RESEARCH-INFORMED DEVELOPMENT OF COMPREHENSIBLE ISIXHOSA TEACHING MATERIALS: THE DEPARTMENT OF BASIC EDUCATION MENTAL STARTERS DOUBLING AND HALVING UNIT

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TABISA BOOI

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ABSTRACT

One of the challenges faced by schools that teach in isiXhosa in the Foundation Phase is the impact of nature of language used in the early-grade mathematics classroom. This is the focus of this research study. Despite numerous programs addressing the poor performance in mathematics, a significant majority of interventions are presented in English, creating barriers for learners and teachers using their native languages. While the Language in Education Policy allows for home language instruction in isiXhosa, the translation of materials often contains distortion in meaning and unfamiliar terms, complicating comprehension for indigenous language learners.

Motivated by concerns over low mathematics performance, as highlighted in TIMSS (2019), and my personal experiences in teaching Foundation Phase mathematics in isiXhosa at a rural primary school, this study explores the challenges arising from using translated materials. The use of mediating materials in isiXhosa can be hindered by unfamiliar terms and distortion in meaning. For this reason, I adopted a translanguaging approach, incorporating transliteration between English and isiXhosa, especially in mathematics teaching.

Grounded in the pragmatism paradigm, this qualitative design research unfolds in an isiXhosa medium primary school in Makhanda. The investigation centers first on document analysis of the Doubling and Halving unit in the Mental Starters Assessment Programme (MSAP) Teacher Guide (in English and isiXhosa), and then focuses on the teaching of two grade 3 classes, in isiXhosa, using the MSAP Doubling and Halving teaching sequence. Two grade 3 teachers and their principal participate as critical friends. The key research questions are: (1) What are the enablers and constraints that are experienced by the teacher during the mediation of the doubling and halving calculating strategies in isiXhosa?; (2) What are the key terms and phrases (vocabulary) needed to teach doubling and halving in isiXhosa?; (3) What are the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that was developed?

The research unfolds in multiple stages, beginning with a document analysis of the MSAP using Toury's Descriptive Translation Studies. Subsequently, I adapt eight lesson starters for doubling and halving, implementing them across two grade 3 classes in a double action research cycle. Focus group discussions with critical friends, aided by video recordings for stimulated recall, provide valuable insights. Data collected throughout these stages are analyzed through the lens of Vygotsky's Socio-Cultural theory, contributing to a

comprehensive understanding of the challenges and potential solutions in this educational context.

STATEMENT OF ORIGINAL AUTHORSHIP

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed:

Date: 26-06-2024

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APPENDICIES

LIST OF ACRONYMS

TIMMS	:	Trends in International Mathematics and Science
CAPS	:	Curriculum Assessment Policy Statement
MSAP	:	Mental Starters Assessment Programme
DBE	:	Department of Basic Education
ANA	:	Annual National Assessments
LoLT	:	Language of Teaching and Learning
UNESCO	:	United Nation Educational, Scientific and Cultural Organisation
LiEP	:	Language in Education Policy
DTS	:	Descriptive Translation Studies
DBR	:	Design-Based Research
ECDOE	:	Eastern Cape Department of Education
BICS	:	Basic Interpersonal Communication Skills
CALP	:	Cognitive Academic Language Proficiency
RUESC	:	Rhodes University Ethical Standards Committee
SAARMSTE	:	South African Association for Research in Mathematics, Science and Technology Education
SAJCE	:	South African Journal of Childhood Education
PanSALB	:	Pan South African Language Board

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It is important to note that the opinions expressed, and conclusions reached in this thesis are entirely my own and should not be attributed to the NRF.

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CHAPTER 1:INTRODUCTION, RATIONALE AND CONTEXT

CHAPTER 1

1.1 INTRODUCTION, RATIONALE and CONTEXT

There is great concern around learners' performance in mathematics in general. Spaull and Kotze (2015) show that by Grade 4 most learners are already two Grades behind curriculum expectations. Many South African researchers have noted that a key factor in the underperformance could in part be a lack of number sense and a dominance of concrete methods of calculation (e.g., Graven et al., 2013; Graven & Venkat, 2021; Hoadley, 2007; Schollar, 2008). The 2019 TIMMS report explains that this poor performance persists into later Grades.

This study was triggered by my concern about the poor performance in mathematics as reflected in TIMSS (2019) and my experience in teaching Foundation Phase (FP) mathematics at a rural primary school using isiXhosa as the language of teaching and learning as prescribed by the Curriculum, Assessment and Policy Statement (CAPS) document. While I speak isiXhosa fluently, I have a predominantly English educational background, and so it was challenging for me to use mediating materials that are written in isiXhosa because of the number of unfamiliar terms used. My schooling from Foundation Phase to tertiary level was predominantly in English, and I was only exposed to isiXhosa in the classroom in the first year of my Bachelor of Education studies.

The challenge that we encounter as teachers and learners is that in school, we are faced with formal standardized isiXhosa while outside of school we are faced with informal non-standardized isiXhosa. This non-standardized isiXhosa is learned as the first language at home, through intensive everyday communication, while standardized isiXhosa can only be acquired formally at school (Sigcau, 1998). To mitigate this challenge, I resorted to using a bilingual approach that used code switching between English and isiXhosa in my teaching, particularly in Mathematics. Code switching is the use of two languages in one sentence to get the message across successfully without distortion (Probyn, 2006).

The code-switching technique seemed to work for me in my class because I discovered that the learners were more familiar with using English mathematical terms than the isiXhosa ones (van der Walt, 2016). The reason behind this could be the fact that in everyday language, money and numbers are named using their English names. The learners therefore come into the classroom with this prior knowledge. It is thus beneficial to build on this knowledge and to recognise that learners' home language includes many English terms or slightly modified

English terms (e.g., *isikwere* for square). Using a familiar language as a bridge to the more formal language of schooling supports educational success because it allows less formal use of language to be the vehicle for sense making. Therefore, a mother tongue based-bilingual education approach is ideal (van der Walt, 2016). The mother tongue-based bilingual education approach allows for pedagogically sound use of isiXhosa and English for teaching and learning which is very similar to the code-switching and translanguaging forms of teaching. Language should not be a barrier to the successful teaching of mathematics (Setati, Teaching mathematics in a primary multilingual classroom, 2005).

Mathematics is a learning area in the South African CAPS (Department of Basic Education, 2011, a, b, c, & d) that is compulsory from Grade R-9. According to CAPS (2011a,b,c,d), "mathematics is a language that uses symbols and notations for describing numerical, geometric, and graphical relationships. It helps develop mental processes that enhance logical and critical thinking, accuracy and problem-solving that will contribute to decision-making." A Foundation Phase mathematics lesson is made up of the following parts: mental mathematics; lesson development; classwork and consolidating learning (Hodgen, et al., 2017).

My study focuses specifically on one mental mathematics skill, the doubling and halving calculating strategy. This skill forms part of the Number, Operations and Relationships element. This element is fundamental in the teaching and development of the other four elements mentioned above. The Number, Operations and Relationships element focuses on the development of number sense for learners. According to the CAPS document (2011), number sense includes the meanings of different kinds of numbers, the relationships between different kinds of numbers, the relative sizes of different numbers, and representation thereof in various ways.

Mental mathematics is a group of skills that assist a person to calculate mentally and without the assistance of pen and study. Mental mathematics strategies are fundamental in mathematics (Gow, 2021). Without these strategies, learners may struggle to calculate fluently. The mental mathematics component of the mathematics lesson is suggested to be the first 10-15 minutes 'warm-up'. In these fifteen minutes, there is a lot of language use; it is therefore vital that the message is concise and easily understood by the learners. The teacher needs to be clear in her instruction for learners to understand what is being taught.

I have had experience of teaching isiXhosa speaking learners in a village school with isiXhosa as a language of instruction from Grade R to 3. My current teaching experience however is

teaching isiXhosa speaking learners in a township school that has English as the medium of instruction from Grade R-3. I am a first language isiXhosa speaker who is fluent in English and completed all my studies in English. As explained in the methodology section, however, I chose to do my research in a school that taught Foundation Phase learners in isiXhosa, and I thus chose to work with a different school than that in which I am currently employed.

From my experience of teaching mathematics in isiXhosa to isiXhosa speaking learners, I found that learners responded better when I used some familiar English terminology. This could be due to the increase in use of non-standard isiXhosa in the community and the diminishing role of standardized isiXhosa in our society with the result that the learners in my classroom do not understand the standardised isiXhosa as they have not been exposed to it. It is no longer a usual practice to hear learners communicating in their pure mother tongue. They mix various languages for better communication (Sigcau, 1998). However, although the South African Language in Education Policy (1997) states that learners should be taught in their mother tongue in the Foundation Phase (FP), school governing bodies can choose the language of instruction for their schools, and many choose English due to the perceived access to socio-economic goods that this provides (Setati, 2005; Graven & Robertson, 2020). Since monolingualism dominates, learners are seldom offered the opportunity of benefitting from a bilingual approach to teaching and learning – even while many teachers resort to code switching. Furthermore, as noted above, this monolingual approach results in the teaching and learning materials for Foundation Phase mathematics in the Eastern Cape being written in a 'standardized' isiXhosa mathematical register that does not always align with the mathematical register used at home. See Robertson and Graven (2015) for an example of the unfamiliar term of '*ulingano-macala*', which was used in the Annual National Assessments (ANA) for symmetry — a term which both learners and teachers were unfamiliar with and which language experts have considered to depart from the meaning of the word symmetry. *Simetri* (adapted from English), on the other hand, was well known to teachers and learners.

The Mental Starters Assessment Programme (MSAP) is being introduced by the Department of Basic Education to schools because most learners continue to perform below Grade level expectations in mathematics in post-apartheid South Africa (https://www.education.gov.za/MSAP2022.aspx) (Graven, 2014; Department of Basic Education (DBE), 2020). However, the isiXhosa translation of the teacher guide appears to have numerous language errors and use of unrelatable terms (similar to what was highlighted in the translation of the ANAs above), thus making it difficult to use and in some sections the

meaning is lost. Examples of unrelatable terms include *'ukuhlela'* (to separate), *'iziphindwa'* (multiples), *'amanani ahlobeneyo'* (related numbers), *'calula'* (discriminate). Because of these issues with the isiXhosa translation, in the design of my research study, I will be teaching the learners using the original English text but adapting it in a way that I am able to teach learners in an isiXhosa medium classroom. This will require me to develop some terms or vocabulary that is relatable to the learners to make the learning process possible.

In this study, I aim to develop a more relatable isiXhosa vocabulary that may be used in conjunction with the English version of the Mental Starters Assessment Programme (MSAP) teacher guide when mediating learning of doubling and halving calculating strategies. While translations of the MSAP materials are done internally by the DBE, providing a teacher with a research-informed translation that has been developed and tested is considered to be useful by the designers of the MSAP who expect that such versions could be made available to teachers on their university-based project website platforms. It is further hoped that insights developed from such research-informed translations will support the reworking of the translated teacher guides. This means that the teacher can teach in isiXhosa through the guidance of the supplementary vocabulary that I will develop without changing the meaning of the original text.

1.2 STATEMENT OF THE PROBLEM

As indicated above a key challenge among South African primary school learners is the absence of number sense and the continued persistence of counting in ones to calculate. Counting in ones is time-consuming, strenuous and error prone and does not lead to a structural understanding of number that is essential for abstract and algebraic thinking and reasoning. The MSAP teacher manual indicates that counting in ones also becomes very inefficient as the number range increases (Graven, et al., 2020).

The Mental Starters Assessment Programme (MSAP) was designed to move Grade 3 learners from counting in ones on their fingers or with tally marks to using strategies that help them to count in a more efficient manner (Graven, et al., 2020). This MSAP focuses on promoting strategic use of calculation strategies and is aimed to move learners on from the concrete one-to-one counting methods that persist in this Grade and into higher Grades (Graven & Venkat, 2021).

This programme was designed and written in English, and then translated into the other ten official languages. In the context of the Eastern Cape Province, the MSAP has been translated into isiXhosa, the mother tongue of the majority of learners in Makhanda where this study was conducted. Through analysing the MSAP document, I realised that the translation work from English to isiXhosa has numerous errors in sentence construction where the original meaning has been lost. There is also the challenge of the use of unrelatable terms and language. This might impact the success of the MSAP's aim.

1.3 PURPOSE AND SIGNIFICANCE OF MY STUDY

The purpose of my study is to develop and use more relatable isiXhosa vocabulary in conjunction with the English version of the Mental Starters Assessment Programme (MSAP) teacher guide when mediating learning of doubling and halving calculating strategies. I used the Mental Starter Assessment Programme English teacher guide but adapted it to isiXhosa by developing terminology that is relatable to the learners. There currently seems to be a challenge where school becomes a place where non-standard isiXhosa speakers' social identity is undermined (Matiwane, 2010). In other words, the curriculum and related materials and assessments tend to undermine the status of the non-standardized isiXhosa, yet it is the language that the learners are familiar with. This could lead to learners developing low self-esteem and negative sentiments about learning which later results in them dropping out of school because they could not handle the pressure of the unrelatable standard isiXhosa that is forced on them in the curriculum (Sigcau, 1998). This study uses the non-standardized isiXhosa to mitigate this challenge. I develop a supplementary vocabulary section in isiXhosa with the relatable terminology that may be used with the English teacher guide. I do this to achieve the aims of the MSAP.

The HSRC illustrated English-isiXhosa maths dictionary for grades R to 9 (2021) serves as an invaluable resource for both educators and learners, as it addresses this critical challenge: the difficulty many learners face in comprehending and retaining mathematical concepts taught in English, which is not their first language. By offering precise definitions of mathematical terms in both English and isiXhosa, the dictionary facilitates a more immediate understanding of concepts, eliminating the need for translation. Additionally, its parent-friendly design enables those without a background in mathematics to assist their children effectively. With terminology selected by experts and illustrated through culturally relevant images, the

dictionary not only enhances engagement but also bridges the gap between mathematics and learners' lived experiences.

The research design for my study encompasses several stages. The initial phase involves conducting a documentary analysis, as elaborated in Chapter 4, where I identify the challenges inherent in the current versioning of the MSAP teacher guide. I then conduct possible revisions of the 8 lessons before trialling them to the first class. I thereafter reflect with my critical friends and revise some of the content. Once that is completed, I teach the revised version to the second class leading to the final write up.

In the process of developing this supplementary terminology, I worked with two Grade 3 classes, two teachers from these classes and the principal as critical friends. I taught the doubling and halving unit of the MSAP in Grade 3A and generated the necessary vocabulary during the teaching. I then implemented the generated vocabulary in lessons that were conducted in Grade 3B. To consider the effectiveness of the teaching of the unit and the possible effectiveness of the generated vocabulary I used the post-test provided by the MSAP to see whether learners improved from the pre-test and the reflections from the critical friends.

Finally, this study is significant to me because it supported me in adding value to the teaching of learners. Reflective practice (Cilanga, et al., 2019; Farrell, 2020) is widely considered important for teachers and this study enabled my ongoing reflection on my own practice with a focus on understanding challenges and enablers to working with a mother tongue-bilingual approach to teaching mathematics. With this study I was able to make amends to the errors that were made in the translation of the Mental Starter Assessment Programme isiXhosa version.

1.4 THE GAP IN RESEARCH ON THE USE OF LANGUAGE IN THE ISIXHOSA MATHEMATICS CLASSROOM

Over time, educational research has consistently directed its focus toward the language dynamics within the Intermediate Phase (see Graven, 2014; Robertson & Graven, 2020). This emphasis stems from the recognition that learners undergo a notable linguistic transition upon entering this stage of their educational journey. Learners shift from using their mother tongue as a language of instructions to English in most cases.

In the Foundation Phase, where instruction is predominantly delivered in the learners' mother tongue, there appears to be a tacit assumption that the learning process should inherently be

smooth (Maluleke, 2019; Robertson & Graven, 2020). This presumption, however, overlooks crucial aspects that deserve research attention. The assumption that familiarity with the mother tongue automatically ensures an easy acquisition of new concepts, fails to consider challenges arising from the introduction of a different linguistic register (including the complex mathematical register) that may differ significantly from the linguistic register that the learners are familiar with.

Furthermore, the assumption extends to the issue of dialects within indigenous languages. In the pursuit of standardized language instruction for younger learners, the various dialects are often neglected (Feza, et al., 2022). The imposition of a standardized form may prove inefficient and even counterproductive, as it may not align with the linguistic variation inherent in various dialects. This assumption not only hinders effective communication but also neglects the cultural and linguistic diversity that enriches the educational experience.

IsiXhosa is a language that is mostly spoken in the southern parts of South Africa. And this study focuses on isiXhosa because it is the language of instruction in the majority of the Makhanda primary schools where the study is situated. IsiXhosa has many dialects, which include isiRharhabe which is the main dialect spoken in the Makhanda part of the Eastern Cape (Crane, et al., 2024). As much as this dialect is relatable to most dialects, it is not the standard isiXhosa.

Referring to a study in Umzimkhulu, KwaZulu-Natal, Majola (2022) reported that teachers' feelings about using isiBhaca, which is an isiXhosa dialect, in education were explored. He mentioned that the study involved 22 teachers from six schools and found that they see many benefits in using isiBhaca in the classroom. According to Majola (2022), the teachers believe it should be taught from Foundation Phase. He reported that the results suggest that using standardised isiXhosa as the main language in schools negatively affects learners' academic performance in Umzimkhulu which is predominantly an isiZulu speaking area. Majola (2022) conveyed that teachers think isiBhaca, being the dialect of the people there, should be used for teaching. He explained that the study adds to our understanding of teachers' attitudes and experiences in communities using nonstandard languages in South Africa. Regarding isiBhaca, Majola reported that teachers feel it is suitable for education, even if it is not an official dialect.

In light of these considerations, it becomes imperative for future research undertakings to explore the complexities of language use in the Foundation Phase. This exploration should extend beyond the assumption of linguistic ease and incorporate a variated understanding of

the diverse registers and dialects present in indigenous languages. By doing so, teachers can develop more informed and inclusive use of language instruction strategies that cater to the varied linguistic backgrounds of young learners, fostering a more effective and culturally sensitive learning environment.

Feza and Ramollo (2022) highlight three crucial findings. Firstly, many African countries face challenges in implementing mother-tongue instruction policies during early education due to complex situations. For instance, a home language might be chosen as the language of instruction for a class, but it may not be familiar to all learners, leading to resistance in implementation. Secondly, there is a deficiency in suitable resources, evidenced by inconsistencies between materials guiding teachers and those used by learners. Lastly, there is a lack of teacher training to support and enhance skills and knowledge for teaching mathematics in learners' home languages, leaving teachers unprepared and at a disadvantage.

1.4 RESEARCH GOAL, OBJECTIVES, AND RESEARCH QUESTIONS

The main goal of this study is to research the development of appropriate isiXhosa vocabulary and language use to develop an appropriate translation of the English MSAP teacher guide for doubling and halving. The vocabulary is used to teach the doubling and halving strategies in isiXhosa without changing the original meaning of the text in the English version.

I developed the vocabulary through an interactive lesson with Grade 3A, teaching them the doubling and halving strategies. The vocabulary development was carried over the full series of eight lessons. I then critically reflect on the generated vocabulary with my critical friends to ensure that no meaning is lost in the choice of words. This vocabulary is then used in conjunction with the English teacher guide to teach the doubling and halving strategies to Grade 3B. The success of this vocabulary was measured to some extent by the performance of the learners in the post test that is available in the MSAP at the end of the doubling and halving strategies unit. While teaching with the vocabulary in the existing isiXhosa teaching guide may have led to some changes from the pre- to post-test improvement was assumed to indicate that learners had on the whole understood what was communicated in the teaching of the unit.

The following objectives were addressed, and the research questions answered:

1.5.1 Main research objective aimed to:

- explore the key enablers and constraints experienced during the mediation of the doubling and halving calculating strategies using the MSAP teacher guide.

1.5.1.1 Secondary research objectives:

- To develop relatable key terms and phrases (vocabulary) that may be needed to teach doubling and halving calculating strategies in isiXhosa for teachers to use as a supplementary to the English teacher guide.
- To establish the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that would have been developed.

1.5.2 The linked research questions included:

1. What are the enablers and constraints that are experienced by the teacher during the mediation of the doubling and halving calculating strategies in isiXhosa?
2. What are the key terms and phrases (vocabulary) that support the teaching of doubling and halving in isiXhosa?
3. What are the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that would have been developed?

1.6 THEORETICAL FRAMING AND METHODOLOGY

Ngulube et al. (2015) contend that distinguishing between a theoretical framework and a conceptual framework poses challenges for many researchers, with some even using the terms interchangeably. In the context of my study, I adopt the perspective that the theoretical framework serves to encapsulate broad assumptions or a guiding "lens" (Kivunja, 2018, p. 46) for my methodological decisions. In contrast, the conceptual framework encompasses specific concepts and theories guiding the actual research processes and the analysis of findings.

I have specifically chosen to position my research within a broadly pragmatic paradigm, which, ontologically, asserts that an individual's experience and interpretation influence reality (Lotz-Sisitka, et al., 2013)

In exploring my own teaching of the doubling and halving calculating strategy from the MSAP isiXhosa teacher guide, I identified design-based and action research as suitable approaches to

merge for the purposes of this study. These methodologies involve enhancing an existing design and engaging in cycles of reflection. This iterative process includes identifying a problem, attempting a solution, discussing the results, and incorporating ways to improve the researched practices. Subsequently, another cycle of attempted improvement and critical reflection follows (Friedman, Gray, & Aragon, 2018; Ferrance, 2000; Cobb, et al., 2015). Chapter 3 delves further into the details of this cyclical process.

1.7 STRUCTURE OF THESIS

Chapter 2 delves into my literature review and a comprehensive exploration of the theoretical framework. Here, I examine both the theoretical and conceptual frameworks, incorporating relevant literature on the discussed topics. This encompasses the Descriptive Translation Studies (DTS) (1991), Cummins' (2008) concepts of BICS and CALP, and Vygotsky's socio-cultural theory, serving as a unifying theory throughout the study.

Transitioning to the nature of language use in teaching and learning mathematics within a Foundation Phase classroom, I draw on insights from my literature review to identify the research gap that shaped the study's design. Chapter 3 focuses on methodological aspects, detailing my choice of design-based and action research approaches, along with the processes for data collection and analysis. Additionally, I address considerations of validity and research ethics, concluding with a brief discussion of study limitations.

Chapter 4 centres on the presentation and analysis of collected data. Given the detailed nature of the findings resulting from the action research intervention, this chapter is notably longer than the others. The aim is to provide a comprehensive overview of the rigorous work involved in refining a teaching and learning tool. In Chapter 5, I discuss findings from the translation work analysis, learner interactions, and recurring themes observed.

The final chapter, Chapter 6, offers a summary of the study's process and findings, linking them back to the conceptual framework. I critically reflect on the extent to which I achieved my research goals in addressing the research question. Additionally, I explore potential avenues for ongoing research concerning the nature of language used in a Foundation Phase mathematics classroom.

CHAPTER 2: LITERATURE REVIEW

CHAPTER 2

2. LITERATURE REVIEW & CONCEPTUAL FRAMING

2.1 INTRODUCTION

The literature review is written to situate a study in relation to existing knowledge and to evaluate the information within any published literature related to the topic chosen (Snyder, 2019). Its purpose is to gain an understanding of the existing research and debates relevant to a particular topic or area of study, and to present that knowledge in the form of a written report (Ridley, 2012). The literature review also helps to identify gaps in existing research, provide context for the research, and to formulate research questions and offers insights into research methodologies, and validation of research findings.

This study aims to address the rigid use of language challenge in the Foundation Phase classroom by using familiar everyday *[1]'lokshin' isiXhosa and evaluating its success in contributing to knowledge acquisition. The first phase of this study 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, drawing on (see Nkomo, 2015) everyday translation of mathematics term in the Oxford School Bilingual Dictionary.

In this section I draw on global literature that is written around concepts that are covered in my study. Firstly, I discuss the concept of code-switching, how it is defined and applied in the teaching of mathematics in the Foundation Phase. I then discuss the concept of translation, focusing on how it impacts the success of teaching mathematics in the Foundation Phase. Lastly, I discuss how language affects the teaching of mathematics in the Foundation Phase.

2.2 LITERATURE REVIEW

A fundamental aspect of teaching and learning mathematics lies in the comprehension of key concepts, and language plays a crucial role as one of the key dimensions in understanding these concepts (Moleko & Mogege, 2020; Essien et al. 2023; Robertson & Graven, 2020). Translanguaging, as proposed by Maluleke (2019), serves as an empowering strategy to

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

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 utilization should be adaptable and malleable to enhance the learning process.

2.2.1 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) tate that translanguaging involves blending and integrating linguistic elements to convey meaning effectively. They continue that it reflects the ability of multilingual speakers to seamlessly navigate and combine their linguistic resources for effective communication. For example, a teacher might be speaking in isiXhosa but choose to use English for certain concepts like number names during an interaction with learners: *'xa sidabulisha u-three, sifumana u-six'.* This creates a hybrid expression that is easily understood by speakers of the dominant language, in the case of this example being isiXhosa. This practice enhances communication by drawing on diverse linguistic tools.

In the classroom, teachers use translanguaging to assist learners to understand complex and new concepts in the curriculum or for 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 study 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 in using English terms which it is then filtered down to the younger learners.

In this study, the learners in Grade 3, generally aged between 9 and 10, 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. The challenge lies in the use of complex register for the young learners and ensuring that they understand the concept fully before migrating to the complex register.

In my 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. 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, 2016). 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, 2016). I therefore used a translanguaging technique between non-standardised isiXhosa and English to teach the doubling and halving calculating strategies to the Grade 3 classes, where English terms that are used in daily conversing isiXhosa were used rather that the Standardised isiXhosa that is not familiar to the learners.

2.2.2 Code-switching

Code switching is a linguistic resource from which educators can choose to draw to encourage learner participation and as a means of enabling learners to use their main languages as a learning resource (Setati & Adler, 2000). It is the practice of alternating between two or more languages and Deuchar (2020) uses the term to describe any switch within a conversation, whether at word or sentence level, or at the level of blocks of speech. In addition, it is the

systematic alternate use of two or more languages in a single utterance or conversational exchange for communicative purposes (Gardner-Chloros, 2020). One of the reasons for employing code-switching is to use familiar terminology in one language when speakers do not know it in the other language and expressing a concept that has no equivalence in the other language (May & Aziz, 2020). Code-switching can occur when a speaker starts his/her conversation in one language, then changes it to another language in the middle of his/her speech (Obaidullah, 2016). In the classroom, teachers use code switching to make learners understand difficult and new concepts in the text. They use contextual reference, that is using the learners' L1 to make the topic enjoyable and relatable. For example, a teacher may switch to a language that is more familiar to the learners to help explain a difficult concept or to provide examples that are relevant to their culture or experiences. This can help young learners to better understand the content being taught and to feel more engaged in the learning process.

In a study in Indonesia, Cahyani, et al. (2018) emphasise the importance of translanguaging as a strategic use of code-switching, involving pedagogical and sociocultural functions designed to facilitate full communication and to engage learners in the learning process. They explain that this can be done by not separating languages, but integrating them within a single clause, sentence or set of sentences, where teachers invite a fully multilingual construction of meaning, drawing on learners' diverse cultural and linguistic resources for the sake of learning and engagement. For example, when introducing a concept such as doubling and halving, Cahyani et al. (2018) further argue that multilingual learning can be maximised when code-switching is done intentionally for pedagogical and sociocultural purposes. This contrasts with the traditional sociolinguistic concept which views code-switching as language interference, a sign of lacking ownership in a language, and associated with non-standard use of language (Canagarajah, 2011). In this study I argue that teachers' use of code-switching should be seen in a positive light, and as a demonstration of the speakers' multilingual communicative competence and their social accomplishment. The way the teachers use code-switching to address differences in meaning across multilingual contexts also suggests a degree of transcultural competence.

In a study in Malta, Farrugia (2017) explains that the most common strategy used to help learners understand concepts is code switching between the two common languages which are Maltese (L1) and English (L2), while another strategy used in some schools is teaching mathematics almost exclusively in English. Farrugia argues that the use of both languages might be more appropriate than the exclusive use of English since learners are likely to find

general discussion easier if they are offered flexibility. Indeed, code-switching appears to offer a resource for enabling mathematics learning especially when there is need for group task activities. In another study, Niesche (2009) argues that the use of home language in the classroom for the learners involved in a project in a region in Australia benefited both the learners and communities. Additionally, code-switching can help to validate the learners' home language and culture, which can help to build their self-esteem and sense of identity. In another study that was conducted between South Africa and America, Piyose (2009) asserts that using ethno-mathematics teaching can help learners learn mathematics better by using cultural artifacts and relevant language in their classroom. Piyose continues that this lets them learn maths in ways that relate to their culture. But not many studies have looked at how learners think about maths using this idea especially in the foundation phase where learners are learning in their mother-tongue.

While code-switching has in the past been viewed as a language deficit, Garcia (2009) explains that more recently this negative connotation is being questioned by scholars. For example, bilingualism is not a deviation from the norm, but a common communication repertoire used by most people in the world (Garcia, 2009). Teachers use code-switching to build rapport with young learners through using a language that is familiar and relatable to the learners. This creates a more relaxed and welcoming learning environment which can help to reduce anxiety and increase motivation among young learners and likely lead to better learning outcomes.

In Nigeria, Jegede (2011) states that the use of code switching in multilingual mathematics classrooms does not result in a deficiency in learning but is a useful strategy in classroom interaction and efficient way of transferring knowledge to learners. He further agrees with Salami (2008) that the language that is used for teaching and learning is important as it may enhance or impede the quality of education. In the study, Jegede found that 40% of the teachers who participated in the study taught in English; another 40% code-switched between English and Yoruba and the remaining 20% taught in the learners' home language which in this case is not English. All these teachers were teaching learners whose home language is not English. In the study he calls on teachers to draw on the learners' language resources to help them achieve academic and communicative competences.

In South Africa, Van Der Walt (2001) argues that teachers need to take first languages or street languages as resources in their teaching. This not only creates familiarity for the learners but also helps young learners to better understand the content being taught and to feel more

engaged in the learning process and be able to make sense of their learning. In other terms, code-switching is a tool that bridges the gap between standardised and non-standardised language and therefore strengthens the learning process (Shinga, 2019) In a local study, Jack (2022) observed that both isiXhosa and English were used during the mathematics lessons in Foundation Phase classrooms. She noted that as learners were learning mathematics, it was not easy for them to say the number names in isiXhosa. She noticed that teachers had to first say the number name in English before they said it in isiXhosa, even though English is not the language of learning and teaching (LoLT) nor the learners' home language. The use of the English language dominated when it came to the naming of numbers. She continues that the teachers had to sometimes probe learners to speak isiXhosa. According to Jack, this probing made teachers code-switch from English to isiXhosa to enhance the names being said in isiXhosa as it was difficult for learners to use isiXhosa to say the number names. She concluded that for isiXhosa-speaking learners, this was a type of reverse code-switching, where the learners would draw from the second language to understand concepts in the first language. These findings validate Setati's (2001) argument that mathematical learning is constrained in a complicated linguistic space. Setati (2001) states that historically, code-switching in South Africa has been viewed negatively, often seen as a language mixture without proper grammar. Some monolinguals consider it an insult to their own language. This perception has led some bilingual/multilingual individuals to avoid code-switching or limit it to situations where it will not be stigmatized, such as among learners in a multilingual classroom conversing without the teacher.

In other research in South Africa, Schafer (2010) concluded that there is urgent need for development of mathematical registers in indigenous languages for mathematics and science. The research indicated that the use of a multilingual concept literacy book impacted noticeably on the code-switching practices of selected teachers who switched between English and isiXhosa in their teaching of mathematics. Code-switching can be used as an empowerment strategy to help learners improve their performance in mathematics (Maluleke, 2019). Learners need to be allowed to engage in mathematical discussion while moving between formal and informal academic registers (Robertson & Graven, 2020). Robertson & Graven (2020) argue that learners need support from their teachers during exploratory talk through feedback and mediation to ensure progress in their communication skills. According to the Language in Education Policy (1997) most learners benefit cognitively and emotionally from the type of structured bilingual education found in dual-medium schools.

Code-switching occurs when individuals are unable to find the right word or expression, or when the language they are using lacks the necessary vocabulary or appropriate translation (Grosjean, 1985). Setati (2001) concurs with this statement and posits that such language switching often takes place in bilingual or multilingual mathematics conversations. For example, in a discussion involving mathematics conducted in isiXhosa, it is possible that mathematical terms will be in English. This is because English possesses a well-established terminology for mathematics, while some indigenous languages do not (Setati, 2001). Even though some technical mathematical terms exist in indigenous languages, they are not commonly recognized or used (Chikiwa & Schafer, 2018). For instance, while there is an isiXhosa word for a half, '*isiqingatha*', it is rarely employed in mathematical or daily discussions in isiXhosa.

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 study 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, which is then filtered down to the young learners.

In this study, the learners in Grade 3, generally aged between 9 and 10, are learning in their home language (isiXhosa), however most of them are likely to 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 isiXhosa mathematical terms can be a constraining factor for learners, 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 my 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 I used reverse code-switching. 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) instead of the standard phrase for it which is '*ukuphinda kabini'* (may also mean to multiply by two). Foundation Phase learners' literacies

are different from those perceived by policy makers, researchers, and curriculum designers (Feza, 2016). 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, 2016). I therefore used the reverse code-switching technique between non-standardised isiXhosa and English to teach the doubling and halving calculating strategies to the Grade 3 classes. I used English terms that are used in daily conversing in isiXhosa rather that the Standardised isiXhosa that is not familiar to the learners.

2.2.2.1 Advantages of Code Switching

Research into classroom interaction focusing on code-switching has the advantage of providing an understanding of the discourse of a shared identity and community among the interlocutors (Losey, 2009). Code-switching can help to bridge the language gap between learners and teachers, particularly in cases where the teacher may not be fluent in the learners' native language. By switching to a language that learners are more comfortable with, teachers can communicate more effectively and build stronger relationships with the learners. Gobodwana (2023) asserts that code-switching is a natural way of communicating among bilinguals and the action to separate languages in a multilingual classroom by only using monolingual communication is unnatural.

Moleko and Mosimege (2020) suggest that code switching gives teachers and learners access to additional meaning and relationships to mathematical concepts, thus helping learners understand the terminology and concepts as well as helping the teacher's instruction. Learners who are learning mathematics in a second language may struggle to understand complex concepts or technical vocabulary. In this case code-switching can help teachers to clarify concepts and explain mathematical terms by using the learners' native language or relatable language. In this study I use the term relatable language to denote words that are derived from English and pronounced in isiXhosa, for example half-*ihafu* (instead of *isqingatha*)*;* doubling-*idabuli* (instead of *pinda kabini*)*.* This can help learners to better understand the subject matter and improve their overall performance.

In South Africa, it is common for learners to switch between languages while speaking. This is seen as normal and expected behaviour. So, using both languages in class might be a good way to connect with learners and provide them with a meaningful learning experience. Code switching is useful to help the teacher understand the prior knowledge of the learners and help

them to learn the target language in a less stressful and efficient way for instance to translate, using the certain code, to understand the procedures and directions, to clarify, and to check for comprehension (Adler, 2001). In addition, code-switching can help teachers to be more culturally competent by understanding and respecting the cultural backgrounds of their learners, as this can lead to more effective communication and teaching strategies that are tailored to the needs of the learners (Ramadiro, 2017). In the same breath, code-switching might promote active participation among learners who may feel more comfortable expressing themselves in their native language. This can help to create a more inclusive classroom environment where all learners feel valued and engaged.

2.2.3 Translation

According to Newmark (1988) 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 (Baloyi, 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 (Sapire & Essien, 2021). Taylor (2021) argues 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 (Kaiser, 2020).

2.2.3.1 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, 2011). However, the second language could also be a salient learning tool considering the cases stated in the previous section where the learners come into the classroom with knowledge of number names and some concepts such as money and time in English due to 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 3 senze iihafu eziy-3*' (we need to cut it 3 times to make 3 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 (Setati, 2001; Setati, et al., 2009; Moleko & Mosimege, 2020). However, learners who do not speak the language of instruction may struggle to communicate their ideas and understand the ideas of others.

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 Taylor (2002), education contexts have recently been transformed into multicultural and multilingual environments due to international learner exchange programs, migration, study programs, and the participants of these education contexts bring their own cultural assumptions and experiences to the common practices conducted in these contexts. Makhanda, where this study was conducted, has experienced a significant influx of individuals relocating for employment opportunities, with these individuals originating from various parts of the Eastern Cape as well as from other provinces. (Graven, et al., 2022)

This diversity presents 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. This study focuses on two Grade 3 classes that have a 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 due to 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.

Most South African 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, 2020). 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 study guide illuminates this challenge where they use direct translation and meaning is lost.

2.2.3.2 Translation into isiXhosa

As noted above, the study takes place in the Eastern Cape province where the majority of learners are isiXhosa speakers; this was motivated by the specific challenge related to the translated version of the MSAP teacher guide rather than the original text.

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). Bearing in mind 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 standardized. 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). As per Chikiwa and Schafer (2016), 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, but his dictionary does not appear to be widely used in the translation of departmentally provided resources from English to isiXhosa, by for example the DBE in the translation of materials.

2.2.3.3 Challenges with translation in maths

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 (Setati & Adler, 2000).

According to Merkel (2016), 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 above example. In the isiXhosa MSAP teacher guide the translation of the terminology is not consistent. Some terms are formed through transliteration while in others, their original isiXhosa terms are used. 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). 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 they may not be familiar with it. However, due to translation inconsistency, the term *'uphindo kabini'* is used for doubling instead of *'idabuli'* (double) which is a borrowed 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 should ideally be skilled in breaking down complex mathematical ideas into simpler, more accessible language that learners can understand especially in the Foundation Phase. They should have both mathematical content knowledge and pedagogical knowledge. Having experience in working with the younger learners would also likely assist in this regard.

Translating mathematics can be challenging due to 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.

In this study I research and mitigate this challenge through revising the translation of the Doubling and Halving section and using indigenisation to translate the unfamiliar terms and those that have dual meanings. This is an ideal 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. 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.

2.2.4 Language in Mathematics Education

A teacher can mediate learning in the classroom and help learners learn better by interacting with them (Hoadley, 2010), this interaction is primarily through language. Language in mathematics learning and teaching has a significant role in influencing performance (Feza, 2016). Feza (2016) adds that there seems to be a limited number of studies focusing on language issues in mathematics teaching and learning in the early years of schooling.

According to Kaphesi (2003), the use of language in mathematics teaching in primary school has a significant impact on learners' understanding and engagement with the subject. Kaphesi

further argues that language plays a crucial role in developing learners' conceptual understanding of mathematical concepts; hence clarity of language helps learners to connect ideas and visualise concepts to develop a solid foundation for future learning in mathematics. Mathematics involves problem-solving and reasoning, which often require learners to explain their thinking and communicate their ideas effectively (Bailey & Heritage, 2014). Language skills, such as vocabulary development, sentence structure, and articulation, support learners in expressing their thoughts and collaborating with their peers during mathematical discussions (Moschovich, 2013).

Effective language use by teachers is salient in ensuring that learners comprehend mathematical instructions and explanations (Bailey & Heritage, 2014). Teachers need to use age-appropriate and accessible language and provide clear explanations to help learners understand mathematical concepts and procedures accurately.

Freeman et al. (2016) state that mathematics has its own unique vocabulary that learners must acquire to understand and communicate mathematical ideas. They further state that teachers should explicitly teach mathematical terms and symbols, provide meaningful contexts for their use, and encourage learners to use precise mathematical language in their discussions and written work.

Language skills are closely linked to problem-solving abilities in mathematics. Learners need to interpret word problems accurately, identify relevant information, and translate real-life situations into mathematical language. Proficient language use supports learners in developing problem-solving strategies and expressing their solutions effectively. Encouraging mathematical discourse in the classroom fosters higher-order thinking and deeper understanding. Through oral and written discussions, learners learn to justify their reasoning, critique others' ideas, and explore multiple approaches to problem-solving. Language facilitates this discourse by providing a means for learners to express their mathematical thinking.

Language sensitivity is crucial in creating an inclusive and equitable learning environment in mathematics classrooms. Teachers should be mindful of learners' diverse linguistic backgrounds, provide support for English language learners, and ensure that language barriers do not hinder learners' access to mathematical content and participation in class activities. Effective use of language in mathematics teaching can enhance learners' motivation and engagement with the subject. When teachers use language that is accessible, relatable, and connected to learners' lives, they can foster a positive attitude towards mathematics and

encourage learners to actively participate in mathematical activities. Vygotsky believed that language and culture play vital roles in shaping a child's cognitive abilities and social interactions. Language serves as a tool for thinking, while cultural practices and social interactions provide the necessary context for cognitive development to occur (Lee & Smagorinsky, 2000).

Mathematics achievements for many South African learners compare poorly with those of learners from most other countries, and language issues have been identified as significant contributory factors (Robertson & Graven, 2022). In this study I focus on the use of language where I look at the options of creating a mathematical register that is user friendly for Grade 3 learners in an isiXhosa medium school. Robertson and Graven's (2022) work points to the importance of investigating opportunities for teachers to fluidly use the multilingual repertoires available in their classroom irrespective of the dominant language of learning and teaching chosen by the school. Their work further points to the need for research that investigates how best to develop bi- and multilingual print resources for use in classrooms, and to research teacher and learner experiences of these.

UNESCO's Education for All Global Monitoring Report (2013-2014) highlights the importance of using local languages in primary education, stating that using the language that children speak and understand is the key to unlocking access to education and improving learning outcomes. This resonates with my thrust that the use of non-standardised isiXhosa which is the language that the learners speak and understand could be more beneficial. Language plays a vital role in mathematics teaching in primary school. It impacts learners' conceptual understanding, communication skills, problem-solving abilities, and overall engagement with the subject. Teachers should employ clear and precise language, promote mathematical discourse, and provide support for diverse learners to create a positive and inclusive learning environment (Robertson & Graven, 2020).

2.2.4.1 Language as the "problem"

"Successful education, especially for vulnerable and marginalised communities, cannot occur unless children understand the language/s through which it is provided" (Heugh, 2017, p 4). In the case of this study, the learners are taught in their mother tongue. However, the dialect and register that is used is too formal and unfamiliar with the learners.

Mathematics is a subject heavily reliant on precise terminology, symbols, and abstract concepts, making it vulnerable to misunderstandings if the language of instruction is not clear or if the learner's grasp of the language is limited (Kersaint, et al., 2014). This barrier can lead to frustration and hinder comprehension, as learners struggle to bridge the gap between their native language and the specialized vocabulary of mathematics (Harmon, et al., 2005). An effective teaching strategy that addresses this language barrier, such as using a familiar language dialect and register, is crucial to support the learners in their mathematical journey.

2.2.4.2 South Africa's Education language practices and policy

The majority of early-grade mathematics materials are initially designed and written in English and subsequently translated into African languages with minimal adaptation, as noted by Mostert (2020). Mostert 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) emphasizes 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 centralized approach. Saphire (2012) concurs that there is a need for increased availability of high-quality teaching and learning resources in relevant African languages.

This said, South Africa's Language in Education Policy (LiEP) (1997) promotes multilingualism, as outlined by the Department of Education in 1997. The National CAPS serves as the foundation for early mathematics education, specifying the content, scope, and progression of concepts for each Grade (DBE, 2011). Learners receive mathematics workbooks aligned with CAPS content areas and presented in the LoLT used in their respective schools. However, it is noteworthy that learner teachers, as mentioned in Ramollo (2014), have reported 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 'standardized' version of isiXhosa and or their own spoken home languages, which are often regional or dialect forms. This highlights the crucial role language plays in teaching and learning mathematics, emphasizing the challenges involved in achieving linguistic accuracy.

Tshuma (2021) underscores the significance of language in mathematics education, emphasizing 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 terms. For example, Jack (2022) found that learner mathematical fluency was jeopardized when learners experience sluggish recall of isiXhosa number names and mathematical terms (Jack, 2022).

My study aims to mitigate this challenge, by designing the set of vocabulary in non-standardised isiXhosa that may be used in conjunction with the English MSAP teacher guide. The reason for this is to ensure that no meaning is lost due to translation. In the process of using the vocabulary during the lesson, I will be using the code-switching technique to keep the register relevant to the learners. Most learners in Makhanda speak isiRharhabe, an isiXhosa dialect that uses a lot of indigenised English words that are derived from English. This therefore means that code-switching between English and isiXhosa terms could be beneficial in teaching doubling and halving strategies to Grade 3s in Makhanda.

2.2.5 The Multilingual Turn

There is a multilingual turn (May, 2014) taking place at the moment in educational research which is seen to be moving from the use of code switching and moving towards translanguaging. Planas (2018) draws on ideas from sociolinguistics and functional grammar and suggests a way of thinking about language that looks at how learners use language and the different systems of language to create shared meanings. Moloi and Hlungulu (2024) highlight this phenomenon within the South African schooling context, where they used the translanguaging technique to translate a test written by learners in a multilingual classroom.

2.3 THEORETICAL AND CONCEPTUAL FRAMING

My study consists of two phases and two cycles, in the first phase I focus on researching the work of translation that has been done on the isiXhosa MSAP and is currently being rolled out in schools. Due to the nature of this study, I employ Vygotsky's Socio-cultural theory as the broader theoretical frame which informs the entire study. Furthermore, I employ Toury's (2012) Descriptive Translation Studies (DTS) revised theory as the conceptual framework in

the first phase which is a document analysis, that suggests better ways of translating mathematics in the Foundation Phase, making it understandable for the learners without distorting the original meaning. In the first cycle I focus on ways of improving current mistakes that exist in the MSAP isiXhosa teacher guide with the help of the Grade 3A class.

In this section, I initially examine the theoretical framework and subsequently connect its concepts to the study. Following this, I analyze the three key concepts utilized throughout the research, and ultimately integrate them with the conceptual framework.

2.3.1 Theoretical Framing - Vygotsky's sociocultural theory

To Vygotsky (1978), social constructivism emphasizes the collaborative nature of learning through which reality is believed to be constructed through human activities. Vygotsky believed that knowledge is a human product that is socially and culturally constructed. This means that individuals create meaning through their interactions with each other and with the environment they live in. Additionally, learning is viewed as a social process that occurs when individuals are engaged in social activities. Like other theorists such as Chalesworth and Lind (2007), Vygotsky believed that the environment contains many opportunities for learners to gain knowledge and thus argued that learners interact with one another, share ideas, and create new thoughts as well as knowledge. In the classroom environment, for instance, this means learners interact with cultural materials in their society as well as more knowledgeable others (MKO). Within this theory, I focus on the following concepts: mediation of learning, culture and language, and social interactions. I focus on my teaching and the language of teaching and learning.

2.3.1.1 Mediation of learning

Vygotsky (1978) proposed that in the learning process, experts use mediatory tools to mediate learning. These mediatory tools can be materials, language, cultural artefacts, or humans within a social environment (Vygotsky, 1978) that will serve the purpose of conveying abstract concepts to the concrete level. Building on Vygotsky's work, Kakambi (2020) indicated that mediation involves the interaction between the teacher, subject content, and learners for the acquisition of knowledge. In this study, a non-standardized isiXhosa version that is derived through a translanguaging technique is purposefully used as a mediational cultural tool to

mediate learning of the doubling and halving calculating strategies. The nature of this version of isiXhosa is more relatable to the learners and therefore serves the purpose of an ideal mediatory tool. This tool is continuously refined throughout the study with assistance from the Grade 3A class and my critical friends to ensure a successful teaching of these calculating strategies.

2.3.1.2 Culture and language

Vygotsky emphasized culture and was of the view that culture provides tools that mediate thinking. To Vygotsky, all high-order mental processes such as reasoning and problem solving are mediated by psychological tools such as signs, symbols, and language (Woolfolk, et al., 2008). Parents use these tools with children in their day-to-day activities and children internalize them, which then help them to advance their development. In the context of this study, the use of a non-standardised isiXhosa is a response to cultural tools that mediate thinking. Hence, I as the knowledgeable other (Vygotsky, 1978) will be carrying out demonstrations using language. This theory will be used as a lens in understanding how the use of a non-standardised isiXhosa influences learning and the impact it has on the attitudes of the learners. Also, since these demonstrations will be carried in their local language (a non-standardised isiXhosa), it might help learners understand concepts better and increase their level of participation (Sedlacek & Sedova, 2017). Notably, active participation is a function of social interactions.

2.3.1.3 Social interactions

To Vygotsky (1978), the world is a social space where individuals interact to negotiate the meaning of the world. Vygotsky believed that learning takes place through social interactions with peers or knowledgeable others (parents, teachers, or other learners). In this study, when I explain and demonstrate the doubling and halving calculating strategies in a non-standardised isiXhosa to the learners, I may contribute to learning experiences amongst the learners. As they are interacting in the class, they may learn from one another. This theory will therefore inform this study on how learning takes place in a sociocultural context (Mavuru & Ramnarain, 2020).

2.3.2 Translation, Translanguaging and Transliteration

This study centres on three primary concepts: translation, translanguaging, and transliteration. These concepts guide both myself and the participants in selecting the appropriate vocabulary for teaching doubling and halving. The table below offers a detailed explanation of these concepts and their application throughout the study, supplemented with examples for clarity.

Table 2.1 *Definitions of concepts used in this study*

	Translation	**Translanguaging**	**Transliteration**
Definition	This is considered to be the communication of the meaning of a source-language text by means of an equivalent target-language text (Madolo, 2021)	This 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).	Transliteration is the process of converting text from one writing system into another. Unlike translation, which conveys the meaning of the original text, transliteration focuses on representing the original sounds or characters as closely as possible using the alphabet or script of another language. This allows the pronunciation of words to be understood across different languages and writing systems, even if the reader does not understand the original language (Chikiwa, 2015).

Example	In the case of the Mental Starters Assessment Program (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 study.	In my interaction with the learners I used a lot of translanguaging where I chose to use English number names but continued to speak in isiXhosa, for example: "Ok, khanindinike ihafu ka-sixty four". The speech is in isiXhosa but the number names are in English.	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.

2.3.3 The Descriptive Translation Studies

The Descriptive Translation Studies (DTS) theory highlights the importance of studying translations within their cultural and historical contexts (Toury, 2012). The theory suggests that translations should be analyzed based on how they function in the target culture rather than solely on their equivalence to the source text. Toury (2012) proposed a systematic approach to understand the norms governing translation practices, the decision-making processes of translators, and the effects of translations on the receiving culture.

DTS is a subset within the broader field of Translation Studies, specifically falling under the "Pure" category. Due to 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.

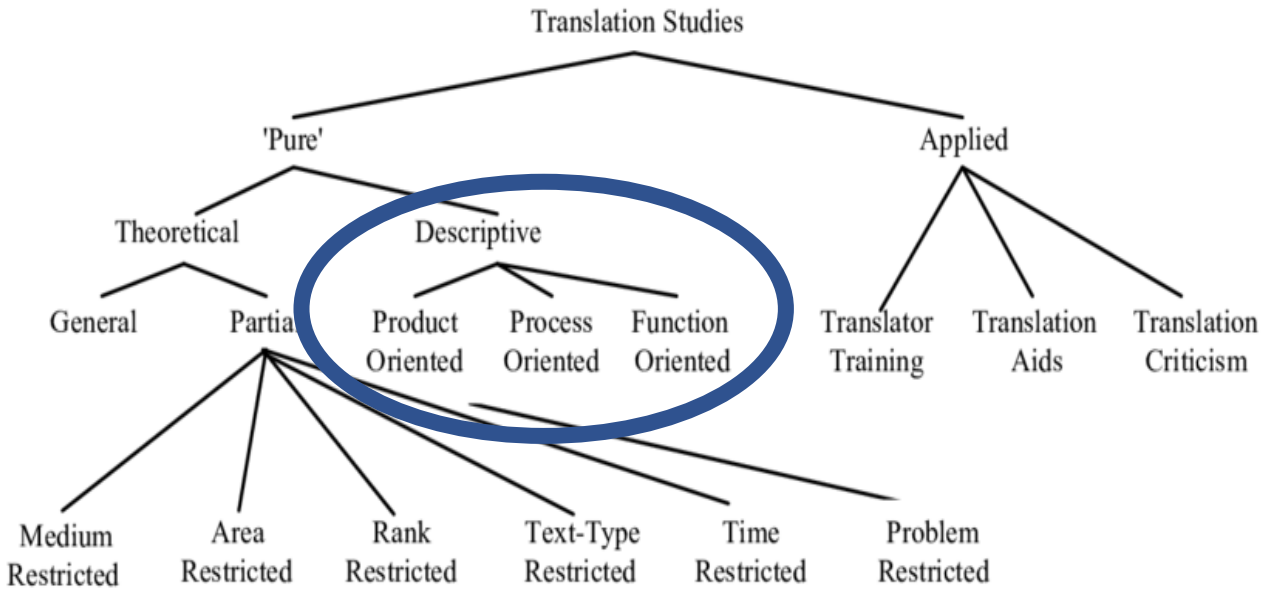


Figure 2.1 *Holmes's conception of Translation Studies (from Toury 1991: 181; 1995: 10)*

The Product orientation: In this study, the product refers to a mathematical teaching and learning tool initially designed in English and later translated into isiXhosa, which is the case for the MSAP materials. However, there is apparent distortion in meaning in the isiXhosa version attributed to ambiguity and direct translation. The 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 though without consistency. This means the translation principles followed are not clear in the production of the teacher guide.

The Function orientation: Due to inconsistencies in the translation process (such as not always using the more accessible familiar term in translations), 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 study not only determines and exposes the treatment of mathematical terms and number names in the isiXhosa translated MSAP teacher guide, but it also investigates the inconsistencies in the translation strategies that are used in the MSAP teacher guide where there is fluctuation in use of standardized and non-standardized isiXhosa.

In addition, I show that the concept of translation of mathematical terms and mediation in mathematics need to use terms that are appropriate for and applicable to particular situations in a community. Furthermore, translation must specify what is prescribed and forbidden as well as what is tolerated and permitted (Toury, 1995) in a society.

2.3.3.1 Challenges with translation in Grade 3 MSAP teacher guide to doubling and halving

In this study I analyse the translation in the isiXhosa teacher guide and contrast this against the use of transliteration to translate the unfamiliar terms and those that have dual meanings. Transliteration is the process of converting text from one script into another, preserving the pronunciation of the words while changing the script (Kaur & Singh, 2014). This is a more transparent and user-friendly technique because languages evolve with time and community structures (Nkomo & Wababa, IsiXhosa Lexicography: Past, Present and Future, 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.

2.4 CONCLUSION

In conclusion, this chapter has provided a comprehensive foundation for understanding the key concepts, theories, and research surrounding language dynamics in educational settings, with a specific focus on isiXhosa vocabulary development. By examining the existing literature, this chapter has illuminated the complexities associated with language use in the classroom, emphasizing the multifaceted influences of cultural, pedagogical, and institutional factors. The exploration of translanguaging as a pedagogical approach and the challenges educators face in reconciling standardized language requirements with the need for flexibility have been central themes. As I move forward with the study, this synthesized knowledge sets the stage for a more nuanced analysis of the specific context under investigation. By building upon the insights gleaned from existing scholarship, this research aims to contribute meaningfully to the broader

discourse on language instruction, pedagogy, and cultural considerations in educational practices.

CHAPTER 3: METHODOLOGY

CHAPTER 3

3. METHODOLOGY

3.1 INTRODUCTION

The Methodology chapter outlines the systematic plan and approach employed to gather, analyse, and interpret data, serving as the methodological framework guiding the entire research process (Cohen et al., 2017). It is a critical component as it not only delineates the specific methods, tools, and techniques employed for data collection but also justifies their selection, demonstrating the rigor and validity of the study (Cresswell, 2014). This chapter illuminates the overall research design, sampling strategy, data collection procedures, and data analysis techniques, providing a transparent roadmap for researchers and readers to understand how the research questions will be addressed (Neuman, 2014). Importantly, a well-constructed methodology chapter enhances the credibility and reliability of the study, ensuring that the research is conducted with transparency, replicability, and adherence to ethical considerations, thus contributing to the overall trustworthiness of the research findings (Denzin, et al., 2023). In essence, the Methodology chapter is essential in establishing the foundation for robust and valid research outcomes by systematically outlining the processes through which data is generated and interpreted within a study.

In this chapter, the process of developing isiXhosa teaching material from existing English resources is comprehensively explained, outlining the systematic approach that was employed to ensure an effective and culturally relevant pedagogical transformation. The chapter describes the research method and procedures, techniques and sources of data that used for data gathering. It includes the research design, participants in and respondents to the study, the research instrument and data gathering process. Finally, I describe the data analysis procedure and ethical considerations.

3.2 RESEARCH PARADIGM - Pragmatism

The paradigm of my study is pragmatism. In social research, the term “paradigm” is used to refer to the philosophical assumptions or to the basic set of beliefs that guide the actions and define the worldview of the researcher (Lincoln, et al., 2011). Pragmatism as a research paradigm is based on the proposition that researchers should use the philosophical and/or methodological approach that works best for the research problem that is being investigated

(Teddlie & Tashakkori, 2009). According to Kelly and Cordeiro (2020), pragmatism is an approach that suggests that there are many ways of interpreting the world. They continue to state that pragmatism involves research designs that incorporate operational decisions based on the most ideal solution in finding answers for the questions under investigation and this enables pragmatic researchers to conduct research in innovative and dynamic ways to find solutions to research problems. Pragmatists generally agree that all knowledge in this world is socially constructed, but some versions of those social constructions match individuals' experiences more than others (Morgan, 2014).

In this study I used a translanguaging shift between isiXhosa and English to mitigate the challenge of the current translation of the isiXhosa teacher guide and examine the relative success of using language in this form to teach. I developed a supplementary vocabulary section in isiXhosa with the relatable terminology and phrases that may be used with the English teacher guide.

3.3 RESEARCH DESIGN

Research design refers to the overall blueprint or plan that guides the structure and implementation of a research study (Huynh, et al., 2018). It is a crucial aspect of the research process as it outlines the specific steps and methods that researchers will use to address their research questions or objectives (Cohen, et al., 2017). The research design is chosen based on the nature of the study, the type of data needed, and the research goals (Osanloo & Grant, 2016). In this study, I integrate Design-based and Action Research which are qualitative techniques. Design-based research focuses on the development and refinement of innovative solutions or resources (Swam, 2014), while action research emphasizes collaboration and iterative cycles of planning, acting, observing, and reflecting to address specific issues within a practical context (Cohen, et al., 2017).

In this kind of study, where Design-based research and Action research are combined, researchers can engage in a collaborative and iterative process of designing, implementing, and refining solutions to real-world problems, all while actively involving stakeholders in the research process (Majgaard, et al., 2011). In the case of this study, I develop the relatable vocabulary with the Grade 3 class and my critical friends are there to support this development. This approach allows for the creation of practical solutions and the simultaneous investigation of the effectiveness of these solutions in addressing identified issues (Nijhawan, 2017).

Ozdamar Kesin & Kuzu (2015) assert that the integration of design and action research can enhance the overall research process by promoting a more dynamic and participatory approach. They add that it enables researchers to not only contribute to theoretical knowledge through the design process but also to directly impact and improve practices in the real-world context through the action research component. The key is to maintain a balance between the creative and innovative aspects of design research and the systematic and reflective nature of action research within the same study (Nijhawan, 2017).

3.3.1 Design-based Research

According to Wang and Hannafin (2005), design research works together with and expands on traditional scientific research methods. They add that it provides a useful approach to solving complicated problems and creating important and influential design solutions. The approach designs/develops "an intervention (such as programs, teaching-learning strategies and materials, products and systems) with the aim to solve a complex educational problem and to advance our knowledge about the characteristics of these interventions and the processes to design and develop them" (Akker et al., 2010, p. 12). Educational design research is a research approach suitable to address complex problems in educational practice for which no clear guidelines for solutions are available (Akker et al., 2010). Design research studies are pragmatic and theoretical in orientation (Design-Based Research Collaborative, 2003); my study involves improving a design for supporting learning. At the same time, it involves developing, testing, and revising ideas about the learning process (Cobb, Jackson, & Dunlap, 2015). In this study I focus on the isiXhosa translation of the MSAP teacher guide which has been developed from a teacher guide that was originally designed in English.

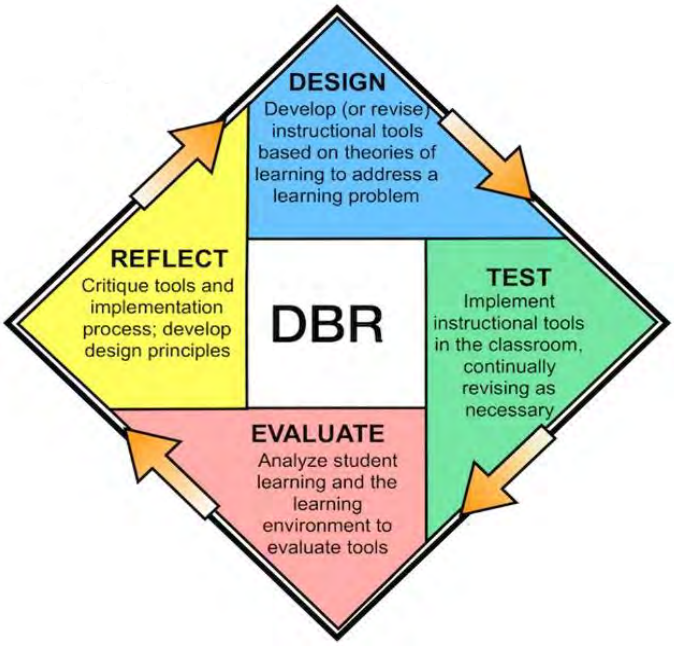


Figure 3.1 *Diagram demonstrating the cyclical nature of Design-based research (Design-Based Research Collaborative, 2003)*

In design research, the main objective is not only to create functional and aesthetically pleasing designs, but also to investigate, ask questions, and understand the basic ideas and difficulties in a specific area (Swam, 2014). The existing isiXhosa translation has areas of distortion in meaning and uses ambiguous terms which are unfamiliar to the young learners. In this study I therefore choose terminology that is less confusing to the learners by discussing with the learners in Grade 3A and their teachers what their ideal choice of words is. I then applied this change when I taught the Grade 3B class.

Qualitative research is a research approach that seeks to understand and interpret human behaviour, experiences, and social phenomena through in-depth exploration of non-numerical data, such as interviews, observations, or textual content. It aims to uncover underlying meanings, perspectives, and themes to provide a deeper understanding of the studied subject.

3.3.2 Action Research

I have chosen to also use the action research approach because it captures the aims of my study. Action research is a form of investigation designed for use by teachers to attempt to solve problems and improve professional practices in their own classrooms (Parsons & Brown, 2002). In agreement, James & Augustin (2018) state that action research is an approach to educational research that is commonly used by educational practitioners and professionals to examine, and ultimately improve, their pedagogical practices. This investigation involves

systematic observations and data collection which can then be used by the practitioner-researcher in reflection, decision-making, and the development of more effective classroom strategies. Drawing on the above definitions, it shows that the aims of action research are to bring about 'practical improvement, innovation, change or development of social practice and the practitioners' better understanding of their practices' (Cohen, et al., 2017).

The core of action research aligns with the objectives of my study, as it involves iterative cycles of reflection. In this process, a problem is identified, a solution is attempted, results are discussed, and enhancements to the researched practices are explored and tested; subsequently, another cycle of improvement and reflection follows (Friedman, Gray, & Aragon, 2018). Action research studies are pragmatic and theoretical in orientation. My study draws on the above, as it involves improving the translation of IsiXhosa MSAP Teacher Guide for supporting learning. At the same time, it involves developing, reflecting on, and revising ideas about the learning process (Cobb, Jackson, & Dunlap, 2015). I conducted the study over 4 cycles of data collection.

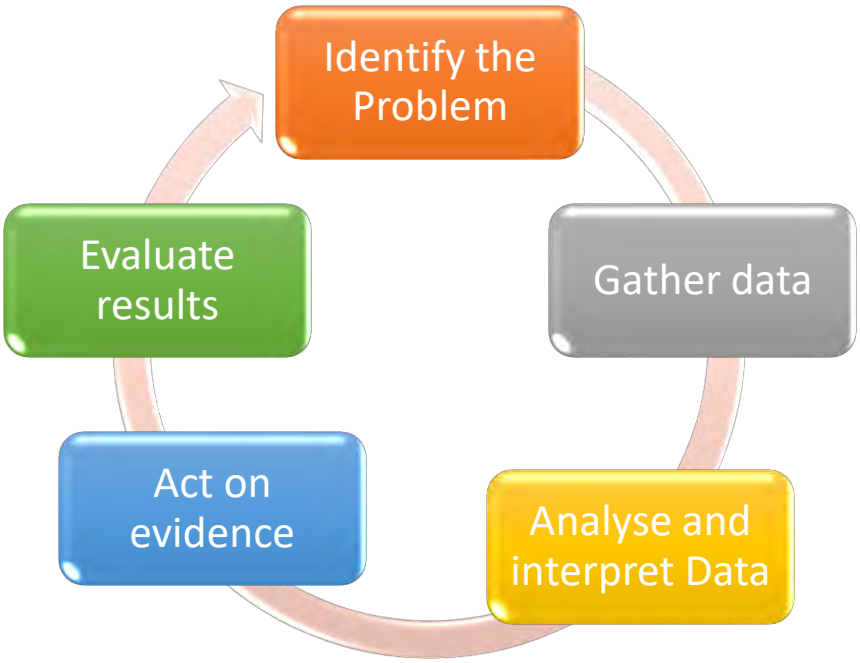


Figure 3.2 *A visual representation of the Action Research cycle (Friedman, Gray, & Aragon, 2018)*

3.4 MERGING DESIGN-BASED RESEARCH AND ACTION RESEARCH

In phase 1, I started with a document analysis where I analysed the translation of the MSAP isiXhosa teacher guide in comparison to the original English text. An outcome of this analysis was a revised guide with alternative translations better suited to the needs of my Grade 3 learners. This development was based on my own knowledge of the language learners use in everyday contexts and my own experience in teaching mathematics in isiXhosa.

In cycle 1 I taught Grade 3A, using the version I had revised in the first cycle of the document analysis. This was followed by a focus group discussion group with the two Grade 3 teachers and the school's principal where we focused on discussion of the language use during the lessons. We critically reflected on the generated vocabulary and phrases with my critical friends to ensure that no meaning was lost in the choice of words that was used.

In phase 2, building on the learning and insights from cycle 2, I designed a re-worded teaching resources that are used with the Doubling and Halving unit and used the vocabulary that was derived in the second cycle with Grade 3A.

In cycle 2 I taught the same unit to Grade 3B class using the new material. This was followed by my own reflection on what worked and what did not and a final revision to the adapted version of doubling and halving for isiXhosa speaking teachers and learners.

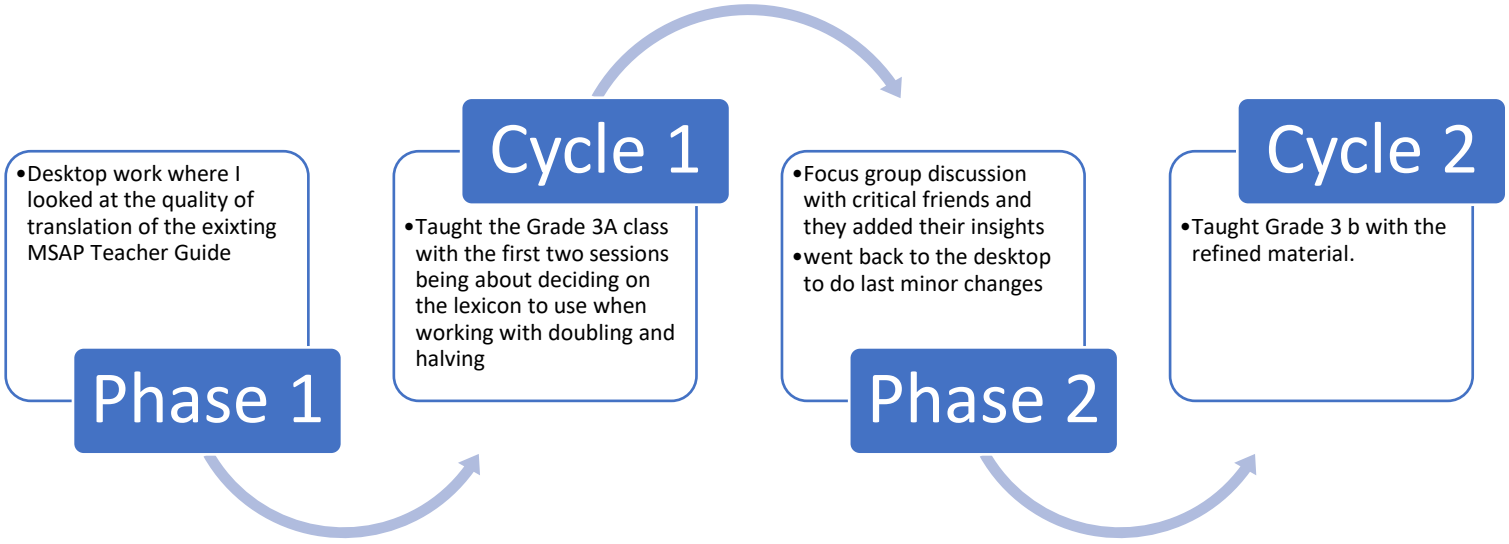


Figure 3.3 *A visual representation of the structure of my data collection*

3.5 RESEARCH SITE AND SAMPLING METHODS

According to Aspers and Corte (2021), a case study ought to set parameters, conduct a thorough analysis of the case(s) that one can research within the constraints of their time and resources, that are directly related to the research questions, and that likely comprise illustrations of what the study intends to investigate. This research was carried out at an isiXhosa medium primary school in Makhanda, distinct from the English medium school where I am employed. In our English medium school, language challenges differ since none of our registered learners have English as their home language, yet they are instructed in English.

I opted for the isiXhosa medium school because the identified challenge pertained to the translated version rather than the original text. This particular school stands out as one of Makhanda's top-performing institutions in its quintile, and I share a positive relationship with the school's management and teachers. Having completed my teaching practice at the school during my final year of undergrad, I continue to support them by sourcing resources for teachers and assisting in generating teaching materials. The average learner at this school hails from a lower-income household, typically under the care of grandparents, as parents are either young and still in school or working in larger cities. In 2022, the Mental Starters Assessment Project (MSAP) was implemented in Grade 3 classes throughout the Eastern Cape by the Eastern Cape Department of Basic Education (ECDOE).

A critical friend, as defined by Baskerville and Goldblatt (2009), is a colleague interested in your research, offering impartial feedback. Members of my school community were eager to participate in this study. For this research, the school principal, also a master's scholar at Rhodes University, joined my teaching sessions with the Grade 3 teachers every morning for 8 sessions in each class, involving the class teachers of the Grade 3 classes in question as well.

3.6 METHODS OF DATA COLLECTION

The data collection process comprised three components: document analysis, lesson observation, and focus group discussions. Video recordings were made of my teaching sessions with the Grade 3 classes. These recordings served as references during the reflection stage and were utilized in the lesson planning, incorporating the newly developed vocabulary. Focus group discussions were also conducted with the three critical friends, taking the form of critical reflections on language use. The discussions were recorded and transcribed to be analysed as part of the action research cycles of reflection and planning. This qualitative approach using

focus group discussions is commonly employed to gain a profound understanding of social issues (Nyumba et al., 2017). They further note that the method involves collecting data from a purposefully selected group of individuals rather than from a statistically representative sample of a broader population.

3.6.1 Document analysis

According to Bowen (2009, p.3), document analysis is the "systematic procedure for reviewing or evaluating documents." In qualitative research, document analysis is done to "elicit meaning, gain understanding, and develop empirical knowledge from relevant documents." Fundamentally, research findings must relate to the study's context to ensure the recommendation of contextualised practices. For the first cycle of this study, I chose document analysis of the MSAP isiXhosa Teacher Guide. It is crucial to note that I did not use document analysis as a tool for research or data collection but rather to analyse the quality of translation and the fidelity (accuracy) and alignment of the translation to the mathematical meaning and concept. This assisted me in answering the first research question that sought to understand the extent to which the translation of the teaching materials for the doubling and halving strategy in the MSAP Teachers' Guide aligns with the intended meaning.

I analysed the data generated from the first cycle through guidance of Toury's (2012) Descriptive Translation Studies (DTS). I focused on finding alternative ways of translating mathematics in the Foundation Phase, keeping the translation in the correct register for the benefit of the learners. For the second cycle of the study, I drew on Cummins' (2000) second language acquisition theoretical concepts of BICS and CALP to describe the type of terminology I used in my teaching. Although the concepts had been developed for a second language acquisition theory, I used them and focused on the use of mother tongue instruction and drawing on the second language as a resource. I also used these frames to analyse and critique the quality of the existing translation in the isiXhosa Teacher Guide (in the first cycle).

3.6.2 Lesson observation

In the second cycle of this study, I conducted an analysis of data derived from video-recorded lessons taught to two grade 3 classes using critical incident analysis. This qualitative research method, recognized for its utility as an investigative tool (Butterfield, et al., 2005), was

employed to scrutinize specific occurrences during interactions with learners. I focused on instances of translanguaging, examining how and why I utilized this technique, as well as its frequency within the lessons.

During the subsequent focus group discussion, I sought feedback and critiques of my teaching approach from participants. This feedback was instrumental in refining the instructional strategies applied in Grade 3B. Surprisingly, I did not encounter some of the anticipated challenges during these sessions, which obviated the need to develop additional activities to foster learner engagement. The students demonstrated a keen willingness to participate actively, fostering a conducive and productive learning environment in both classrooms. Their enthusiastic engagement made the teaching experience both enjoyable and rewarding.

3.6.3 Focus group discussions

Focus group discussion is a technique where a researcher assembles a group of individuals to discuss a specific topic, aiming to draw from the complex personal experiences, beliefs, perceptions and attitudes of the participants through a moderated interaction (Hayward, Simpson, & Wood, 2004). In a focus group discussion, researcher adopts the role of a facilitator or a moderator. In this setting, I facilitated or moderated a group discussion between two classroom teachers and their principal after every lesson that I delivered while they observed.

The aim of conducting both the lesson observations and the subsequent focus group discussions was twofold. Firstly, through the lesson observations, we sought to gather firsthand insights into how learners engaged with the isiXhosa vocabulary being developed. By closely examining their interactions and contributions during classroom activities, we aimed to uncover nuanced details about the efficacy and appropriateness of the vocabulary in educational contexts.

Secondly, the focus group discussions with the critical friends who participated in the observations were designed to delve deeper into their perspectives and pedagogical insights. These discussions provided a platform to collectively reflect on and analyse the observed interactions and outcomes. We aimed to understand their viewpoints regarding the effectiveness of the isiXhosa vocabulary in supporting teaching and learning objectives, as well as its alignment with educational practices and linguistic norms.

In essence, the lesson observations and focus group discussions were integral to addressing the third research question: "What are the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that was developed?" Through these activities, we aimed to illuminate not only how the vocabulary was perceived and utilized in classroom settings but also to gain informed opinions on its potential impact and relevance in enhancing educational outcomes.

3.7 METHODS OF DATA ANALYSIS

This section forms the foundation of this study, outlining the systematic approach used to extract meaningful insights from collected data (Cohen, et al., 2002). It details the methodologies and techniques employed to organize, interpret, and synthesize the diverse data gathered through lesson observations, video transcription, audio transcription and focus groups discussions, aiming to ensure transparency and rigor in the research process.

In this study, data analysis goes beyond mere compilation and categorization; it represents a dynamic process of exploration and interpretation. This is done through the process of interacting with the participants and getting their contributions of knowledge. As highlighted by Morrison (2002), this analytical journey entails intricate stages of organization, transcription, description, and interpretation, interwoven with reflective dialogues and theoretical foundations. Timmermans and Tavory (2012) characterizes this process as a cyclical exploration, where empirical observations are continually compared with abstract concepts to gather coherent patterns and insights. This section clarifies how these elements synergistically contribute to constructing a robust analytical framework, facilitating a nuanced exploration of the development of comprehensible isiXhosa teaching and learning materials.

In this study, I collected data through video recordings, which I then reviewed and transcribed to pinpoint critical incidents that shaped my findings. I created a table to record the lessons observed by my critical friends, focusing on instances where learners made noteworthy contributions. These contributions were pivotal in deciding the appropriate vocabulary to use for developing isiXhosa teaching and learning materials.

Furthermore, I conducted focus group discussions with the critical friends who observed the lessons. In these discussions, we analysed the language use patterns of learners during a mental

starter in a mathematics classroom, discussing and generating supporting arguments based on our collective observations.

3.8 ETHICAL CONSIDERATION

Ethical considerations in research are guided by a set of principles influencing research designs and practices (Govil, 2013). These considerations are aimed to protect the rights of research participants, enhance research validity, and maintain scientific integrity.

Initially, as part of the research proposal phase, I had to complete a written form to seek ethical clearance. The Education Faculty's Higher Degrees Committee provisionally approved it, pending final approval from my University's Ethical Standards Committee (RUESC) (Refer to Appendix A for the confirmation letter). After obtaining approval from the RUESC, I proceeded to request ethical clearance from the Eastern Cape Department of Basic Education (ECDOE). As part of this process, I was tasked with creating a 5-slide PowerPoint presentation to present to their committee, outlining the potential benefits of my study. Subsequently, I received an email inviting me to deliver the presentation through a Zoom meeting organized by the ECDOE research ethics committee. Unfortunately, the presentation could not proceed as the number of present committee members did not meet the required quorum. Consequently, I had to submit the PowerPoint presentation along with a brief motivation letter. Following this, I promptly received approval for my ethics from the ECDOE (see Appendix B).

The key ethical considerations I addressed in my ethics application included obtaining gatekeeper permission from the school principal where I was conducting my research and from the school principal at my school (see Appendix F, G & H), securing written assent from the learners, and obtaining written consent from their parents (see Appendix C & E), as well as written permission from my colleagues (see Appendix D). These permission letters detailed each aspect of the study and clarified the expectations for each participant, ensuring informed consent was obtained (see Appendix A & B). I outlined my intentions with the action research design, emphasizing that the focus was on evaluating my teaching strategies rather than assessing the achievements or abilities of the learners. I also underscored my respect for the rights of parents who preferred their children not to participate in the study for any reason. Additionally, I assured participants of their anonymity and the option to withdraw from the study at any point. I ensured that the letters, consent and assent forms to the learners and their parents were written in isiXhosa for transparency to my participants.

The study was conducted during regular school hours, following the established timetable to avoid negatively impacting the school's curriculum and academic planning. Throughout the process, I remained vigilant not to let my research distract me from my routine teaching responsibilities. Due to the need for commuting to the school where my research was taking place, I ensured that my learners had assignments and a teacher assistant present during the 30 minutes when I was off the school premises. The school is located approximately 3 kilometres from my own school, so the travel time was relatively short. This routine was followed for eight sessions for each class, Grade 3A and B. Arriving just before their mathematics lesson began, I engaged in a 15-minute mental starter interaction (as outlined in the MSAP doubling and halving teacher guide) with them before departing to return to my own school.

The study was classified low risk as it focused on my own teaching practice rather than on learners and it indeed turned out to be so. The risk to learners was no greater than the risks ordinarily experienced in attending school. Learner test data were used solely to assess whether the class improved, not for researching individual learners. Learner and parent consent were obtained for the use of the video and the analysis of tests. Real names of participants were avoided to protect their identity. To ensure fairness between the two classes I taught, lessons learned during the study were used to create enrichment sessions for Grade 3A. This approach ensured that Grade 3A received benefits similar to those Grade 3B would have received since Grade 3B's lessons were more refined. (These lessons had the benefit of the improvements made following reflections on the lessons in 3A). Video recordings were employed as a stimulated recall strategy for focus group reflections, not as part of the data collection methods. The safety and confidentiality of the videos were maintained by securely storing them in a designated drop box, accessible only to myself and my supervisor.

After submitting this thesis, my plan is to revisit the school and communicate to the classes involved in my study about the impact of their participation on the work I have accomplished. I aim for them to recognize and comprehend the significance of their contribution to the development of this vocabulary. This act may serve as encouragement for them to continue working diligently in their studies, especially considering they will be in Grade 4 when we meet, now studying in English.

3.9 TRIANGULATION, VALIDITY AND RELIABILITY

Denzin (2012) noted that triangulation involves the employment of multiple external data collection methods concerning the same events may be enhanced by multiple external analysis methods. According to Marshall and Rossman (2016) the concept encompasses multiple external analysis methods concerning the same events to enhance the validity of the process. In my research, the implementation of triangulation emerged as a vital and integral aspect. This approach aims to facilitate a comprehensive understanding of the studied case by comparing information and drawing conclusions from multiple perspectives, thereby minimizing the risk of bias associated with reliance on a single data source (Ferrance, 2000; Bush, 2002; Willis, 2007). In my study, triangulation was executed through the collection of data from multiple and diverse individuals, employing various data collection methods and instruments. This multifaceted approach served as a valuable means of 'cross-checking', contributing to the robustness and reliability of the study's findings (Maxwell, 2003, p. 245).

In my study I ensured that there was triangulation through the analysis of collected data obtained through various methods. The use of video recordings as references enhanced the validity of my reflections, allowing me to refer back to the recordings rather than solely relying on my memory. Inviting critical friends to be present during the lessons was believed to further enhance the validity and trustworthiness of the data, benefiting from their teaching experience and input. Opportunities for member checking transcripts or participating in focus group discussions were also provided to the critical friends and they approved of the transcription. Sharing my study experience and emerging findings with other scholars and conference delegates at the South African Association for Research in Mathematics, Science, and Technology Education (SAARMSTE) conferences in 2023 and 2024, and publishing in the South African Journal of Childhood Education (SAJCE) Special Edition 2024 contributed to checking the resonance of my data within the South African field of mathematics education.

In the course of my research, the implementation of triangulation emerged as a vital and integral aspect. Triangulation, as a methodological strategy, involves the deliberate consideration of a variety of data sources and diverse methods of data collection. This approach aims to facilitate a comprehensive understanding of the studied case by comparing information and drawing conclusions from multiple perspectives, thereby minimizing the risk of bias associated with reliance on a single data source (Ferrance, 2000; Bush, 2002; Willis, 2007). In my study, triangulation was executed through the collection of data from multiple and diverse individuals,

employing various data collection methods and instruments. This multifaceted approach served as a valuable means of ‘cross-checking’, contributing to the robustness and reliability of the study's findings (Maxwell, 2003, p. 245).

Megheirkouni and Moir (2023) explain that transferability in qualitative research refers to the extent to which the findings of a study can be applied in another setting, context, or nation. More specifically, transferability asks whether the same findings can be obtained with other respondents if we repeat a qualitative study in other locations (Hellström, 2008). The findings in my study may be transferable to the same context only: that is the isiXhosa speaking context.

3.10 CONCLUSION

In conclusion, this chapter provides a comprehensive overview of the structured approach employed in my study, detailing the systematic plan for data collection, analysis, and interpretation.

This chapter not only expounds the specific methods, tools, and techniques used but also justifies their selection, ensuring the study's rigor and validity. The integration of Design-based Research and Action Research within a pragmatist paradigm emphasizes the study's innovative and dynamic nature, aimed at solving real-world problems through practical and theoretical insights. The detailed description of the research design, sampling strategies, data collection procedures, and ethical considerations underscores the study's transparency and replicability.

By meticulously outlining the processes involved in developing isiXhosa teaching materials from existing English MSAP teacher guide, this chapter lays a solid foundation for the research, enhancing its credibility and reliability. Ultimately, this chapter serves as a vital component, ensuring that the research is conducted with thoroughness and integrity, thereby contributing significantly to the trustworthiness and robustness of the research findings.

CHAPTER 4: DATA COLLECTION, PRESENTATION AND ANALYSIS

CHAPTER 4

4. DATA ANALYSIS

4.1 INTRODUCTION

The purpose of the data analysis chapter in research is to systematically examine, interpret, and present the data collected during the study. In this chapter I interpret the data I have collected in a meaningful way in order to uncover patterns or relationships that lie within the data. I also assess whether the collected data supports or contradicts the initial research questions by identifying recurring patterns in the data, providing a deeper understanding of the nature of language use in the Foundation Phase mathematics classroom in an isiXhosa school. I will adhere to the sequence of events illustrated in Figure 3-3 from the preceding chapter.

4.2 DESIGN PROCESS

In this section I provide an overview of the process I followed to gather data. I share the strategic approach I took to navigate the complexities of data collection, offering a transparent lens into the robust framework that underpins my study.

The first phase of this study was the identification of linguistic challenges in the isiXhosa translation of the MSAP Doubling and Halving Unit. My intention, after an initial examination of the materials, was to systematically identify whether there were unfamiliar and potentially confusing terms in the MSAP doubling and halving unit. I then carried out a retranslation of the doubling and halving unit into Grade 3-Friendly isiXhosa. I did this retranslation to provide a version of isiXhosa tailored for Grade 3 learners in Makhanda to ensure comprehension and engagement.

I focused on the interactions from the 1st cycle with Grade 3A, where the most valuable contributions were made. The Grade 3B class, having already covered the content and using refined materials (see Appendix L) later in the year, made minimal to no new contributions during the interaction.

Due to the assumption that test materials required no rewording (there are very few words used on the tests) I first administered the English doubling and halving pre-test. I later realised that it would have been preferable to have administered the pre-tests in isiXhosa. Upon this realization, I administered the same pre-test in isiXhosa. Upon the administration of the

isiXhosa pre-test, I realized that learners struggled when asked to rewrite the test in isiXhosa. I realised that a more comprehensive translation of test and other supporting material was needed and not just the teacher guide. I then translated all instructional materials, including tests and worksheets, into isiXhosa.

After my initial translation (see Appendix I), I had a collaborative vocabulary selection session with the Grade 3A class where they helped me choose vocabulary that is easy for them to understand. We achieved this through identification of unfamiliar words in the first lesson and we collaboratively decided on alternative vocabulary. This was the first cycle of the study. The first cycle of eight translated lesson starters proved to be successful because the post test results indicated improvement from the pre-test, suggesting enhanced understanding.

I then discuss the feedback I gathered from critical friends through a focus group discussion where I collected insights and recommendations from peers who observed the lessons. No suggested changes were made based on the observations.

For cycle 2 I implemented the newly translated (see Appendix J) in the Grade 3B class. I applied lessons from Grade 3A to Grade 3B, ensuring smooth execution and it proved to be successful because the lessons proceeded smoothly, and learners demonstrated good fluency.

4.3 PREPARATION OF RESEARCH PARTICIPANTS

I carried out my study with two Grade 3 classes from a township isiXhosa medium school, comprising 35 and 39 learners in each class. Not all learners were present for each session. This was usually due to absenteeism because of bad weather. The school is situated in a rather rural area of Makhanda with muddy roads on rainy days. I did, however, find that these ‘missing’ learners were able to cope well with the tasks in subsequent lessons and that they appeared to catch on quickly to the terminology and the activities with the language we chose to use during lessons. This positive realisation was an indication that my design of the less rigid use of language and translation techniques was effective, and that my teaching strategies had enabled learning, even in these instances. Both Grade 3 teachers and the principal, were present in my class during most lessons. I had anticipated that the learners may feel intimidated by the presence of their teachers and principal during the lessons, but the learners interacted with me well during the lessons. While I explained to the critical friends reasons for the ‘non-standard’ use of language by myself and the learners it was a challenge for one teacher who sometimes

‘corrected’ the learners if they were using what is known as lokshen isiXhosa, which she deemed inappropriate for use in the classroom. I thus had to request that she simply observe and allow the learners the freedom to speak as they wished.

I had planned for a two weeks per class for covering the whole unit, however there were times I could not drive to the school due to weather conditions. This led to me conducting each session over a period of three weeks per class. I thought that this break in between our sessions would have a negative impact. But it did not reflect in the way the learners were interacting with me during lessons. The mental starter lessons are meant to be ten minutes long, but the first two lessons with Grade 3A took longer because we were deciding on which vocabulary to use for the lessons. The lessons thereafter were fluent and paced according to the way they should be. Each mental starter took 10-12 minutes thereafter and all 8 sessions with Grade 3B were fluent and well-paced at 10-12 minutes per lesson.

The Grade 3A teacher was mostly absent due to ill health, and therefore ended up partly participating in the focus group discussion. Her commitment and diligence to her work has kept her strong.

I was recording the lessons and we used *iziduko* (clan names) to call each other, the teachers included. This created a relaxed feeling for the learners because this is the kind of language that is used at home. In the Xhosa culture, when an elder wants to show adoration towards their child or any younger person, they call them by their *isiduko*. This eliminated the need to use pseudonyms because *iziduko* are general family names (one *isiduko* could be for more than one learner per class). The reason I chose to use *iziduko* was related to the fact that I wanted the learners to feel that they belonged and had control of their own learning. The principal of the school also agreed and said “being called *ngesiduko* gives me wings”, suggesting that it gives him a certain level of confidence.

4.4 DATA PRESENTATION PHASE

The data presentation phase is a critical component of this study, serving as the bridge between data collection and analysis. This phase aims to systematically showcase the findings derived from the diverse data sources, providing a clear and comprehensive view of the evidence gathered. By presenting the data in an organized manner, we can highlight key themes, patterns, and insights that emerged during the research process.

In this section, we will outline the various forms of data collected, including video recordings of classroom lessons, transcriptions of critical incidents, and summaries from focus group discussions. Each data type will be presented in a structured format, accompanied by relevant tables, charts, and illustrative quotes to enhance clarity and understanding.

The primary objective of this phase is to transparently display the raw data and preliminary interpretations, setting the stage for deeper analysis and discussion. By doing so, we aim to provide a robust foundation for addressing the research questions and drawing meaningful conclusions. This phase not only illuminates the empirical basis of our findings but also ensures the rigor and validity of the study by allowing for a thorough examination of the data.

4.4.1 Phase 1 - Document Translation Analysis

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 standardization, and supports effective teacher-learner communication, particularly in diverse, multilingual classrooms.

The aim of this phase was to analyse the quality of translation and the fidelity (accuracy) and alignment of the translation to the mathematical meaning and concept. This therefore answers the first research question that states, (1) To what extent does the translation of the teaching materials for the doubling and halving strategy align with the intended meaning?

The isiXhosa translation of the MSAP teacher guide is translated in a manner which constrains comprehension of mathematical terms by both teachers and learners in the Makhanda district, even though the dialect spoken in this district is isiRharhabe, which is considered to be the standard isiXhosa by Pan South African Language Board (PanSALB). 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 document is not relatable to the learners in the Makanda 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 was done and therefore meaning was lost. In this cycle

of this study, I present my work in translating the materials into a form of isiXhosa that proved to be comprehensible to Grade 3 learners in Makhanda in the Eastern Cape and that conveyed the concept of doubling and halving accurately to the learners. In this cycle, I compared this to the existing isiXhosa translation of the MSAP materials to highlight how this new translation differs and to show how it may be more accurately conveyed.

Before starting the study, I developed my own isiXhosa translation of the MSAP materials (see Appendix I), focusing in particular on the terms and phrases that I use in explaining the doubling and halving strategy. This development was based on my own knowledge of the language learners use in everyday contexts and my own experience in teaching mathematics in isiXhosa. In this cycle of the study, I utilise these translations when teaching the Grade 3A class, but also further developed the vocabulary and phrases through my own constant reflection throughout the lessons and input from the learners during the lessons.

In this phase I present the initial development work in translating the materials into a form of isiXhosa that is comprehensible to Grade 3 learners in Makhanda in the Eastern Cape and that conveys the concept of doubling and halving accurately to the learners. I compare this to the existing isiXhosa translation of the MSAP materials to highlight how this new translation differs and to show how it should more accurately convey the concepts and procedures of doubling and halving.

I employed Toury's Descriptive Translation Studies theory to construct the vocabulary utilized in this study. This theory was chosen due to 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 creation of descriptive terms. Toury (2012) emphasizes the importance of translation specifying prescribed, forbidden, tolerated, and permitted linguistic and societal norms. The utilization of indigenized English 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.

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 composed or formulated in English. According to Gauton et al. (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.

I identified transliteration as the most appropriate translation technique for this assignment. Upon examining different aspects of the isiXhosa MSAP teacher guide, I observed inconsistencies in the translation methodology. This runs counter to the fundamental principles of document translation as outlined in the DTS theory, which emphasizes maintaining consistent translation techniques throughout the document. These inconsistencies include but not limited to translation through transliteration, where the term adapts the phonological structure of the loanword to the phonemic system of isiXhosa. Table 4.1 below summarises this phenomenon.

Table 4.1 *English mathematical terms and their translation in the MSAP isiXhosa Teacher guide with alternative proposed translations (with justification).*

English terms	**Current MSAP isiXhosa Translation**	**Proposed MSAP isiXhosa Translation**	**Justification**
Doubling	Ukuphinda kabini	Idabuli	More relatable
Halving	Ihafu	Ihafu	The only transliterated word in the teacher guide
Number names	Original isiXhosa number names e.g. 26 – amashumi amabini anesithandathu (twenty six)	English number names e.g. twenty six	too long for rapid recall
Number name prefixes	Prefixes suited for isiXhosa number names e.g.: Ihafu ye10 (half of 10); Ihafu yesi8 (half of 8); Ihafu yama30 (half of 30)	Prefixes suited for transliteration, e.g.: Ihafu ka10 Ihafu ka8 Ihafu ka30	Confusion as numbers are written in symbols
"friendly" numbers	*Amanani 'ahlobeneyo'* (*ahlobeneyo* means related)	*amanani anobubele* (friendly numbers)	*'ahlobeneyo'* means 'related' – distorted meaning

Doubles	*'iziphindwa'* (multiples)	Iidabuli	Unfamiliar term

Table 2 focuses on the phrases where meaning is distorted due to direct translation, and I provide the alternative I used in my teaching. The justification section is elaborated on in the next chapter.

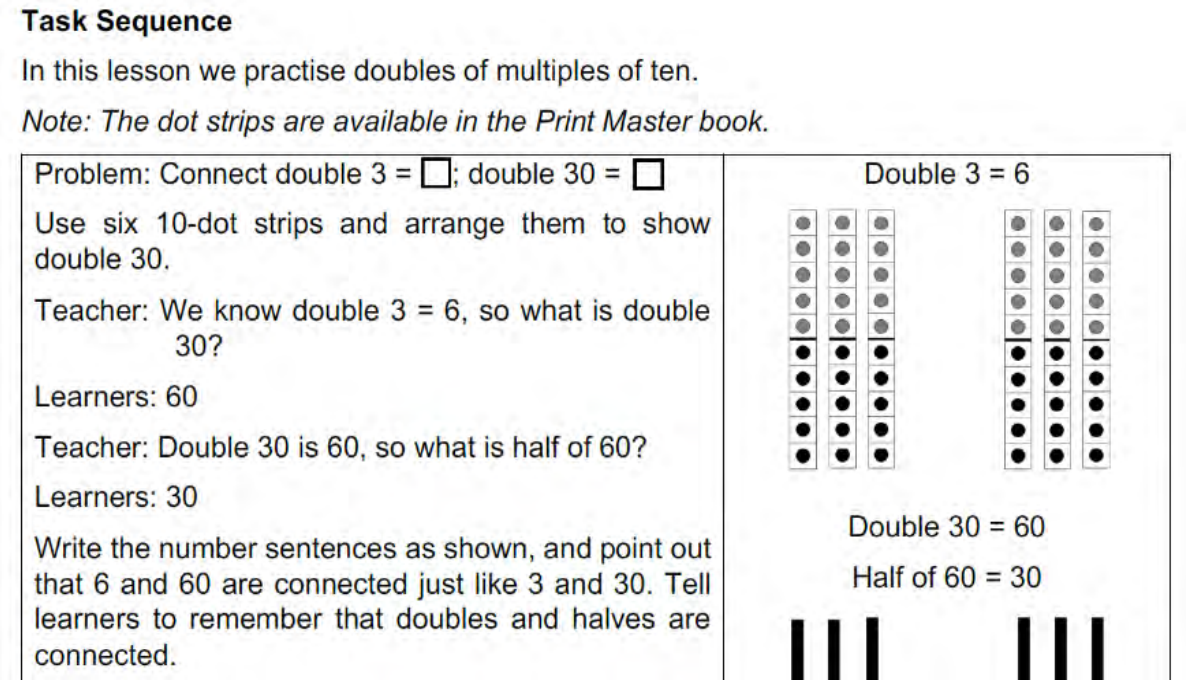
Table 4.2 *Examples of phrases that have lost meaning due to direct translation in the isiXhosa MSAP Teacher Guide.*

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*" pg. 51	**"***Kunezakhono zokukhumbula ngokukhawuleza ezintathu ekufuneka abafundi e benazo ukuze bafunde ukuphinda kabini kunye nehafu***"** pg. 52	"Ukuze abafundi bafunde ukubala ngedabuli nehafu, kufuneka babenezizakhono zilandelayo"	Possible Spelling errors and direct translation leading to distorted meaning
"*Now tell me the doubles sentence for the fingers I show*." pg. 54	"*Ngoku ndixelele iziphindwa zezivakalisi zale minwe ndiyibonisayo*" pg. 55	"Sithini isivakalisi sedabuli saleminwe ndiyibonisayo"	Direct translation, not contextualising the use of the word "sentence" and therefore leading to distorted meaning.

4.4.1.1 Challenges with translation in Grade 3 MSAP teacher guid doubling and halving

In this section I contrast the translation in the isiXhosa teacher guide against the use of 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, IsiXhosa Lexicography: Past, Present and Future,

2013). There are now more transliterated English words used in isiXhosa daily language than before. Correct language translation is an essential part of mathematics teaching and learning, particularly in multilingual and multicultural settings (Essien, 2010). 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 (Essien, et al., 2023). In Figure 4.1 I display an extract of the English MSAP. This is the original text and captures the intended meaning.



Task Sequence

In this lesson we practise doubles of multiples of ten.

Note: The dot strips are available in the Print Master book.

Problem: Connect double 3 = ☐; double 30 = ☐

Use six 10-dot strips and arrange them to show double 30.

Teacher: We know double 3 = 6, so what is double 30?

Learners: 60

Teacher: Double 30 is 60, so what is half of 60?

Learners: 30

Write the number sentences as shown, and point out that 6 and 60 are connected just like 3 and 30. Tell learners to remember that doubles and halves are connected.

Figure 4.1 – *extracted from page 60 in the MSAP English Teacher Guide*

In Figure 4.2 I display an extract from the current isiXhosa MSAP teacher guide (p. 62). However, in Figure 4.2 I highlight the common challenges that I identified during the desk work of planning before conducting the re-translation and the planning of teaching the Grade 3A class that kept re-appearing throughout the doubling and halving unit. Each translation challenge highlighted in the diagram is explained in more detail following the diagram. Such issues are discussed further in the next chapter.

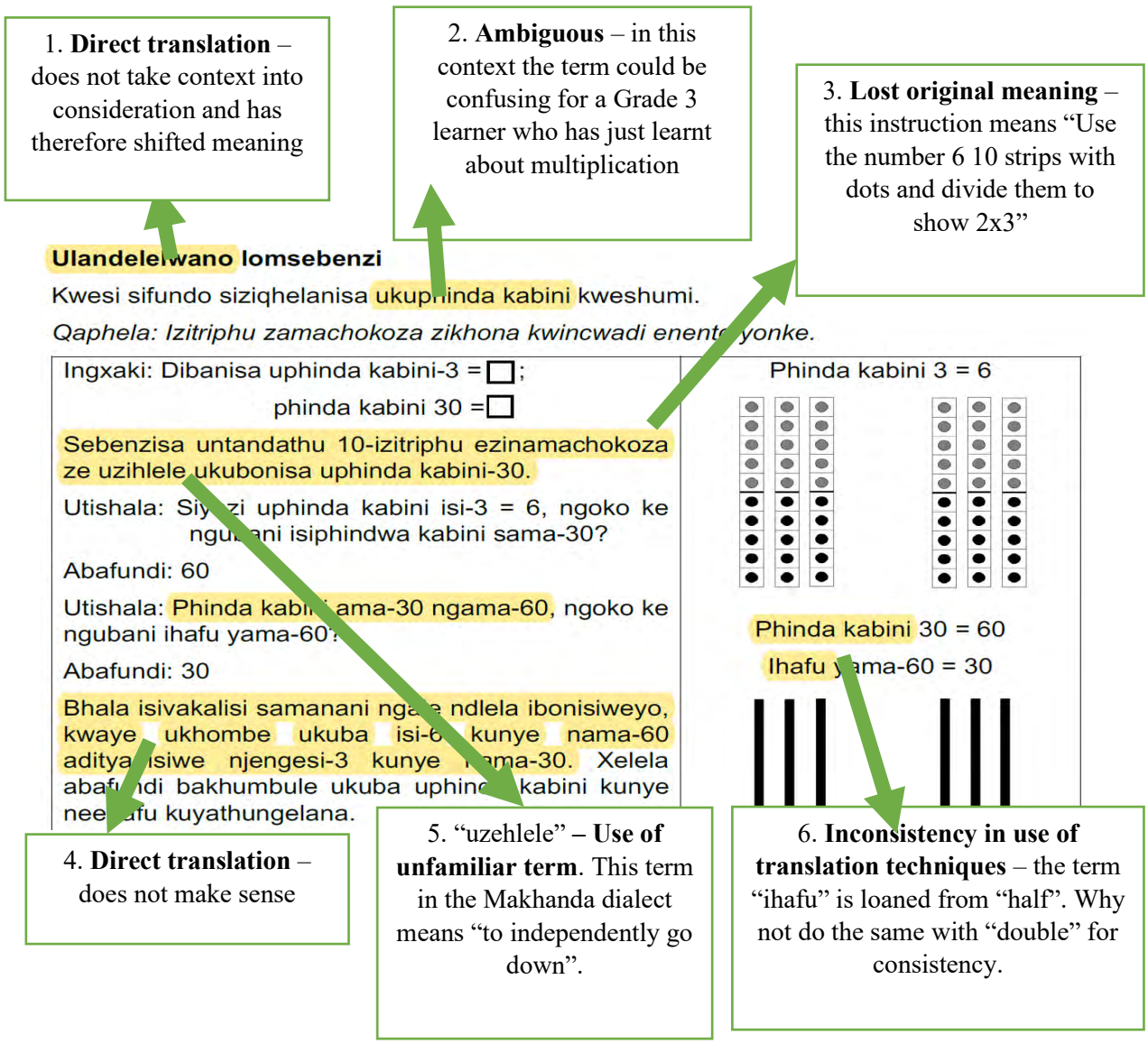


Figure 4.2 *extracted from page 62 in the MSAP isiXhosa Teacher Guide*

The following points provide explanation of the annotations in Figure 3:

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 the task rather than explaining. For a teacher that has limited experience in teaching, this could be confusing. For example in my case where I was trained in English, and had no historical isiXhosa education experience. The suggested translation would be *'indlela yokusebenza'*.
2. *'ukuphinda kanbini'* also means to multiply by two (especially in grade 2), this then may confuse a grade 3 learner and limits the teacher with a poor mathematical vocabulary. Causing a breakdown in communication between the teacher and the

learners. While doubling is indeed a form of multiplication, it is helpful to use a specific term, "doubling," to describe it. This allows learners to more easily recognize and understand the patterns involved in this type of multiplication.

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 2x3” instead of what is displayed in Figure 5. Without the English teacher guide, a teacher will not be able to make sense of the instruction.
4. Direct translation has removed any opportunity for making sense of the sentence. The current sentence now states ‘write a number sentence in the way you have been shown and point that 6 and 60 are together just like 3 and 30.’ Similar to point 3 above the instruction is confusing and likely constrain the teacher’s understanding of what is intended in the task and thus the teaching and learning of the strategy.
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. The intention of the instruction is changed and will constrain the teacher’s understanding of what is required from the instruction.
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. When translating a document, according to Toury (2012), the techniques employed need to be consistant.

4.4.1.2 The power of the prefix in isiXhosa orthography

Languages have unique linguistic structures and rules that build the way the language works. In isiXhosa there is a rule of “agreement”, where the prefix of the noun has to agree with the noun class. This is very important because if you use the wrong prefix, the sentence may lose or change meaning. There are 15 noun classes and each one has a different prefix. The prefixes used in the existing MSAP isiXhosa teacher guide are used in a way that may cause confusion to teachers and learners. This confusion is worsened by the use of number symbols because in everyday language, isiXhosa speakers use English names for numbers, money and time. For example, *ama-23 ‘*should’ be read as *amashumi amabini anesithathu* (twenty-three) but because of the nature of everyday language use and fluency, the number can be read more easily as *ama-twenty-three.* This however then breaks the prefix law in isiXhosa and takes away meaning. A linguistically acceptable way to use prefix with number symbols should

ideally be the application of a standard prefix for all numbers, for consistency and fluency. This is possible with translanguaging. If the translanguaging approach is used, where number names are retained in English the prefix remains the same for all numbers, *ka-* meaning of.

I have identified the prefixes used in the MSAP isiXhosa teacher guide and they vary with each number used. Table 4.3 illustrates this phenomenon.

Table 4.3 *A breakdown of the different noun classes for the different numbers*

Prefix	Number	Proposed Prefix	Justification
ihafu ***yesi-***	1	*Ihafu ka-*	The number has now become class 9 because of transliteration, this brings consistency to the translation throughout the document.
ihafu ***ye-***	9	*Ihafu ka-*	
ihafu ***yama-***	20	*Ihafu ka-*	
ihafu ***ye-***	100	*Ihafu ka-*	
ihafu ***yama-***	230	*Ihafu ka-*	
ihafu ***ye-***	1000	*Ihafu ka-*	

In table 4.3 above, I illustrate how the prefix for each number changes. To fully grasp the functioning of prefixes in isiXhosa, one must understand the noun class system, which is typically taught in the later grades of high school. However, when English number names are incorporated through translanguaging, a consistent prefix is used for all numbers. This is because the English number names fall under the same noun class, class 9, in isiXhosa. This uniformity helps prevent confusion among young learners and teachers who may have limited knowledge of isiXhosa linguistics.

4.4.2 Lesson Observations – Grade 3A

Table 4.4 below provides the overview of the lesson observation with my narrative of what transpired and anecdotal moments within those lessons. Because transcribing the whole lesson in isiXhosa was time consuming, I chose to transcribe what seemed to valuable contributions from the learners towards this study. The table is sectioned into these two sections clearly, my narrative and the transcription of the learners' contribution.

Table 4.4 *Lesson Observation and Transcription – Grade 3A*

Lesson	Observation Description	Learner's contributions and Time of contribution in the Video
First meeting with both Grade 3 classes at the beginning of Term 2	I introduced myself and explained in detail what I was going to do with them. We went through the ascent form together, reading through every point and clarifying any questions. The teachers managed to fit both classes into the school's hall and everyone was comfortable. The ascent forms are written in isiXhosa and the nature of the language I used on the form was less formal. I had done this intentionally as I wanted all the learners to fully understand what we were about to do. All the learners were happy to take part in the study and they all signed the ascent forms. I had met with their teachers in the previous week and had given them the consent forms for the parents, all the parents signed the consent forms.	
Day 1 (Monday) - 1st Pre-Test	I administered the pre-test to the learners and explained to them what I required them to do. The teacher had set the timer and I was walking around the classroom to monitor	

	and be available for any assistance to the learners. They completed both pre-tests, and I took them in. When I got home to mark the tests, I realised that they were in English and this was not ideal as the research is meant for observing the teaching and learning in isiXhosa, and this is an isiXhosa medium school.	
Day 2 (Tuesday) - 2nd Pre-Test with Gr3A	I administered the same pre-test in isiXhosa. We followed the same rules as yesterday. But the difference between today and yesterday was, there were learners who were asking for clarification of questions. This was not the case yesterday, in fact most of them finished writing yesterday. Today only half the class managed to finish because with the help of the class teacher we were assisting the learners to understand the terminology and phrasing of questions by using *translanguaging* (see Chapter 2.2.7) instead of the "pure" isiXhosa terms that are used in the Teacher guide. I took in all the pre-tests and marked them. Some learners only attempted one pre-test out of the two that is prescribed. Some learners wrote both but did not finish both sides perhaps they ran out of time as there is only 2 min for the 1st test and 3 min for the	**<u>Video 2</u>** (07:47) Me: "*Kuthini udabulisha?"* ("What does it mean to double?") (07:50) Learners: *"kuphinda"* ("it is to multiply") (07:51) Me: *"Kuphinda kangaphi?"* ("multiply by how many?") (07:53) Learners: *"kabini"* ("two times") (07:57) Me: "*Kuthini uhafisha?"* ("What does it mean to half?")

	2nd one. Only 2 learners managed to finish in time. I had taken the language used in the test for granted as there was minimal use of words. While I was marking the learners' tests I noticed most learners did not complete the isiXhosa test, I decided to go back the following day to ask them what they found confusing in the test.	(07:58) Learners: *"kukwahlula"* ("it is to divide") (08:00) Me: *"uyohlula kangaphi"* ("divide how many times") (08:06) Learners: *"kabini"* ("two times")
Day 3 (Wednesday) – Lesson Starter 1	The lesson took 30 min instead of the intended 10 minutes. I asked the learners what they found challenging about yesterday's test. Dikiza immediately pointed out issue of the prefix saying that it gets confusing for her when the number is presented in numerals because she reads *ama-20* as *ama-twenty* (the twenty), which is grammatically incorrect. The intended meaning is to represent twenty, which should be read as *amashumi amabini* (twenty). The teacher assistant echoed this saying that she also had the same struggle with other teaching materials that they use. We could not seem to come up with a quick resolution for this. Unfortunately this discussion was erroneously uncaptured.	**Video 3**

	We moved on and discussed the kind of vocabulary that we would use for the unit, we started with number names. We all agreed that we will use English names for the numbers as this was familiar with all of us and we were not breaking any rules. The class teacher was unfortunately absent on this day due to illness, but the teacher from Gr 3B and the principal who were present later agreed that the use of English number names was helpful to the learners. This then meant that we could not keep the prefixes used in the original isiXhosa text as they were designed for using isiXhosa number names.	(00:10) Me: *"nikholwa ndithi amashumi amabini okanye twenty?"* ("Do you prefer I use amashumi amabini or twenty?") (00:12) Learners: *"twenty"* (00:19) Me: *"Nikholwa nditi ukuphinda kabini okanye idabuli?"* ("Do you prefer I use multiply by two or double?" (00:21) Learners (chorusing): *"ukuphinda kabini/idabuli"* ("multiply by two/double") Because of the stalemate, I decided to let them vote for their preferred terminology. (00:31) Me: *"Abantu abathi idabuli mabaphakamise isandla"* ('Those who say double lift up your hands') (00:32) 12 learners lifted their hands

I now had to go back and redesign the pre-test, post-test and the worksheets that are used in the unit.

We also looked at the frequently used words within the unit. The words that were frequently used throughout the D&H unit were *'uphinda kabini', 'ukwehlela', 'isiphindwa'*. Together with the critical friends who were present in the lesson, we all agreed on the following:

English Terms	**Terms in the MSAP isiXhosa Teacher Guide**	**Proposed terms**
Double	Uphinda kabini	Idabuli
Half	Ihafu	Ihafu
To separate	Ukwehlela	Ukohlula
Double of -	Isiphindwa	Idabuli ka -

(00:35) Me: *"Abantu abathi ukuphinda kabini mabaphakamise isandla"* ("Those who say multiply by two lift up your hands")

(00:38) 6 learners lifted their hands

(00:39) *"Udabuli uwinile"* ("Double has won")

	We attempted the first lesson in the D&H unit and it was good. I displayed my fingers and they would tell me the double I was demonstrating. Using English names, the interaction seemed to go faster. The next step of the lesson starter is to show half or double of the given numbers using the dot strips provided. Once the learners were done with this activity, we started writing sentences representing the forms of double or halves. Each learner was to write 3 sentences (which they call number facts using the spider diagram). But because we ran out of time, we decided to complete the Task sheet for Lesson starter 1 with Lesson Starter 2 instead.	
Day 4 (Thursday) – Lesson Starter 2	The lesson took 20 min. We started off with FIZZ POP using English number names up to 10. The flow of the lesson was better than yesterday because it was very similar to the first lesson starter. The learners were still not used to having the freedom of using English number names because they would keep correcting themselves every time, they found themselves trying to recite the number name in isiXhosa. Off the record, MaLisa explained to me that they must use isiXhosa names in class daily and that it felt different and more liberal to use English names, like	**<u>Video 4</u>** (07:28) Learner: "*usix umphinde kabini*" ("multiply six by two") (09:01) Learner: "*six divide by….. yoh, twelve divide by two equals six*" Although the learners learn in isiXhosa, they preferred explaining their thinking in English.

	we are breaking the law. I could see that there was some excitement of using English number names. We talked through how I had made changes with the prefixes and they confirmed that they understood the worksheet better with the new way of writing. Writing as you speak. After the discussion, we continued with the lesson starter and got to the task sheet which they managed to complete independently.	
Day 5 (Friday) – Lesson Starter 3	The lesson took 12 min There were less learners present due to unfavourable weather conditions. Today's session's pace was fast. The learners were responding well to the activities. We started off with FIZZ POP but using numbers up to 20. We worked with dot strips again this time showing halves and doubles of bigger numbers. Khuboni noticed that this was similar to the activities we did in the past 2 lessons. The lesson ended.	**<u>Video 5</u>** (13:14) Learner: "*ziyafana neziyana"* ("these are the same as those ones")
Day 6 (Monday) – Lesson Starter 4	The lesson took 12 minutes.	**<u>Video 6</u>**

	It is towards the end of the term and most learners remain at home because of the weather and they have completed their assessments. But today's number is more than last week Friday's. We started the lesson with FIZZ POP and they were responding well. This Lesson stater was the same as the one they did yesterday but the shift was in moving from talking and showing the dot strips to writing it. We worked with multiples of 10 which are friendly numbers and shifted to multiples of 5, which are also friendly numbers. MaLisa knew the correct answer for double 35 but struggled to articulate it because he was trying to say it in isiXhosa. This was before we wrote them on the board so we firstly worked mentally. I told him to use English number names, he gave the correct answer. We thereafter looked at the worksheet that consolidates the work covered in LS4. The learners took the task sheet home to complete it	(04:23) Learner: "*xa sino seventy, siqhawula phakathi elashumi… laten… simenze iimi… oofive ababini sizokufumana ama…. Amashumi…. Sizofumana uthirty five*" ("when we have 70, we break ten …… that ten….. we make it…… two fives so we can get ……. Tens…… so we can get thirty five")
Day 7 (Tuesday) – Lesson Starter 5	The lesson took 10 minutes. We swoped the worksheets and marked ourselves. The structure for LS5 is the same as LS4, the difference was that we were halving instead of doubling. The was no worksheet for this LS.	

Day 8 (Wednesday) – Lesson Starter 6	The lesson took 10 minutes Learners used passed experiences from previous lesson starters to approach this lesson starter. I was surprised at how they were comfortable with the web diagram. The teacher explained that they have been doing it but they call it the spider diagram.	
Day 9 & 10 (Thursday & Friday) – Lesson Starters 7 & 8	The Lesson starters all have the same set up and the learners noticed that. But the difficulty changed with the number range. So, by this time they knew what to expect. I was happy with their participation.	
Day 11 – Monday **Post-Test**	We successfully wrote the edited post-test without queries. Most of them completed both post-tests in time. Those who did not finish managed to get most answers correctly.	

4.4.2 Cycle 1 – Teaching Grade 3A

According to Feza et al. (2022) considering the diverse perspectives on language medium and literacy in mathematics education, it is essential to bridge the gap between policy recommendations and the actual linguistic competencies of Foundation Phase learners. They add that by acknowledging the role of learners' home language in acquiring mathematical

knowledge and communication skills, educators can optimize teaching methodologies to foster a more inclusive and effective learning environment.

The aim of this cycle was to develop relatable key terms and phrases (vocabulary) that may be needed to teach doubling and halving counting strategies in isiXhosa for teachers to use as a supplementary to the English teacher guide. This therefore answers the second research question that states, (2) What are the key terms and phrases (vocabulary) needed to teach doubling and halving in isiXhosa?

4.4.2.1 The pre/post-tests and worksheets

The Grade 3A learners wrote a pre-test prior to learning the doubling and halving unit. During the first data collection and analysis, I learnt that the learners had challenges with their own documentation such as the pre\post-tests and their worksheets. The pre\post-tests and worksheets were designed and published in English, and then translated into the indigenous languages of South Africa. In the case of this study, I focus on the isiXhosa translation.

During the second cycle of the research study, an unintentional oversight resulted in the administration of the English pre-test to the Grade 3A class, instead of the intended isiXhosa translation. The error came to light during the preparation phase for the initial mental starter lesson, prompting corrective action. Consequently, the isiXhosa version of the pre-test was administered on the following day to rectify the situation.

This incident assumes critical importance as the primary objective of the main study is to develop an isiXhosa vocabulary that can be effectively utilized by teachers to instruct the doubling and halving unit of the Mental Starters Assessment Project (MSAP). The accurate implementation of the isiXhosa pre-test is vital to achieve this objective and to gauge the learners' understanding of mathematical concepts in their mother tongue, which aligns with the overall focus of the research.

Photo 1 *A snapshot from video recording 2 – the Pre-Test (Grade 3A)*

Throughout the administration of the isiXhosa pre-test, a notable occurrence was the frequent requests for clarifications regarding the questions from the learners as represented in Table 4.5 below.

Table 4.5 *Requests for clarifications in the IsiXhosa pre-test*

Lesson	**Observation Description**	**Learner's contributions and Time of contribution in the Video**
Day 2 (Tuesday) - 2nd Pre-Test with Gr3A	I administered the same pre-test in isiXhosa. We followed the same rules as yesterday. But the difference between today and yesterday was, there were learners who were asking for clarification of questions. This was not the case yesterday, in fact most of them finished writing yesterday. Today only half the class managed to finish because with the help of the class teacher we were assisting the learners to understand the terminology and phrasing of questions by using *translanguaging* (see Chapter 2.2.7) instead of the "pure" isiXhosa terms that are used in the Teacher guide.	**<u>Video 2</u>** (07:47) Me: "*Kuthini udabulisha?"* ("What does it mean to double?") (07:50) Learners: *"kuphinda"* ("it is to multiply") (07:51) Me: *"Kuphinda kangaphi?"* ("multiply by how many?") (07:53) Learners: *"kabini"* ("two times") (07:57) Me: "*Kuthini uhafisha?"* ("What does it mean to half?")

	I took in all the pre-tests and marked them. Some learners only attempted one pre-test out of the two that is prescribed. Some learners wrote both but did not finish both sides perhaps they ran out of time as there is only 2 min for the 1st test and 3 min for the 2nd one. Only 2 learners managed to finish in time. I had taken the language used in the test for granted as there was minimal use of words. While I was marking the learners' tests I noticed most learners did not complete the isiXhosa test, I decided to go back the following day to ask them what they found confusing in the test.	(07:58) Learners: *"kukwahlula"* ("it is to divide") (08:00) Me: *"uyohlula kangaphi"* ("divide how many times") (08:06) Learners: *"kabini"* ("two times")
Day 3 (Wednesday) – Lesson Starter 1	The lesson took 30 min instead of the intended 10 minutes. I asked the learners what they found challenging about yesterday's test. Dikiza immediately pointed out issue of the prefix saying that it gets confusing for her when the number is presented in numerals because she reads ama-20 as ama-twenty (the twenty), which is grammatically incorrect. The intended meaning is to represent twenty, which should be read as amashumi amabini (twenty). The teacher assistant echoed this saying that she also had the same struggle with other teaching materials that they use. We could not seem to come up with a quick resolution for this. Unfortunately this discussion was erroneously uncaptured.	**<u>Video 3</u>** The video recording only began five minutes into the lesson (00:10) Me: *"nikholwa ndithi amashumi amabini okanye twenty?"* ("Do you prefer I use amashumi amabini or twenty?") (00:12) Learners: *"twenty"* (00:19) Me: *"Nikholwa nditi ukuphinda kabini okanye idabuli?"* ("Do you prefer I use multiply by two or double?"

	We moved on and discussed the kind of vocabulary that we would use for the unit, we started with number names. We all agreed that we will use English names for the numbers as this was familiar with all of us and we were not breaking any rules. The class teacher was unfortunately absent on this day due to illness, but the teacher from Gr 3B and the principal who were present later agreed that the use of English number names was helpful to the learners. This then meant that we could not keep the prefixes (refer to chapter SAJCE) used in the original isiXhosa text as they were designed for using isiXhosa number names. I now had to go back and redesign the pre-test, post-test and the worksheets that are used in the unit. We also looked at the frequently used words within the unit. The words that were frequently used throughout the D&H unit were 'uphinda kabini', 'ukwehlela', 'isiphindwa'. Together with the critical friends who were present in the lesson, we all agreed on the following: English Terms Terms in the MSAP isiXhosa Teacher Guide Proposed terms Double Uphinda kabini Idabuli Half Ihafu Ihafu To separate Ukwehlela Ukohlula Double of - Isiphindwa Idabuli ka -	(00:21) Learners (chorusing): *"ukuphinda kabini/idabuli"* ("multiply by two/double") Because of the stalemate, I decided to let them vote for their preferred terminology. (00:31) Me: *"Abantu abathi idabuli mabaphakamise isandla"* ('Those who say double lift up your hands') (00:32) 12 learners lifted their hands (00:35) Me: *"Abantu abathi ukuphinda kabini mabaphakamise isandla"* ("Those who say multiply by two lift up your hands") (00:38) 6 learners lifted their hands (00:39) *"Udabuli uwinile"* ("Double has won")

	We attempted the first lesson in the D&H unit and it was good. I displayed my fingers and they would tell me the double I was demonstrating. Using English names, the interaction seemed to go faster. The next step of the lesson starter is to show half or double of the given numbers using the dot strips provided. Once the learners were done with this activity, we started writing sentences representing the forms of double or halves. Each learner was to write 3 sentences (which they call number facts using the spider diagram). But because we ran out of time, we decided to complete the Task sheet for Lesson starter 1 with Lesson Starter 2 instead.	

This observation was unexpected, given that no such inquiries were made during the administration of the English test. It is important to note that these learners are currently being instructed in their mother-tongue, isiXhosa, as they are in the Foundation Phase. I initially believed that no modifications were necessary for the pre and post-tests as well as the worksheets due to the limited use of words. However, this assumption was proven to be inaccurate.

Photo 2 *A snapshot of video 3 – Lesson Strater 1 (Grade 3A)*

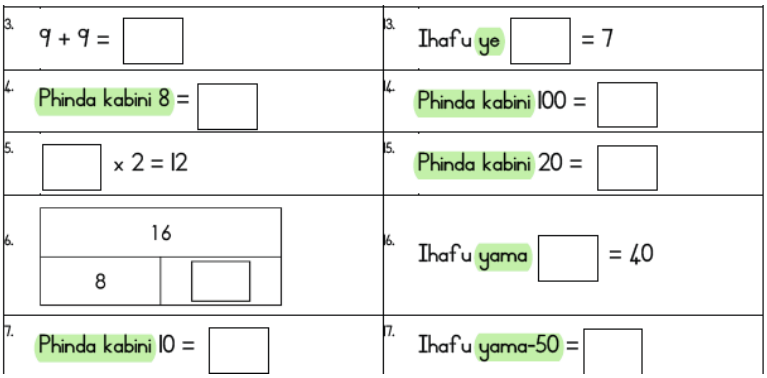
The disparity in the number of questions raised between the English and isiXhosa tests raises intriguing questions about the learners' comprehension and familiarity with the respective languages. As the learners are exposed to isiXhosa as their primary medium of instruction, it is somewhat worrisome that they encountered difficulties during the isiXhosa pre-test. These findings warrant further investigation into the factors influencing language-based disparities in mathematical comprehension among learners, particularly in the context of mother tongue-based instruction during the early stages of education. Such investigation may offer valuable insights to enhance the effectiveness of instructional approaches and support better academic outcomes for these learners.

Photo 3 *A snapshot of video 4 (Grade 3A)*

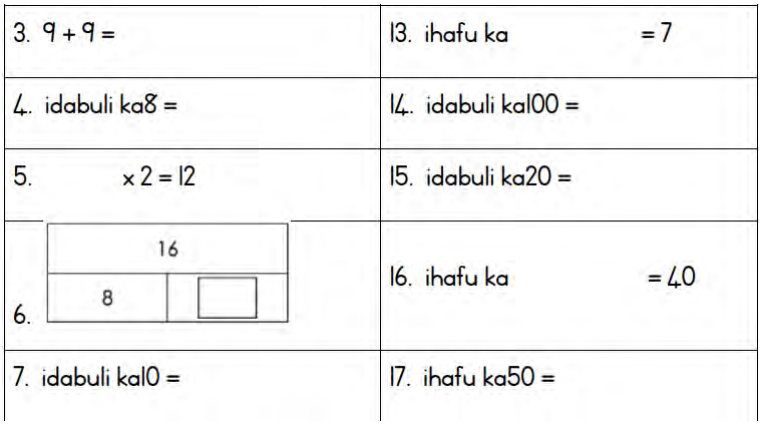
Upon analysis when comparing only the completion of the pre-test, out of 37 learners 33 managed to finish writing the English test and only 26 out of 36 managed to finish writing the isiXhosa test. The total number of learners varied between the two days due to absenteeism. This noticeable difference could be due to the slower pace the learners displayed when completing the isiXhosa test because the tests are timed to encourage fluency. This then led me to adapting all the worksheets and post-test to the transliteral version which displayed in Figure 1 below. The transliteral translations follow the translanguaging trend, where the number names are kept in English, but the interaction is in isiXhosa. Some of the isiXhosa words and

prefixes that appear on the documents are transliterated, for example "*idabuli ka6 ngu12"* instead of "*isiphindwa se6 ngama12"*. This type of language use resonates with the way they regularly speak.

The highlighted text is the text that causes confusion due to the ambiguous meaning of '*phinda kabini'* and the prefixes are better suited when the numbers are written in isiXhosa rather than the numerals.



The unmodified Pre-test



The modified Pre-test

Figure 4.3 *A comparison between the original pre-test and the moderated pre-test.*

The prefix *"yama"* in isiXhosa is used for indicating a plural noun and needs to be in agreement with the correct noun class. For example, eight, nine, eleven and twenty are all plural numbers but in isiXhosa they have different prefixes; *isi8 (isibhozo), li9 (lithoba), i11 (ishumi elinanye)* and *ama20 (amashumi amabini).* This becomes challenging to read when the numbers are written in symbols and not the number names. A learner is left to first figure out the quantity of the number and then link it with the prefix (as in fig. 1-1). Whereas if the learners use English number names, the prefix remains the same for all numbers, *ka-* (as in fig. 1-2) and there is no

need to figure out the agreement of the prefix and the noun class. Another constraint is the interpretation of the number symbols with a dash (–) in front as in Figure 1. The dash sign in mathematics can mean a negative number if placed in front of a digit. These challenges then eliminate the fluency in calculating and hence the slower pace.

In developing the modified pre-test, I employed the translanguaging technique, incorporating and effectively blending English and isiXhosa to formulate instructions that facilitated easy comprehension for the learners. This aligns with Baker's (2011, p. 288) notion of "translanguaging," emphasizing the cognitive process of utilizing two languages for generating significance and expertise. Integrating learners' existing linguistic competencies in mathematics education acknowledges their familiarity with English-derived terms and fosters a comfortable learning environment. Translanguaging contributed to effective communication and comprehension, promoting inclusivity and cultural relevance while optimizing mathematical assessment in the bilingual education setting. Further research is warranted to explore broader implications and long-term impacts on learners' proficiency.

During the first lesson, I presented the class with options of words that I may use during our interaction. In table 4.6 below the first choice was between English number names and isiXhosa number names, the entire class unanimously agreed that using English number names was much better for them. We then looked at the terms that I had brought and presented them with the following options:

Table 4.6 *Terms that appear in the existing MSAP isiXhosa Teacher Guide vs the proposed terms*

English Terms	**Terms in the MSAP isiXhosa Teacher Guide**	**Proposed terms**
Double	Uphinda kabini	Idabuli
Half	Ihafu	Ihafu
To separate	Ukwehlela	Ukohlula
Double of -	Isiphindwa	Idabuli ka -

The learners preferred *idabuli* to *uphinda kabini* saying that the latter option sounded ambiguous to multiplication and they use *idabuli* when they communicate. In the isiXhosa

version, the transliteration approach is used to translate the term “half” and this is user friendly for the learners. The third option was *ukohlula* rather than *ukwehlela*, and their justification was that *ukwehlela* in their dialect meant to decrease or to go down which was not the intended meaning for the specific instruction. The last word the learners chose was *idabuli* instead of *isiphindwa,* they said that they understood *isiphindwa* to be a multiple of a number. This therefore meant that if I ask for *isiphindwa sika12,* they will give me a multiple of 12. This is a good example of the lost intended meaning.

4.4.3 Phase 2 - Focus Group Discussion

The aim of this cycle was to establish the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that was developed. This therefore answers the third research question that states, (3) what are the perspectives and pedagogical insights of the critical friends on the isiXhosa vocabulary that would have been developed?

After the first round of the full set of eight lessons and their pre and post-tests, I sat with my critical friends that observed our lessons.

In discussing the lessons with the two Grade 3 teachers and their school principal we were guided by the following questions:

1. What is your perspective on the use of colloquial isiXhosa in the classroom?
2. What is your opinion of the translation of the two programs, Bala Wande and/ MSAP?
3. What do you notice on my language use during the lesson?
4. Is the use of colloquial isiXhosa and English (translanguaging) useful in mathematics lessons? Why?
5. What is your perspective on use of English number names?
6. Comment on changes on the pre-test.
7. What would you change in my lessons?

The questions were presented to the critical friends in both English and isiXhosa. This allowed for everyone to freely communicate in their most proficient language. The discussion was done in a Grade 3 class, because I felt that it was a less intimidating space for them. I recorded the

discussion with their permission and then transcribed and partially translated the discussion as in Appendix M. The way they use language is noteworthy as they use a lot of translanguaging. This can be seen in the extracts below and the transcribed discussion in Appendix M.

4.4.4 The Critical Friends' perspectives

The two teachers who participated as critical friends in this study hold significant positions in the Foundation Phase at the school. MaGaba serves as the Departmental Head, while Gcwanini is a senior teacher. Recognizing their roles is crucial, as both have considerable influence within the school.

The data indicates that while the teachers are yet to incorporate MSAP due to perceived lack of training and unfamiliarity with calculating strategies, they are actively using Bala Wande and finding it beneficial in conjunction with the Department of Basic Education (DBE) workbook. In the focus group discussion Gcwanini said:

> *"ewe ezincwadi zimbini ziyangqinelana because ukuba ndenza i-multiplication kuBala Wande, siya siye kwiDBE (the workbook) kula page uyabona, so ziyangqamelana nale kaDepartment (the workbook). Kodwa kuBala Wande ba bhale ngesiNgesi nesiXhosa kodwa ke thina sisebenzisa isiXhosa. Kuba naxa usiya kwiDBE ufika kwiDBE lambuzo ububuzwa kuBala Wande ukhona kwiDBE."* (Yes, these two books are complementary because when I do multiplication in Bala Wande, we proceed to the same section in the DBE workbook. But the Bala Wande books are written in both isiXhosa and English but we use isiXhosa.).

The hesitation to adopt MSAP stems from teachers' lack of awareness and familiarity with the books and calculating strategies. This indicates a potential gap in professional development that, if addressed, could improve teachers' confidence and competence in using MSAP. Implementing effective training programs would empower teachers to integrate innovative approaches into their mathematics instruction.

While teachers may not yet be familiar with MSAP, they are actively using Bala Wande and appreciating its utility. The positive reception of Bala Wande indicates that teachers are open to incorporating supplementary materials into their teaching practices. The complementarity of Bala Wande with the DBE workbook underscores the potential for a well-rounded instructional

approach, combining different resources to enhance learners' understanding and skills. MaGaba resonates with this by saying:

> *"And ke thina asikazisebenzisi ezincwadi zakho. Sisaqhuba ngoBala Wande. Asikazinikwa ezi thina."* (We have not started using these books that you are using [the MSAP teacher guide] We are still using the Bala Wande books. We have not received these ones [MSAP] yet.

Teachers express a commitment to maintaining strict language rules, adhering to formal "standardised" isiXhosa. This commitment aligns with established language policies, ensuring consistency and adherence to educational standards. However, the teachers also acknowledge the efficacy of a more flexible language approach in promoting rapid pace and fluency in mental mathematics, as observed in my interaction with learners. Magaba says:

> *"Ibengaba ke kunzinyana ke kufuneka ucacisele ngesiXhosa"* (It is a bit difficult to
>
> explain their thinking in isiXhosa)

While Gcwanini agrees that:

> *Yena ihafu uyibhala ngehlobo lesiXhosa kodwa yena abe eyibiza esithi yihafu. So khange ndifumane bunzima after uphumile eklasini.* (The learner uses the term half, but writes it in isiXhosa (*ihafu*). So I did not struggle after you left the classroom)

She also adds that:

> *"Bayakwazi kengoku ukuzimela nokuphendulela ngendlela oye wabafundisa ngayo, ingeyiyo indlela mna endibafundisa ngayo."*(The learners are able to work out answers on their own without my help because of the way you have been teaching them which is different from the way I teach them).

A noteworthy finding is the teachers' fear of deviating from the language policy, even when recognizing the potential benefits of a more flexible approach. This fear may stem from concerns about violating established standards and regulations. MaGaba says:

> *"Kaloku wena Tabisa, umthetho uthi masifundise ngesiXhosa, then xa kufika umhloli apha ndibe mna ndikhumsha, ndisengxakini. So siyazama ukuhlala apha esiXhoseni.* (By law we must teach in isiXhosa. I can't be teaching in English and when an official comes to visit they reprimand me for not teaching in isiXhosa.

She also says earlier in the discussion:

> *ezindlela zokubala ziboniswa apha asizazi thina, thina sazi ezisizaziyo. Ngoku xa kuthi gqi lencwadi* (pointing to MSAP) *sifunda iindlela ezintsha, so ngaske siboniswe uba siyisebenzisa njani.* (These calculating strategies are not the ones we know and use. So when this book [pointing at MSAP] comes we learn new ways, so it would be nice to be trained on how to use it)

Addressing this apprehension requires a nuanced approach, possibly through targeted professional development and open dialogues that reconcile the benefits of language flexibility with policy adherence.

The analysis reveals a complex landscape in which teachers are open to innovative teaching tools like Bala Wande but face barriers in adopting MSAP due to training and familiarity issues. Additionally, the tension between language policy adherence and recognizing the effectiveness of a more flexible approach poses a challenge. A comprehensive strategy that addresses training needs, highlights the benefits of innovative tools, and navigates the complexities of language policies is essential to support teachers in enhancing mathematics instruction in the classroom.

4.4.5 Feedback from the principal

This analysis examines the positive feedback from the principal regarding the incorporation of isiXhosa in mathematics instruction, highlighting the increased engagement of learners. The principal's endorsement of leveraging learners' home language in the classroom setting signals a significant opportunity for promoting inclusive pedagogical practices and potentially influencing school policy. Dibashe says:

> *"For me i-use* (the use) *of colloquial isiXhosa okanye le translanguaging in the classroom, I think is the right way to do because now abantwana ilanguage esetyenziswayo now abantwana bayayi understanda because yilanguage esetyenziswayo ekhaya as well. So akukho point yokuba uze namagama esiXhosa angasetyenziswayo even nasekhaya".* (For me the use of colloquial isiXhosa or translanguaging in the classroom is the right way to do because now the learners understand the language because they use it at home as well. So there is no point of using isiXhosa vocabulary that is not even used at home.)

Dibashe continues that:

> *"So if kusetyenziswa ilanguage abantwana abayisebenzisa nasekhaya, umzekelo umntana uyathunywa ekhaya kuthiwe makayayokuthenga ihafa dazin yamaqanda, umntana okwa grade 1, umntana aze nehafa dazin yamaqanda. Ihafa dazin yintoni ilangauage? iyiEnglish but umntana uyayazi into yokuba le hafa dazing uyithatha as ilanguage esetyenziswayo, uyayazi ukuba ekhaya ihafa dazin yintoni na."* (So if we use the language that the learners use at home, for example when a child is sent to buy a half dozen of eggs, a learner in grade 1, the learner returns with the half dozen of eggs. What language is half dozen? It's English but the learner knows that what a half dozen is because it is the language they use at home.)

The principal's recognition of the effectiveness of isiXhosa in teaching mathematics underscores the importance of culturally responsive instruction. By acknowledging the language spoken at home and its potential impact on learner engagement, the principal demonstrates a commitment to meeting learners' diverse needs and capitalizing on their linguistic assets. The observed increase in learner engagement suggests that incorporating familiar language elements can foster a conducive learning environment that resonates with learners. Dibashe says that:

> *"Ndicinga ilanguage oyisebenzisayo nje ngokuba besenditshilo pha ekuqaleni, ilanguage oyisebenzisayo yilanguage eyabantwana abafikelelayo kuyo."* (I think the language you used is accessible to the learners.)

He adds that:

> *"Akukho point yokuba sisebenzise ilanguage abantwana babe befuneka batransleythe ilanguage kuqala, and babe benga understandi le language, bazanga understandi nalento uyifundisayo. But kuba ubusebenzisa le language ubuyisebenzisa ibangele abantwana ba-understande yonke lento ubuyenza nabo."* (There is no point of using a language where the learners have to first figure out what you are saying, they will not even understand what you will be trying to teach them. But because you were using a language that is accessible to them, it helped them understand the mathematics.)

The principal's intention to advocate for the adoption of language-inclusive policies represents a proactive step towards promoting educational equity and inclusivity within the school community. By advocating for the incorporation of isiXhosa and English translanguaging in

mathematics instruction, the principal aims to create an environment where learners feel valued and empowered to express themselves in their native language. Such initiatives not only enhance learner learning experiences but also contribute to preserving cultural heritage and promoting linguistic diversity.

> *"and also nasemakhaya xa kubalwayo akuthiwa nye, khandiphathele into enye, sithi into ey-one. "Akuthiwa iza nezilishumi elinambini, kuthiwa twelve"* (At home they don't talk of bringing 'nezilishumi elinambini' (isiXhosa number name for 12), they say twelve)

He adds that:

> *"Ndiyacela ukubangaba ninayo indlela xa utitsha ukuba ukutsheka ukuba abantwana baya-understanda lento uza nayo ngesiXhosa, khakhe uyikhangele nange English."* (I plead that [addressing the teachers] if there is a way that when you teach, that you check that they understand what you are teaching in both English and isiXhosa)

The proposed advocacy to institutionalize language-inclusive practices through the School Governing Body (SGB) carries significant implications for educational policy and decision-making. Embedding language-inclusive policies within the school framework reflects a commitment to embracing cultural diversity and fostering inclusive learning environments. The SGB's endorsement of such policies can pave the way for systemic changes that prioritize the linguistic and cultural needs of learners, promoting a more holistic approach to education. Dibashe contributes that:

> *"And mna ndizobaxelela nakwiSGB uba yenziwe lento apha sayibona, iyasebenza."* (I will even tell the SGB that we witnessed this thing [translanguaging technique] work well with our learners.)

While the principal's advocacy for language-inclusive mathematics instruction is commendable, challenges may arise in implementing and sustaining such initiatives. Resistance to change, logistical constraints, and the need for additional resources may pose obstacles to effectively integrating isiXhosa into the curriculum. Furthermore, ensuring alignment with curriculum standards and educational guidelines is essential to maintaining academic rigor and coherence.

The principal's endorsement of language-inclusive mathematics instruction reflects a progressive approach to promoting educational equity and cultural responsiveness within the

school community. By recognizing the value of learners' home language and advocating for its integration into classroom practices, the principal underscores the importance of embracing linguistic diversity as a catalyst for learner engagement and academic success. Moving forward, collaborative efforts among school stakeholders, including teachers, administrators, and the SGB, will be essential in realizing the vision of a language-inclusive educational environment that empowers all learners to thrive.

4.4.6 Cycle 2- Teaching Grade 3B

In this section I explore the impact of language dynamics on learner performance, particularly in my interaction with Grade 3B class. Through my efforts to enhance preparation by translating materials and making minimal adjustments (see Appendix L), valuable insights were gained into learner response patterns and the profound influence of language on both communication and comprehension. This can be seen in the extract below of the table of lesson observations from Grade 3B, where the learners respond rapidly.

Table 4.7 *Lesson Starter 3: The learners responding at a faster pace (Grade 3B)*

Lesson Observation Grade 3B		
Lesson	**Observation Description**	**Learners' contributions and Time of contribution in the Video**
Day 3 – Lesson Starter 2	Lesson took 11 minutes We quickly recapped on what we had done yesterday. The learners were very responsive and knew the work. The pace of the lesson was rapid and quick. The learners knew their answers and their language use was comfortable.	**<u>Video 3</u>** (00:20) Me : *"ngubani kanene ozakusikhumbuza besisenza ntoni izolo?"* ("Who is going to remind us about what we did yesterday?")

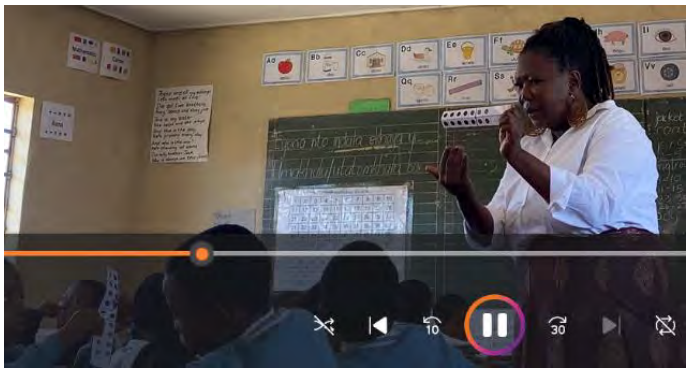


Photo 4 *A snapshot from video 3(Grade 3B)*

I admired the way they helped each other quickly when one learner used the wrong expression. The hands were up and willing to assist the learner with the correct answer.

We wrote down the different ways of expressing the double and half relationship between 6 and 12.

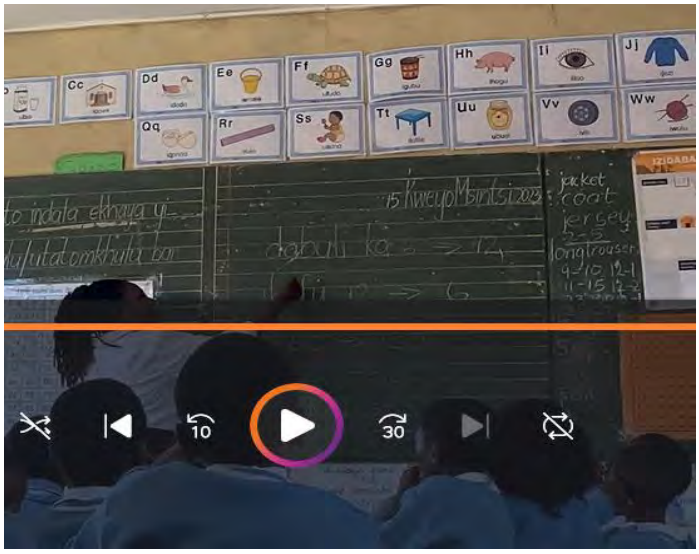


Photo 5 *A snapshot from video 3 (Grade 3B)*

(00:28) Learner: *"besisenza iidabuli"* ("we were doing doubles")

(00:30) Me: *"ewe! Ufunde idabuli, ngubani omnye?"* ("Yes! He learnt about doubles, who else?")

(00:33) Learner: *"Mna ndifunde ngehafu ka6"* ("I learnt about the half of 6")

(00:41) Me: *"ewe! Very nice. Kengoku ngubani ihafu ka6?"* ("Yes! Very nice. Now what is the half of 6)

(00:43) Learner: *"nguthree"* ("It's 3)

(00:45) Me: *"very nice! Ngubani omnye?"* ("Very nice! Who else?")

		(00:50) *Learner: "ihafu ka 5 ngu10"* ("the half of 5 is 10") (1:00) Learners make gruntling noise in reaction to her incorrect answer. (01:02) Me: *"haykaloku, masimncede"* ("No, let's help her") (01:04) Learner: *"ihafu ka10 ngu5"* (The half of 10 is 5) (01:09) Me: *"ewe! But masiyizame ngalandlela ebesiza nayo ngayo yokuqala ngo5"* ("Yes! But I want us to try and say it the way she did by starting with the number 5") (01:12) Learner: *"idabuli ka5 ngu10 misi"* ("double 5 is 10 miss")

Day 5 – Lesson Starter 6	Lesson took 10 minutes Today's warm up exercise was different. We needed to work in pairs and I wanted them to divide themselves into pair. I asked them a tricky question but I could see them quickly applying out calculating skills that we have been learning. The lesson went fast and they demonstrated lovely calculating skills.  **Photo 6** *A snapshot from video 5 (Grade 3B)*	**<u>Video 5</u>** (00:14) Me: *"ok, khanindincede. Ndinee-strips eziyi-fourteen apha ne. Ndifuna unika igruphu nganye zibeyi-two. Kuzophuma iigruphu ezingaphi?"* ("ok, I need your help. I have 14 strips with me. I want to give each group two strips. How many groups am I going to have?") (00:28) Learners: [murmuring] *"zingaphi izitriphu?"* ("how many strips?") (00:30) Me: *"Ziyi-fourteen"* (14) (00:32) *Learner: "zizobayi seven!!"* ("there will be seven!!")

This cycle was implemented during Term 3, by which time the learners had already completed the doubling and halving section as outlined in the annual teaching plans. Consequently, the engagement with this class was anticipated to proceed more swiftly compared to that with Grade 3A. Notably, there was a significant anecdotal encounter with a learner from this class, which I will discuss in detail later in this section.

My comprehensive preparation, characterized by translated materials (see Appendix L) and minimal modifications, yielded positive outcomes during the second-class session. The absence of questions during the test-writing process and the successful completion of the pre-test by all 37 learners indicated a heightened understanding of the assessment materials. This improvement suggests that well-prepared, translated content contributes to a more comfortable and comprehensible testing environment.

A significant observation emerged during learner interaction which was similar to one that occurred in the Grade 3A class, where one learner faced challenges in providing a prompt response due to a preference for answering in isiXhosa, and I assume it could have been influenced by the teacher's presence. In this instance I asked a learner '*idabuli ka 36'* (double 36) the learner knew the answer as but when asked to explain, because the class teacher was present and the language expected in that classroom was formal isiXhosa terms, the learner struggled to explain as this required use of much longer unfamiliar words e.g *'amashumi asixhenxe anambini'* (seventy two).

Table 4.8 *Lesson Starter 3: The learner who struggled with language (Grade 3B)*

Lesson	**Observation Description**	**Learners' contributions and Time of contribution in the Video**
Day 4 – Lesson Starter 3	Lesson took 10 minutes I started off with the usual FIZZ POP game and we used friendly numbers, like double 30, double 20. And the learners would give me the double of the number I call out. For this task we used the 10 dot strips to represent 10s and small blocks to represent 1s. Learners were working in pairs, and I gave each	**<u>Video 4</u>** (02:59) Me: *"Ok khandenzele u36 ke tshomi"* (Ok make 36 for me)

	pair enough strips to build the number doubles that I was calling out. In the task, we had now moved from doubling single digits to doubling double digit numbers. And in the double digit numbers we moved from friendly numbers to slightly challenging numbers such as 35. The learners responded very well to the activity. When we started working with slightly challenging numbers, I had an experience with Limakhwe. I asked for the double of 36 and he stuttered trying to explain his thinking using the correct isiXhosa number name. This took a bit of time and ended up slowing the rapid pace we were going at. I think he was aware of his teacher's presence and did not want to deviate from the way they usually work in the class room because, once I told him to use any language he recited the correct answer. I saw a sense of relief in him once I 'gave him permission' to use any language. The teacher later confirmed that Limakhwe is one of her brightest learners and that he always strives to be perfect.  **Photo 7** *A snapshot from video 4*	(03:01) Learners: [start building 36 with strips and blocks] (03:02) Me: *"yeke, khandibonise ke. Ngubani lona?"* ("Good! Show me. What is this number?") (03:06) Learner: *"ngu-thirty"* ("it's 30") (03:09) Me: *"ngubani lona?"* [putting all the strips together] ("what is this number?") (03:10) Learner: *"ngu-sixty"* ("it's 60") (03:12) Me: *"xa idibene izobangubani"* [putting together the blocks] ("when I put all of them together, what will the number be?")

		(03:14) Learner: *"ngu-twelve"* ("it's 12") (03:16) Me: *"good, ngoku xa zizonke ngubani?"* ("Good, now when we put all of them together how many are there?") (03:18) Learner: *"ngu-sixty six"* ("it's 66") (03:19) Me: *"xa sizidibanise zonke kaloku tshomi"* ("when we are counting everything together") (03:21) Learner: *" oh, ngu…"* [looks around, and to the teacher] ("oh, it's…..") (03:25) Me: *"thetha tshomi, sukoyika"* ("speak, don't be afraid")

		(03:30) Learner: *"ngu-seventy two"* [cringing] (it's 72) (03:33) Me: "good!"

This incident illuminates the intricate interplay between language preferences, cultural factors, and learner communication during important assessments. While the learner's inclination to respond in isiXhosa holds cultural significance, it also resulted in a momentary lapse in recall, underscoring the potential challenges associated with language preferences in multilingual classrooms.

The incident with the learner struggling to answer quickly due to language preferences highlights the imperative for educators to adeptly navigate language challenges. While acknowledging and promoting linguistic diversity remains crucial, strategies to manage language transitions during assessments are pivotal for maintaining the integrity and efficiency of the evaluation process. Recognizing when to provide language flexibility and when to prioritize a standardized language can contribute to a more inclusive and equitable assessment experience.

This incident underscores the necessity of incorporating instructional strategies that specifically address language dynamics in the classroom. Teachers may consider implementing explicit language transition guidelines during assessments, emphasizing the importance of a shared language for efficient communication in testing situations. This approach aims to strike a balance between preserving cultural and linguistic diversity and the necessity for standardized communication in academic assessments.

4.5 CONCLUSION

The analysis highlights the impact of language dynamics on learner performance and communication during a mathematics pre-test. While improved preparation and translated materials contributed to a more positive testing experience, the incident with a learner struggling to answer in isiXhosa underscores the need for thoughtful navigation of language

preferences in the classroom. Balancing linguistic diversity and standardized communication is essential for creating an inclusive and effective learning environment, ensuring that all learners can demonstrate their understanding without unnecessary language-related barriers.

CHAPTER 5: DISCUSSION OF FINDINGS

CHAPTER 5

5. DISCUSSION OF FINDINGS

5.1 INTRODUCTION

This chapter represents the outcome of an extensive research journey, presenting a thorough exploration of the results obtained through the meticulous application of design-based and action research study. This pivotal chapter delves into the diverse array of collected data, resolving the insights, patterns, and fine points embedded within. The empirical evidence showcased here forms the foundation upon which the study's conclusions and implications are built. Each revealed aspect and identified trend contributes to a nuanced comprehension of the research questions, offering valuable insights that transcend the confines of the specific study. As I go through the findings, a comprehensive analysis of the transformed isiXhosa teaching materials is undertaken, providing illumination on their effectiveness, cultural resonance, and pedagogical influence.

5.2 DISCUSSION OF TRANSLATION ISSUES

This section presents a discussion of the findings related to translation issues encountered during the study. The complexities and nuances of translating educational materials, especially in a multilingual context, pose significant challenges that can impact the effectiveness of teaching and learning. By examining these issues, I highlight the underlying factors that affect translation accuracy and clarity, and how they influence both teachers' instructional strategies and students' comprehension.

The analysis draws on data from classroom observations, video recordings, and focus group discussions, providing a comprehensive view of the translation dynamics at play. I explore specific instances where translation difficulties arose, the strategies employed to address these challenges, and the resulting implications for educational practice. Key themes include the consistency and appropriateness of translated terms, the role of cultural context in translation, and the impact of linguistic differences on learners' understanding.

Furthermore, this discussion connects my findings to broader theoretical frameworks and existing literature on translation in educational settings. By doing so, I highlight possible 'best practice' principles and offer practical recommendations for educators and policymakers to enhance the quality of translated materials. Ultimately, this section underscores the importance

of accurate and contextually relevant translation in fostering an inclusive and effective learning environment.

5.2.1 Phase 1 – Document Analysis

In this particular study, the prevalent words involve numbers and concepts used by learners at home, either in English or foreignized isiXhosa (equivalent to indigenized English). For instance, learners tend to be more at ease with employing English terms for numbers and mathematical operations. The document analysis identified specific problematic areas, which encompassed the following issues:

1. Direct translation resulting in a loss of the original intended meaning.
2. Ambiguity within the translations, contributing to learner confusion.
3. Employment of unfamiliar terminology, noticeably affecting the learners' operational efficiency.

5.2.1.1 Reflection and Next Steps:

The design process involved iterative adjustments to address linguistic and cultural nuances, ultimately resulting in successful implementation in both Grade 3A and Grade 3B. Reflection on oversight in test language highlighted the importance of thorough planning and attention to detail. Moving forward, continuous collaboration with critical friends and ongoing adaptation based on learner feedback will be key to refining and enhancing the effectiveness of the instructional approach. The success observed in Grade 3B encourages further exploration and application of culturally and linguistically sensitive teaching methodologies.

In this section, I present and elaborate on two fundamental challenges encountered in the translation process, aiming to provide a comprehensive understanding of the complexities involved. The initial column focuses on the translation of individual words or mathematical terms, as outlined in Table 5.1, while the subsequent column delves into instances where entire sentences are translated, resulting in the loss of the intended meaning. The third column introduces alternative vocabulary unanimously deemed most suitable by the learners in Grade 3A & B class for our lessons, with a particular emphasis on words extensively utilized throughout the doubling and halving unit. The final column elucidates the rationale behind

either adopting or rejecting the proposed changes in the choice of words during the lesson, offering a nuanced exploration of the decision-making process and highlighting the importance of context-aware linguistic choices in effective teaching.

Table 5.1 *Words that are and may be transliterated from English to isiXhosa in the MSAP Teacher Guide.*

English terms	Current MSAP isiXhosa Translation	Possible transliterated isiXhosa Translation	Justification for transliterated version
Doubling	Ukuphinda kabini (Phinda means kubini means to multiply two times)	Idabuli	More relatable
Halving	Ihafu	Ihafu	The only transliterated word in the teacher guide
Number names	Original isiXhosa number names e.g. Ishumi elinesihlanu	English number names e.g. fifteen	too long for rapid recall
Number name prefixes	Prefixes suited for isiXhosa number names e.g. 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

5.2.1.2 Explaining the justification for the transliterated versions in Table 5.1

• The term 'idabuli' is selected due to its clear and unambiguous meaning, making it more relatable to learners, who frequently use the term in everyday language. This choice is preferable to 'ukuphinda kabini,' which might lead to misinterpretation, potentially associating it with multiplication, a concept introduced during the times tables in Grade 2.

• The length of isiXhosa number names is considered impractical for the exercise's nature, which demands a brisk pace and fluency. Using English number names streamlines the process, as all number names fall under a single noun class, eliminating the need for varied prefixes.

• In isiXhosa, the term 'ahlobeneyo' is misleading, as it means 'that are related' and not 'friendly.' The accurate term, 'anobubele,' is more relatable to learners and aligns with their linguistic understanding.

• The term 'iziphindwa' is not commonly used, and learners express a preference for 'idabuli,' indicating a linguistic choice that resonates more effectively within the learning context.

In Table 5.2, I illustrate specific cases of expressions identified in the existing MSAP isiXhosa teacher guide, where the meaning is compromised, or linguistic rules are violated due to direct translation without contextual consideration. While there are numerous errors within the translated teacher guide, for the sake of brevity, I have selected two instances that aptly exemplify the types of distortions examined throughout this study. These examples are chosen to offer a representative snapshot of the prevalent issues observed in the broader dataset, demonstrating the challenges arising from direct translation and underscoring the need for a more nuanced approach to preserve meaning and linguistic integrity in educational materials.

Table 5.2 *Examples of phrases that have lost meaning due to 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*	**"***Kunezakhono zokukhumbula*	"Ukuze abafundi bafunde ukubala	Possible Spelling errors and direct

that learners need in order to learn doubling and halving" Pg. 51	*ngokukhawuleza ezintathu ekufuneka abafundi e benazo ukuze bafunde ukuphinda kabini kunye nehafu***"** pg 52 (There are skills that learners needed in order to learn multiplying by two and a half)	ngedabuli nehafu, kufuneka babenezizakhono zilandelayo"	translation leading to distorted meaning
"*Now tell me the doubles sentence for the fingers I show*." Pg. 54	"*Ngoku ndixelele iziphindwa zezivakalisi zale minwe ndiyibonisayo*." Pg. 55 (Now tell me the doubles of the sentences of the fingers I am showing)	"Sithini isivakalisi sedabuli saleminwe ndiyibonisayo"	Direct translation, not contextualising the use of the word "sentence" and therefore leading to distorted meaning.

5.2.1.3 Explaining the justification for the proposed translations in Table 5.2

• The incorrect prefix ('abafundi e benazo') is utilized in reference to learners possessing the required skills. The accurate prefix is 'ba,' designated for plural nouns in class 2, ensuring linguistic precision. The correct translation should read "abafundi babenazo" , which is the correct translation of the original text.

• The inclusion of the unfamiliar term 'iziphindwa' may lead to confusion for the teacher and among learners. The intended focus is on the doubles related to fingers, not the sentence itself. Choosing a more familiar term enhances clarity in communication and comprehension. A more relatable term would be 'iidabuli zika' instead of 'iziphindwa' which means 'the multiples of'.

In the next section I provide a detailed analysis of a full extract from the Doubling and Halving Unit in the English Teacher Guide and the isiXhosa teacher guide 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 5 provides the original English version and the intended meaning.

Figure 6 shows the distortion in meaning that occurs throughout the MSAP isiXhosa Teacher Guide due to direct translation and not taking into consideration the context.

Figure 5.1 *extracted from page 60 in the MSAP English Teacher Guide*

Task Sequence

In this lesson we practise doubles of multiples of ten.

Note: The dot strips are available in the Print Master book.

Problem: Connect double 3 = ☐; double 30 = ☐

Use six 10-dot strips and arrange them to show double 30.

Teacher: We know double 3 = 6, so what is double 30?

Learners: 60

Teacher: Double 30 is 60, so what is half of 60?

Learners: 30

Write the number sentences as shown, and point out that 6 and 60 are connected just like 3 and 30. Tell learners to remember that doubles and halves are connected.

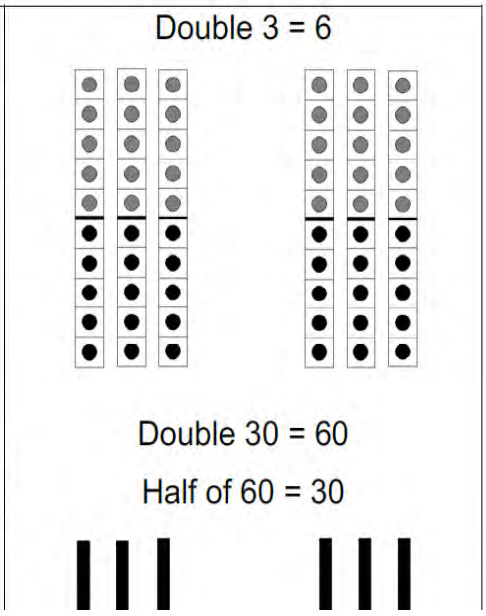
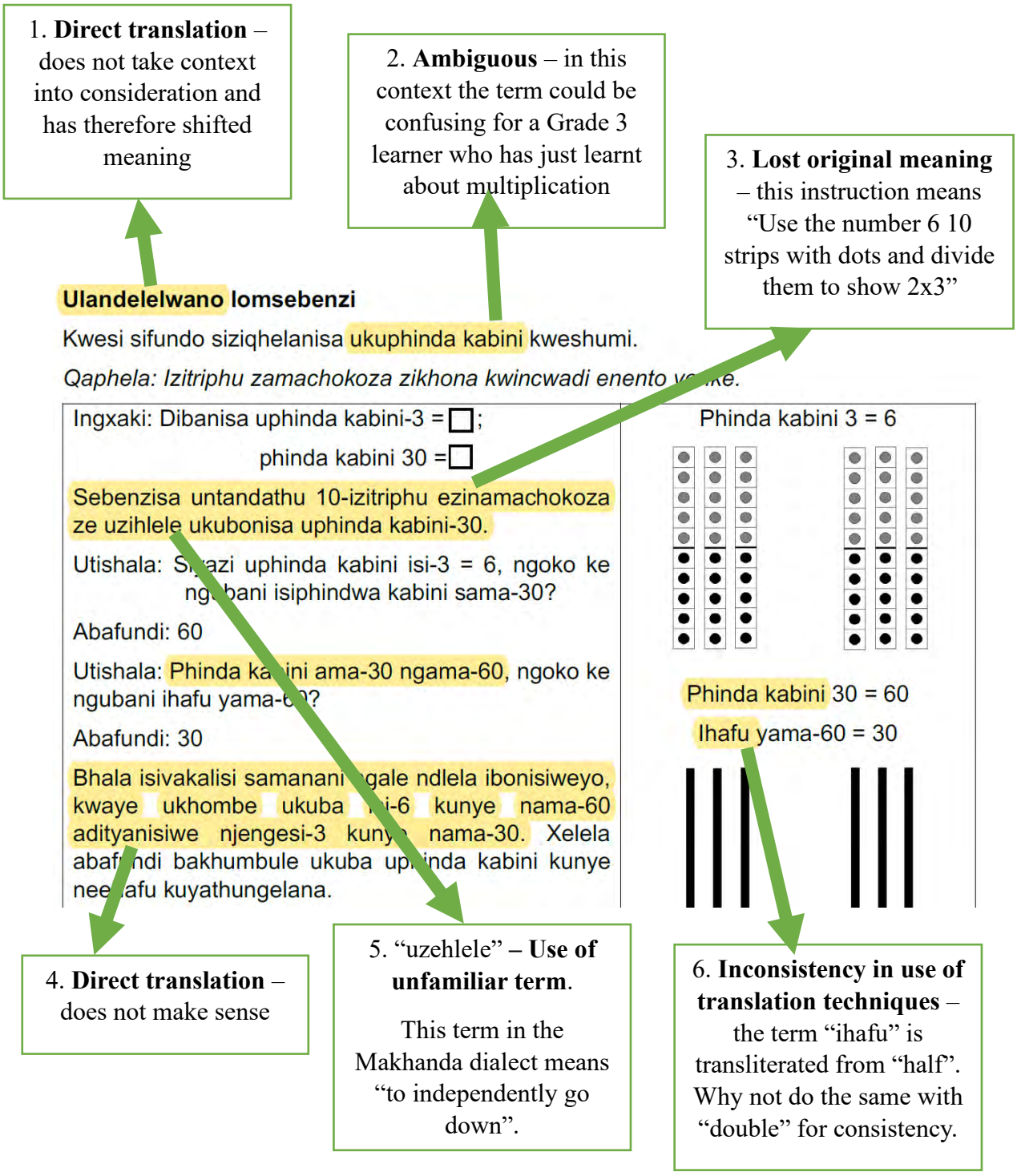


Figure 5.2 *extracted from page 62 in the MSAP isiXhosa Teacher Guide*



5.2.1.4 Explanation of points in Figure 5.2

- *'Ulandelelwano' (sequence) is mistakenly translated as an adjective instead of a noun, deviating from its intended role in the English version. This alteration shifts its meaning*

from explanatory to descriptive. This shift has potential to slow the teacher down from understanding what is required of her/him.

- *'Ukuphinda kanbini' carries the additional meaning of multiplication by two, particularly emphasized in Grade 2, posing potential confusion for Grade 3 learners. This ambiguity has potential to affect one of the skills that are meant to be developed by the doubling and halving unit in the MSAP, the ability to recall halves up to 10 rapidly.*
- *Direct translation results in a sentence with altered meaning, now instructing, "Use the number 6 10 strips with dots and divide them to show 2x3," contrary to the intended depiction in Figure 5. The aim of the activities is to practice the calculating strategies, however if the instruction is distorted then the development of the skill is missed.*
- *Direct translation (i.e., word for word) has rendered the sentence nonsensical, now conveying, "Write a number sentence in the way you have been shown and point out that 6 and 60 are together, just like 3 and 30." Similar to the above example, the teacher and the learner are left to figure out what they are meant to understand from the instruction, unless they have an English translation at their disposal.*
- *The term 'uzihlele' presents a dialectical difference for isiXhosa speakers in Makhanda, meaning to independently roll or decrease, rather than to separate. The use of unfamiliar terms has potential to again, shift the meaning that is intended by the instruction.*
- *The term 'ihafu' is transliterated, but the rest of the text remains unchanged. While there is an isiXhosa word for half ('isiqingatha'), it is possibly omitted in the translated teacher guide due to its unfamiliarity among young isiXhosa speakers. The lack in consistency in the translation of the document appears to be the major issue. Some words are transliterated, meaning this technique of translating is acceptable. However, it is not used throughout the teacher guide.*

5.3 DISCUSSION OF NATURE OF LANGUAGE USED IN A FP CLASSROOM

The following section delves into the discussion of the findings related to the nature of language employed in a foundation phase classroom. This analysis sheds light on how linguistic practices influence learning experiences and outcomes among young learners. By exploring the dynamic interactions and language use observed in the classroom, I have developed an understanding of

the role of translanguaging and other linguistic strategies in facilitating comprehension and engagement.

Through this discussion, I examine key themes and patterns that emerged from the data, including the ways in which language choices impact both teaching and learning processes. The insights gained from video-recorded lessons, transcriptions of critical incidents, and focus group discussions with critical friends provide a rich foundation for this analysis. I explore how the integration of isiXhosa and English in classroom instruction aids in vocabulary development, comprehension, and overall cognitive growth.

Furthermore, this section addresses the pedagogical implications of these findings, offering recommendations for educators on effective language use in multilingual classrooms. By linking the empirical evidence to broader educational theories and practices, I contribute to the ongoing discourse on language education in the foundation phase. This discussion not only highlights the practical applications of this research but also underscores the importance of language diversity and inclusivity in early childhood education.

5.3.1 Cycle 1 & 2 – Lessons with Grade 3A and B

In addressing my primary research question, the translation of the original MSAP to isiXhosa exhibits distortions, resulting in a loss of meaning. To illustrate, within the unit centered on doubling and halving strategies, an instructional sentence directed at the teacher reads, "Use six 10-dot strips and arrange them to show double 30" in the English Teacher guide on page 60. However, the isiXhosa translation reads, "Sebenzisa untandathu 10-izitriphu ezinamachokoza ze uzihlele ukubonisa uphinda kabini-30," which translates to "Use the number 6, 10 strips with dots and divide them to show double 30." This direct word by word translation neglects the context and syntactic rules, resulting in a deviation from the original intended meaning. The translated isiXhosa instruction introduces elements that are not present in the English text, such as the mention of division and ten strips (Mpalami, 2022).

Moreover, the challenge of translating mathematical concepts is highlighted, as some concepts lack direct equivalence across languages and cultures. As an example, the concept of "zero" did not exist as a number in certain cultures until introduced through contact with others (Ogbu, 1985). Therefore, accurate translation of mathematical concepts requires meticulous consideration of linguistic, cultural, and historical factors. Additionally, the potential ambiguity

of mathematical terms and symbols, each carrying multiple meanings in different contexts, poses a risk of confusion and misunderstanding (Feza , 2016). For instance, in isiXhosa, 'phinda kabini' signifies both "multiply by 2" or "double," while 'ukohlula' can mean either "divide" or "share," contingent on the context. Translators must possess a nuanced understanding of the various meanings of mathematical terms and symbols to accurately convey the intended message.

Mpalami (2022) emphasizes that learners faced difficulty comprehending tasks when translated into their mother tongue, preferring the English version. This phenomenon, observed in a Grade 11 class, likely resonates with some of the challenges highlighted in this study and encountered in the Foundation Phase. This research and that of Mpalami highlight the importance of effective translation strategies, and of considering learners' linguistic competences and preferences for meaningful pedagogical impact.

5.3.2 Discussion with Critical Friends

In addressing the third research question, which explores the perspectives and pedagogical insights of my critical friends regarding the development of isiXhosa vocabulary, a divergence of opinions emerged among teachers and the principal. While some viewpoints were congruent, others displayed marked differences.

Teachers expressed a sense of satisfaction in witnessing their learners engaging freely in class discussions. However, their contentment was tempered by concerns about the casual use of language. They conveyed apprehensions, emphasizing that teaching in a "standardized" isiXhosa was a requisite, as per feedback received from subject advisors during school visits and moderation. This concern underscores a perceived lack of flexibility (Majola, 2022) that teachers believe they are permitted to exercise within their classrooms. When probed about their thoughts on translanguaging, teachers expressed a positive inclination towards the concept but were hesitant to incorporate it into their teaching practices due to the perceived rigidness (Jack, 2022) imposed by educational standards.

Conversely, the principal advocated for a relaxation of the rigid language norms in the classroom. This perspective may be influenced by the hierarchical dynamics within the school, where teachers may feel obligated to adhere strictly to instructions from subject advisors who hold a superior position (Feza, et. al, 2022). The principal, holding a leadership role and possessing a Master's degree, could be driven by a belief that a more flexible approach to

language instruction is conducive to effective pedagogy. The varying opinions of teachers and the principal highlight the potential impact of their respective positions and roles within the school environment on their perspectives regarding language use and instruction.

5.4 CONCLUSION

In conclusion, this chapter has shared valuable insights into the language dynamics within the context of Grade 3 friendly isiXhosa vocabulary development. The diverse perspectives of the critical friends have been systematically presented, shedding light on the intricate relationships between language preferences, cultural influences, and pedagogical practices. The divergence of opinions among educators and the principal underscores the nuanced challenges faced in reconciling standardized language requirements with the desire for more flexible teaching approaches. The identification of concerns related to the casual use of language and the hesitation to embrace translanguaging further highlights the complexities surrounding language instruction in multilingual classrooms in South Africa. As I reflect on these findings, it becomes evident that the study's contribution lies not only in unveiling the current state of language dynamics but also in paving the way for targeted interventions and strategies to enhance isiXhosa vocabulary development within the South African Foundation Phase educational setting. This chapter sets the stage for the subsequent discussion, interpretation, and implications, providing a robust foundation for the study's broader significance in the field of language use in early Grade education.

CHAPTER 6:CONCLUDING DISCUSSION

CHAPTER 6

6. CONCLUDING DISCUSSION

6.1 INTRODUCTION

In this concluding chapter, I bring together the threads of my exploration into the complex landscape of language dynamics and isiXhosa vocabulary development within the South African multilingual educational context. Throughout the study, I have delved into the perspectives of critical friends, uncovering multifaceted insights into the challenges and opportunities associated with the nature of language use in the instruction of mathematics in the Foundation Phase classroom. As I navigate the concluding chapter, I synthesize the findings, discuss their implications, and offer recommendations for educators, policymakers, and researchers. The culmination of this study not only contributes to the existing body of knowledge on language dynamics but also provides practical insights for enhancing the effectiveness and inclusivity of language instruction in South African multilingual classrooms. This chapter serves as the culmination of my journey, offering a holistic perspective on the implications and significance of the findings for the broader educational landscape.

6.2 REITERATION OF RESEARCH QUESTION AND OBJECTIVES

The primary aim of this study was to employ design-based research and action research methodologies to investigate the dynamics of language use in a South African Foundation Phase mathematics classroom. The focus centred on the implementation of the MSAP isiXhosa teacher guide, particularly within the doubling and halving unit. The research objectives encompassed exploring the enablers and constraints encountered during the mediation of doubling and halving calculating strategies using the MSAP teacher guide, developing relatable isiXhosa vocabulary for teaching these strategies, and discerning the perspectives of critical friends on the developed isiXhosa vocabulary. These objectives guided the formulation of specific research questions aimed at comprehensively addressing the intricacies of language dynamics in mathematics instruction within the South African Foundation Phase context.

In pursuing these objectives, the study addressed three fundamental research questions:

- What enablers and constraints are experienced by teachers when mediating doubling and halving calculating strategies in isiXhosa?

- What key terms and phrases (vocabulary) are essential for teaching doubling and halving in isiXhosa?
- What are the perspectives and pedagogical insights of critical friends regarding the isiXhosa vocabulary developed in the process?

Through a meticulous exploration of these research questions, the study aimed to provide practical insights into enhancing mathematics instruction in isiXhosa within the Foundation Phase, contributing valuable knowledge for educators and policymakers alike.

6.3 SUMMARY OF KEY FINDINGS

The research is essentially structured to evaluate the convergence or divergence of elements such as linguistic fidelity, terminological coherence, conceptual exactitude, and cultural congruence 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 Jackson and Amvela (2007), 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 above example. In the isiXhosa MSAP teacher guide the translation of the terminology is not consistent. Some terms are formed through transliteration while in others, their original isiXhosa terms are used. 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). 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 they may not be familiar with it. However, due to 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, Taljard, & De Schryver, 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 due to 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.

6.4 IMPLICATIONS DERIVED FROM THE STUDY

The tables and figures shared in the previous chapter 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 I suggest that the following strategies be implemented and researched:

- Standardizing 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 appeared to be the most accessible method to the learners in this study, as it retains familiar English terms while altering their orthography. Transliteration may thus be a good option when conducting translations across languages.

In essence, this study advocates for a nuanced and thoughtful approach to translation, acknowledging the intricacies of language and emphasizing 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.

First and foremost, 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.

Additionally, 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 prioritizes 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 optimize clarity and instructional effectiveness.

6.5 ETHICAL CONSIDERATIONS

I have meticulously adhered to all ethical considerations outlined at the commencement of the study. Preserving individuals' anonymity was prioritized, achieved through the use of [2]iziduko for identification purposes, while also withholding the identity of the school under investigation. The inclusion of photographs was avoided, and transcripts of interviews were shared with critical colleagues for additional scrutiny. Throughout the study, learners, guardians, and critical peers were provided the option to withdraw at any stage, yet none chose to do so. To safeguard confidentiality, the raw data is stored on an external USB drive, securely locked with a passcode known only to me. This approach ensures the utmost privacy and ethical integrity in handling and safeguarding the study's data.

6.6 STRENGTHS AND LIMITATIONS OF THE STUDY

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 recognizes 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 study has undertaken a comprehensive comparative document analysis, focusing on the translation quality and conceptual fidelity of the MSAP and other mathematics teaching materials within the South African context. The study not only highlights the disparities in linguistic fidelity, terminological coherence, conceptual exactitude, 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.

[2] Iziduko – general family clan names

6.7 RECOMMENDATIONS FOR FUTURE STUDIES

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 due to unfamiliar terms, emphasize the importance of translanguaging and consideration of translation theories in the translation process.

The study provides practical recommendations for improving the effectiveness of translated materials, advocating for translanguaging approaches, the application of translation theories, and the use of transliteration to strike a balance between linguistic fidelity and pedagogical efficacy. By embracing these recommendations, educators can ensure that translated materials facilitate comprehensive and accessible education without compromising their intended purpose. The research also offers educators alternative approaches to utilizing translated materials that may initially seem restrictive. This is achieved by illustrating my application of translanguaging and involving my learners in the selection of isiXhosa vocabulary, ensuring it is accessible and user-friendly.

Looking ahead, the study recommends 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 strict 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. Similarly a collaborative and comprehensive approach would be likely useful for the translation and development of teaching materials across other South African languages.

In essence, this thesis 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.

6.8 MY REFLECTION

During my undergraduate studies, I engaged in translating teaching and learning materials for the South African Numeracy Chair, a practice that allowed me to apply the translation techniques honed during my isiXhosa Mother Tongue Translation class in the second year of my Bachelor in Education program. Having been educated in English throughout my schooling, this experience was particularly valuable, even though I encountered frustration with the materials used during my studies and subsequent teaching in schools.

This study has significantly broadened my understanding of the pivotal role that teaching, and learning objectives play, emphasizing the profound impact language can have on these objectives. It has underscored the critical importance of comprehending South Africa's Language in Education Policy. In the realm of teaching mathematics, the language employed in the classroom should not be perceived as a hindrance; rather, it should be viewed as a facilitative tool. The goal is for language to assist teachers in imparting knowledge without distortion, focusing on ensuring learners develop their calculating skills at the required pace.

My perspective on the use of colloquial isiXhosa in teaching mathematics has evolved through this study. I recognize the potential benefits of employing isiXhosa number names, especially in topics like place value, where their descriptive nature can offer clarity. However, their extended length poses challenges for the intended rapid recall and the fast-paced learning required for the MSAP calculating strategies.

Presenting snippets of my study at two SAARMSTE conferences was a fortunate opportunity that significantly boosted my research confidence. Engaging with esteemed colleagues provided me with valuable ideas and suggestions, contributing to the refinement of my work. These experiences collectively enriched my research journey, fostering a deeper understanding of the complexities surrounding language use in mathematics education.

6.9 CONCLUSION

In conclusion, this study has delved into the intricate interplay of language dynamics within the South African educational context, specifically focusing on the development of isiXhosa vocabulary used in Grade 3 classroom when teaching the doubling and halving unit of the MSAP. Through a thorough exploration of critical friends' perspectives, a nuanced understanding has emerged. The findings underscore the challenges and complexities inherent

in maintaining a balance between standardized language requirements and the desire for more flexible, inclusive teaching practices. The reluctance of teachers to embrace translanguaging reveals the perceived constraints imposed by educational standards in the South African context. The principal's call for a more relaxed approach signifies a potential shift in the pedagogical landscape. As we navigate the evolving landscape of language instruction, it is essential to consider the diverse perspectives and positionalities of educators and leaders, paving the way for future research and the implementation of effective strategies that foster linguistic diversity while maintaining educational standards. This study contributes to the ongoing discourse on language in multilingual education settings, offering valuable insights for educators, policymakers, and researchers striving to create inclusive and effective learning environments.

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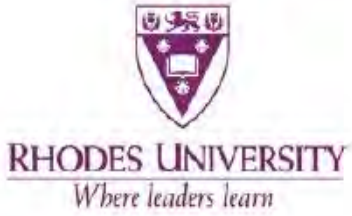
APPENDIX A



Rhodes University, Education Faculty
Research Ethics Committee
PO Box 94, Makhanda, 6140, South Africa
Tel: +27 (0) 46 603 8393
Fax: +27 (0) 46 603 8028
email: e.rosenberg@ru.ac.za

https://www.ru.ac.za/researchgateway/ethics/

17 March 2023

Dr Pamela Vale

Education Department

Pamela.Vale@ru.ac.za

Dear Dr Pamela Vale and Ms Tabisa Booi

Your application Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit, 2023-7135-7516has been reviewed by the Education Faculty Research Ethics Committee [EF-REC].

Ethics approval has been granted pending the required Permission Letters being obtained from the organisation(s) listed in your application.

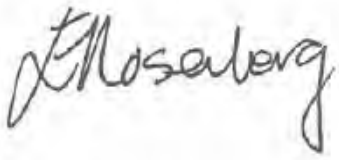
Eastern Cape Department of Education

Principal

Your application can be downloaded as a PDF version and forwarded with your permission letter request. Please refer to the Applicant User Guide for how to do so.

Please forward the required permission letter/s, once received, to the EF-REC Chair (E.Rosenberg@ru.ac.za) and to the Education Research Ethics Coordinator (ethics-committee@ru.ac.za) in order for your approval to be finalised.

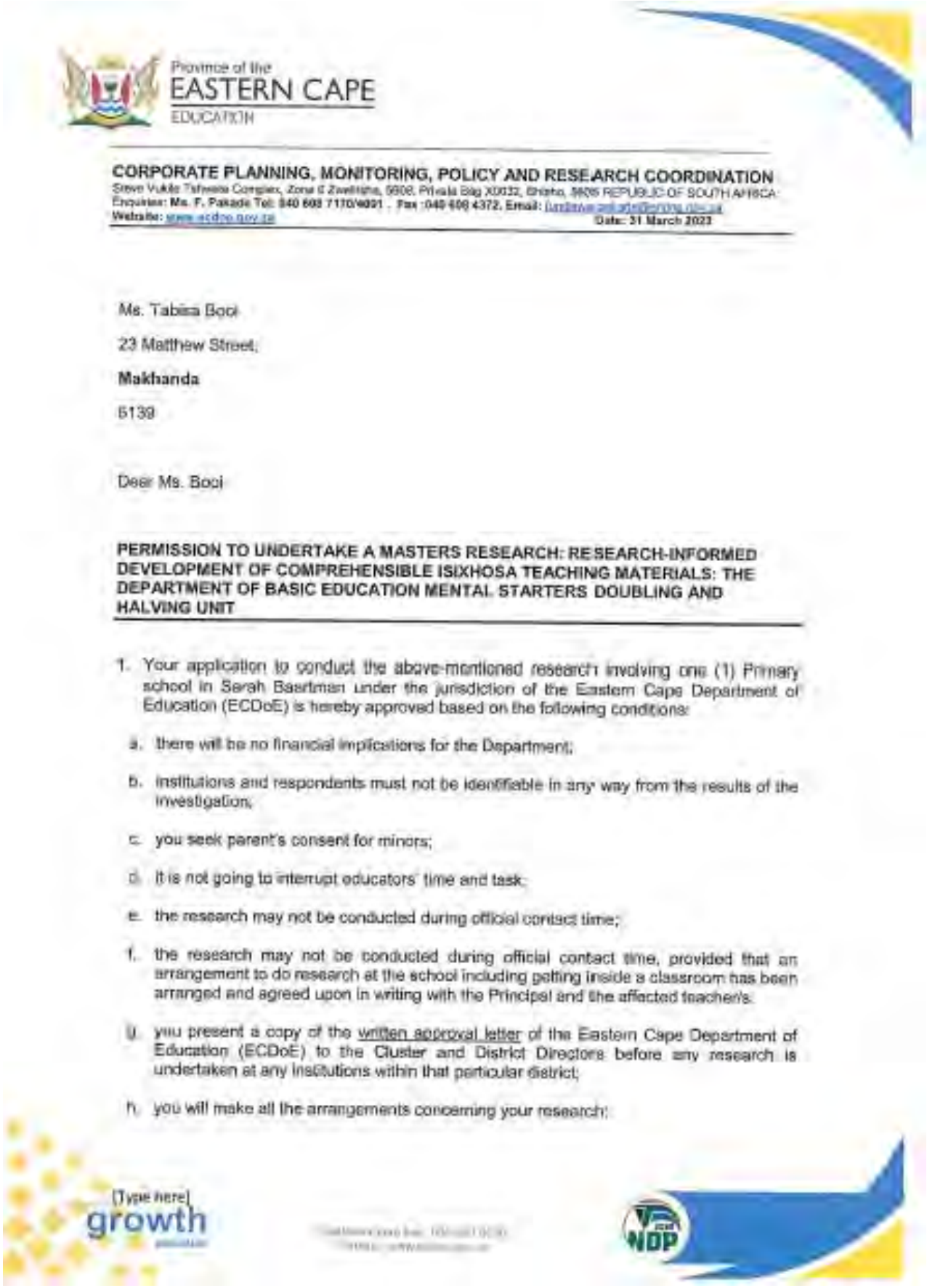
Sincerely



Professor Eureta Rosenberg

Chair: Education Faculty Research Ethics Committee

APPENDIX B



Province of the
EASTERN CAPE
EDUCATION

CORPORATE PLANNING, MONITORING, POLICY AND RESEARCH COORDINATION
Steve Vukile Tshwete Complex, Zone 6 Zwelitsha, 5608, Private Bag X0032, Bhisho, 5605 REPUBLIC OF SOUTH AFRICA
Enquiries: Ms. F. Pakade Tel: 040 608 7110/4021 . Fax :040 608 4372, Email: [illegible]
Website: www.ecdoe.gov.za
Date: 31 March 2023

Ms. Tabisa Booi

23 Matthew Street,

Makhanda

5139

Dear Ms. Booi

PERMISSION TO UNDERTAKE A MASTERS RESEARCH: RESEARCH-INFORMED DEVELOPMENT OF COMPREHENSIBLE ISIXHOSA TEACHING MATERIALS: THE DEPARTMENT OF BASIC EDUCATION MENTAL STARTERS DOUBLING AND HALVING UNIT

1. Your application to conduct the above-mentioned research involving one (1) Primary school in Sarah Baartman under the jurisdiction of the Eastern Cape Department of Education (ECDoE) is hereby approved based on the following conditions:

   a. there will be no financial implications for the Department;

   b. institutions and respondents must not be identifiable in any way from the results of the investigation;

   c. you seek parent's consent for minors;

   d. it is not going to interrupt educators' time and task;

   e. the research may not be conducted during official contact time;

   f. the research may not be conducted during official contact time, provided that an arrangement to do research at the school including getting inside a classroom has been arranged and agreed upon in writing with the Principal and the affected teachers;

   g. you present a copy of the written approval letter of the Eastern Cape Department of Education (ECDoE) to the Cluster and District Directors before any research is undertaken at any institutions within that particular district;

   h. you will make all the arrangements concerning your research;

[Type here]
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EASTERN CAPE
EDUCATION

i. should you wish to extend the period of research after approval has been granted, an application to do this must be directed to Chief Director: Corporate Strategy Management;

j. you present the Department with a copy of your final paper/report/dissertation/thesis free of charge in hard copy and electronic format. This must be accompanied by a separate synopsis (maximum 2 – 3 typed pages) of the most important findings and recommendations if it does not already contain a synopsis;

k. you present the findings to the Research Committee and/or Senior Management of the Department when and/or where necessary;

l. you are requested to provide the above to the Chief Director: Corporate Strategy Management upon completion of your research;

m. you comply with all the requirements as completed in the Terms and Conditions to conduct Research in the ECDoE document duly completed by you;

n. you comply with your ethical undertaking (commitment form);

o. You submit on a six-monthly basis, from the date of permission of the research, concise reports to the Chief Director: Corporate Strategy Management.

2. The Department reserves a right to withdraw the permission should there be non-compliance to the approval letter and contract signed in the Terms and Conditions to conduct Research in the ECDoE and/or legal requirements to do so.

3. The Department will publish the completed Research on its website.

4. The Department wishes you well in your undertaking. You can contact the Mrs. Fundiswa Pakade on the numbers indicated in the letterhead or email fundiswa.pakade@ecdoe.gov.za should you need any assistance.

T. MASOELU
CHIEF DIRECTOR: CORPORATE STRATEGY MANAGEMENT

FOR ACTING HEAD OF DEPARTMENT: EDUCATION

[Type here]
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APPENDIX C

ACCESS LETTER REQUESTING PERMISSION TO CONDUCT RESEARCH

Rhodes University

Drostdy Road,

Grahamstown,

6139

The Principal

[redacted]

Date 5 June 2023

Dear Mr [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH

I am a registered Master's student in the Department of Primary and Early Childhood Education at Rhodes University. My supervisors are Dr Pamela Vale and Prof Mellony Graven.

The proposed topic of my research is: *Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit.*

The objectives of the study are:

- To analyse the quality of translation and the fidelity (accuracy) and alignment of the translation of the doubling and halving mental starters to the mathematical meaning and concept.
- To research the development and use of more relatable isiXhosa vocabulary in conjunction with the English version of the Mental Starters Assessment Programme (MSAP) teacher guide when mediating learning of doubling and halving counting strategies

- To analyse the nature of my isiXhosa language use in teaching the doubling and halving mental maths strategy as outlined in DBE English teacher guide.
- To establish the relationship between the nature of the teacher's language use and the quality of translation of the DBE teacher guide in English and isiXhosa.

I am hereby seeking your consent to teach doubling and halving to the Grade 3 classes in your school during the mental mathematics portion of their mathematics lessons for eight lessons in total. To assist you in reaching a decision, I have attached to this letter:

(a) A copy of an ethical clearance certificate issued by the University
(b) A copy the research instruments which I intend using in my research

Should you require any further information, please do not hesitate to contact me or my supervisor. Our contact details are as follows:

Ms Tabisa Booi (g16b1823@campus.ru.ac.za)

Dr Pamela Vale (pamela.vale@ru.ac.za)

Prof Mellony Graven (m.graven@ru.ac.za)

Upon completion of the study, I undertake to provide you with feedback.

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

Tabisa Booi

APPENDIX D

09 June 2023

Dear Sir/Madam

Re: Permission granted to Miss Thabisa Booi to conduct her research study at [redacted] Primary School

This communique serves to affirm that permission has been granted for Miss Thabisa Booi to conduct her research study at our school.

Thanking you in advance

Yours Sincerely

The Principal

APPENDIX E

23 Matthew Street

Makhanda

6139

The Principal

[redacted]

PO Box [redacted]

Makhanda

6140

6 June 2023

Dear Mr [redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT [redacted] [redacted] PRIMARY SCHOOL

The above subject refers. I am a registered Master of Education student in the Department of Primary and Early Childhood Education at Rhodes University. My supervisors are Dr Pamela Vale and Prof Mellony Graven. The research lessons will be carried out in two cycles with the first cycle commencing on Monday 12 June 2023 and ending Friday 23 June 2023. The second cycle will be carried on 24 July 2023 to 3 August 2023. All the lessons will be conducted from 08h00 to 10h00 daily. I undertake to return to school daily at 11h00 to attend to my learners.

The proposed topic of my research is: *Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit.*

The objectives of the study are:

- To analyse the quality of translation and the fidelity (accuracy) and alignment of the translation of the doubling and halving mental starters to the mathematical meaning and concept.
- To research the development and use of more relatable isiXhosa vocabulary in conjunction with the English version of the Mental Starters Assessment Programme (MSAP) teacher guide when mediating learning of doubling and halving counting strategies
- To analyse the nature of my isiXhosa language use in teaching the doubling and halving mental maths strategy as outlined in DBE English teacher guide.
- To establish the relationship between the nature of the teacher's language use and the quality of translation of the DBE teacher guide in English and isiXhosa.

The benefits of the research study include:

For learners: a better understanding of the content taught because the language being used should be more accessible and comprehensible and should allow greater engagement with the mathematical concept.

For teachers: the teachers who observe and participate as critical friends should be better equipped to engage with the learners around this specific content, as well as having an opportunity to contribute to a study that interrogates what the best use of language would look like for conveying mathematical concepts.

Should you require any further information, please do not hesitate to contact my supervisors on the following contact details:

Dr Pamela Vale (pamela.vale@ru.ac.za)

Prof Mellony Graven (m.graven@ru.ac.za)

Your permission to conduct this study will be greatly appreciated.

Yours sincerely,

Tabisa Booi

APPENDIX F

PARENT AND GUARDIAN'S INFORMED CONSENT

INFORMED CONSENT DECLARATION

(Parent or Guardian)

Isihloko sophando: Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit

Igama lam nguTabisa Booi. Ndingumfundi eDyunivesithi iRhodes, ndenza iiMasters of Education. Ndinqwenela ukwenza uphando eklasini yomntwana wakho. Ndifuna ukuqonda ukuba ngesiphi esona sigama sinokufundisa kakuhle kakhulu ukubala ngedabuli nehafu kubantwana abathetha isiXhosa. Ngexesha loluphando ndizakube ndifundisa umntwana wakho ukubala ngedabuli nehafu, oku kuyingxanye yezifundo sebanga lesi-3. Ndizakubaseklasini yomntwana wakho imizuzu eli-15 yokuqala yesifundo sezibalo rhoqo kusasa iiveki ezintathu. Umntwana wakho uzokwenza iphetshana lomsebenzi elithatha imizuzu emi-5 kuze emva koko siqale ngezifundo zethu ezisi-8. Ekupheleni kwezizifundo, umntwana wakho uzokuphinda enze elinye iphetshana lomsebenzi ukuzivavanya ukuba ufunde kangakanani na kwizifundo. Utitshala wabo uzakube ekhona kunye nathi eklasini ngalo lonke ixesha.

UTabisa Booi wakwiCandelo lePrimary and Early Childhood Education kwiDyunivesithi iRhodes undicele imvume yokuvumela umntwana wam athabathe inxaxheba koluphando lubhalwe ngasentla.

Isimo nenjongo yoluphando, kwakunye neliphepha linekeza imvume ndilicaciselwe kakuhle ngolwimi nendlela endiyiqondayo.

Ndiyaqonda ukuba:

1. Injongo yoluphando kukukhangela isigama esinokuthi sincedise ngcono ekufundiseni ukubala ngedabuli nehafu ebantwaneni abathetha isiXhosa.

2. IDyunivethi iRhodes indivumele ukuba ndenze oluphando [**Certificate number**] kwaye ndinalo iphepha lemvume elivela ***kwi-ofisi ye-Research Ethics.***

3. Ngokuthabatha inxaxheba koluphando, umntwana wam uzakubanegalelo ekuphuhliseni indlela yokufunda nokufundisa izibalo zentloko ngesiXhosa.

4. Umntwana wam uzakuthabatha inxaxheba koluphando ngokuthi enze amaphetshana emisebenzi yemizuzu emi-5 amabini kwakunye nokuthabatha inxacheba kwizifundo ezisi-8 ezili -10-15 yemizuzu ubude.

5. Umntwana wam uthabatha inxaxheba kulophando ngaphandle kokujonga inzuzo, kwaye ukuba umdala kuneminyaka esisxhenxe (7) naye kufuneka ezivumele ukuthabatha inxaxheba.

6. Singayeka ukuthabatha inxaxheba koluphando nangaliphi na ixesha, oku singakwenza ngaphandle kwenkathazo.
7. Umntwana wam angacelwa ukuba ayeke ukuthabatha inxaxheba koluphando ukuba kubonakala ngathi uphando luyamphazamisa kwizifundo okanye yena akalandeli imiyalelo.

8. Mna nomntwana wam asilindelanga nzuzo ngokuthabatha inxaxheba koluphando.

9. Akukho bungozi bungahlangana nomntwana wam koluphando.

10. Umphandi undixelele ukuba uzakupapasha iziphumo zophando kwi-thisisi, nakumaphepha ejenali, nakumaphepha eenkomfa. Kuko konke oku, amagama ethu azakufihlwa ukukhusela mna nomntwana wam, ***ngaphandle kokuba sivumelene ukuba siwasebenzise amagama ethu.***

11. Andizokufumana imbalelwano echaza iziphumo zophando ***ngaphandle kokuba ndifake isicelo nge-phone number okanye nge-email endiyinikeze ekupheleni kweliphepha.***

12. Imibuzo nayiphi na onokuthi ubenayo malunga oluphando okanye inxaxheba yam kulo iyakuphendulwa nguDr Pamela Vale (pamela.vale@ru.ac.za; 083 401 3670)

13. Ngokutyikitya eliphepha andinikezi ngabango elisemthethweni okanye amalungelo am nomntwana wam.

14. Ndizakunikwa ikopi yeliphepha lemvume, kwaye eloqobelo lizakugcinwa kwirekhodi.

Mna, ……. ndikufundile konke okubhalwe ngasentla/ ndiyavuma ukuba yonke into ebhalwe apha ndiyicaciselwe

ngolwimi endiliqondayo kwaye ndiyakuqonda konke okubhalwe kweliphepha. Ndiyibuzile yonke imibuzo ebendinayo kwaye iphenduliwe ngokupheleleyo. Ndiyayiqondisisa yonke into elindeleke emntwaneni wam koluphando.

Andifakwa ngaphantsi kocinzelelo nangayiphi na indlela ukuze umntwana wam athabathe inxaxheba koluphando. Ngokutyikitya ngezantsi ndiyavuma ukuba umntwana wam u……(**igama lomntwana)** oneminyaka e-…… angathabatha inxaxheba koluphando lungasentla.

……. …….

Utyikityo lomzali **Umhla**

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-commitee@ru.ac.za

t: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building, Drostdy Road, Grahamstown, 6139

PARENT AND GUARDIAN'S INFORMED CONSENT

INFORMED CONSENT DECLARATION

(Parent or Guardian)

Project Title: Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit

My name is Tabisa Booi. I am a Masters of Education student at Rhodes University and would like to carry out research in your child's class. I want to study what words and terminology is best for teaching doubling and halving to isiXhosa-speaking children. During this research I will be teaching your child how to do doubling and halving, which is part of the Grade 3 curriculum. I will be in your child's class for the first 15 minutes of their mathematics lesson each day for approximately three weeks. Your child will first complete a five minute worksheet and then the lessons will start. At the end of the lessons, your child will do another five minute worksheet to assess how much they have learned in the lessons. Their teacher will be in the class for the whole time that I am there.

Tabisa Booi from the Department of Primary and Early Childhood Education, Rhodes University has requested my permission to allow my child/ ward to participate in the above-mentioned research project.

The nature and the purpose of the research project, and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

15. The purpose of the research project is to learn about what words and terminology is best for teaching doubling and halving to isiXhosa-speaking children.

16. The Rhodes University has given ethical clearance to this research project [**Certificate number**] and I have seen/ may request to see the clearance certificate ***from the Research Ethics Office***

17. By participating in this research project my child/ward will be contributing towards better teaching and learning of mental mathematics in isiXhosa.

18. My child/ward will participate in the project by completing a five minute worksheet, participating in eight 10-15 minute lessons and completing another five minute worksheet.

19. My child's participation is entirely voluntary and if my child/ward is older than seven (7) years, s/he must also agree to participate.

20. Should I or my child/ward at any stage wish to withdraw from participating further, we may do so without any negative consequences.

21. My child may be asked to withdraw from the research before it has finished if the researcher or any other appropriate person feels it is in my child's best interests, or if my child does not follow instructions.

22. Neither my child nor I will be compensated for participating in the research.

23. There are no risks associated with my child's participation in the project.

24. The researcher intends publishing the research results in the form of a thesis and journal articles and/or conference papers**.** However, confidentiality and anonymity of records will be maintained and that my or my child's/ward's name and identity will not be revealed to anyone who has not been involved in the conduct of the research, ***unless my child (over the age of seven 7) and I agree to waive this confidentiality***.

25. I will not receive written/verbal feedback regarding the results obtained during the study ***unless specifically requested in the form of a phone number or email address provided at the end of this document***.

26. Any further questions that I might have concerning the research or my participation will be answered by Dr Pamela Vale (pamela.vale@ru.ac.za; 083 401 3670)

27. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies that I or my child/ward may have.

28. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, …….. have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished

to ask and these have been answered to my satisfaction. I fully understand what is expected of my child during the research.

I have not been pressurised in any way to let my child take part. By signing below, I voluntarily agree that my child/ward …… (**insert name of child**), who is …….. years old, may participate in the above-mentioned research project.

……. …….

Parent/Guardian's signature **Date**

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-commitee@ru.ac.za

t: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building, Drostdy Road, Grahamstown, 6139

APPENDIX G

CHILD PARTICIPANT'S ASSENT FORM

INFORMED CONSENT DECLARATION

(Child participant)

Isihloko sophando : *Ukufundisa ukubala ngokudabulisha nangehafu*

Igama lomphandi : Ms Tabisa Booi

Igama lomthathi-nxaxheba :
……..……

1. Ingaba umphandi ukucacisele yonke into azokuyenza kwakunye nafuna wena uyenze?

EWE	HAYI

2. Ingaba umphandi ukucacisele na ukuba kutheni efuna wena uthathe inxaxheba?

EWE	HAYI

3. Uyayiqonda na into ezanywa ekwenziwa ngoluphando?

EWE	HAYI

4. Ucinga ukuba ingakhona into entle okanye embi engathi ikwahlele ngelixesha loluphando?

EWE	HAYI

5. Uyayazi ukuba igama lakho nezinto ozozitsho koluphando azizokuboniswa abanye abantu?

EWE	HAYI

6. Umbuzile umphandi imibuzo nayiphi ngoluphando?

EWE	HAYI

7. Ingaba umphandi uyiphendule yonke imibuzo yakho?

EWE	HAYI

8. Uyaqonda ukuba ungangavumi ukuthabatha inxaxheba koluphando ukuba uyafuna, kwaye akukho nto izakwehlela ukuba akuvumanga?

EWE	HAYI

9. Uyaqonda ukuba ungayeka ukuthabatha inxaxheba koluphando nanini na xa uziva ungafuni ukuqhubeka?

EWE	HAYI

10. Uyazazi ukuba ungathetha nabani xa uziva ukhathazekile okanye unemibuzo ngoluphando?

EWE	HAYI

11. Ukhona umntu okunyanzelisa ngokuthabatha inxaxheba koluphando?

EWE	HAYI

12. Uyavuma ukuthabatha inxaxheba koluphando?

EWE	HAYI

_____ _____

Utyikityo lomfundi **Umhla**

Mfundi Obekekileyo

Igama lam nguTabisa Booi. Ndizakundwendwela iklasi yenu rhoqo kusasa kwiiveki ezintathu ndizokunifundisa ukubala ngedabuli nehafu. Ndifuna ukuqonda ukuba ngawaphi amagama esiXhosa nawesiNgesi anokuthi akuncede ekufundeni ukubala ngedabuli nehafu.

Xa sisebenza kunye, uzokwenza iphetshana lomsebenzi elizokuthatha imizuzu emi-5 ukuze sibone ukuba sowusazi kangakanani na. Emva koko sizakuba nezifundo ezisi-8 rhoqo kusasa ezili-10-15 imizuzu ubude. Ukugqiba kwethu ngezizifundo, uzokuphinda wenze elinye iphetshana lomsebenzi lemizuzu emi-5. Eli lelokuvavanya ukuba ufundile na kunasekuqaleni kwezifundo.

Ndizakwenza ividiyo yezifundo ukwenzela ukuba ndikhumbule ukuba kwenzeke ntoni kwisifundo. Nayiphi na indawo ekubonakalisayo kwividiyo izakubonwa ndim nomphathi wam uPamela Vale kuphela.

Ungandibuza nayiphi na imibuzo malunga konke esizakube sikwenza kunye.

Ukuba kukho into ekukhathazayo malunga oluphando, nazi iinkcukhaca zomntu onokunceda ngezantsi:

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-commitee@ru.ac.za

t: +27 (0) 46 603 7727 f: +27 (0) 86 616 7707

Room 220, Main Admin Building, Drostdy Road, Grahamstown, 6139

CHILD PARTICIPANT'S ASSENT FORM

INFORMED CONSENT DECLARATION

(Child participant)

Project Title: *Teaching Doubling and Halving*

Researcher's name: Ms Tabisa Booi

Name of participant: ……

1. Has the researcher explained what s/he will be doing and wants you to do?

YES	NO

2. Has the researcher explained why s/he wants you to take part?

YES	NO

3. Do you understand what the research wants to do?

YES	NO

4. Do you know if anything good or bad can happen to you during the research?

YES	NO

5. Do you know that your name and what you say will not be shown to other people?

YES	NO

6. Did you ask the researcher any questions about the research?

YES	NO

7. Has the researcher answered all your questions?

YES	NO

8. Do you understand that you can refuse to participate if you do not want to take part and that nothing will happen to you if you refuse?

YES	NO

9. Do you understand that you may pull out of the study at any time if you no longer want to continue?

YES	NO

10. Do you know who to talk to if you are worried or have any other questions to ask?

YES	NO

11. Has anyone forced or put pressure on you to take part in this research?

YES	NO

12. Are you willing to take part in the research?

YES	NO

_____ _____

Signature of Child **Date**

Dear Learner

My name is Tabisa Booi. I will be visiting your classroom each morning for three weeks to teach you how to do doubling and halving. I want to understand what isiXhosa and English words help you to understand how to do doubling and halving.

When we work together, you will be doing a 5 minute worksheet to see how much you already know. Then you will have one 10-15 minute lesson with me each morning for 8 days. After we are finished with the lessons, you will do another worksheet, for you to see if you have learned and improved since the first one you wrote.

Please ask me if you have any questions about what we will be doing together.

If you are worried about anything to do with this project, the details of who you can contact are listed here:

Rhodes University, Research Office, Ethics

Ethics Coordinator: ethics-commitee@ru.ac.za

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APPENDIX H

PARTICIPANT'S INFORMED CONSENT

INFORMED CONSENT DECLARATION

(Critical Friend)

Project Title: Research-informed development of comprehensible isiXhosa teaching materials: The Department of Basic Education Mental Starters doubling and halving unit

My name is Tabisa Booi. I am a Masters of Education student at Rhodes University and would like to carry out research in your class/school. I want to study what words and terminology is best for teaching doubling and halving to isiXhosa-speaking children. During this research I will be teaching your learners how to do doubling and halving, which is part of the Grade 3 curriculum. I will be in your class for the first 15 minutes of their mathematics lesson each day for approximately three weeks. Your learners will first complete a five minute worksheet and then the lessons will start. At the end of the lessons, your learners will do another five minute worksheet to assess how much they have learned in the lessons. You will be in the class for the whole time that I am there.

Tabisa Booi from the Department of Primary and Early Childhood Education, Rhodes University has requested my permission to allow my child/ ward to participate in the above-mentioned research project.

The nature and the purpose of the research project, and of this informed consent declaration have been explained to me in a language that I understand.

I am aware that:

29. The purpose of the research project is to learn about what words and terminology is best for teaching doubling and halving to isiXhosa-speaking children.

30. The Rhodes University has given ethical clearance to this research project [**Certificate number**] and I have seen/ may request to see the clearance certificate ***from the Research Ethics Office***

31. By participating in this research project my learners will be contributing towards better teaching and learning of mental mathematics in isiXhosa.

32. My learners will participate in the project by completing a five minute worksheet, participating in eight 10-15 minute lessons and completing another five minute worksheet.

33. My learners' participation is entirely voluntary and if my learners are older than seven (7) years, s/he must also agree to participate.

34. Should I or my learners at any stage wish to withdraw from participating further, we may do so without any negative consequences.

35. My learners may be asked to withdraw from the research before it has finished if the researcher or any other appropriate person feels it is in my learners' best interests, or if my learners do not follow instructions.

36. Neither my learners nor I will be compensated for participating in the research.

37. There are no risks associated with my learners's nor myself participation in the project.

38. The researcher intends publishing the research results in the form of a thesis and journal articles and/or conference papers**.** However, confidentiality and anonymity of records will be maintained and that my or my child's/ward's name and identity will not be revealed to anyone who has not been involved in the conduct of the research, ***unless my learners (over the age of seven 7) and I agree to waive this confidentiality***.

39. I will not receive written/verbal feedback regarding the results obtained during the study ***unless specifically requested in the form of a phone number or email address provided at the end of this document***.

40. Any further questions that I might have concerning the research or my participation will be answered by Dr Pamela Vale (pamela.vale@ru.ac.za; 083 401 3670)

41. By signing this informed consent declaration I am not waiving any legal claims, rights or remedies that I or my child/ward may have.

42. A copy of this informed consent declaration will be given to me, and the original will be kept on record.

I, …….. have read the above information / confirm that the above information has been explained to me in a language that I understand and I am aware of this document's contents. I have asked all questions that I wished

to ask and these have been answered to my satisfaction. I fully understand what is expected of my child during the research.

I have not been pressurised in any way to take part. By signing below, I voluntarily agree that I …… (**insert name**), am willing to participate in the above-mentioned research project.

……. …….

Participant's signature **Date**

Rhodes University, Research Office, Ethics

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APPENDIX I

Sample of Translanguaging Lesson

Introduction

Pg 52

IIndlela zokukhumbula msinya

Zintathu iindlela zokukhumbula msinyane ekufuneka abafundi benazo ukuze bafunde ukubala ngedabul nehafu.

- Iidabuli ukuya kwi10 (umz. Idabuli ka4 ngu8 okanye idabuli ka7 ngu14);
- Iihafu zee-even numbers ukuyakutsho ku-20 (umz. Ihafu ka 6 ngu 3; ihafu ka18 ngu 9)
- Iidabuli neehafu zamanani aqhelekileyo

Lesson Starter 1

Pg 55

UKUBALA NGEEDABULI KUNYE NEEHAFU: LESSON STARTER 1

Umzuzu o-1 wokubala ngentloko

"Ndithi, uthi" (abafundi bonke ze benze ngababini)

a. Utishala usebenzisa izandla ezimbini ukubonakalisa isivakalisi samanani akhiwe ngedabuli.
   Idabuli ka3 ngu 6. Ngoku ndizakubonisa ezinye iidabuli, nina nindixelele ukuba zithini.
   Utishala uveza: Dabuli 4 Dabuli 1 Dabuli 3 Dabuli 5
   Abafundi bakhwaza izivakalisi ezizizo: umz. "idabuli ka4 ngu 8"
b. Dibanisa abafundi basebenze ngababini. Angongezelelwa amanani ukubonisa iidabuli eziqala ku6 ukuya ku10 ngeminwe yabo bobabini.

   Utishala: Iqela ngalinye, ndiboniseni idabuli ka6

   Abafundi:

Utishala: Mingaphi iminwe xa idibene yonke kudabuli 6?

Cela abafundi batshatise izandla zabo zijongene nezandla zabalingani babo, kubekho umnwe omnye ovuliweyo. Nceda abafundi bazibonele ukuba impendulo engu-12 yenziwe zizandla ezimbini ezineminwe emi-5 nezandla ezimbini ezinomnwe om-1: 5 + 5 kunye 1 + 1.

Ulandelelwano lomsebenzi

Kwesisifundo sisebenzisa iindlela ezilula zokubala ngedabuli nehafu ukuyakutsho ku-20.

Ingxaki: idabuli ka-6

Bonisa amachokoza amathandathu kwihafu enye yekhadi ledabuli. Vula ikhadi.

Utishala: Ngoku ndenza idabuli ka-6. Mangaphi amachokoza ewonke?

Abafundi: 12

Utishala: Wazi njani ukuba idabuli ka-6 ngu-12?

Mamela kubafundi abathi ikhadi ledabuli libonisa: ‘6

no 6’, ‘oo-6 ababini’, ‘bini Phinda ka-6’, ‘6 x 2’

Ingxaki: ihafu ye-12

Bonisa amachokoza alishumi elinesibini kumakhadi

anamachokoza eziphindwa. Songa ikhadi ngobude

ehafini.

Utishala: Ngoku ndiyabona ihafu yamachaphaza ye-12

kwaye ungayibona ihafu. Ngoko ke ngubani

ihafu ye-12?

Abafundi: 6

Utishala: Uyazi njani impendulo ukuba sisi-6?

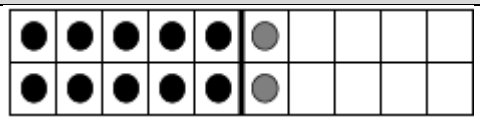
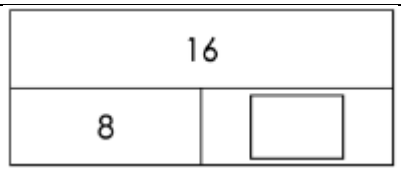
Mamela kubafundi abanika inkcazelo efana: ‘ihafu ye12 sisi 6’ okanye ‘ishumi elinesibini ulohlule libe

ngamaqela amabini sisi-6’ okanye ‘ishumi elinesibini ulohlulele ababini sisithandathu’ okanye ‘12 ÷ 2 = 6’.

Ukuba akukho zinikezelo zifanayo ezenziweyo, vumbulula abafundi baphinde ezi zivakalisi emva kwakho.

Bhala ezimpendulo zahlukeneyo ebhodini

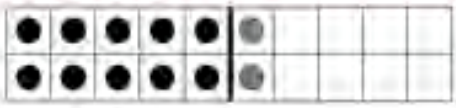
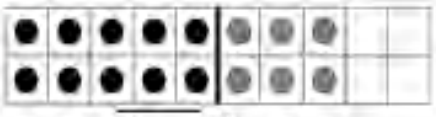
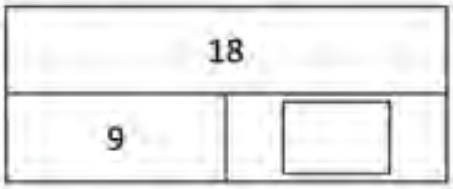
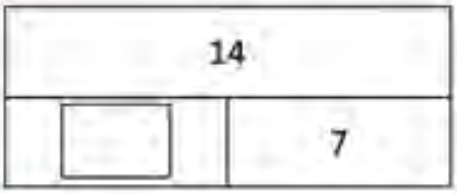
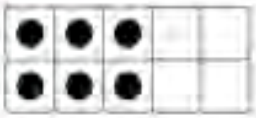
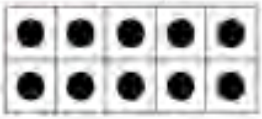
APPENDIX J

Igama:	
Idabuli nehafu: Uvavanyo lwangaphambili ICANDELO 1 2 imizuzu kweli phepha	
1.  6 + 6 =	11. 15 + 15 =
2. ihafu ka12 =	12. 7 x 2 =
3. 9 + 9 =	13. ihafu ka = 7
4. idabuli ka8 =	14. idabuli ka100 =
5. x 2 = 12	15. idabuli ka20 =
6. 	16. ihafu ka = 40
7. idabuli ka10 =	17. ihafu ka50 =
8. ihafu ka14 =	18. 16 ÷ 2 =
9. 10 ÷ 2 =	19. ihafu ka30 =
10. ihafu ka18 =	20. 2 x 60 =
Itotali: 20	

Idabuli nehafu: Uvavanyo lwangaphambili	
ICANDELO 2	3 imizuzu kweli phepha
1. Idabuli ka42 =	
2. 36 x 2 =	
3. 64 ÷ 2 =	
4. Ihafu ka102 =	
5. Idabuli ka47 =	
6. Ihafu ka38 =	
7. Ihafu ka52 =	
Idabuli ka 39 ngu78 8. Ihafu ka78 ngu 9. 39 + 38 = 10. Idabuli ka39 = 40 + 40 -	
Itotali: 10	

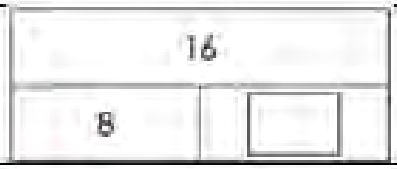
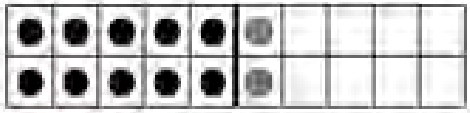
Igama:.....

Idabuli neHafu- Iphepha lomsebenzi lokuqala

1.  6 + 6 = ☐	11.  8 + 8 = ☐
2. Ihafu ka 12 = ☐	12. 11 x 2 = ☐
3. 9 + 9 = ☐	13. Ihafu ka ☐ = 8
4. Idabuli ka 7 = ☐	14. Idabuli ka 30 = ☐
5. ☐ x 2 = 16	15. Idabuli ka 50 = ☐
6. 	16. 
7. Idabuli ka 10 = ☐	17. Ihafu ka 40 = ☐
8.  Ihafu ka 6 = ☐	18.  Ihafu ka 40 = ☐
9. 12 ÷ 2 = ☐	19. Ihafu ka 70 = ☐
10. Ihafu ka 14 = ☐	20. 2 x 70 = ☐

Igama:	
Idabuli nehafu: iphepha lokusebenzela 2	
I. Idabuli ka32 ngu	II. Idabuli ka44 ngu
2. 26 x 2 =	12. 38 x 2 =
3. 42 ÷ 2 =	13. 86 ÷ 2 =
4. Ihafu kal10 =	14. Ihafu kal04 =
5. Idabuli ka32 =	15. Idabuli ka39 =
6. Ihafu ka36 =	16. Ihafu ka48 =
Idabuli ka31 ngu 62 7. 2 x 3 = 8. Ihafu ka62 ngu 9. 31 + 32 = 10. Idabuli ka 31 = 30 + 30 +	**Idabuli ka40 ngu98** 17. 2 x 49 = 18. Ihafu ka98 ngu 19. 49 + 48 = 20. Idabuli ka49 = 50 + 50 -

Igama:

Idabuli nehafu: Uvavanyo lwamva ICANDELO I	2 imizuzu kweli phepha
1.  7 + 7 =	11. 14 + 14 =
2. Ihafu ka14 =	12. 7 × 2 =
3. 9 + 9 =	13. Ihafu ka = 7
4. Idabuli ka 8 =	14. Idabuli ka100 =
5. × 2 = 14	15. Idabuli ka20 =
6. 	16. Ihafu ka = 40
7. Idabuli ka10 =	17. Ihafu ka50 =
8.  Ihafu ka12 =	18. 18 ÷ 2 =
9. 10 ÷ 2 =	19. Ihafu ka30 =
10. Ihafu ka18 =	20. 2 × 60 =
Itotali: 20	

Idabuli nehafu: Uvavanyo lwamva	
ICANDELO 2	3 imizuzu kweli phepha
1. Idabuli ka42 =	
2. 36 x 2 =	
3. 64 ÷ 2 =	
4. Ihafu ka102 =	
5. Idabuli ka99 =	
6. Ihafu ka38 =	
7. Ihafu ka = 52	
Idabuli ka39 ngu78 8. Ihafu ka78 ngu 9. 39 + 38 = 10. Idabuli ka39 = 40 + 40 —	
Itotali: 10	