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Research-informed translation of mental strategy teaching materials into isiXhosa

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Background: This article critically examines the nature of isiXhosa translations in mathematics learning materials, specifically focusing on the doubling and halving unit within the 'South African Grade 3 Mental Starters Assessment Project (MSAP): Teacher Guide'. Teaching in home languages is encouraged in the Foundation Phase, but unfamiliar standardised isiXhosa translations in support materials often contain barriers to understanding and/or distortion in meaning.

Aim: The article addresses three questions: (1) To what extent is there fidelity and alignment of the translated isiXhosa materials to the original mathematical meaning? (2) To what extent do the selected terms align with the everyday isiXhosa that learners are accustomed to? (3) What are the implications for future translation of such materials?

Setting: Analysis of the isiXhosa translation of a doubling and halving teaching unit and adapted translation for use in a Grade 3 classroom in the Eastern Cape.

Methods: This qualitative research uses Toury's Descriptive Translation Studies theory.

Results: The findings highlight several ambiguities and incoherent translations. The article advocates for a comprehensive approach to translation, emphasising the importance of maintaining conceptual fidelity and clarity.

Conclusion: The authors suggest the need for transliteration techniques in translations to support teacher and learner access to mathematical sense-making.

Contribution: This research provides insights for translators of materials and implications for teachers, proposing an approach to translation. In particular, it argues that the involvement of Foundation Phase teachers in the translation of such materials is crucial.

Keywords: mental strategies; translation; isiXhosa; Foundation Phase; transliteration; doubling and halving.

Introduction

This article forms a component of the first author's Masters study into the nature of the language use when teaching the doubling and halving (D&H) strategy of the Mental Starters Assessment Project (MSAP) (Department of Basic Education [DBE] 2020a, 2020b) in a Grade 3 mathematics classroom. The first phase of that study examined the nature of isiXhosa translations in the MSAP teaching materials, specifically focusing on the D&H unit. The second part of the study compared these translations with the first author's personal isiXhosa translation that she used when teaching her Grade 3 class. This article focuses on the findings from the first phase of the study.

The rationale for the study stems from the first author's experiences as a Foundation Phase teacher with a predominantly English educational background who faced challenges in her own learning as an umXhosa in an English medium school, as well as when she taught it. The challenges she experienced in school when learning in a second language and when she began teaching in isiXhosa having learned her higher education (and how to teach) in English, motivated her to embark on this study.

Teaching with materials translated into isiXhosa can be challenging because of the nature of language translation from English. These translated materials often contain unfamiliar terms

Note: Special Collection: Mental mathematics and number sense in the early grades.

and unclear sentences. Past translations have typically used a purist approach, resulting in the use of an outdated or unfamiliar standardised version of isiXhosa that both learners and teachers find difficult to understand. This challenge is not unique to the materials in focus in this study. In the Annual National Assessments, for example, the term 'umlingano macala' [equal sides] was used for 'symmetry', which was unfamiliar to teachers and learners and departed from the meaning of symmetry. The term *isimetri,* however, was well known, and the avoidance of its use was challenged by mathematics educators and language experts (Robertson & Graven 2015).

For the purposes of this article, the difference between translation and translanguaging is that while translation is considered to be the communication of the meaning of a source-language text by means of an equivalent target-language text, translanguaging is a linguistic practice where multilingual individuals fluidly and dynamically use their language resources, moving between different languages or language varieties in communication (Garcia & Lin 2017; Wei 2018). An example of translation would be, in the case of the MSAP, the programme is designed in English. This therefore means it may not be acceptable to be used in schools where English is not the language of teaching and learning, and a more suitable language would then need to be used. This will be done through the process of translating the content of the MSAP teacher guide from English to isiXhosa, which is the target language in the context of this article. The technique that will be used for the translation process employs i-/ or /u-/ depending on the noun class. Therefore, the terms 'double', 'half' and all number names (e.g. two, four, five, etc.) become 'idabuli', 'ihafu' and *(uthu, ufo, ufayifu). Idabuli* and *ihafu* are examples of translation that involves transliteration where the word retains the English pronunciation but takes the orthographic form of isiXhosa.

From this point, these terms are used with these definitions in mind. A challenge for translation lies in the various dialects that exist within languages, and thus finding a common term across dialects can be tricky. In this article, the focus is on translation to isiXhosa, which is the most widely spoken language in the Eastern Cape province where the study took place. The disparity between formal standardised isiXhosa used in school teaching and learning support materials and informal non-standardised isiXhosa used outside of school can be vast (as in the example of symmetry above).

The latter is typically learned as the first language at home through everyday communication, while the former is formally acquired in a school setting (Sigcau 1998). To address this challenge, teachers often resort to code switching and/or translanguaging between English and isiXhosa, particularly in mathematics. However, while South African policy promotes multilingualism in education, it does not clearly promote translanguaging as it tends to have a purist monolingual bias towards use of language in class (Essien et al. 2024). Thus, teachers often feel that translanguaging is not allowed in the Foundation Phase. However, translanguaging worked well in the first author's class. Learners in her class were, for example, more familiar with English number names and most mathematical terms than isiXhosa ones (Van der Walt 2016). This familiarity stems from everyday language use, where money and numbers are commonly named in English. Leveraging this prior knowledge for teaching them was therefore beneficial (especially important in the initial years of schooling). A mother tongue-based bilingual education approach, as advocated by Van der Walt (2016), would support pedagogically sound use of both isiXhosa and English in teaching and learning, ensuring language is not a barrier to successful mathematics education (Setati 2005). Yet some subject advisors and other influential stakeholders such as principals insist on retaining the purity of the isiXhosa (Spofana 2011) without considering that learners do not speak pure isiXhosa at home.

The broader study aims to address this challenge by using familiar everyday [1]'lokshin' isiXhosa and evaluating its success in contributing to knowledge acquisition. This article specifically focuses on analysing the quality of isiXhosa translation in mathematics learning materials and interrogating the fidelity and alignment of the translation to the original mathematical meaning and concept and the familiarity of the term in everyday isiXhosa.

Literature review

A fundamental aspect of teaching and learning mathematics lies in the comprehension of key concepts. Language plays a crucial role as one of the key dimensions in understanding these concepts (Essien, Sapire & Taylor 2023; Henning 2016). According to Maluleke (2019), translanguaging serves as an empowering strategy to enhance learners' performance in mathematics. It involves allowing learners to engage in mathematical discussions while transitioning between formal and informal academic registers (Robertson & Graven 2020). Makalela (2015) contends that in multilingual settings, where bilingualism is acknowledged and appreciated, language utilisation should be 'fluid and flexible' (p. 16) to enhance the learning process.

Translation into isiXhosa

As noted above, the study takes place in the Eastern Cape province where most learners are isiXhosa speakers. This study is motivated by this challenge and the problematic translation of the isiXhosa version of the MSAP teacher guide compared to the original text in English. For example, in the isiXhosa translated version on page 62, the instruction to the teacher is meaningless because of direct word-by-word translation. The translated version reads as 'Use the number 6, 10 strips with dots and separate them to show

1.Lokshin isiXhosa – the isiXhosa that is spoken in the township, which is mixed with English and Afrikaans.

2 × 30', which does not convey the meaning of the original that stated 'Use six 10-dot strips and arrange them to show double 30'.

IsiXhosa boasts the lengthiest history of lexicographical development among the African languages in southern Africa, with the earliest written isiXhosa lexicography dating back to 1776 (Nkomo & Wababa 2013). Despite the publication of approximately 16 isiXhosa lexicographical works between 1776 and 2008 and its extensive history of lexicography, one might anticipate that isiXhosa, as a language, would be relatively standardised. However, challenges such as mistranslations and dialectical issues continue to persist (Combrinck & Mtsatse 2018).

The use of unfamiliar isiXhosa mathematical terms may pose a limitation for learners (Jack 2022). Schäfer (2010) argued that there is an urgent requirement for the development of mathematical registers in indigenous languages, particularly for the subjects of mathematics and science. One response to the call of using everyday language is Nkomo's (2015) non-purist approach to providing an English and isiXhosa mathematical dictionary, yet this dictionary does not appear to be widely used in the translation of resources provided for use in classrooms by the DBE.

South Africa's education language practices and policy

The majority of early-grade mathematics materials (including the MSAP materials) are initially designed and written in English and subsequently translated into African languages with minimal adaptation, as noted by Mostert (2019). Mostert (2019) argues that this practice overlooks the linguistic differences between English and African languages, leading to a loss of meaning in the translation process. Mpalami (2022) emphasises the importance of maintaining consistency in terminology for accurate and timely translations. He adds that this responsibility should not be left to individual mathematics teachers but requires a broader and more centralised approach. Sapire (2012) concurs that there is a need for increased availability of high-quality teaching and learning resources in relevant African languages.

Teaching and learning in South Africa are guided by the Language in Education Policy (LiEP) of 1997 and is still valid today. Likewise, the National Curriculum and Assessment Statement Policy Statement of 2011. Both of these documents are still the informing documents that are used today. This said, South Africa's LiEP promotes multilingualism, as outlined by the Department of Education in 1997. The National Curriculum and Assessment Policy Statement (CAPS) serves as the foundation for early mathematics education, specifying the content, scope and progression of concepts for each grade (DBE 2011). Learners are given mathematics workbooks aligned with CAPS content areas and presented in the language of learning and teaching (LoLT) used in their respective schools. However, it is noteworthy that student teachers, as mentioned in Ramollo (2014), have reported to her during her study potential inaccuracies in the language used in the CAPS document translated into African languages. These inaccuracies seem to stem from the translators' bias towards a formal 'standardised' version of isiXhosa and/or their own spoken home language, with specific regional or dialect forms. This highlights the crucial role language plays in teaching and learning mathematics, emphasising the challenges involved in achieving linguistic accuracy.

Tshuma (2021) underscores the significance of language in mathematics education, emphasising its potential to either facilitate learners' comprehension or impede their progress in mathematics. Learners need to grasp both the everyday language employed in tasks and the corresponding mathematical terminology (Mpalami 2022). Mbekwa (2009) adds that teaching learners in the language they comprehend most effectively is both educationally sound and preferable, and often, this language is one that is familiar and relatable to the learners.

Fluency in communication of mathematical ideas and procedures and strategies can be hampered by lengthy and unfamiliar isiXhosa names. For example, Jack (2022) found that learner mathematical fluency was jeopardised when learners experienced sluggish recall of the long and complex isiXhosa number names and mathematical terms.

Translanguaging

Translanguaging is a linguistic practice where multilingual individuals fluidly and dynamically use their language resources, moving between different languages or language varieties in communication (Wei 2018). Garcia and Lin (2017) state that translanguaging involves blending and integrating linguistic elements to convey meaning effectively. They continue that it reflects the ability multilingual speakers possess to seamlessly navigate and combine their linguistic resource for effective communication. For example, a teacher might be speaking in isiXhosa but may substitute English names/words for certain concepts like number names during an interaction with learners. This creates a hybrid expression that is easily understood by speakers of the dominant language; in this case, it being isiXhosa. This practice enhances communication by drawing on diverse linguistic tools.

In the classroom, teachers use translanguaging to make learners understand complex and new concepts in the text like long number names (Prinsloo & Krause 2019). They use contextual reference, that is using English for number names, money and telling time to create some level of relatability (Essien 2010). This can help young learners to better understand the content being taught and to feel more engaged in the learning process.

There are instances when a multilingual mathematics learner knows a particular mathematical term in both English and their primary language, in the case of this

article, this being isiXhosa, but the English term tends to be more readily accessible during mathematical conversations. This phenomenon can be explained by the fact that the majority of African language speakers in South Africa receive their mathematics education in English (Setati 2001) and therefore tend to converse using English terms that are then filtered down to the younger learners.

In this article, the teaching materials are intended for learners in Grade 3, generally aged between 9 and 10 years. The learners in the broader study are learning in their home language (isiXhosa); however, most of them may know the mathematical terms that have been borrowed from the English language through social interaction of cultures and the evolution of language (Mpalami 2022). Using unrelatable and unfamiliar isiXhosa mathematical terms, such as 'ukuthabatha' instead of 'ukususa' ['subtraction' instead of 'taking away'] and 'ukuhlela' instead of 'ukulungisa' ['assemble' instead of 'arrange'], can be a constraining factor for learners to acquire conceptual understanding; hence teachers need to be more aware of the importance of everyday language that learners bring into the classroom and support and encourage the learners' use of everyday language.

In the first author's experience of teaching in a rural area where the learners are expected to use a more formalised version of (standard) isiXhosa, the learners responded better when translanguaging was used. For example, for number names, money and time, she would use English. This could have been because they could relate to the mathematical terms and number names better in non-standardised isiXhosa and English than the standardised isiXhosa. This non-standardised isiXhosa is learned as the first language at home, through intensive everyday communication, but it is not necessarily standardised; for example, learners are familiar with the phrase 'ukudabulisha' (to double – the 'uku' meaning to and the 'dabulisha' meaning double) instead of the standard phrase for it which is 'ukuphinda kabini' (also meaning to repeat or multiply twice but is most used in multiplication talk). Foundation Phase learners' literacies are different from those perceived by policy makers, researchers and curriculum designers (Feza 2016a). It is therefore important to contextualise the registers used in teaching younger learners. Learning mathematics through a well-understood language proves to be beneficial to the learners (Feza 2016b). The first author therefore used translanguaging between non-standardised isiXhosa and English to teach the D&H calculating strategies to the Grade 3 classes. English terms are used in daily conversing between amaXhosa rather that the standardised isiXhosa that is presented in the isiXhosa teacher guide. For example, instead of using 'ukuphinda kabini' [multiply by two] as used in the teacher guide, she chose to use 'ukudabulisha' [to double].

Translation

According to Newmark (1981), translation is a process that attempts to produce on its readers an effect as close as possible to that obtained on the readers of the original. The process of translation attempts to render the exact contextual meaning of the original, taking into account the semantic and syntactic structures of the second language (Daminov 2022). This involves interpreting the meaning of each word, sentence and phrase in the source text and then finding the equivalent expressions in the target language. In other words, the translation process converts written and spoken language from one source language to a target language while maintaining the meaning and context of the original text.

In mathematics education, translating mathematical terms and concepts from one language to another is crucial to ensure that learners understand the concepts correctly (Schleppegrell 2007). Fidele et al. (2019) argue that teachers must translate mathematical concepts and terms into everyday language to make them understandable to learners. Such translation helps learners to understand the abstract nature of mathematical concepts and enables them to apply these concepts to real-life situations.

Mathematics has a unique language and notation that can be difficult to translate accurately into other languages. For example, the meaning of common mathematical symbols such as +, -, ÷ and × may differ across languages. Mathematical terms may have different translations depending on the context in which they are used, making it challenging to ensure consistent translation across different contexts (Jourdain & Sharma 2016).

Why accessible user-friendly translation matters?

Translation helps in breaking down language barriers and facilitating communication between individuals and cultures that speak different languages (Leonardi 2010). Research shows that learners who learn mathematics in their second language may struggle to transfer their knowledge and skills to other contexts (Tan & Lan 2011). However, the second language could also be a salient learning tool considering the case where the learners come into the classroom with knowledge of number names and some concepts such as money and time in English because of cultural dynamics. For example, Jack (2022) states that in her study, during group discussions, the learners were discussing among themselves using some English words and named all the numbers in English. She provides an example where a learner explains to the other group members that 'funeka siyi-cut-e kay three senze iihafu eziy-three' [we need to cut it three times to make three halves]. Translation may help to facilitate the transfer of knowledge by making sure that learners understand the concepts in a way that is meaningful to them. For example, teachers can use real-life examples and translate mathematical terms into the learners' native language to help them make connections between the concepts and their own experiences. Mathematics is a language and being able to communicate mathematical ideas effectively is a crucial part of learning (Schleppegrell 2007).

Translation can help to enhance mathematical communication by making sure that learners understand the mathematical terms and symbols used by their peers and teachers. In many countries, classrooms are becoming more diverse, with learners from different linguistic and cultural backgrounds. According to Holmes (2006), education contexts have recently been transformed into pluricultural and plurilingual environments because of international learner exchange programmes, migration study programmes, and the participants of these education contexts bring their own cultural assumptions and experiences to the common practices conducted in these contexts (Francehini 2009; Sierens & Van Avemaet 2014). This diversity presents a challenge and an opportunity for teachers to enrich their teaching by incorporating different perspectives and approaches to problem-solving.

However, this can also pose a challenge if learners do not understand the language of instruction. The broader study focuses on two Grade 3 classes that have majority of isiXhosa speakers, who are learning in their mother tongue. However, isiXhosa has many dialects, and it does not have a single standardised version that all the dialects may use. The learners in this study are not only from the Makhanda area, but there are learners who have relocated from other parts of the Eastern Cape with their parents because of working conditions who therefore do not speak the Makhanda dialect. There are different dialects within the Eastern Cape. These learners must be accommodated, and one of the tools that may be of aid to the situation is a less rigid or a less pure translation that uses words that belong to only one dialect. Translation can help to bridge the gap between different languages and cultures, making mathematics education more accessible and inclusive for all learners. Therefore, this article focuses on the translation of the teaching materials used for teaching D&H as a mental strategy.

Most early-grade mathematics materials are still conceptualised and written in English and then translated into African languages without much adaptation and this results in the differences between the linguistic features of English and African languages being ignored and therefore meaning inevitably lost (Mostert 2019). According to Mpalami (2022), the work of translating mathematics tasks is challenging and should be carried out carefully. He further states that when translating technical mathematics terms, the meaning of the original task is usually distorted and therefore makes it hard for learners to understand the concepts that are envisioned. The MSAP teaching guide in focus in this study illuminates this challenge where direct translation has been used and meaning has been lost.

Conceptual framing

We employ Toury's (1995) Descriptive Translation Studies (DTS) theory. This theory highlights that 'translations first and foremost occupy a position in the social and literary system of the target culture, and this position determines the translation strategies that are employed' (Toury 1995:13). The different types of translations include and are not limited to indigenising (similar to transliteration), literal translation, loaning, adaptation and compensation.

Descriptive Translation Studies is a subset within the broader field of Translation Studies, specifically falling under the 'pure' category. The 'pure' strand in this context refers to an approach that emphasises strict adherence to linguistic and cultural norms of the target language, often resulting in translations that prioritise formal equivalence and traditional language standards over contemporary usage and accessibility (Munday, 2001). Because of the descriptive nature of isiXhosa, this subset is effective. The descriptive subset concentrates on three key orientations: the product, the process and the function. The place of descriptive studies within broader translation studies is captured in Figure 1.

The product orientation

In the broader study and this article, the product refers to a mathematical teaching and learning tool initially designed in English and later translated into isiXhosa. However, there is apparent distortion in meaning in the isiXhosa version attributed to ambiguity and direct translation. One objective of this study is to propose solutions for addressing such translation issues.

The process orientation

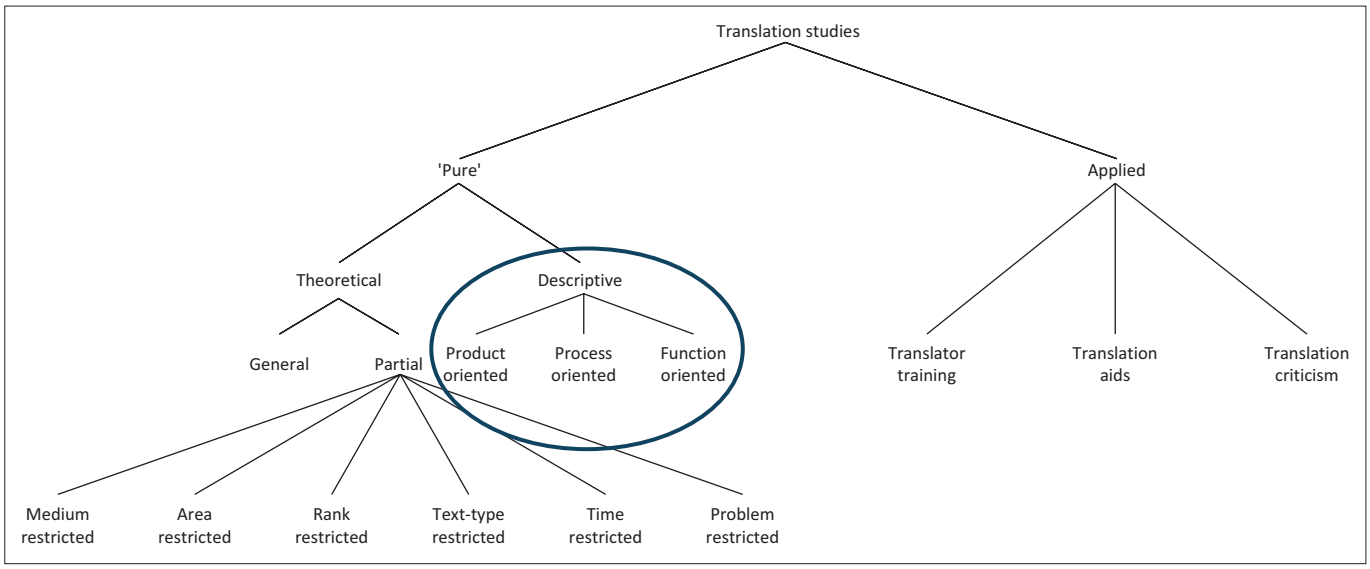
In the isiXhosa version, various translation techniques seem to be employed, leading to inconsistency in the production of the teacher guide.

The function

Because of inconsistencies in the translation process, the isiXhosa teacher guide may impede the intended function of the MSAP teacher guide, which is to foster learners' conceptual understanding and procedural fluency by somewhat distorting the original meaning. Drawing on this theory, this article not only determines and exposes the treatment of mathematical terms and number names in the isiXhosa-translated MSAP teacher guide, but also investigates the inconsistencies in the translation strategies that are used in the MSAP teacher guide where there is fluctuation in use of standardised and non-standardised isiXhosa. In addition, we show that the concept of translation of mathematical terms and mediation in mathematics needs to use terms that are appropriate for and applicable to certain situations in a community.

Challenges with translation in Grade 3 Mental Starters Assessment Project teacher guide doubling and halving

In this study, we analyse the translation in the isiXhosa teacher guide and contrast this against the use of



Source: From Toury, G., 1991, 'What are descriptive studies into translation likely to yield apart from isolated descriptions', in *translation studies: The state of the art*, pp. 179–192, Brill

FIGURE 1: Holmes's conception of translation studies.

transliteration to translate the unfamiliar terms and those that have dual meanings. This is a more transparent and user-friendly technique because languages evolve with time and community structures (Nkomo & Wababa 2013). There are now more indigenised English words used in isiXhosa daily language than before through transliteration. Correct language translation is an essential part of mathematics teaching and learning, particularly in multilingual and multicultural settings. Teachers must be able to translate mathematical terms and concepts into a language that learners can understand to ensure that all learners have equal access to the curriculum and are able to develop their mathematical understanding.

Research methods and design

This article shares a selection of data and findings that emerged from the first author's broader study (Booi, forthcoming) that employed documentary analysis of the MSAP Grade 3 Teacher Guide in two languages – the original English and the translated isiXhosa. Thus, two documents, namely the original English MSAP teacher guide and the translated isiXhosa guide are analysed (specifically focusing on the D&H unit). The analysis focuses on examining the fidelity and accessibility of the isiXhosa guide D&H unit.

We utilise the everyday translations of mathematical terms from the Oxford School Bilingual Dictionary of Nkomo (2015) and the first author's expertise as an isiXhosa native speaker. These terms were previously discussed and form the basis for our considerations. We further analyse the translation in the isiXhosa teacher guide from the perspective of whether the use of transliteration to translate the unfamiliar terms could have resolved any challenges noted. As noted above, transliteration is a more transparent and user-friendly technique because languages evolve with time and community structures (Nkomo & Wababa 2013). There are now more indigenised English words used in isiXhosa daily language than before through transliteration. Accessible language translation is an essential part of mathematics teaching and learning, particularly in multilingual and multicultural settings. Teachers must be able to translate mathematical terms and concepts into a language that learners can understand to ensure that all learners have equal access to the curriculum and are able to develop their mathematical understanding.

According to Mpalami (2022), accurate translation in mathematics is crucial for ensuring learners' conceptual understanding and academic success by preventing confusion and maintaining continuity in their education. He adds that it also promotes confidence, facilitates standardisation and supports effective teacher-learner communication, particularly in diverse, multilingual classrooms.

The aim of this article was to analyse the quality of translation and the fidelity (accuracy) of the translation to the mathematical meaning and concept. This therefore answers the first research question that states, (1) To what extent is there fidelity and alignment of the translated isiXhosa materials to the original mathematical meaning?

Mental Starters Assessment Project – Teacher Guide for doubling and halving

The isiXhosa translation of the MSAP teacher guide and learner materials will likely be used by many teachers and learners across the Eastern Cape. It is thus important that the translations be sensible, accurate and accessible. In the Makhanda district of the Eastern Cape, the dialect spoken in this district is isiRharhabe, which is the standard isiXhosa by Pan South African Language Board (PanSALB). The PanSALB supports the incorporation of indigenous languages into the education system to enhance accessibility and inclusivity, thereby fostering cultural diversity and improving educational outcomes for speakers of all South African languages (Orman 2009). The recognition of this

dialect stems from the historical development of isiXhosa orthography. It holds significance as one of the earliest indigenous languages in South Africa to be transcribed, a task undertaken by missionaries under the leadership of John Bennie and John Ross in 1823 (Maseko 2017).

The choice of words used in the MSAP teacher guide is not, however, relatable to the learners in the Makhanda district. It appears as a more standardised version of isiXhosa that includes words from various isiXhosa dialects. And in the translation process, in most instances, the context of the words was not considered. Direct translation appears to have been done often resulting in the loss of meaning.

We employed Toury's DTS theory to construct the language of description for the nature of the translations, the process, from the English MSAP teacher guide to the isiXhosa. This theory was chosen because of its applicability to languages like isiXhosa, which can be classified as a descriptive language. In the context of isiXhosa, descriptiveness manifests when direct equivalents are absent, resulting in the product being of descriptive nature. The utilisation of transliteration terms like 'ihafu' and 'idabuli' is commonplace and acceptable in the classroom during numerical discussions. Additionally, Toury (2012) posits that translation predominantly occupies a specific position within the social and literary system of the target culture, influencing the translation strategies employed. If we opt for the transliteration strategy in translation, it is essential to consistently apply this approach throughout the entire translation of the book. Additionally, the selected terms must align with the same linguistic register.

The initial phase of this research involved identifying instances of distortion in meaning and the use of unfamiliar terminology. The aim was to locate more appropriate equivalents that were both familiar and comparable to the original text, which, in this context, was formulated in English. According to Gauton, Taljard and De Schryver (2003), the common practice in South Africa, particularly when translating technical content into indigenous languages like isiXhosa, is to begin with the original English text. They add that this is primarily because indigenous languages may lack the requisite technical vocabulary.

Upon examining different aspects of the isiXhosa MSAP teacher guide, we observed a few instances of the use of transliteration and several more 'missed opportunities' where transliteration could have been used but was not. For example, terms like 'ihafu' and 'izitriphu' are transliterated because maybe the translator did not have the vocabulary for these terms; yet for terms like 'ukuphinda kabini' and 'ukuhlela', the terms are translated through the descriptive approach when they may be transliterated. This runs counter to the fundamental principles of document translation as outlined in the DTS theory, which emphasises maintaining consistent translation techniques throughout the document.

The author's Grade 3 class confirmed that they also preferred using the suggested vocabulary (Booi, forthcoming or in progress). This was achieved through an interactive discussion with the Grade 3 class. The learners shared their contributions towards the selection of vocabulary to be used. Table 1 summarises this selection process.

Ethical considerations

Ethical clearance to conduct this study was obtained from the Rhodes University Education Faculty Research Ethics Committee (EF-REC) on 8 August 2023. The application number is 2023-7135-7516.

Results

It is beyond the scope of this article to share the wide range of translation challenges that were found as a result of the documentary analysis of the isiXhosa translation of the MSAP teacher guide. Instead, in this section, we share selected examples of two primary translation challenges that were identified during the analysis. These two challenges emerged from the broader analysis (Booi, forthcoming) as the primary recurring challenges across the MSAP D&H unit. The first relates to word or mathematical term translations (see Table 1), while the second relates to translation of whole sentences in which the meaning of the idea is lost. Table 1 provides an overview of the utilisation of transliterated words as opposed to direct translation, aiming to preserve the intended meaning.

Transliterated words

- The term 'idabuli' is unambiguous and is more relatable to the learners as they use the term in everyday language, unlike the term 'ukuphinda kabini', which they may misinterpret as multiplication because that is the language used when learning the times tables in Grade 2.

TABLE 1: Words that are and may be transliterated from English to isiXhosa in the D&H (MSAP teacher guide).

English terms	Current MSAP isiXhosa translation	Possible transliterated isiXhosa translation	Justification for transliterated version
Doubling	Ukuphinda kabini (Phinda kubini means to multiply two times)	Idabuli	More relatable
Halving	Ihafu	Ihafu	The only transliterated word in the D&H unit
Number names	Original isiXhosa number names For example, Ishumi elinesihlanu	English number names for example, fifteen	too long for rapid recall
Number name prefixes	Prefixes suited for isiXhosa number names For example ama- for 20; isi- for 1; i- for 9	Prefixes suited for transliteration e.g. ka- for all numbers	Confusion as numbers are written in symbols
'friendly' numbers	Amanani 'ahlobeneyo'	amanani anobubele	'ahlobeneyo' means 'related' – distorted meaning
Doubles	'iziphindwa'	Iidabuli	Unfamiliar term

D&H, doubling and halving; MSAP, mental starters assessment project.

- The number names in isiXhosa are too long for the nature of the rapid recall exercise in the mental starters where pace is vital, and fluency is required.
- In isiXhosa, the prefix of the number name depends on the noun class to which the number name belongs to; however, if we use English number names, all the number name falls under one noun class and therefore one prefix is used for all the numbers. For example, 'ka-' becomes the prefix for all the numbers when they are named in English. Unlike 'ama-', 'isi-', among others, depending on the noun class of the number name. When we use a loaned term, the noun class remains the same.
- Ten and multiples of 10 are referred to as friendly numbers in the MSAP teacher guide because they are easy numbers to work with. The term 'ahlobeneyo' means 'that are related' and not 'friendly'. The correct term is 'anobubele', and this term is more relatable to the learners. The term 'iziphindwa' is not a common term and the learners prefer using 'idabuli'.

In Table 2, we present instances of expressions found in the current MSAP isiXhosa teacher guide for D&H, where meaning is compromised, or linguistic rules are violated as a result of direct translation without taking the context into consideration.

Phrases with lost meaning

- The prefix used for referring to the learners possessing the skills in question is incorrect ('abafundi e benazo'); the correct prefix is 'ba', which is used for plural nouns in class 2 and the expression becomes 'abafundi babenazo'.
- The use of an unfamiliar term 'iziphindwa' by teachers may confuse the learners. The doubles that are required in the question are that of the fingers and not the sentence.

In the next section, we provide a detailed analysis of a full extract from the Doubling and Halving unit in the English Teacher Guide (DBE 2020a) and the isiXhosa Teacher Guide (DBE 2020b) in order to exemplify several translation issues across a full task sequence that would likely create challenges for both teachers and learners when using the isiXhosa version. Figure 2 shows the distortion in meaning that occurs throughout the MSAP isiXhosa Teacher Guide because of direct translation and not taking into consideration the context.

The following points provide explanation of the annotations in Figure 2:

1. 'Ulandelelwano' [sequence] is translated as an adjective and not as a noun as intended in the English version. The meaning therefore changes to describing task rather than explaining.
2. 'ukuphinda kanbini' also means to multiply by two (especially in Grade 2); this then may confuse a Grade 3 learner.
3. Direct translation has changed the meaning of the sentence; it now reads as 'Use the number 6 10 strips with dots and divide them to show 2 × 3'.
4. Direct translation has removed any sense in the sentence. The current sentence now means 'write a number sentence in the way you have been shown and point that 6 and 60 are together just like 3 and 30'.

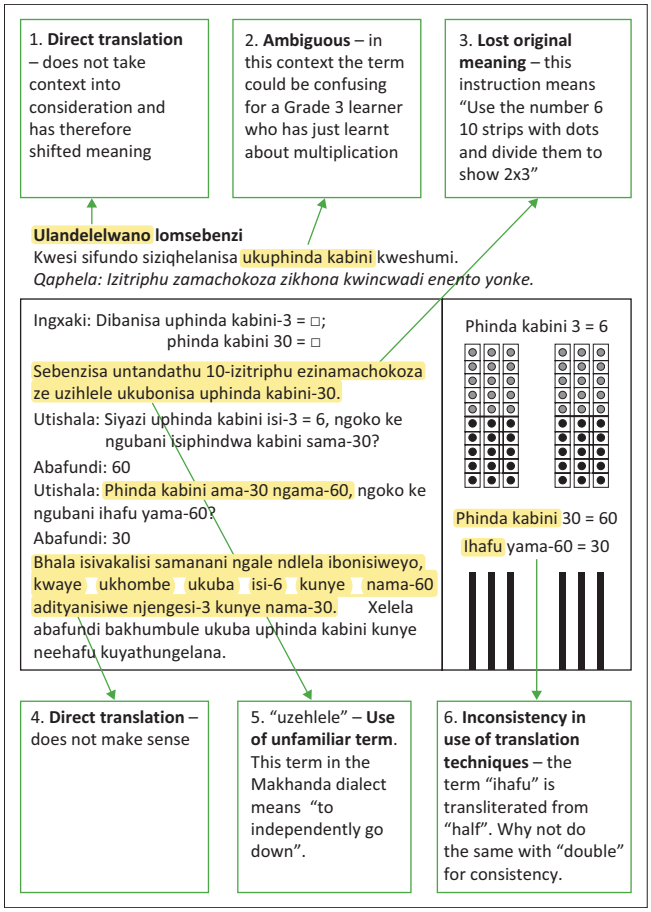


FIGURE 2: Annotated extract from the Mental Starters Assessment Project isiXhosa Teacher Guide.

TABLE 2: Examples of phrases that have lost meaning because of direct translation in the isiXhosa MSAP teacher guide.

English phrases	Current MSAP isiXhosa translation	Proposed MSAP isiXhosa translation	Justification
'There are three rapid recall skills that learners need in order to learn doubling and halving' (DBE, 2020a:51)	'Kunezakhono zokukhumbula ngokukhawuleza ezintathu ekufuneka abafundi e benazo ukuze bafunde ukuphinda kabini kunye nehafu'. (DBE, 2020b:52) [There are skills that learners needed in order to learn multiplying by two and a half]	'Ukuze abafundi bafunde ukubala ngedabuli nehafu, kufuneka babenezizakhono zilandelayo' [In order for learners to learn doubling and halving calculating strategies, they should have the following skills]	Possible spelling errors and direct translation leading to distorted meaning
'Now tell me the doubles sentence for the fingers I show'. (DBE, 2020a:54)	'Ngoku ndixelele iziphindwa zezivakalisi zale minwe ndiyibonisayo'. p. 55 (DBE, 2020b:55) [Now tell me the doubles of the sentences of the fingers I am showing]	'Sithini isivakalisi sedabuli saleminwe ndiyibonisayo?' [What is the doubles sentence for the fingers I am showing?]	Direct translation, not contextualising the use of the word 'sentence' and therefore leading to distorted meaning.

MSAP, mental starters assessment project.

5. The term 'uzihlele' is a different dialect for the isiXhosa speakers in Makhanda; this term means to independently roll or decrease and not to separate.
6. The term *ihafu* is transliterated but not the rest of the text. There is an isiXhosa word for a half [*isiqingatha*] but because it is unfamiliar to most young isiXhosa speakers, it is not used in the book.

Discussion

The research evaluated the convergence or divergence of elements such as linguistic fidelity, terminological consistency, conceptual accuracy and cultural equivalence between the translated MSAP materials and their counterparts in educational resources. This focused exploration found challenges of translation quality, providing a comprehensive understanding of the challenges or opportunities it introduces within the pedagogical framework of mathematics education in the South African context.

According to Giroux (2006), terminology consistency is vital in producing accurate translations and words that say what they mean and mean what they say to avoid misunderstandings and other unwanted consequences as seen in the examples extracted from the isiXhosa MSAP Teacher Guide. The translation of the terminology is not consistent. While some terms (e.g. *idabuli* for double) are formed through transliteration (where the word retains the English pronunciation but takes on isiXhosa orthographic form), many terms were original isiXhosa terms.

Transliteration refers to the creation of new scientific and technical terms by adapting the sound structure of a borrowed word to match the phonetic system of the language into which it is being incorporated (Gauton et al 2003). In isiXhosa orthography, a consonant does not exist on its own; it must always have a vowel companion to make a sound (Nkomo & Wababa 2013). Therefore, transliteration allows for this nature of word transformation. For example, in the MSAP isiXhosa teacher guide on page 62 of the Doubling and Halving section, the translator has chosen to use 'ihafu' [half] instead of 'isiqingatha' (which is the original isiXhosa term) – This was shown in Table 1. The former [*ihafu*] is an acceptable term to use because the learners in Grade 3 will be able to relate to its use, unlike the use of 'isiqingatha', which is standard, but which they may not yet be familiar with. However, because of the translator's inconsistency, the term 'uphindo kabini' is used for doubling instead of 'idabuli' [double], which is a transliterated term that learners could be more familiar with.

The success of translation depends on the experience and proficiency of the translator in both mathematics and the target language. Translators must be knowledgeable about the mathematical concepts they are translating and have a deep understanding of the target language to ensure accurate and effective translation (Gauton et al. 2003). Mathematical concepts are largely complex and abstract, making them challenging to communicate in any language. Translators must be skilled in breaking down complex mathematical ideas into simpler, more accessible language that learners can understand especially in the Foundation Phase. Having experience in working with the younger learners might help in this regard.

Translating mathematics can be challenging because of the unique language and notation of mathematics, conceptual differences, multiple meanings, complexity of mathematical ideas and the expertise required of the translator (Jourdain & Sharma 2016). Overcoming these challenges requires careful consideration and expertise to ensure that mathematical ideas are communicated accurately and effectively across languages and cultures.

Implications

The tables and figures provided in this article highlight several translation issues that are likely to create barriers to teachers' opportunities to communicate mathematical meaning to learners. From these to improve the effectiveness of translated materials, we suggest that the following strategies be implemented and researched:

- Translanguaging: Standardising a language should involve translanguaging, allowing for the use of familiar terms, such as number names in English, to facilitate the understanding of new concepts.
- Consideration of translation theories: When translating teaching materials from English into indigenous languages, translation theories should be considered, employing a descriptive approach when terms do not directly correspond.
- Transliteration as an ideal approach: Transliteration appears to be the most suitable method to 'standardise' a language in the early stages of learning. It not only retains the English term, which they will need to learn when they switch to learning in English in later years but retains the terms of the English mathematical register. Altering only the orthography allows for the terms to flow fluently within isiXhosa sentences.

In essence, this study advocates for a nuanced and thoughtful approach to translation, acknowledging the intricacies of language and emphasising the importance of retaining meaning and effectiveness in teaching and learning materials. By embracing translanguaging and informed translation theories, educators can ensure that translated materials truly serve their purpose in facilitating comprehensive and accessible education.

In the development of isiXhosa teaching materials for the Foundation Phase, it is crucial to adopt a comprehensive and collaborative approach that involves active participation from various stakeholders. These stakeholders include language and mathematics educators, indigenous language scholars and a departure from a strict linguistic purist standpoint. Notably, while numerous educational resources have been created to address language-related challenges in other educational phases, there is a noticeable lack of similar efforts dedicated to the Foundation Phase.

Firstly, the collaborative engagement of educators from both language and mathematical disciplines is essential. This collaboration is based on the recognition that effective pedagogical materials must harmoniously integrate language and mathematical concepts. Therefore, the dual participation of language and mathematics teachers is vital, as their combined expertise ensures alignment between linguistic clarity and mathematical precision, fostering a cohesive learning experience.

Secondly, the involvement of indigenous language academics holds paramount importance. These scholars bring a nuanced understanding of isiXhosa to the forefront, ensuring that the translation and adaptation of mathematical concepts are not only linguistically accurate but also culturally resonant. This cultural alignment plays a key role in enhancing the relevance of teaching materials and instilling a sense of belonging and cultural pride among learners.

In contrast to a purist approach that prioritises linguistic purity potentially at the expense of pedagogical effectiveness, it is crucial to adopt a pragmatic stance. A purist approach, often inflexible in its linguistic standards, may inadvertently hinder the development of materials that are accessible and comprehensible to learners. Therefore, a departure from linguistic purism is recommended, allowing for some linguistic adaptation to optimise clarity and instructional effectiveness.

The collaborative involvement of educators from both language and mathematics domains, the inclusion of indigenous language academics and a departure from linguistic purism collectively form a crucial strategy for creating isiXhosa teaching materials tailored to the unique requirements of the Foundation Phase. This approach recognises the distinctive linguistic and pedagogical nuances inherent in this phase, aiming to bridge the existing gap in educational resources and ensure equitable support and opportunities for scholastic achievement for isiXhosa-speaking learners.

This comparative document analysis undertaken, focusing on the translation quality and conceptual fidelity of the MSAP D&H teaching materials not only highlights the disparities in linguistic fidelity, terminological consistency, conceptual accuracy and cultural alignment between inadequately translated MSAP materials and their counterparts but also offers valuable insights into the multifaceted implications of translation quality on mathematics education in South Africa. The findings of the study underscore the urgent need for a broader translation effort of learning materials from English to isiXhosa and other indigenous languages. However, the complexities of translation, particularly in the intricate isiXhosa language, demand a nuanced approach. The challenges identified, such as the loss of meaning through direct translation and the hindrance to understanding because of unfamiliar terms, emphasise the importance of translanguaging and consideration of translation theories in the translation process.

Looking ahead, we recommend a collaborative and comprehensive approach to the development of isiXhosa teaching materials for the Foundation Phase. The active participation of language and mathematics educators, indigenous language scholars and a departure from linguistic purism are crucial elements in creating materials that bridge the existing gap in educational resources. This approach acknowledges the unique linguistic and pedagogical nuances of the Foundation Phase, aiming to provide equitable support and opportunities for isiXhosa-speaking learners.

We trust this article contributes to the ongoing discourse on the intersection of language and mathematics education, advocating for a thoughtful and collaborative approach to translation and material development. By addressing the identified challenges and implementing the recommended strategies, educators and stakeholders can work towards fostering a more inclusive and effective educational environment for isiXhosa-speaking learners in South Africa's Foundation Phase.

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The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

T.B. conceptualised the study, conducted the analysis and wrote the first draft. P.V. and M.H.G. assisted in the conceptualisation, acted as supervisors, aided in validating the findings and assisted in refining the article through reviewing and editing.

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Data availability

The data informing this study is available from the corresponding author, T.B., upon reasonable request.

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