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Post-apartheid Complexities of Xitsonga and Mathematics Teaching in Rural Foundation Phase Classrooms: A Case of Number Patterns

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Abstract: The study conducted in rural Acornhoek, Mpumalanga, addresses the inadequate research and understanding surrounding the teaching of mathematics in the early grades, particularly in rural South African schools where indigenous languages like Xitsonga are used as the medium of instruction. This gap in research highlights the broader issue of the implications of language policy in South Africa for educational success, where the political nature of language use complicates effective teaching practices. The primary objective of this study is to contribute to the ongoing discourse on the role of home languages in mathematics teaching, specifically focusing on how the use of Xitsonga during lessons on patterns in early-grade classrooms limits the effectiveness of teachers' instruction on the concepts. The theoretical grounding of this research is rooted in the understanding that language is not merely a tool for communication but is intricately linked to identity and learning. Within an interpretive paradigm, the data collection process for this qualitative study involved three main components: unstructured non-participatory classroom observations, semi-structured interviews, and video-stimulated recall interviews. In this paper, we focus solely on the data from classroom observations to illustrate the dynamics of using the Xitsonga language to teach patterns in rural Foundation Phase classrooms. The sample consisted of 33 teachers from three different school sites in Acornhoek. The findings reveal the complexities involved in using Xitsonga to teach mathematical concepts. Teachers faced challenges related to language proficiency, pedagogical strategies, and the integration of local cultural contexts into their teaching practices.

Keywords: Post-apartheid, Xitsonga, Patterns, Rural classroom, Foundation Phase, Mathematics.

1. Introduction

The historical injustices of the Apartheid era continue to profoundly impact educational practices in South Africa, particularly in the field of mathematics (Barends, 2024). The legacy of apartheid has left a fragmented education system characterised by significant disparities in access to quality education, especially for historically disadvantaged communities. The apartheid regime enforced a racially segregated education system that systematically marginalised Black South Africans, resulting in a lack of resources, poorly trained teachers, and inadequate infrastructure in schools serving these populations (Ngcobo & Tikly, 2010; Christian, 2024). This historical context, which included educational segregation along language lines, has led to enduring inequalities in educational outcomes, particularly evident in mathematics performance among learners from disadvantaged backgrounds (Adonis, 2017; Lewis, 2018). Post-apartheid, the South African Department of Basic Education (DBE) language policy mandates that subjects, including mathematics, must be taught in the home languages of children across the Foundation Phase (Grades R to 3) and transition to using English as the medium of teaching when they reach Grade 4 (Taylor & Fintel, 2016). At surface value, this policy appears to align with inclusivity, social justice, and transformation agendas aimed at ensuring equitable learning opportunities for all learners,

regardless of race, socio-economic status, and geographic location. However, it can be argued that this policy constrains the effective learning of subjects such as mathematics and contributes to learners performing below their actual age level.

The compulsory use of home languages for teaching may further entrench inequalities and impede educational equity by excluding certain learners (Koloti & Jita, 2021). According to Sapire and Essien (2021), "Studies have also shown that the implementation of some of the language policies in mathematics classrooms has been fraught with difficulties" (p. 76). In this paper, we attempt to demonstrate some of these difficulties by drawing on empirical evidence from a study we conducted with Grades 1 to 3 in rural Foundation Phase classrooms in Acornhoek, Mpumalanga Province, South Africa. The schools we researched serve Xitsonga Home Language speakers, and we focused on the teaching of patterns. What is the agenda behind requiring non-English-speaking learners to learn mathematics in their home language during the Foundation Phase but changing to English when they reach Grade 4?

Taylor and Coetzee (2013) investigated learners' performance across Grades 1 to 6 within South African indigenous language teaching and learning contexts. Their study concluded that there is a significant hindrance when mathematics is taught in English instead of the child's home language. Although it can be argued that leveraging the utilisation of home languages to teach mathematics in the Foundation Phase is intended to take advantage of learners' linguistic assets (Lüssenhop, 2024), challenges persist in practice, particularly in rural schools where non-English speaking learners encounter language-related barriers (Wildsmith, 2012). Research on language and mathematics education often avoids highlighting the tension between the practical considerations of using English in mathematics teaching and the promotion of African languages, resulting in biased narratives about the need for learners to be taught the subject in their home languages. This is compounded by a dearth of insights into the complexities inherent in teaching mathematics using home language in practice (Ngcobo & Barnes, 2020). Thus, we are initiating the conversation in this paper about how using the home language, Xitsonga, in the context of the current study limits learners' epistemological access to the concept of patterns in the Foundation Phase. Alternatively, we might consider reframing our contribution to critically examine how home language is understood within the context of mathematics teaching in South Africa, particularly in the early grades, shedding light on the implications of language policies on classroom practices. In the current paper, we focus on the following research question:

- What role does the use of Xitsonga play in enabling and/or constraining the effective teaching of patterns in the rural Foundation Phase?

Our concern is that there is a dearth of research focused on rural areas that explores how teachers make mathematical content accessible to learners, especially considering that most schools in these areas primarily use non-English home languages.

2. Monolingual Approach in Mathematics Education in South Africa

In the context of mathematics education in South Africa, the prevailing monolingual approach that emphasises the exclusive use of indigenous languages within the Foundation Phase can inadvertently create a deficit framework that limits learners' opportunities for learning (Nugraha, 2019). This approach not only marginalises the linguistic diversity of learners but can also delay the development of literate mathematical discourse. Research has consistently shown that when mathematics is taught in a learner's native language, it enhances their comprehension and academic performance (Chiphambo & Feza, 2022; Mashau & Mokwena, 2017). However, the insistence on a monolingual approach often leads to the exclusion of other languages that learners may understand, including English. This exclusion can create barriers to understanding mathematical concepts, as learners may struggle to grasp the content when it is presented solely in a language in which they

are less proficient, especially when they transition to the Intermediate Phase (Carrim & Nkomo, 2023). We argue that the focus should not be on enforcing a strict language policy but rather on ensuring that learners understand the mathematical skills and knowledge being communicated during teaching.

The concept of translanguaging offers a valuable framework for addressing these challenges (Nhongo & Tshotsho, 2019; Plans & Chronaki, 2021). By allowing learners to draw on all their linguistic resources, including their native languages and English, teachers can create a more inclusive and effective learning environment (Carrim & Nkomo, 2023). Translanguaging encourages learners to fluidly navigate between languages, thereby facilitating deeper engagement with mathematical concepts. This approach recognises the multilingual realities of learners and values their linguistic repertoires as assets rather than deficits or misalignments to the prescribed language policy in education (Mbirimi-Hungwe, 2023). Instead of viewing the use of multiple languages as a hindrance, it should be seen as a potential asset that can enrich the learning experience and enhance learners' understanding of mathematics.

2.1 Theoretical framing

The current study utilised language ideology (Woolard, 2020) as a theoretical framework to examine language practices in the context of teaching Patterns in Grades 1, 2, and 3 in rural Acornhoek, Mpumalanga. Language ideologies are diverse and closely tied to how individuals perceive and engage with language. García and Wei (2014) have associated monoglossia and heteroglossia with specific ideologies, highlighting the treatment of language within these frameworks. Monoglossic ideologies view languages as distinct and separate entities, disregarding the actual language practices of speakers, whereas heteroglossic ideologies recognise and respect the diverse language practices and interactions among speakers (García & Wei, 2014). A monoglossic ideology aligns with a purist perspective on language, suggesting that a single language can effectively convey meaning. In contrast, a heteroglossic ideology embraces a pluralistic view of language, acknowledging that individuals with a repertoire of languages can draw upon multiple linguistic resources when communicating. This inclusive ideology recognises and values linguistic diversity within communication contexts.

Language ideologies can manifest as articulated or embodied in language practices (Kroskrity, 2004). Articulated ideologies are evident when speakers provide explicit reasons for their language choices, demonstrating awareness of their linguistic decisions. For instance, a teacher explaining a concept using code-switching and articulating reasons for this choice reflects an articulated ideology. On the other hand, embodied ideologies are observed when speakers unconsciously use language in specific ways, either through conscious consideration or automatic linguistic behaviour. For example, a teacher seamlessly incorporating translanguaging in her explanations to a multilingual class demonstrates an embodied ideology. This study also considered written artefacts to identify embodied ideologies in language use. Language practices can be categorised as either multilingual or monolingual, with multilingual practices encompassing various forms such as code-switching and translanguaging. In contrast, monolingual practices involve the exclusive use of a single recognised language (Woolard, 2020). In this study, the focus was on examining the language choices made by teachers in the sampled schools, particularly in situations where mixed language use, involving code-switching and/or translanguaging, was observed. By investigating language practices through the lens of language ideologies, this study aimed to provide insights into how teachers and learners navigate linguistic diversity in the teaching and learning of mathematics, specifically focusing on Patterns in early grade classrooms. The analysis of language use choices in the context of multilingual education contributes to a broader understanding of language ideologies and their implications for educational practices.

3. Methodology

The empirical research data in the current study consists of videotaped lessons presented by teachers at three different rural schools in the Acornhoek region of the Mpumalanga province of South Africa, representing multiple cases. We espoused the qualitative research approach as suggested by Creswell (2013) is used. According to Mulisa (2022), qualitative research heavily depends on the interpretation and ingenuity of researchers who collect, interpret, and analyse data. Tenny et al. (2022) assert that participants' experiences, perceptions, and behaviours are generated through a qualitative approach. Hence, using this approach, we were able to gain insight into teachers' teaching of patterns and the uniqueness of using Xitsonga as a home language. To understand their lived experiences, we explored Grades 1 to 3 teachers in the foundation phase when teaching patterns in mathematics classrooms.

The sample consisted of 33 teachers from three different school sites in Acornhoek. Using convenient sampling technique, the three schools were selected based on their participation in previous projects that the first author has led in the region, and purposively as they had FP classrooms. The region is classified as rural, with a predominance of residents working on farms to sustain themselves and their families. There are poor transportation services and isolation from national and provincial government offices. In this paper, we selected two episodes from Andiswa's Grade 1 and Danise's Grade 2 teaching on number patterns, as they exemplify the intricate dynamics involved in utilising Xitsonga as a medium for teaching mathematics.

We generated the empirical research data using unstructured videotaped classroom observations as a technique. According to Cohen et al. (2017), the observation technique involves watching participants' behavioural patterns in their lived context to obtain information about a phenomenon. Through this technique, classroom observation can be used to investigate an in-depth understanding of the nature of teachers' classroom practices related to pattern teaching. Our involvement in the observations was non-participatory. In all the classrooms we observed, we adopted a non-intrusive role during teaching.

3.1 Data analysis

Malterud (2012, p. 795) states, "In qualitative analysis, knowledge is developed from experiences by interpreting and summarising the organised empirical data." In this study, we began the process of data analysis during data collection, identifying the units of analysis by ascribing codes to teachers' pedagogical actions during the lessons on patterns across the Foundation Phase, as well as the information they provided during semi-structured interviews (Muir & Beswick, 2007). Considering that the lessons were in Xitsonga, it was beneficial that the primary investigator for the project is a Xitsonga home language speaker. This enabled a comprehensive understanding of not only the pedagogical approaches the teachers used but also the complexities of language in use during the lessons, and how the use of the language enabled and/or constrained the effective teaching of the topic.

After transcribing and summarising the observed lessons, we analysed them to segment and distinguish the pedagogical actions that were utilised by the teachers, focusing on how they used the Xitsonga language to make patterns content available for the learners, while characterising the opportunities and challenges of using the language to teach mathematics within rural classrooms. In our analysis, we first examined each lesson taught by Andiswa and Danise separately, focusing on the pedagogical strategies they employed during their teaching. This initial analysis allowed us to identify specific pedagogical moves that were instrumental in their teaching practices. Subsequently, we conducted a comparative analysis across the lessons from Grades 1 to 3, which revealed both similarities and differences in how the teachers utilised Xitsonga to convey mathematical concepts

related to patterns. This comparative approach not only highlighted the nuances in each teacher's teaching methods but also informed and reshaped our overall analysis of the lessons.

The complexity of teaching mathematics through a native language like Xitsonga necessitates a framework that considers language ideologies. As indicated earlier, language ideologies refer to the beliefs and assumptions that shape how languages are perceived and used within educational contexts (Bacon, 2018; Liddicoat & Taylor-Leech, 2015). In our analysis, we recognised that the teachers' pedagogical choices were influenced by their underlying language ideologies, which in turn affected how they integrated Xitsonga into their mathematics teaching. For instance, perspectives on language use in education suggest that teachers' beliefs about the value of learners' home languages can significantly impact their teaching practices (Nupus et al., 2023). This perspective aligns with the notion that promoting the use of a native language in the classroom can enhance learners' engagement and understanding of mathematical concepts (Khan & Zaki, 2022). In this study, it was interesting to observe the teachers navigating the complex nature of using Xitsonga in the context of teaching patterns. Furthermore, our analysis of the teaching episodes across different grades allowed us to explore the interplay between language ideologies and pedagogical practices. We found that the teachers' approaches to using Xitsonga were shaped by their personal beliefs and by broader teaching language ideologies that may prioritise monolingualism over bilingual mathematics education (Barbosa, 2020). This tension between individual and institutional ideologies is crucial for understanding the complexities of language use in mathematics education, as it reflects the challenges teachers face in navigating their teaching choices within the constraints of educational policies (Khan & Zaki, 2022).

4. Presentation of Data

The data analysis of teachers' approaches during lessons on patterns in rural classrooms revealed the complexities associated with using learners' indigenous language, Xitsonga, in the context of this paper to teach number patterns. The theme *"Hi hlayela hi Xitsonga ntsena" (we only count in Xitsonga)* highlights teachers' focus on ensuring that learners become conversant in using the Xitsonga language during lessons. In this paper, we selected two episodes from two teachers, Andiswa and Danise, to demonstrate the drawbacks of an overemphasis on fluency in the Xitsonga language, while neglecting the effective teaching of number patterns. The selection of Andiswa's and Danise's lessons from a pool of 33 teachers is justified by their representative demonstration of the inherent complexities involved in centring the teaching of mathematics using Xitsonga in the Foundation Phase. These episodes exemplify the multifaceted challenges and opportunities that arise when integrating indigenous languages into mathematics education, particularly in a South African context characterised by linguistic diversity and cultural richness.

5.1 "Hi hlayela hi Xitsonga ntsena" (we only count in Xitsonga)

The first theme elucidates teachers' efforts to incorporate Xitsonga language teaching alongside mathematics teaching. Classroom observations revealed a significant emphasis on teaching Xitsonga, which may divert attention from core mathematical concepts and patterns. This diversion could result in the under-teaching of essential mathematical patterns, ultimately impacting learners' learning outcomes. Consider the activities of Teacher Andiswa below.

Teacher Andiswa (Teacher activities/migingiriko ya mudyondzisi

Andiswa started the lesson by asking learners to count from 1 to 10 as depicted in the dialogue below:

Andiswa: *Ndzi lava leswaku mi sungula ku hlayela, mi sukela ka whani (one) miya fika ka thene (ten). Sungulani*

Learners: *(chorusing) one, two…*

Andiswa: *Hayi, hlayelani hi Xitsonga (No! Count in Xitsonga)*

Learners: *(chorusing) N'we, mbirhi, nharhu, mune, ntlhanu, ntsevu, nkombo, nhungu, nkaye, khume! (counting one, two, three, four, five, six, seven, eight, nine, ten).*

Andiswa: *Inkomu, sweswi ndzi lava mi hlayela ku suka ka n'we kuya fika ka ntlhanu (thank you, now I want you to count from one to five).*

Learners: *(chorusing) N'we, mbirhi, nharhu, mune, ntlhanu! (one, two, three, four, five).*

Andiswa: *Sweswi, hlayelani ku suka ka n'we kuya fika ka khume. (now count from one to ten).*

Learners: *(chorusing) N'we, mbirhi, nharhu, mune, ntlhanu, ntsevu, nkombo, ngungu, nkaye, khume! (counting one, two, three, four, five, six, seven, eight, nine, ten).*

Andiswa: *Sweswi langutisani eka xitsalelo. Mi ndzi byela leswaku nomboro leyi ndziyi tsalaku i mani. And ndzi lava u yimisa voko undzi byela. (now look at the board and tell me what the numbers I am writing is). (she writes number 4 on the board)*

(learners raising hands). Masesi!

Masesi: *Four*

Andiswa: *Hayi, hi Xitsonga hiri i Mune! (No in Xitsonga, we say it's Mune). Hi hlayela hi Xitsonga ntsena (we only count in Xitsonga).*

In the exchange above, Andiswa effectively engages the learners by prompting them to count aloud together. This collective participation encourages a sense of community and collaboration among the learners, which is essential for fostering a positive learning environment. The use of choral responses can also aid in reinforcing memory and understanding of number patterns, as it allows learners to practice together and learn from one another (Bratland et al., 2022). However, the dialogue lacks opportunities for deeper exploration of number patterns beyond simple counting. While the initial counting exercises are valuable for establishing foundational skills, the lesson could be enriched by incorporating discussions about the relationships between numbers, such as identifying patterns in sequences (e.g., odd and even numbers, or counting by twos). Engaging learners in identifying and creating number patterns would align with previous research findings that emphasise the importance of conceptual understanding in mathematics (Purpura et al., 2020). This could also involve asking learners to predict the next number in a sequence or to create their own number patterns, thereby fostering critical thinking and problem-solving skills. Of interest to note here is that Andiswa's choice of words '*whani*' and '*thene*' are slang way of referring to the two numbers, one

and ten in Xitsonga. Also, from this extract, Andiswa did not include numbers 7 and 9 as she constantly got distracted by learners switching to English in giving their responses.

It is important to address that Andiswa's correction of the learners' "*Hayi, hlayelani hi Xitsonga*" and of Andiswa's response *("Hayi, hi Xitsonga hiri i Mune!")* may come across as overly authoritative, diverting the focus of the lesson to ensuring Xitsonga fluency instead of number patterns. While it is important to encourage the use of the target language, the teacher could adopt a more supportive approach by acknowledging the learners' efforts before emphasising the need to use Xitsonga. Research suggests that positive reinforcement can enhance learner motivation and willingness to participate in classroom discussions (Jacobs et al., 2014). A more constructive feedback mechanism could help create a more encouraging atmosphere for learners to express themselves and learn number patterns with understanding. Consider Danise's exchange with the learners:

> *Danise: Xewani, vana! (Hello, children!)*
> *Learners: Ahee, mudyondzisi (Hello, teacher)*
> *Danise: Namuntlha, hi ta dyondza hi tipatironi ta ti nomboro. (Today, we will learn about number patterns.) Mi tiva yini hi tipatironi? (What do you know about number patterns?)*
> *Learner 1: Swi vula leswaku ku na swilo leswi **repetiwaka**! (It means there are things that repeat!)*
> *Danise: Ahiri ku repeat, hi Xitsonga hiri iku vuyelela, kuna patironi (we don't say repeat, in Xitsonga we say it is to recure, there is a pattern). Tipatironi ti nga va na swiyimo swo hambanahambana. (Patterns can have different forms.) Hi ta sungula hi ku hlaya tipatironi ta tinomboro (We will start by looking at number patterns.) Loko hi taka ku hlaya, hi ta tirhisa tinomboro, mbirhi, mine, ntsevu (When we count, we will use the numbers 2, 4, 6.) I mani aswi tivaku leswaku ku landzela nomboro yihi? (who knows what comes next?)*
> *Learners (together): Eight!*
> *Danise: Hay, i nhungu! (no, it's 8). Minga vuli tinomboro hi xilungu, i nhungu! I yini? (don't name numbers in English, it's eight, what is it?)*
> *Learners: Nhungu (eight).*
> *Danise: Hiti kuma njhani tinomboro leti landzelaka? (how do we determine the next numbers?)*
> *Learner 2: Hi engetela hi two! (we increase the numbers by two).*
> *Danise: Learner 2 kasi nite yini, hi tirhisa Xitsonga, vula kambe.*
> *Learner 2: Hi engetela tinomboro hi two two. (We increase the numbers by adding two two)*
> *Danise: Hayi, hiri hi engetela tinomboro hi timbiri (No, we say we increase the numbers by two).*

This opening sets a positive tone for the lesson and establishes a welcoming environment conducive to mathematics learning. The teacher's use of Xitsonga throughout the dialogue is commendable, as it promotes linguistic inclusivity, reinforces the cultural context of the learners' experience, and upholds the curriculum standards (Department of Basic Education, 2011). One of the notable strengths of this dialogue is the active engagement of the learners. When Danise asks, "*I mani aswi tivaku leswaku ku landzela nomboro yihi?*" *(Who knows what comes next?)*, the learners respond collectively with "Eight!" This demonstrates their participation and understanding of the concept being taught. However, the teacher's immediate correction of the learners' use of English "*Minga vuli tinomboro hi xilungu*" raises questions about the balance between encouraging learner expression and maintaining Xitsonga language proficiency. While it is important to promote the use of Xitsonga as stipulated in the curriculum policy for the Foundation Phase, the teacher could consider allowing learners to express their thoughts in English to foster a more inclusive dialogue and continuity in the teaching and learning of the concept of number patterns. This approach is supported by the findings of Zhu and Xu (2023), which emphasise the importance of learner thought processes in classroom interactions.

Consider Andiswa and Danise's insistence on using specific terminology and their commitment to using Xitsonga without diverging into English:

> "*Hi engetela tinomboro hi timbiri*" *(we increase the numbers by two)* (Danise).
> "*Hayi, hi Xitsonga hiri i Mune! (No in Xitsonga, we say it's Mune). Hi hlayela hi Xitsonga ntsena*" *(we only count in Xitsonga).* (Andiswa).

These iterations reflect teachers' commitment to vernacular linguistic accuracy. Notwithstanding the importance of such commitments, this could inadvertently stifle learners' creativity and expression during the lessons. Both dialogues could benefit from a more flexible approach that encourages learners to articulate their understanding in their own words, thereby enhancing their critical thinking skills and fostering a deeper understanding of mathematical concepts, specifically the concept of number patterns in the lessons, as indicated by research on the role of dialogue in educational settings (Song et al., 2020). Both teachers' interactions also highlight the initiation-response-evaluation (IRE) pattern commonly observed in classroom dialogues, where the teacher poses a question, learners respond, and the teacher evaluates the response (Zhu & Xu, 2023). While this structure can provide clarity, it may limit opportunities for extended dialogue and exploration of learners' thinking and ideas. Encouraging more open-ended questions and allowing learners to elaborate on their reasoning could lead to richer discussions and a deeper understanding of number patterns.

Furthermore, Danise's and Andiswa's approaches to correcting learner responses could be perceived as somewhat authoritative. For instance, when Danise states, "*Hay, i nhungu!*" *(No, it's 8)* and when Andiswa says, "*Hayi, hlayelani hi Xitsonga*" *(No, we are counting in Xitsonga)*, it may discourage learners from taking risks in their responses. A more constructive approach could involve acknowledging the learners' attempts while gently guiding them towards using Xitsonga in their engagements.

5. Discussion of Findings

In the South African context, the integration of indigenous languages such as Xitsonga into mathematics education has garnered significant attention and debate, particularly considering classroom dialogues exemplified by Andiswa and Danise. These dialogues highlight the importance of using Xitsonga in teaching number patterns, which raises critical considerations regarding the impact on learners' mathematics learning outcomes. While incorporating Xitsonga can enhance cultural relevance and support linguistic proficiency as enshrined in the curriculum, there is a risk that an excessive focus on language teaching may detract from the core mathematical concepts and patterns being taught. The dialogues reveal a strong emphasis on counting in Xitsonga, which aligns with the theoretical position of language ideologies that advocate for a solid foundation in a child's home language before transitioning to a second language (García & Wei, 2014). This approach is crucial, as it acknowledges the role of language in shaping educational experiences and outcomes. However, as observed in the dialogues, the insistence on using Xitsonga exclusively may inadvertently lead to the under-teaching of essential mathematical patterns, particularly if learners are not provided with opportunities to explore these concepts in depth.

Literature from the South African educational research landscape supports the notion that a strong foundation in the home language is beneficial for learning. For instance, Visser et al. (2019) emphasise the significance of early learning experiences and foundational skills in mathematics achievement, highlighting the complexities of language integration in education (Sumarni et al., 2022). Similarly, Spaull et al. (2020) discuss the challenges faced by learners in reading comprehension, even when using their home language, accentuating the need for careful consideration of language use in mathematics teaching (Kaufmann, 2010). Coetzer (2022) stresses the critical role of language in teaching and learning, particularly within South Africa's multilingual context. The dialogues reflect this complexity, as Andiswa and Danise navigate the balance between promoting Xitsonga and

ensuring that learners grasp essential mathematical concepts related to number patterns. While the dialogues illustrate the potential benefits of using Xitsonga in mathematics teaching and learning, they also highlight the need for a more nuanced approach. Teachers should be mindful of the balance between language teaching and the teaching of mathematical concepts. As noted by Han (2022), sustainable teaching strategies that engage indigenous learners can enhance their learning experiences and outcomes (Zhu & Xu, 2023). This suggests that while promoting indigenous languages is vital, it should not come at the expense of learners' understanding of core mathematical principles.

6. Conclusion and Recommendations

This study highlights the complexities of implementing language policies in mathematics education in South Africa. The findings underscore the need for a balanced approach that integrates indigenous languages like Xitsonga while ensuring the effective teaching of mathematical concepts and patterns. Teachers and policymakers can use these insights to enhance language integration strategies and improve learners' experiences in indigenous language teaching and learning settings. Further research is warranted to explore the long-term effects of language policy implementation on learners' academic performance in mathematics and language proficiency.

While incorporating indigenous languages like Xitsonga in mathematics is valuable for cultural preservation and inclusivity, as well as ensuring foundational language fluency, it is essential to strike a balance to ensure that core mathematical concepts, such as number patterns, are effectively taught. By considering insights from South African literature and language ideologies, teachers and policymakers can navigate the complexities of language policy implementation in mathematics education to enhance learners' experiences and outcomes. The integration of Xitsonga into mathematics teaching, as demonstrated in the dialogues, presents both opportunities and challenges. While it is essential to promote indigenous languages to foster cultural relevance and inclusivity, teachers should ensure that this focus does not detract from teaching fundamental mathematical concepts and patterns. A balanced approach that values both language and mathematics is crucial for enhancing learners' overall experiences and outcomes in the South African educational context. The selected episodes in this paper highlighted that an excessive focus on teaching the indigenous language distracts from the key object of learning, resulting in the under-teaching of number patterns in the current study.

7. Declarations

Authors contributions: Conceptualization (H.W.M.); Literature review (H.W.M., A.Z, S.M. & V.B.M.); methodology (H.W.M., A.Z, S.M. & V.B.M.); software (N/A); validation (H.W.M.); formal analysis (H.W.M. & A.Z.); investigation (H.W.M. & A.Z.); data curation (H.W.M. & A.Z.); drafting and preparation (H.W.M., & A.Z); review and editing (H.W.M. & A.Z.); supervision (H.W.M.); project administration (H.W.M.); funding acquisition (H.W.M). All authors have read and approved the final version of the article.

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Data availability: Due to ethical standards and the conditions outlined in the consent agreement with participants, the data must remain confidential. However, interested persons may contact the corresponding author for more information.

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