isiZulu, Afrikaans, and other African languages. The literature reviewed focuses on teaching strategies adopted in multilingual mathematics classrooms, the use of resources and indigenous knowledge, and the challenges associated with implementing multilingual pedagogies.

Code-Switching and Translanguaging as Teaching Strategies

Code-switching and translanguaging have become important pedagogical strategies for supporting mathematics learning in multilingual classrooms. Translanguaging refers to the flexible use of learners' full linguistic repertoires to construct meaning and enhance understanding (García, 2009; Robertson & Graven, 2020b). Rather than viewing languages as separate systems, translanguaging enables learners to draw on all their linguistic resources when engaging with mathematical concepts.

Research indicates that translanguaging promotes deeper conceptual understanding and learner participation. Perfecto (2022) found that teachers employed strategies such as code-switching, direct translation, metalinguistic comparison, and metalinguistic explanations to support learning. Similarly, Mwiinga and Mwanza (2024) reported that teachers used translanguaging, picture stories, songs, and real objects to acknowledge learners' multilingual identities and increase access to learning. Guzula and Abdulatief (2024) further argue that flexible language use, particularly during collaborative activities, enables learners to engage more deeply with mathematical tasks and move beyond procedural understanding.

Several studies have demonstrated the benefits of translanguaging for creating inclusive learning environments. Ndhlovana and Charamba (2023) found that translanguaging contributes positively to learners' academic performance, while Omidire and Ayob (2022) reported that learners experienced a sense of pride and belonging when their home languages were acknowledged in classroom interactions. However, Norro (2024) observed that translanguaging is

often used spontaneously rather than as a deliberate instructional strategy, suggesting a need for greater pedagogical planning.

Closely linked to translanguaging is code-switching, which is widely used to bridge linguistic gaps and improve comprehension in multilingual mathematics classrooms. Marawu (2018) and Maluleke (2019) found that code-switching helps learners understand mathematical concepts by connecting the language of instruction with familiar linguistic resources. Similarly, Habintwali et al. (2024) identified code-switching as an essential mechanism for clarifying concepts and facilitating communication in mathematics lessons. Teachers frequently switch languages to explain mathematical terminology, clarify abstract concepts, and support conceptual understanding rather than rote learning (Maluleke, 2019; Mawela & Mahlambi, 2021).

Research also emphasises the importance of teacher preparedness in implementing these strategies effectively. Chikiwa and Schäfer (2019) argue that teachers require training to use code-switching purposefully and consistently, while Prediger (2019) advocates for approaches that integrate mathematics instruction and language development. Furthermore, McKinney and Guzula (2024) and Olawale et al. (2024) highlight the importance of teacher collaboration, multilingual resources, and collaborative lesson planning in strengthening translanguaging practices. Together, these studies suggest that code-switching and translanguaging are valuable tools for promoting inclusion, participation, and conceptual understanding in multilingual mathematics classrooms.

The Integration of Relevant Resources and Indigenous Knowledge

Effective mathematics teaching in multilingual settings extends beyond language use to include the integration of culturally responsive resources and indigenous knowledge. Resources can serve as important mediators of learning by making abstract mathematical concepts more concrete, meaningful, and accessible. Turner et al. (2019) argue that community-based resources, indigenous counting systems, architecture, and local cultural practices provide learners with familiar contexts for understanding mathematical concepts. These resources help bridge the gap between learners lived experiences and formal mathematical knowledge. Similarly, Martell and Zahner (2023) and Alameddine (2021) advocate using visual, digital, and interactive resources that reduce the cognitive demands of learning mathematics through language learners may not fully master.

Studies further demonstrate that culturally relevant resources improve learner engagement and achievement. Mensah-Brown (2025) found that teaching academic content through culturally relevant approaches enhances learners' retention and performance. Likewise, Ester et al. (2025) reported that resources incorporating local languages alongside standard instructional materials contributed to significantly higher mathematics achievement. Such findings suggest that multilingual resources play an important role in supporting both language development and mathematical understanding.

The integration of indigenous knowledge systems (IKS) is also increasingly recognised as a valuable component of mathematics teaching. Khupe (2020) argues that indigenous languages and cultural practices function as important intellectual resources that strengthen participation and collaboration. Patterson and Gardyne (2022) found that teachers who used Tshivenḓa as the language of instruction successfully drew on learners' cultural knowledge to explain mathematical concepts and promote emotional well-being. Similarly, Gula and Jojo (2024) found that integrating indigenous knowledge and home-language instruction increased participation and reinforced learners' cultural identities. Research therefore suggests that incorporating relevant resources and indigenous knowledge not only supports mathematical understanding but also promotes cultural inclusion and learner engagement. This aligns with broader efforts to create responsive and equitable multilingual learning environments.

Challenges to Transformative Trends in Multilingual Mathematics Teaching

Despite the potential benefits of multilingual pedagogies, several challenges continue to affect their implementation in mathematics classrooms. One significant challenge is translating mathematical concepts into indigenous languages. Nahole and Haimbodi (2022) found that direct translations often lead to ambiguity, while Cekiso et al. (2019) note that mathematical precision can be lost when complex concepts are translated literally. A related challenge is the limited availability of standardised mathematical vocabulary in many indigenous languages. Edmonds-Wathen et al. (2019) found that teachers often struggle to identify or develop appropriate mathematical terminology, while Guzula and Abdulatief (2024) argue that the absence of mathematical glossaries makes it difficult to maintain conceptual accuracy. Makena et al. (2025) further found that limited mathematical vocabulary negatively affects learners' academic achievement.

Teachers also face challenges related to language ideologies and policy implementation. Sapire and Essien (2021) found that monoglossic beliefs continue to influence classroom practices despite policies that promote multilingualism. Similarly, Szelei et al. (2021) reported that teachers often prioritise dominant languages, reflecting limited awareness of multilingual pedagogical approaches. Makupe and Machaba (2024) observed that many learners continue to perceive English as the preferred language for mathematics learning, highlighting tensions between educational policy and classroom realities. Robertson and Graven (2020a) argue that the status of English frequently overshadows the educational value of learners' home languages.

Teacher preparedness and resource constraints present additional barriers. Chauma (2016) found that teachers often lack adequate training to teach mathematics through indigenous languages, while Omidire and Ayob (2022) identified resource shortages, limited lesson time, and insufficient experience with multilingual approaches as major challenges. Likewise, Shuukwanyama et al. (2022) and Bacan (2025) reported that many teachers feel inadequately prepared to implement translanguaging practices effectively.

These challenges highlight the need for sustained professional development, multilingual resource development, and stronger institutional support. Collaboration among teachers, linguists, curriculum developers, and policymakers is necessary to strengthen multilingual mathematics education and ensure that transformative pedagogical approaches can be successfully implemented in diverse classroom contexts.

Research Methodology

This study employed a qualitative research approach to explore pedagogical shifts in multilingual Grade 3 mathematics classrooms in which Sepedi is the language of learning and teaching. A qualitative approach was considered appropriate because it enabled the researcher to obtain an in-depth understanding of teachers' instructional practices, experiences, and interactions within naturally occurring classroom settings. Qualitative research focuses on understanding phenomena from participants' perspectives and studying them in their natural contexts, thereby generating rich and detailed descriptions of social realities (Creswell & Poth, 2018; Tisdell et al., 2025). Furthermore, a qualitative approach enabled the exploration of meanings, beliefs, and behaviours associated with teaching mathematics in multilingual classrooms through Sepedi, that could not be adequately captured through quantitative methods, as it seeks to understand how individuals interpret and make sense of their experiences (Tisdell et al., 2025; Creswell & Poth, 2018).

Sampling and Research Participants

Purposive sampling was used to select participants who could provide rich and relevant information regarding the phenomenon under investigation (Robinson, 2020). Two Grade 3 mathematics teachers from two primary schools in a semi-urban township in Nylstroom circuit of the Waterberg District in Limpopo Province were selected. The selection of only two teachers was intentional and aligned with the qualitative nature of the study, which prioritises depth of understanding rather than breadth or statistical generalisation. The selected teachers had extensive experience in the Foundation Phase and were directly responsible for teaching mathematics in Sepedi in linguistically diverse classrooms. They were therefore considered information-rich participants capable of providing detailed insights into instructional practices in multilingual settings.

The participating schools were selected because they served learners from diverse linguistic backgrounds, including Sepedi, Xitsonga, Setswana, Tshivenda, Afrikaans, isiZulu, and isiNdebele, as well as learners from African countries such as Zimbabwe, Mozambique, Nigeria, Ghana, and Ethiopia. These schools, therefore, represented suitable sites for investigating mathematics teaching in multilingual contexts where Sepedi serves as the Language of Learning and Teaching (LoLT).

Ethical Considerations

Ethical clearance was obtained from the University of South Africa (UNISA) College of Education Ethics Review Committee (No. 2020/11/11/31640036/07/AM). Permission to conduct the study was also granted by the Limpopo Department of Education and the principals of the participating schools. Informed consent was obtained from all participating teachers, and parental consent was obtained for learners present during classroom observations. Participants were informed of the purpose of the study, their right to withdraw at any stage without penalty, and the measures taken to protect their confidentiality and anonymity. Pseudonyms (T1 and T2) were used throughout the study, and all collected data were stored securely.

Data Collection Procedures

Data were collected through lesson observations and semi-structured interviews over approximately 8 weeks between April and June 2021.

Lesson Observations. The researcher assumed the role of a non-participant observer, allowing classroom activities to unfold naturally without interference. Two mathematics lessons were observed per week at each of the two schools. An observation protocol was developed to guide data collection and ensure consistency across observations. The protocol focused on:

- Teaching strategies used in multilingual mathematics classrooms;
- Use of Sepedi and other languages during instruction;
- Teacher-learner interactions;

- Learner participation and engagement;
- Learner-learner interactions during group activities;
- Questioning techniques used by teachers;
- Teaching and learning resources utilised during lessons.

Table 1

Teacher Biographical Information

T	School (S)	Home language	Qualifications	Teaching Experience
1	A	Sepedi	Secondary Teachers Diploma (STD) specialised in Sepedi and Maths BEd Degree	• 30 years teaching experience • Taught all Foundation Phase subjects: Sepedi HL (Home Language), Maths in both English and then in Sepedi, English First Additional Language (EFAL) and Life Skills. • Taught multigrade classes in Foundation Phase • Taught Grade 2 for 10 years and 20 years Grade 3
2	B	Sepedi	Junior Primary Teachers Diploma (JPTD) Advanced Certificate in Education (ACE)	• 19 years teaching experience. • She has been teaching Grade 3 since she started teaching. • Taught Sepedi HL, Maths in both English and in Sepedi, EFAL and Life Skills.

Data were recorded through detailed field notes and observation schedules completed during and immediately after each lesson. Particular attention was given to classroom interactions, instructional practices, learners' responses, and examples of code-switching and translanguaging. The researcher assumed the role of a non-participant observer to collect data in a natural setting, thereby maintaining a degree of objectivity while avoiding engagement in the observed activities (Ciesielska et al., 2017).

Semi-Structured Interviews. Following the classroom observations, semi-structured interviews were conducted individually with each teacher. The interview schedule was developed from the study objectives, relevant literature on multilingual mathematics education, and concepts derived from Vygotsky's Sociocultural Theory.

The interview questions explored:

- Teachers' experiences of teaching mathematics in multilingual classrooms;
- Strategies used to support learners from diverse linguistic backgrounds;
- Perceptions of teaching mathematics in Sepedi;
- Use of teaching and learning resources;
- Challenges encountered when teaching multilingual learners;
- Professional support and training needs.

The interview included questions such as: How does the use of Sepedi influence learners' understanding of mathematical concepts? What challenges do you encounter when teaching mathematics in a multilingual classroom? What strategies do you use to support learners with diverse language backgrounds? How do learners respond to the use of Sepedi during mathematics lessons? In-depth semi-structured interviews were conducted in English (clarification provided in Sepedi where needed) with the participating teachers. The semi-structured format enabled the researcher to ask follow-up questions and probe responses further while maintaining consistency across interviews (Kvale & Brinkmann, 2015). All interviews were audio-recorded, with participants' permission, and later transcribed verbatim. Teachers were selected as primary participants because they play a central role in mediating language and mathematics instruction and are directly responsible for implementing classroom teaching strategies. Gathering learner perspectives was therefore beyond the scope of the present study, but it is recommended for future research to provide a more comprehensive understanding of the phenomenon.

Data Analysis

The data collected were analysed using thematic analysis. This involves a systematic process of identifying, analysing, and reporting patterns (themes) within the data (Braun & Clarke, 2006). The steps included transcribing all interview recordings verbatim, re-reading transcripts and observation notes to generate initial codes, grouping codes to create themes, and finally presenting and discussing the themes.

- Transcription: All interview recordings were transcribed verbatim.
- Coding: Transcripts and observation notes were read and re-read to generate initial codes.
- Theme Development: Codes were grouped into broader themes and sub-themes.
- Reporting: The final themes were presented and discussed, supported by direct quotes from interviews and excerpts from observation notes.

Results

The findings presented in this section were derived from lesson observations and semi-structured interviews conducted with two Grade 3 mathematics teachers (T1 and T2). Lesson observations provided insights into instructional strategies employed in natural classroom settings. At the same time, interviews enabled the researcher to explore teachers' experiences and perspectives on teaching mathematics in multilingual classrooms using Sepedi.

The findings are organised into five themes: Code-Switching and Translanguaging as a Scaffold for Mathematical Understanding; Questioning as an Instructional Scaffold; Social Interaction as a Catalyst for Mathematical Learning; Teacher-Made Resources as Cognitive Support; and Challenges and Support Needs in Multilingual Mathematics Teaching.

Theme 1: Code-Switching and Translanguaging as a Scaffold for Mathematical Understanding

The findings revealed that both teachers used code-switching between Sepedi and English to facilitate mathematical understanding, particularly during mental mathematics activities. Lesson observations showed that learners were often required to count forwards and backwards using number charts, with counting frequently conducted in English. Both teachers explained that counting in English was perceived as simpler and more efficient than counting in Sepedi, especially when dealing with larger numbers.

T1 explained:

> "Because we are teaching learners maths in Sepedi, counting in English is simpler and faster than in Sepedi. In Sepedi, counting takes time and learners sometimes confuses the numbers in singular "lesome" (one ten) and "masome" (more than one ten). For example, before twenty, "lesome tee" (11) until (19) "lesome senyane" and from twenty "masome pedi" they become plural, "masome pedi tee" (21), "masome pedi pedi" (22), masome pedi tharo (23) etc and after one hundred, "lekgolo masome pedi senyane" (129), "lekgolo masome tharo" (130) etc and from two hundred "makgolo pedi" (200) etc. I sometimes switch to English when calling numbers and doing mental maths to prepare them for Grade 4."

Similarly, T2 stated:

> "I let my learners count in English because counting is more straightforward in English than in Sepedi. Additionally, in Grade 4, learners will be learning maths in English. Therefore, they must expand their vocabulary."

Classroom observations further demonstrated that code-switching supported participation among learners who were not Sepedi speakers. When mathematical terms or numbers were clarified in English, learners were more willing and able to respond. Teachers moved flexibly between English and Sepedi, allowing learners to engage with mathematical

concepts through both languages. This practice functioned as a scaffold that bridged learners' existing linguistic knowledge with new mathematical concepts, thereby promoting inclusion and participation in multilingual classrooms.

Theme 2: Questioning as an Instructional Scaffold

The findings showed that questioning was a commonly used instructional strategy; however, differences were observed in its implementation. While both teachers employed question-and-answer techniques, T1 adopted a more learner-centred approach than T2.

Classroom observations revealed that T1 regularly asked learners to justify their answers, explain their reasoning, and identify the key words that helped them solve mathematical problems. Rather than focusing solely on the correctness of an answer, T1 encouraged learners to explain how they arrived at their responses. This approach promoted deeper engagement with mathematical concepts and encouraged learners to articulate their thinking processes.

Furthermore, T1 actively involved all learners during classroom discussions, regardless of whether they volunteered to answer questions. This created opportunities for broader participation and allowed learners from diverse linguistic backgrounds to contribute to lessons.

In contrast, T2 focused predominantly on obtaining the correct answer. When learners responded incorrectly, the teacher frequently moved to another learner without probing the reasoning behind the response or inviting peer discussion. Observations showed that questioning was often directed at learners who volunteered answers, resulting in limited participation from quieter learners. Consequently, opportunities to explore misconceptions and develop mathematical reasoning were reduced.

These findings suggest that effective questioning serves as an important instructional scaffold that supports conceptual understanding, learner engagement, and mathematical discourse in multilingual mathematics classrooms.

Theme 3: Social Interaction as a Catalyst for Mathematical Learning

The findings indicated that both teachers utilised group work as a strategy to support learning through social interaction. Although both recognised the value of collaborative learning, differences were evident in how groups were organised.

T1 deliberately formed groups based on mixed learning abilities. During the interview, she explained that this approach enabled stronger learners to assist those experiencing difficulties. Lesson observations confirmed that learners collaborated effectively, shared ideas, and provided peer support when completing mathematical activities. Shy learners who rarely participated during whole-class discussions were observed contributing more actively within group settings.

T2 also used group work, but organised groups randomly. While learners assisted one another during activities, observations revealed that some groups consisted predominantly of learners with similar learning challenges or learners who were unfamiliar with Sepedi. In such cases, group interaction was less productive, and some learners struggled to complete tasks independently.

The findings suggest that group work serves as an important platform for peer learning, collaboration, and knowledge construction. Through interaction with peers, learners were able to negotiate meaning, explain concepts, and support one another's learning. However, the effectiveness of group work appeared to depend largely on how groups were structured and managed.

Theme 4: Teacher-Made Resources as Cognitive Support

Another significant finding was the extensive use of teacher-made resources to support mathematics instruction. Observations showed that both teachers employed number cards, word cards, number charts, and six bricks during teaching and learning activities.

T1 explained:

> "I use number cards, word cards and number charts to help learners in counting and writing numbers. It helps learners quickly understand and identify numbers. I use six bricks to emphasise the values of numbers, and I also use them when teaching words in languages."

Similarly, T2 stated:

> "Number charts make counting easier for learners and help them recognise their order when counting forwards or backwards. I use six bricks in mathematics when teaching languages. In mathematics, bricks help in adding and subtracting numbers."

Lesson observations revealed that these resources supported learners' understanding of mathematical concepts. Number charts assisted learners in counting forwards and backwards, while word cards displayed in both Sepedi and English enabled learners to identify and spell number names correctly. Furthermore, the use of six bricks was reported and observed for demonstrating addition, subtraction, and place value. Six bricks were selected because they allowed learners to physically manipulate concrete objects while illustrating numerical relationships and place-value concepts appropriate to the lesson content.

The findings further showed that concrete resources helped learners visualise mathematical concepts and move from abstract thinking to concrete understanding. However, a significant challenge was that manipulatives such as six-brick sets were primarily available to the teacher rather than to individual learners. As a result, learners had limited opportunities for hands-on interaction with the resources. Increased access to manipulatives would likely enhance learner participation and independent exploration of mathematical concepts.

Theme 5: Challenges and Support Needs in Multilingual Mathematics Teaching

The findings identified several challenges teachers face when teaching mathematics in multilingual classrooms.

Lack of Resources and Culturally Relevant Materials

The participants also confirmed during the interviews that they rely primarily on workbooks and lesson plans, indicating that there are limited mathematics textbooks and supplementary resources available in Sepedi. Although teachers may be capable of developing their own teaching materials, doing so requires time, expertise, and access to appropriate support and resources. Participants reported that heavy workloads and limited access to translated mathematics materials constrained their ability to produce additional resources. Consequently, they relied largely on the materials officially provided by the Department of Basic Education. While teacher-made materials provided some support, the shortage of culturally and linguistically relevant mathematics resources limited opportunities for fully contextualised learning.

Lack of Knowledge and Professional Support

The findings further revealed that teachers felt inadequately prepared to teach mathematics in multilingual classrooms using Sepedi. Both participants expressed uncertainty regarding which strategies could best support learners from diverse linguistic backgrounds.

T1 explained:

> "We are teaching learners who speak different languages, and we have learners who come from other African countries who cannot even speak Sepedi, so it is difficult when teaching in the classroom. We do not know which strategies to use to support all learners who experience challenges during teaching and learning."

Similarly, T2 stated:

> "Teaching in a multilingual classroom can be challenging because learners who are admitted to this school speak different languages, and some of them come from Zimbabwe, Mozambique, Nigeria, Ghana, Ethiopia and other African countries."

The teachers also expressed frustration regarding the nature of professional development workshops. They reported that mathematics workshops were conducted in English, despite expectations that they would be conducted in Sepedi.

T1 commented:

> "We attend workshops, but the workshops are conducted in English. The curriculum advisors advise us to return to school and teach in Sepedi. Sometimes, we asked them to come to school and support us by demonstrating in the classrooms, but they never came."

T2 similarly noted:

> "Workshops are conducted in English, and they do not visit schools to support us. They only come when they need curriculum coverage."

These findings suggest a need for targeted professional development focused on multilingual mathematics pedagogy in vernacular languages. Teachers indicated that ongoing classroom-based support, mentoring, and demonstrations by Subject Education Specialists would help them implement effective strategies for teaching mathematics in multilingual classrooms.

Discussions

Language Flexibility Through Code-Switching and Translanguaging

The findings suggest that code-switching and translanguaging are important pedagogical strategies for supporting mathematics learning in multilingual Grade 3 classrooms. Although Sepedi was the language of learning and teaching (LoLT), teachers frequently shifted between Sepedi and English, particularly during counting and mental mathematics activities. Participants perceived counting in English as quicker and more familiar, especially when working with larger numbers. This may reflect the influence of English as the dominant language of mathematical learning beyond the Foundation Phase.

The findings support previous studies highlighting the value of flexible language practices in multilingual mathematics classrooms. Ngqunguza and Seleke (2024) contend that code-switching serves as an important support mechanism when learners are not learning through their home language. Similarly, Mwiinga and Mwanza (2024) found that translanguaging enables teachers to acknowledge learners' multilingual identities and improve access to learning. In the current study, code-switching appeared to facilitate participation by learners who were not proficient in Sepedi and helped create a more inclusive learning environment.

From a sociocultural perspective, language functions as a cultural tool that mediates learning (Vygotsky, 1978). The findings therefore suggest that teachers' flexible use of language may support learners' access to mathematical concepts by connecting new knowledge to familiar linguistic resources. However, given the small sample size, these findings should be interpreted with caution and treated as context-specific rather than broadly representative.

Questioning and Learner Participation

The findings indicate that questioning played an important role in shaping learner engagement and mathematical reasoning. Classroom observations suggested differences in how questioning was used, with some interactions encouraging learners to explain their thinking while others focused primarily on obtaining correct answers.

These findings support Giri's (2021) argument that multilingual classrooms require teaching approaches that enable learners to reason and communicate mathematically. Opportunities for learners to explain their strategies and justify their responses appear consistent with research advocating for conceptual rather than purely procedural mathematics

instruction (Guzula & Abdulatief, 2024). Such questioning practices align with Vygotsky's (1978) view of learning as a socially mediated process, where interaction with a more knowledgeable other supports movement through the Zone of Proximal Development (ZPD).

The findings, therefore, suggest that questioning can function as an instructional scaffold that helps learners connect language and mathematical thinking. However, the extent to which questioning alone contributed to learners' conceptual development cannot be determined from this study and warrants further investigation.

Collaborative Learning as Social Support

Group work emerged as a prominent strategy for supporting learning in multilingual mathematics classrooms. Observations showed that small-group activities created opportunities for peer discussion, explanation, and collaborative problem-solving. Learners were observed assisting one another, particularly when language barriers affected understanding of mathematical tasks.

These findings are consistent with Vygotsky's (1978) sociocultural theory, which emphasises the role of social interaction in cognitive development. Peer collaboration appeared to provide opportunities for learners with stronger linguistic or mathematical understanding to support those experiencing difficulties. The findings also resonate with Guzula and Abdulatief's (2024) assertion that multilingual interaction during collaborative activities can deepen engagement with mathematical tasks.

The apparent benefits of group work, particularly for shy learners and non-Sepedi speakers, suggest that collaborative learning may promote inclusion and participation. However, observations also indicated that randomly formed groups did not always maximise opportunities for peer support. This suggests that thoughtful grouping strategies may be necessary to realise the benefits of collaborative learning in multilingual classrooms fully.

Resources as Scaffolds for Mathematical Understanding

The findings suggest that teacher-made resources play an important role in supporting the development of number sense in multilingual classrooms. Resources such as number charts, number cards, number-name cards, and six bricks were used to make mathematical concepts more concrete and accessible. These materials appeared to help learners develop foundational number concepts, including counting, number recognition, and place value.

This finding aligns with Vygotsky's (1978) view that cultural tools mediate learning and facilitate movement from concrete experiences to abstract understanding. It also supports Martell and Zahner (2023) argument that instructional resources can reduce the cognitive demands associated with learning mathematical concepts through a language that learners may not fully master. Similarly, Turner et al. (2019) found that culturally familiar resources help ground abstract mathematical ideas in learners lived experiences.

Despite these benefits, observations and interviews highlighted significant resource limitations. Teachers relied heavily on self-created materials and departmental workbooks because of a lack of suitable Sepedi mathematics resources. This finding echoes Omidire and Ayob's (2022) observation that inadequate resources remain a challenge in multilingual classrooms. The findings suggest that increased availability of culturally and linguistically relevant materials may strengthen learner participation and conceptual understanding.

Teacher Support and Challenges in Multilingual Mathematics Teaching

A recurring theme in the study was teachers' perceived need for greater support in teaching mathematics within multilingual classrooms. Participants reported challenges related to accommodating linguistically diverse learners, limited access to multilingual teaching resources, and insufficient professional development focused on vernacular-language mathematics instruction.

These findings are consistent with previous research highlighting teacher preparedness as a significant challenge in multilingual education (Omidire & Ayob, 2022; Bacan, 2025). Participants expressed concerns that professional development opportunities were often conducted in English despite expectations that mathematics be taught in Sepedi. This perceived disconnect may limit teachers' ability to develop contextually appropriate pedagogical strategies.

From a sociocultural perspective, teacher learning is also socially mediated and dependent on access to appropriate tools and support structures (Vygotsky, 1978). The findings therefore suggest that ongoing professional development, collaborative learning opportunities, and access to multilingual resources may be necessary to strengthen teachers' capacity to implement inclusive mathematics teaching practices. However, these findings reflect the experiences of only two participants and should therefore be interpreted as indicative rather than conclusive.

Conclusion

This study explored the instructional strategies used by two Grade 3 teachers to develop number sense in Sepedi-medium multilingual classrooms. The findings revealed that both teachers employed code-switching, questioning, group work, and teacher-made resources to support learners' mathematical understanding and participation. These strategies created opportunities for learners to engage with mathematical concepts despite linguistic diversity in the classroom. The findings further suggest that language flexibility, purposeful questioning, collaborative learning, and the use of teacher-made resources can support mathematical learning in multilingual Grade 3 classrooms. However, the effectiveness of these strategies depended largely on how they were implemented. For example, questioning techniques that encouraged learners to explain and justify their thinking promoted greater engagement and mathematical reasoning than those that focused primarily on obtaining correct answers. Similarly, the use of Sepedi alongside English facilitated participation among learners from diverse linguistic backgrounds, while collaborative activities and teacher-made resources supported conceptual understanding. At the same time, challenges relating to limited resource availability and insufficient teacher support constrained the effective implementation of multilingual pedagogies. Viewed through Vygotsky's sociocultural theory, the findings underscore the important role of language, social interaction, and instructional tools in mediating learners' mathematical understanding. Overall, the study

contributes to a deeper understanding of how teachers navigate multilingual realities in Foundation Phase mathematics classrooms and highlights the importance of purposeful instructional practices in supporting number sense development through vernacular languages.

Limitations of the Study

This study involved only two Grade 3 teachers from two primary schools, and therefore the findings cannot be generalised to all multilingual classroom contexts. The instructional practices observed may differ from those used in other schools, provinces, or vernacular language settings. Furthermore, classroom observations were conducted over a limited period and may not have captured the full range of instructional strategies used throughout the school year. The researcher's presence during observations may also have influenced participants' behaviour. In addition, the study was intentionally designed to explore teachers' experiences, instructional practices, and perspectives regarding the teaching of mathematics in Sepedi in multilingual classrooms, resulting in the exclusion of learners as participants. Consequently, the absence of learner perspectives limits a comprehensive understanding of how learners experience and perceive the effectiveness of learning mathematics through Sepedi in multilingual classroom contexts. The inclusion of learners' voices could have enriched the findings by providing valuable insights into the perceived effectiveness of using Sepedi as a medium of instruction for mathematics. Therefore, while the study offers valuable insights into instructional practices and challenges, its findings should be interpreted within the specific context of the research. Future studies should incorporate learners' perspectives to provide a more holistic understanding of inclusive educational practices in multilingual classrooms.

Recommendations

Based on the findings, several recommendations are proposed to strengthen mathematics teaching and learning in multilingual Grade 3 classrooms. First, professional development programmes should equip teachers with effective pedagogical strategies for multilingual mathematics instruction, particularly questioning techniques that promote learner reasoning, explanation, and active participation. Second, teachers should be encouraged to continue using flexible language practices, such as code-switching and translanguaging, to support understanding and engagement among learners from diverse linguistic backgrounds. Third, education stakeholders should provide greater support for the development, distribution, and accessibility of high-quality mathematics resources in vernacular languages, reducing teachers' reliance on self-developed materials and enhancing instructional effectiveness. In addition, ongoing support and guidance should be provided to teachers to strengthen the implementation of multilingual pedagogies in Foundation Phase classrooms. Finally, future research should include learners' perspectives and involve a broader range of schools and contexts to develop a more comprehensive understanding of how multilingual and vernacular-based instructional practices influence mathematics learning, participation, and the development of number sense.

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