EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM

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WESTERN CAPE

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By

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Declaration Statement

I, Leona Claasen, declare that the study entitled: *Exploring translanguaging practices in a multilingual grade 6 mathematics classroom* is the product of my own research. All sources used in the study have been indicated and fully acknowledged in a complete list of references by means of complete references.

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Abstract

Even though the South-African education system has undergone profound changes in the decades of democracy, and various language policies have been implemented and re-implemented, language practices in basic and higher education still reflect the legacy of colonialism and apartheid. A particular consequence of this is evident in mathematics where learners' poor performance can be located in a disjuncture between multilingual classrooms and the language of instruction.

This study analyses how translanguaging practices are used in a multilingual grade 6 mathematics classroom to facilitate mathematical understanding. The aim of the study was to see whether, and if so how, the teacher and learners use translanguaging practices in the mathematics classroom in lessons relating to the topic in question. The research questions explored in this study examine firstly, the purpose of translanguaging in a grade 6 mathematics classroom; secondly, the dynamics of translanguaging and thirdly, perceptions and experiences of the teacher and the learners with respect to translanguaging.

Participants in this study comprised a class of 34 bi-/multilingual grade 6 learners between the ages of 12 and 14 and one teacher with more than 20 years teaching experience. This study was based on a qualitative research paradigm. The theoretical framework is largely translanguaging theory as formulated by Garcia and Lin (2016) and its relationship to the Common Underlying Proficiency (CUP) model established by Cummins (1984). Also central to the study are the two principles of translanguaging and the Theory of Action. Data collection was done by means of observation of the teacher and learners verbally interacting in the mathematics classroom, documentary analysis recordings of the classroom interaction between the teacher and the learners and amongst the learners themselves. The process included recordings of focus group interviews with both learners and teacher, as well as an activity worksheet based on problem solving questions relating to Perimeter and Area. The teacher was interviewed alone.

A rigorous and systematic data collection and analysis process was followed to ensure measures of validity and reliability were met. Several data collection methods were used and a thorough record of data collection was kept.

Permission for the study was sought by the researcher to ensure ethical clearance from the Ethics Committee of the University of the Western Cape (UWC), would be granted, including permission from the Western Cape Education Department (WCED), the school and the parents of the learners with whom the study was conducted. All parties were informed about the research and the voluntary nature of their participation.

The findings of the study showed that translanguaging practices did take place in the mathematics classroom, but mostly amongst learners. This indicated that translanguaging was mostly learner-centred during problem-solving activities. The teacher's limited language proficiency inspired him to encourage learners to use their home languages by incorporating the buddy system.

However, the interviews showed the majority favoured learning mathematics in English as opposed to their home languages. Yet, when learners were asked whether they preferred the teacher to utilize the language of instruction with English and Afrikaans and their home languages, most were in favour of this arrangement. They claimed this would make it easier for them to understand the mathematical concepts. Those who were in favour of learning in the language of instruction exclusively stated that they wanted to avoid confusion in the mathematical content.

The interview with the teacher revealed that although he did not use any translanguaging directly, he was in favour of incorporating the home languages of the learners into the learning and teaching of mathematics and believed that doing so would facilitate mathematical learning and understanding.

The study supports the view that the use of translanguaging practices can be a contributing factor to success in the teaching and learning of mathematics especially in cases where the language of instruction is not the learner's first language.

Key terms: translanguaging practices, grade 6 mathematics; classroom, practices, multilingual, mathematical understanding

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Acronyms

ANA - Annual National Assessment

CAPS - Curriculum and Assessment Policy

CUP - Common Underlying Proficiency

DoE - Department of Education

EFAL - English First Additional Language

LiEP - Language in Education Policy

LoLT - Language of Learning and Teaching

L1 - First Language

L2 - Second Language

NCS - National Curriculum Statement

SUP - Separate Underlying Proficiency

TIMMS - Trends in International Mathematics and Science Study

WCED - Western Cape Education Department

Chapter 1: An overview of the study

1.1 Introduction

According to Halliday (1988), the language of mathematics involves learning how to form and share mathematical meanings using context-appropriate language. This involves more than simply responding to words alone. The main role of this language is to enable teachers and learners to share their conceptual mathematical knowledge accurately. Ishumi (1994) explains that language is a powerful tool in concept formation and thus in the transfer of communication of mathematical concepts. The import of these assertions is that language has three important functions: firstly, language allows for communication amongst people; secondly, it facilitates thought processes; and thirdly, it helps people recall information beyond the limits of memory. It therefore stands to reason that because language not only conveys meaning but also facilitates thinking, the language used for thinking is likely to be one's home language. Thus, in the field of mathematics, to enable conceptual engagement in thinking, mathematics taught in one language may have to be translated into another and then re-translated back to the original to facilitate learner interaction with the teacher (Klein, 1998).

In other words, before language can be used as a medium of instruction, learners must be comfortable with it, otherwise they will find it difficult to follow lessons, to deduce or assimilate information and to ask or answer questions in class, all of which would compromise learning. It becomes evident that learners with poor linguistic facility will most probably become underachievers.

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. This study sought to explore the use of translanguaging practices in a grade 6 mathematics classroom.

Chapter 1 discusses the background to the research, the rationale for the research, the problem statement, and the aims and objectives of the research. This is followed by an outline of the research methodology, the research questions, and the significance of the research. This chapter concludes with an overview which sums up its contents.

1.2 Background to the study

As noted earlier, the South African education system underwent a profound transformation after the 1994 democratic elections. According to Desai (2016), despite its status as a multilingual nation with 11 official languages, after two decades of democracy South Africa's language practices in primary and tertiary education still reflect the legacy of colonialism and apartheid. This, despite the fact that South Africa's Democratic Constitution (1996) and the Higher Education Language in Education Policy (LiEP) (Department of Education, 1997) have promoted language equality and equity in education. For instance, one important principle that has informed language documentation in education is that all learners should have the same access to the curriculum. This implies that the learner's first language will continue to be used and developed while they are learning a second language, a process best accomplished through the national system of additional bilingual or multilingual education (Heugh, 2015). However, despite the fact that over 76% of South Africa's population speak African languages, Afrikaans and English continue as the dominant languages for the production and dissemination of knowledge in education, resulting in a gap between policy and practice (Alexander, 2005; Desai, 2016; Heugh, 2003; Plüddemann, 2013; Prah, 2006; Probyn, 2009). After 1994, despite official language status having been accorded to the nine African languages, these remain marginalised in education, causing South Africa to produce young people who are unable to, or can barely read and write in their home languages.

As indicated, language and its role in the understanding of mathematics is imperative. Yet there is a great deal of concern around the world about the performance of mathematics learners because as Van der Walt et al. (2008) and Ndlovu (2011) observe, in many cases, the language of instruction is not the learner's first language. In South Africa, this factor contributes to the poor mathematics performance of South African learners.

In efforts to address the situation, translanguaging practices as a learning and teaching resource in bi-/multilingual classrooms have been the focus of research in the past (e.g Adler, 1998, 2001; Arthur 1994; Merritt, Cleghorn, Abagi & Bunyi, 1992; Moschkovich, 2009; Ncedo, Peires and Morar, 2002 as cited in Setati, 2008, p3; Setati, 1998; Setati & Adler, 2000). The term 'translanguaging' derives from the Welsh term

"trawsiethu". It is referenced by many in several parts of the world, including the United States (for example, Garcia, 2009; Canagarajah, 2011) and in the United Kingdom (for example, Creese & Blackledge, 2010; Wei, 2011). In South Africa Makalela (2015) and Probyn (2015) are its advocates.

According to Garcia and Wei (2014), translanguaging refers to language use, bilingualism and bilingual education. Bilingualism is defined as the use of two languages to make the learner bilingual and biliterate, and to improve comprehension and develop their language proficiency in the dominant language (Baker (2011). Translanguaging does not view the language practices of bilinguals as two separate language systems, but as one repertoire.

Being in the teaching profession, I play a role with the tools I incorporate to facilitate mathematical understanding whether I use social, traditional or technological tools. Teaching can be very challenging with a diverse class of learners from different backgrounds who speak different languages (English, isiXhosa, isiZulu, Afrikaans, SeSotho etc.) especially when the language of instruction is not their home language. The difficulty is that a learner does not understand the content properly when they do not properly understand the language in which the content is being taught.

1.3 Problem Statement

The Constitution of South Africa (1996, 11) states that "everyone has the right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practicable". However, in schools there appears to be a negative attitude towards the use of African languages as languages of learning and teaching. Many factors stemming from the inequality of the apartheid system contribute to the attitudes currently expressed towards African languages. One factor relates to the importance Afrikaans and English assumed as languages of socio-economic mobility under the apartheid regime.

Many African people were under the impression that learning in their language would hinder their access to socio-economic improvement, mainly because the apartheid government introduced Bantu education, aimed at providing African learners with an inferior education (Benjamin, 1994; Cluver, 1992; Maake, 1994; Verhoef, 1998).

According to De Klerk (2002), home language education was and is still not perceived by many African people as a valuable democratic asset, but rather as a hindrance curtailing access to international, economic and social progress. Consequently, in English classes challenges confronting learners and teachers who are non-native English speakers include the following:

- few teachers are sufficiently well trained to help learners master English
- little to no support exists for English outside of school
- learners find it difficult to understand English as the language of instruction
- a high dropout and failure rate ensues(O-saki, 2005).

According to Heugh (2003) and Desai (2001), studies – notably in Southern Africa – also show that learners in Africa are at an educational disadvantage as they find it challenging to learn through English as a second language. Due to a lack of language exposure or support outside of school, these learners find it difficult to understand the content of subjects taught in English. This has a negative effect on their academic performance.

1.4 Rationale for the study

Rationale based on literature

South Africa is a multilingual country and the South African Education system thus constitutes a multilingual environment. It follows that an awareness of the importance of language in the acquisition and construction of knowledge is vital in a mathematics classroom. So, perhaps a key reason for South African learners' poor performance in mathematics is that assessment is not conducted in their home languages.

Furthermore, scholars such as Roberts et al. (2019) note that an international benchmark is used by many countries to evaluate performance in mathematics education. 'Trends in International Mathematics and Science Study (TIMMS)' provides this kind of platform for which it is recognized and used. SA's participation in TIMMS occurred in 1995, 1999, 2003, 2011, 2015 and 2019. In TIMMS 2015 it featured amongst the lowest performing countries with a mean score of 372. Of the many factors attributable to under-achievement in mathematics, language must play a key role.

It is important to realise that bilingual learners comprise over 75% of the total number of Grade R to Grade 12 students in black schools in South Africa and still have limited English proficiency (Department of Education, 2017). The country is currently experiencing challenges with providing effective and equitable education for these learners, and there is much debate and practice regarding policies, programs and languages of instruction.

National and international research continues to provide compelling evidence for the effectiveness of translanguaging practices in education. Ciechanowski's study (2014) of language teaching in the case of emerging bilinguals showed an improvement in language and content measured before and after testing. The use of increased purposeful language, word choice, vocabulary, and word count demonstrated this improvement.

Another study, conducted by Kachchaf et al. (2016) on Language Complexity expressed by 5th Grade learners, indicates that certain individual linguistic traits can differentially affect academic performance in learners who are taught in a language that is not their first language. More pointedly, research undertaken by Msimanga and Lelliott (2014) also reported that multilingual learners face academic challenges and therefore use translanguaging practices in the classrooms, resulting in positive gains.

In relation to academic challenges, Cummins (2008) argues that learners must be proficient in the language of instruction in order to understand relevant subject specific concepts. Hence, it has been emphasized repeatedly that language of instruction proficiency plays an important role in a learner's academic performance in a subject area (Garcia, 2011; Madiba, 2014; Makalela, 2018).

According to an article in UNESCO's Global Education Monitoring Report (GEM Report, 2016), more than 40% of the population in the world do not have access to education in a language they understand. The policy paper, "How Can You Learn If You Don't Understand It?" published on 21 February 2016 to mark International Mothertongue Day added their voices to the argument that not being taught in one's home language can have a negative impact on learning and literacy development.

Irina Bokova, the UNESCO Director-General underscored the rationale for learners to learn in their own language, within a new worldwide education agenda that prioritizes equity, quality, and lifelong learning for everyone. Concurring with this idea, Gem (2016) argues that valuing the use of learners' first language in education is critical in fostering full linguistic diversity. Translanguaging practices in the classroom not only lead to

higher learning outcomes, but also add to social cohesion, tolerance and ultimately, peace.

It is a well-known fact that language plays a vital role in learners' cognitive development and in their construction and expansion of conceptual and procedural knowledge in mathematics. Babaci-Wilhite's (2016) observation that learners have difficulty with mathematics when it is taught in a second language appears to be addressed in the analysis of Baker (2011), Hornberger and Link (2012). They assert the need for translanguaging approaches in multilingual classes in South Africa where multiple languages can be simultaneously utilized for teaching and learning purposes.

Rationale based on personal experience

I decided to pursue the concept of translanguaging practices in a mathematics classroom as a resource for facilitating mathematical understanding, based on my early struggle with mathematics because the language of instruction was not my first language. Many mathematical concepts were lost on me and I had to translate many into my home language to be able to understand them.

The intentional nature of translanguaging means that teachers and learners use the expanded language repertoire as regular classroom practice, without judgment (Banda, 2017). Research on bilingual learners by Garcia (2009, 2014), Garcia and Wei (2014), and Canagarajah (2011) shows how learners can overcome the ideological limitations of 'pure' English through strategic translanguaging. According to Canagarajah (2011), learners acquired sufficient agency to empower themselves to resist policies that contribute to symbolic domination. This awareness challenges the ability of the dominant classes to convince themselves and others that existing social strata are justified by some inherent qualities and knowledge.

1.5 Aims and Objectives of the study

The study was aimed at exploring translanguaging practices in a multilingual grade 6 mathematics classroom. The specific objectives guiding the study were:

i. to explore the purpose of translanguaging in a grade 6 mathematics classroom ii. to explore the dynamics of translanguaging in the mathematics classroom, and iii. to

investigate the teacher's and learners' perceptions and experiences of translanguaging in the mathematics classroom.

1.6 Research design and methodology

1.6.1 Research approach and design

The methodological aspects of the study are presented in this section together with a description of the paper's structure and a justification for the selected research methods.

This research investigation employed a qualitative methodological approach as qualitative research seeks to explore and discover issues regarding the problem at hand (Domegan & Feming, 2007). According to Myers (2009), the purpose of qualitative research is to help the researcher understand the individual, social and cultural contexts in which they live.

In qualitative research, the researcher's main goal is to assess and understand the situation under investigation, primarily from the participants' point of view. The aforementioned statements by Domegan and Feming (2007) and Myers (2009) serve to explain why a qualitative method was best suited to the study, and used as a paradigm.

The instruments deployed in this investigation consist of observations, video and audio recordings, a problem-solving assessment worksheet and qualitative approaches in data collection that allowed for an in-depth and insightful approach.

Hence, data was collected using classroom observations, audio and video recordings. As indicated, learners were also provided with a problem-solving assessment worksheet containing a set of questions relating to Area and Perimeter. The sample consisted of 34 grade 6 learners with different home languages, and one teacher from a primary school in the Western Cape. The selected group of learners comprised a purposive sample as the researcher wished to focus on particular characteristics of the participants to best explore the research questions. In addition, focus group discussions and open-ended interviews were also used for data collection.

Data analysis was done of each observation, and of the video and audio recording made. Learners' responses to each question were classified and the results collected are presented here in the form of tables and figures.

In general, the procedure was as follows: firstly, the researcher analysed the classroom, audio and video recordings to identify the dynamics of translanguaging in the classroom – to assess whether translanguaging practices were taking place – and if so, to what extent and to what purpose. Secondly, the researcher analysed the participants' written task to see whether they were able to interpret and understand the questions in a language that is not the home language of the majority of the learners. (They were allowed to communicate with their peers and teacher in their home languages to interpret and complete the task.) Thirdly, open-ended interviews were conducted with the learners and teacher to find out what their experiences and perceptions were of translanguaging practices in the mathematics classroom.

Tables and Figures are used to illustrate the data and to provide an analytical overview.

1.7 Research questions

The primary research question investigated in this study is:

> To what extent do the teacher and the learners use translanguaging practices in a multilingual grade 6 mathematics classroom?

The following sub-questions were focused on:

1) What is the purpose of translanguaging in a grade 6 mathematics classroom?

2) What are the dynamics of translanguaging in the mathematics classroom?

3) What are the teacher's and learners' perceptions and experiences of translanguaging in the mathematics classroom?

1.8 Significance of the study

As the study was aimed at exploring translanguaging practices in a grade 6 multilingual classroom, the teacher and the learners were allowed to use their home languages in the teaching and learning of mathematical content. Area and Perimeter constituted the focus. It was envisaged that the data gathered from this research will encourage the use of learners' home languages in a systematic way in schools. It is also hoped that the data will serve to encourage other teachers to incorporate translanguaging practices in their mathematics classes and possibly to make policy makers, curriculum advisors and parents aware of its merits in teaching and learning.

1.9 Limitations of the study

As a fundamental first step, a researcher has to recognise the meaning and the operational definition of the words 'limitations' and 'delimitations'.

In any study limitations have to do with potential weaknesses beyond the researcher's control which may affect the study design. Statistical model constraints and funding constraints may also affect the results and ultimately the conclusion (Montori, Jaeschke, Schunemann, Bhandari, Brozek, Devereaux, Guyatt, 2004).

The results emerging in this study were dependent on my observations, thus predicting the outcomes of my study would have limited the study. The technique of triangulation was used by implementing various kinds of data collection to confirm the suggested findings. According to Bryman (n.d.), triangulation is commonly associated with research methods and design, which may involve multiple theories, data source methods, or the researchers' use of phenomena.

In the 1950s the technique of triangulation was introduced into qualitative research to avert possible biases which may emerge in the exclusive use of a single method only. The triangulation technique is used to confirm proposed results, but can also be used to determine whether the data is complete. To ensure that both the data collected and the results were free of bias, a colleague (peer) assisted in the data collection and discussion concerning the process and the outcomes.

Time became a limiting factor especially during the period marked by the Covid19 pandemic. Due to the phased-in approach that the schools adopted then, the time for data

collection was limited by the fact that the grade 6 learners attended school on only three days a week; sometimes only twice a week.

Delimitations are limitations which the researcher/author has consciously set for themselves. Delimitations refer to the definition set by the researcher as a boundary or limit, to ensure that the goal of the study is not impossible to achieve. It can be argued that the delimitation is within the control of the researcher and primarily concerns the theoretical background, objectives, research questions and samples of the study. Delimitations are neither positive nor negative, but rather a detailed explanation of why, in relation to the research design and framework, they determine the scope of the research's main interests (Leedy & Omrod, 2016, as cited in Theofanidis & Fountouki, 2019).

1.10 Operational definitions

Grade 6 mathematics classroom – For the purpose of this study, a grade 6 mathematics classroom refers to a room in which a class of grade 6 pupils or learners are taught mathematics.

Mathematical understanding - The ability to understand mathematics by making connections between representations of a mathematical concept (Sierpinska, 1994).

Multilingual – Various languages spoken in a given community, and linguistic proficiency in various languages (Desai, 2003; Burcu, Fannin, Montanera, Cummins, 2014; Prah, 2006). According to Reyes (2006), multilingualism has to do with biliteracy, given the variety of contexts and media in which languages are used.

Practices - The action of doing something as opposed to theorizing it (Soanes, 2002).

Translanguaging practices - This term is used to refer to the 'educational practice' in which learners consciously combine and use language to acquire and disseminate information. Translanguaging practices also refer to new language practices that show the complexity in language exchanges between people with different histories. Translanguaging is a deliberate and strategic teaching practice in which a teacher creates learning activities with inputs and outputs in two different languages. For example, consciously reading a lesson in one language and discussing it in another (Baker, 2001).

1.11 Organisation of the study

Chapter 1 - Overview of the study: This chapter presents the introduction, background, problem statement and the rationale for the study. The aims and objectives, research design, methodology and the research questions form part of this chapter. Additionally, the significance of the study is presented together with an overview of the chapters of which it is comprised.

Chapter 2 - Literature review: In this chapter, local and international literature related to the study is discussed.

Chapter 3 - Methodology: This chapter focuses on the research design and methodology. It details the design of the qualitative case study, the motivation for the research approach, and the data collection methods. Ethical considerations related to data collection are also mentioned, with detailed explanations of sample size, data analysis methods and study limitations.

Chapter 4 - Data analysis and findings: This chapter describes the findings of the study and presents a systematic analysis of data collected from problem-solving worksheets, focus group interviews and observations.

Chapter 5 - Discussion and conclusion: This chapter examines the findings in relation to the research questions. The limitations of the study are outlined, followed by the recommendations and conclusions.

1.12 Conclusion

In this chapter, the background to the study is presented, together with the problem statement, rationale, aims and objectives, research design and methodology and the research questions. The discussion on the significance of the study, its limitations and a sketch of the organization of the four thesis chapters to follow are presented as well.

In Chapter 2, the literature review on translanguaging practices is presented as well as the theoretical framework which directed the study design.

Chapter 2: Literature Review

2.1 Introduction

The focus of this chapter is to review literature on multilingual education, in particular, translanguaging practices in South Africa and internationally.

The opening section of this chapter introduces key elements in the study namely, multilingual education, the Language in Education Policy (LiEP) in South Africa, translanguaging and education, the use of language in mathematics education, the concept of translanguaging and the purpose of translanguaging. This is followed by a discussion about translanguaging practices in the world, translanguaging in the African context and translanguaging in the South African context.

This chapter also presents the theoretical framework of the thesis: translanguaging theory, Cummins' theory and processes related to conceptualizing the use of translanguaging in content assessment.

Research in and outside the country continues to supply strong evidence of the effectiveness of translanguaging approaches to education, implying that the use of learners' home language greatly contributes to effective learning both within and outside the classroom.

2.2 Multilingual education

The African continent represents over 2000 languages and is thus rich in cultural and linguistic diversity, but the matter of the Language of Learning and Teaching (LoLT), remains complex in both primary and tertiary education. Language teaching is still largely based on monolingual instructional assumptions. Close to 50% of Africa's population are home language speakers of African languages, yet only 25% of the African languages are used in secondary education and a mere 5% in higher education (UNESCO, 2010).

Due to domination by certain languages, South Africa is in a state where it produces young people who can hardly read and write in their home languages and this worsens the stigmatisation of African languages in education (Prah, 2006).

As indicated earlier, since the birth of democracy in 1994, the concept of multilingualism has received significant attention. Multilingualism refers to the variety of languages spoken in a particular community, as well as to language competencies in a variety of languages (Burcu, Fannin, Montanera, Cummins, 2014; Desai, 2003; Prah, 2006). According to Reyes (2006), multilingualism can be associated with biliteracy given the varying contexts and media in which languages are used. For example, in a classroom setting learners might access reading and writing systems in two or more languages for different purposes. There is also a variety of literacies for communication in the classroom – beyond reading and writing – which support learners' cultural- and home languages (Burcu et al., 2014). Hence the 'multiliteracies approach' advocated by Burcu et al. (2014) is a relevant one for addressing the variety of sociocultural and linguistic resources which may help learners access knowledge, notably in the South- African context.

The Multiliteracies Approach was initially proposed in 1996 by the New London Group, a group of ten authors (educators) who met for a week in September in 1994 in New London, in the USA. Their purpose was to discuss the state of literacy pedagogy focussing on areas of common or complementary concern including, amongst others, the challenge of cultural and linguistic diversity. The Multiliteracies Approach was elaborated upon by numerous researchers (namely, Alexander, 2008; Anstey & Bull, 2006; Cope & Kalantzis, 2000; Heydon, 2012; Hibbert, 2013) with the focus on multimodality. This approach stresses the need for schools in the 21st century to focus on a range of literacies beyond basic traditional reading and writing skills. It draws attention to multiple modes of meaning-making, using approaches to communication media of an auditory, visual, linguistic, spatial and performative nature. The approach entails initiatives that show how multimodality might assist learners to optimize their language and literacy learning. It also emphasises the importance of multilingualism and the use of learners' first language in classrooms of increasing cultural and linguistic diversity.

UNESCO (2011) reports that multilingual education obtains in classrooms representative of at least three languages: the home language, a regional language or national language and an international language. In education, the concept of multilingualism therefore entails the use of linguistic resources as the capital with which to challenge English hegemony while affirming learners' home languages, culture and identity (Hopewell & Escamilla, 2014). The growing number of linguistically diverse learners across the world makes it more urgent that multilingualism be promoted.

According to Giambo and Szecsi (2015), classroom multilingualism has been used for the alternative strategies it enables to ensure that learners thrive in their multilingual environments.

Multilingual practice manifests in both Africa and the rest of the world. The general state of multilingualism in many societies and countries tends to be either official or unofficial. When a society described as 'multilingual' is declared official, this is normally overtly enshrined in the country's constitution. The practical application will be evident in the functioning of the education sector, and in national and international official engagements. Functions of the education sector include teaching and learning in primary, secondary and tertiary institutions.

In the South- African context, many speakers of African languages are fluent in more than two languages other than English (Heugh, 2003; Prah, 2006), because there is a mutual intelligibility between the African language groups such as the Nguni languages – isiXhosa, isiZulu, isiNdebele and SiSwati. However, the linguistic abilities of African language speakers are often exclusively measured in relation to their proficiency in English only, and this compromises their rich linguistic repertoires which serve as, and potentially offer, social and academic resources.

2.3 The Language in Education Policy

The Language in Education Policy (LiEP) (1997) was developed as a fundamental and necessary aspect of the government's strategy to combat racism and to build a nation that was non-racial in South Africa. The LiEP allows for communication beyond barriers such as colour, language and region, while at the same time creating an environment that encourages respect for languages other than one's own. The LiEP assumes that in our society a general principle should prevail, to learn more than one language. In other words, being multilingual in South Africa should be a defining feature of its citizens. The basic principle upon which the LiEP is founded is to sustain the use of home languages while gaining and providing access to additional languages.

The language-in-education policy and curriculum policy documents were originally influenced and drafted by two sets of stakeholders with divergent conceptions of how multilingualism may be understood (De Klerk, 2002). The drafting of the language

education policy occurred subsequent to the consultative LANGTAN process, in which a wide range of Socio- and Applied Linguistics parties contributed to discussions about multilingualism and the prospect of its centrality in the implementation of policy. A crucial principle informing the Language-in Education Policy document was that school learners have equal access to the curriculum. The belief was that practical implications of this idea would best be realized through a national system of additive bilingual or multilingual education.

It was also held that multilingual education would allow African learners/students the best opportunity to develop their proficiency in the English language (De Klerk, 2002; DoE, 1997a). Although these principles were included in the policy document, the texts that explained what they might mean in practice were removed from the document during the National DoE's editing process on the basis that they would be included in a language-in-education implementation plan that was to follow. Contributions to the implementation plan were submitted in the wake of classroom-based research conducted in linguistically homogeneous settings as well as diverse urban settings (Agnihotri, 1995; Robb, 1995; Versfeld, 1995). Although the term "mother tongue" was replaced by the term "home language" in the new education policy documentation, the abiding stigma of apartheid mother tongue education led to a misapprehension that a policy promoting the use of the home language as the language of learning and teaching alongside English is too close to the previous regime's segregationist language policy (Fleisch, 2008).

Former policies had established language status inequalities, the development and domination of English, the rejection of Afrikaans by Africans, the development of Afrikaans and the marginalisation of African languages.

The formulation of the new LiEP in 1997 was informed by the previous LiEPs, and other policy frameworks such as the National Policy Act (Act 27 of 1996) and the South African Schools Act (DoE, 1997b). The main aim of the then Minister of Education in formulating the new LiEP, was the promotion of additive multilingualism as an approach to language in education.

The LiEP (DoE, 1997b) ensures that learners learn through the medium of any official language of their choice. It also makes provision for learners to learn a home language and one additional language, emphasizing the importance of maintaining the home language while offering access to the acquisition of additional languages (DoE,

1997b). The language policy therefore encourages and promotes the use of home language to be consistent with that of other languages such as English (Heugh, 2000). The policy also ensures that no one is discriminated against at school, by being denied the use of their languages either as LoLTs or as subjects. The policy provides support for single medium schools, but encourages schools to provide more than one LoLT if necessary (DoE, 1997b).

Thus irrespective of the challenges relating to the current LiEP, the policy indicates a democratic approach to language-in-education planning because it includes all official languages. Indeed, there is enough evidence of the educational value of bi-and multilingual education in the use of African languages alongside English in South Africa, in Africa and elsewhere. Despite this, and despite more recent research (Ouane & Glanz, 2010, 2011; Skutnabb- Kangas & Heugh, 2012), many stakeholders in South Africa find it difficult to accept the evidence. According to Plüddemann (2013), the result has been that although the principle of additive multilingual education did find its way into the initial pages of new curriculum documentation, it has not been implemented.

However, between 1994 and 2013 three attempts were made to modernize and transform curriculum and assessment policy. The attempt to change language policy and curriculum change were huge failures. The first tragic mistake related to the language education policy (DoE, 1997a) because discussions excluded debates on curriculum and assessment change. The second mistake was that within the curriculum discussions, language was treated as a subject, while its role as a language of learning across the curriculum received little attention. The third mistake was that literacy was conceptualized as independent of the language(s) in the curriculum documentation through which reading and writing take place in the school.

> The Language-in-education policy (DoE, 1997a), based on an additive notion of bi-and multilingualism was informed by decades of research on bi-and multilingual education in South Africa, across Africa and in the international sphere (Alexander & Heugh, 1999; De Klerk, 2002 as cited in Heugh, 2013, p.7).

Important research in Sub- Saharan Africa further supports the extended use of the first language as a medium of instruction alongside competent teaching of an international language of wider communication, such as English, as an additional language. In Africa the switch to English medium is successful only when learners have sufficient levels of academic literacy in both languages to safely facilitate this. This is

usually after 6-8 years of learning the additional language as a subject (Alidou et al., 2006; Bamgbose, 2000; Ouane & Glanz, 2010, 2011; Skutnabb- Kangas & Heugh, 2012).

It is important to note that even if schools report that their medium of instruction is English, this is inaccurate because learners are taught through code switching practices in the spoken form, but are still expected to read and write in English (Plüddemann, 2013; Plüddemann, Braam, October & Wababa, 2004; Probyn, 2009). This can be considered as translanguaging, a term popularized by Garcia (2009) and a more modern manifestation of the fluidity of language practices.

According to the DoE:

> It is recommended that the learner's home languages should be used for learning and teaching wherever possible. This is particularly important in the Foundation Phase [Grade R-3] where children learn to read and write. Where learners have to make a transition from their home languages to an additional language (DoE, 2002, p.4-5).

The discrepancy exists between the current LiEP and the Curriculum and Assessment Policy Statement (CAPS) because in the National Curriculum Statements (NCS) and CAPS, there is no emphasis on the choice of three languages. Thus, the language of instruction continues to be English and Afrikaans from Grade 4 onwards in South Africa.

As a result of the lack of synergy between the current LiEP and CAPS, many learners have to learn mathematics in a language that is not their home or first language. This is the situation for the majority of classrooms in South Africa.

2.4 Translanguaging and Education

Translanguaging theory has proved most fertile in education. Formal educational environments globally tend to uphold structuralist notions (examining of language in a detailed manner) of language use. Bilingualism is still seen through subtractive (learning a second language at the expense of the first language) or additive (second language is seen as an addition to the first language) prisms throughout the world by educators, school leaders and policy makers. However, as globalisation increases, especially as more

bilingual learners enter schools, translanguaging is being identified as a practice in classrooms around the world.

According to Garcia and Lin (2016), there is a strong and weak version of translanguaging in education. The weak version of translanguaging upholds national languages, but calls for a softening of those boundaries in education, calling for bilingual instructional strategies that leverage what society would call the learners' first language.

As a scholar interested in the effects on students of language policies, Cummins (2007) has challenged the "two solitudes" that disregards the extent to which students' linguistic resources are intertwined in cognitive processes and social activity and has called for a more flexible instructional approach so that transfer between languages can take place. A strong version of translanguaging as linguistic theory however posits that bilinguals build a single linguistic repertoire from which they learn to select appropriate features (Otheguy, Garcia & Reid, 2015). The strong version also places emphasis on the role schools play in the construction of exclusive language categories, the regulation of language use and the maintenance of the notion of standard languages. A "strong" version of translanguaging may assist teachers to take up a critical stance with regard to the construction of standard languages. Only then can learners' full linguistic repertoires be maximized, and their bilingualism be developed (Garcia & Kleyn, 2016).

According to Lewis, Jones and Baker (2012B), much of translanguaging that takes place in the classroom is learner-directed. For example, learners use translanguaging to mediate understanding, construct meaning for themselves, include and exclude others, and to demonstrate knowledge – among other meta-functions. Translanguaging as a practice in schools is being recognised.

In the last several years, translanguaging theory has been applied in different educational contexts. In translanguaging pedagogy, teachers aim to build on learners' diverse linguistic practices in order to support them in expanding their linguistic repertoires. Linguistic repertoires are cultivated to develop different kinds of literacies and subject-matter knowledge, and to enhance performance in academic environments (Garcia & Li Wei, 2014). Garcia and Wei observe that:

> In instances where teachers are, or are not familiar with the language practices of their learners, they can "set up the affordances for learners to engage in discursive and semiotic practices that respond to their cognitive and social intentions" (Garcia & Li Wei, 2014, p.93).

Teachers have maximized on learners' translanguaging to contextualize key words and concepts, to assist learners in developing metalinguistic awareness, to create socioemotional bonds with learners and to provide learners with the chance to challenge language hierarchies and inequalities.

2.5 The use of language in mathematics education

Mathematics has a strong connection to languages and to be successful in mathematics it is important that a learner competently understands and uses mathematical language (Anthony & Walshaw, 2007; Boero et al., 2008; Kazima, 2007; Kotsopoulos, 2007; Schleppegrell, 2011; Xi & Yeping, 2008). Boero et al. (2008) wrote about the role of natural and symbolic languages in mathematics, explaining that if learners reach an adequate level of familiarity with the use of natural language in mathematical activities, will they be able to perform in a satisfactory way.

Because there is an increase in the number of multilingual learners in the classroom, it is important to perceive that language and mathematics are connected in mathematics learning. Therefore, teachers need to be aware of such issues surrounding teaching mathematics and to plan accordingly. Being unaware of these issues can have damaging consequences for all learners.

Translanguaging is thus a reality in multilingual environments and should not be overlooked in teaching and learning in African educational contexts. According to Lubliner and Grisham (2007), translanguaging is based on the reality that bilinguals use the full repertoire of linguistic resources to communicate with one another. They argue that this forms the basis for why translanguaging should be acknowledged and adopted in African education, especially in the teaching of mathematics where African languages have been tabooed.

In translanguaging, bilinguals activate a variety of communicative possibilities, practices and choices (Chumak-Horbatsch, 2012). Using language flexibility – shifting, mixing and blending linguistic features – translanguaging bilinguals go back and forth from one language to another and combine elements from each language, revealing their language, social skills, cultural knowledge and understanding. A study conducted by Setati et al. (2008) was undertaken with a grade 11 class in a multilingual high school in Soweto, Johannesburg. It investigated the use of language as a transparent resource in

the teaching and learning of mathematics. There were 36 learners in the multilingual class, with different home languages such as Setswana, Xitsonga, IsiZulu and Tshivenda. The teacher of the class was fluent in eight languages that included all the home languages of the learners. Each of the learners was able to communicate in at least four languages and they were learning English as a subject at second language level.

Sesati's investigation collected data through lesson observations and individual learner interviews. Lessons were observed and video recorded, and learners with a selection of home languages were interviewed. Learners were given a task that was translated into the four home languages of the learners in the class. Participants were explicitly made aware of the two language versions of the task and were encouraged to communicate in any language including their home languages at any stage during the lessons.

The exploration of a strategy for using language as a transparent resource in the teaching and learning of mathematics in a multilingual classroom was guided by two main principles – the deliberate, proactive and strategic use of the learners' home languages and the selection of real life, interesting and high-cognitive mathematical tasks. The analysis showed that with this strategy language became both a visible and invisible resource in the sense that while learners drew on different languages at any time they wished, language was also invisible because it did not hinder their focus on mathematics.

The study also indicated the challenges of translating tasks into multiple languages. Yet translation is part of how meaning is transferred, made, and re-negotiated; thus, the aspect of linguistic diversity remains an important consideration. Pedagogically, is important in the educational system and much needs to be done to ensure this.

According to UNESCO (2010), language used in teaching and learning is a key factor in promoting or preventing learners' access to, and success in learning. Heugh (2015) explains that research conducted by government-led and independent agencies indicated declining student achievement in the South African education system which employs 11 home languages for education in the first three grades of primary schools, followed by a transition to English medium for the majority (approximately 80%) of speakers of African languages.

In mathematics, word problems often cause difficulties for learners because such sums use words found outside mathematical registers. Barwell (2005) explains that learners from minority cultural or linguistic backgrounds will frequently have trouble

with word problems because they are unlikely to be familiar with the vocabulary. When learners struggle with unfamiliar vocabulary or syntax, before even attempting the mathematical problem, this can negatively impact their learning. Not only does it influence their ability to learn in class, but it also impacts and invalidates assessment measures

According to Moschkovich (2010), Planas and Setati-Phakeng (2014), it is important to support learners' mathematical development by encouraging the use of learners' home languages in the mathematical classroom. Much as their different mathematical strategies might be respected, to further support learners, home languages should be recognised as a resource and not as an obstacle. Xi and Yeping reiterate the point as they argue that when learners have access to, and use of their home languages, the development of their mathematical vocabulary is faster (Xi & Yeping, 2008).

2.6 The notion of translanguaging

According to MacSwan (2017), the term 'translanguaging' was originally coined by Williams (1994) to refer to two languages being used in a planned and systematic manner within the same lesson at schools. In the same vein it has also been acknowledged by Baker (2011), and Garcia (2009), Lewis, Jones and Baker (2012). Canagarajah (2011) defines translanguaging as the ability of multilinguals to alternate between languages. In this respect, translanguaging implies that there are no clear-cut boundaries between the learner's first and second languages.

According to Garcia and Wei (2014), translanguaging does not refer to two separate languages or to the combination of different language practices, nor to a hybrid mixture, but to new language practices that show the complexity of language exchanges among individuals with different histories. Translanguaging is a planned and strategic educational practice through which teachers create learning activities, in terms of input and output in two different languages, for example the deliberate reading of a lesson in one language and the discussion in another language (Baker, 2001).

The original conceptualization of translanguaging laid the foundation for an epistemological change regarding how multilinguals dynamically create their everyday language practices in and outside the classroom. Translanguaging is about recognising all

the languages and linguistic resources present in the learning environment, as well as all the political and historical sets of resources (Heller, 2007).

According to Gamede (2005), translanguaging promises to end a hidden curriculum that is in favour of some languages to the exclusion of others. A hidden curriculum refers to the unspoken or indirect values, behaviours, procedures and norms found in the education setting. A hidden curriculum concerns the unstated promotion and enforcement of certain behavioural patterns, social beliefs and professional standards to which the school community is exposed while navigating a learning environment (Miller & Seller, 1990).

The main aim of translanguaging is to address the realities of 21st century multilingualism. It represents a new paradigm and is not just some fancy postmodernist term to replace terms such as code switching or language crossing, to refer to multilingual behaviour (Li Wei, 2016). As made clear by Garcia (2009), translanguaging incorporates, but goes beyond code-switching. Translanguaging is about transcending linguistic systems.

Languages are constantly shaped, constructed and reconstructed, and thus cannot be seen as fixed or stable entities. From a translanguaging perspective, language is practice and action performed by individuals in reflexive, relational and dialogical ways, as opposed to being an abstract system of fixed rules and norms. According to Otheguy, Garcia and Reid (2015), a proper understanding of translanguaging calls for a return to the well-known but often forgotten idea that named languages are social, not linguistic objects. Translanguaging refers to using one's repertoire irrespective of socially and politically defined language labels or boundaries.

Translanguaging as a pedagogical practice thus presents both cognitive and sociocultural benefits. It maximises understanding and develops skills in the "weaker language" by rebalancing the hierarchical ordering of languages in the classroom. Additionally, it assists home-school co-operation, by favouring parental intervention in children's school activities, and supports classroom interaction between the dominant language and language learners (Baker, 2001).

As a conceptual framework, translanguaging and its offshoots promote a positive view of bilingualism, allowing bilinguals to act naturally, using language as they do at home and in their communities (MacSwan, 2017).

2.7 The purpose of translanguaging

According to Li Wei (2016), the main purpose of translanguaging is to address the realities of 21st century multilingualism; it is not simply a term to replace terms such as code-switching or language crossing when referring to multilingual behaviour.

As Garcia (2009) explains, the aim of translanguaging is not to describe a new phenomenon, but to capture complex processes of meaning making through organizing languages, language varieties and semiotic, multimodal and cognitive resources.

Li Wei and Zhu Hua (2013) also explain that translanguaging relates to the idea of humans acting through all available linguistic, semiotic, social and cognitive resources to make sense of their social reality and to construct meaning. Translanguaging therefore deals with language or the process of knowledge construction that contributes to changes in cognitive skills, experiences or ideologies and the ongoing development of new practices and identities of individuals.

The diagram to follow explains how translanguaging is used in a context of multilingual practice. The various components delineate how translanguaging is used in a purposeful way for social or academic reasons. In a social setting, translanguaging can be used interpersonally where individuals communicate with each other face to face for example, with friends, family or members of the community, or electronically. For academic reasons, translanguaging can be used collaboratively where learners use different languages to help each other or behave in a particular way in the classroom. For cognitive, mathematical and textual reasons, translanguaging can become more individualized where thinking about concepts between languages helps with the problem-solving aspects of maths and the written texts.

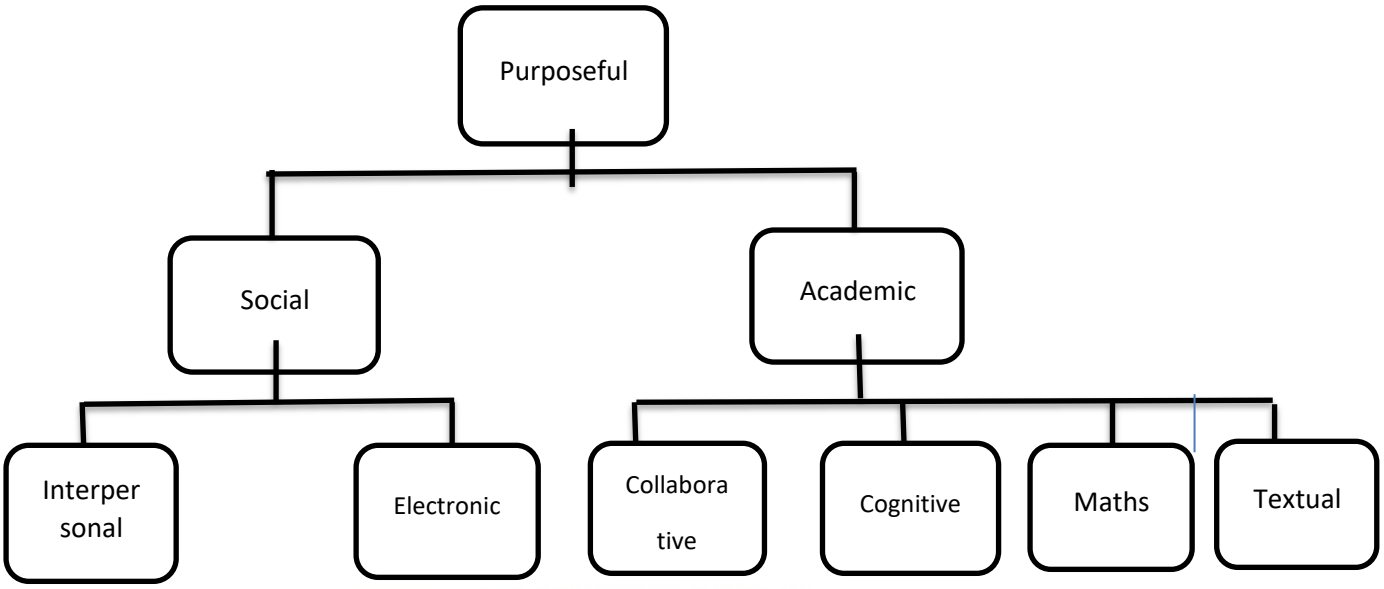


Diagram 2.1: Diagram of translanguaging in multilingual practice (French, 2017, p.13)

The purpose of translanguaging is to encourage a positive view of bilingualism, allowing bilinguals to act naturally, using language as they do at home and within their environments. Grosjean (1982, 2010) explains that bilingual is not two monolinguals in one, but a linguistically unique language user whose languages reflect the differential experience a bilingual may have with each language. He illustrates this with a sports analogy from the domain of athletics: hurdlers blend two different athletic competencies, high jumping and sprinting, as a combined whole. Compared to individual high jumpers or sprinters, the hurdler does not meet any of the set of expectations they each require, but by combining the two sets, hurdlers compete athletically in their own right, excelling in a sport that neither the high jumper nor the sprinter could.

Lewis (2012) concurs that the purpose of translanguaging is the use of one language to reinforce the other in order to expand understanding and to increase the pupil's activity in both languages. In his study, Baker (2011) observed how the practice of translanguaging assisted students in making meaning, in comprehending and acquiring knowledge. He explained that to read and discuss a topic in one language and then to write about it in another language, means that the subject matter has to have been processed and digested.

Outlined in the list that follows, Baker (2001) as cited in Garcia and Lin (2016, p.3) provides four educational advantages of translanguaging.

1) It may promote a profound understanding of the subject matter.

2) It may aid in the development of the weaker language.

3) It may facilitate home-school links and cooperation.

4) It may aid in the integration of fluent speakers with early learners.

Translanguaging does not deny the existence of different languages and language varieties. Pennycook presents a cryptic description, captured in the quotation that follows.

Translanguaging is a specific language theory that proposes an integrated approach to the understanding of language, multilingualism and multilingual practices in contexts of unprecedented mobility where language mixing is the norm and does not need explanation, communication occurs across what have been thought of as language, speakers draw on repertoires of semiotic resources and language is best understood in terms of social practices (Pennycook, 2016a, p.212).

2.8 Translanguaging practices in the world

Because translanguaging challenges the practices of conventional classrooms, several studies in the field of translanguaging have set out to justify its use in the classroom. Translanguaging challenges the stance of pitting one language against the other, and of treating multilinguals as non-native and therefore of lacking ownership in certain languages (Canagarajah, 2011b).

Current research is yielding useful results that offer insight into translanguaging. These are outlined in the next section.

Indonesia

In his study of an ESL class in Indonesia, Rasman (2018) found that contrary to traditional beliefs, the use of home languages in the classroom does not hinder learners in their acquisition of a second language. He concluded that through scaffolding and peer interaction, translanguaging helps improve learners' linguistic repertoire. He stated that the outdated idea of having a native-like proficiency should be removed with the help of the teacher so that learners will become more open to translanguaging.

China

Wang's (2016) study produced similar results. Wang administered a questionnaire to Chinese students in a beginner level English class to show their attitudes towards the use of multiple languages. The results showed that students and teachers believe translanguaging reveals practical scaffolding techniques and strengthens classroom communication and teacher-student relationships. Wang also suggested a number of ways through which translanguaging can be developed, and according to which, teachers should: a) renew knowledge about learning; b) facilitate structured translanguaging strategies; and c) develop a transformative teacher-student role.

United States

In the United States, translanguaging has been taken up by scholars especially in efforts to push back against the "two solitudes", a phrase used to critique practices which essentialize teaching English-only classes to the exclusion of home languages. The "two solitudes" assumption characterizes dual language bilingual programs. In those programs the languages are strictly separate and are sometimes called "two-way immersion". Many of the dual language bilingual programs attempt to balance the numbers by including an equal number of majority language and minority language students. In the United States this is viewed as the only way to develop bilingualism, thus it is very popular in the social imagination and among teachers. Scholars have started to use the concept of translanguaging to describe the actual language practices in classrooms as well as to form a space for different language use in order to educate minority language children meaningfully.

Gort and Sembiante (2015) explored how translanguaging pedagogies supported young bilingual preschool children in a Spanish-English dual language bilingual program. All the scholars reported that in spite of the policy of linguistic compartmentalization in the classroom, teachers crossed the artificial boundaries to ensure that children were educationally bilingual. The issue of the International Multilingual Research Journal, edited by Gort (2015), provides evidence for a growing appeal to make the structures and practices of dual language bilingual education classrooms more flexible by increasing the use of translanguaging.

2.9 Translanguaging in the African context

Namibia

A study done by Shifidi (2014) focused on exploring translanguaging in three Namibian schools, specifically on the extent to which translanguaging occurred during lessons. The study also focused on the opinions of the teachers, and on whether translanguaging had the potential to enhance or hinder learners' understanding of the subject content. Data collection took place at the Namibian schools during classroom lessons. Learners and teachers were observed and semi-structured interviews were conducted with the participants.

Results from the three schools showed that teachers were less familiar with the concept of translanguaging than they were with that of code switching. The results also indicated that teachers and learners acknowledged the need for translanguaging and its potential to enhance learning and understanding, participation and socialising in multilingual classrooms.

Ethiopia

A study done by Heugh et al. (2007) in Ethiopia indicated that Grade 7 and 8 performed better in mathematics and sciences between 2000 and 2004, due to the use of the mother tongue. According to the World Bank (2005), the use of mother tongue education is also beneficial to teachers who speak the same languages as the learners because it allows the teachers to use more engaging and effective teaching methods.

Nigeria

According to Akinpelu (2020), no known study has been found to use translanguaging techniques in formal education. However, the current situation in the country requires a more effective and well-oriented pedagogical approach that uses local languages in education efficiently. The country's general educational system faces various challenges including the academic performances of learners which can be attributed to the inadequate and defective language-in-education policy. Considering that Nigerians undergo unnecessary emotional and intellectual hurt through being taught in a foreign language at an elementary age, the Minister of Science and Technology stressed the importance of an education in the mother tongue to assist and better equip learners during the first twelve years of their lives.

Using translanguaging techniques as a learning method would help in a meaningful way to achieve this goal.

2.10 Translanguaging in the South African context

In South- Africa, the average learner must, at a minimum, be bilingual to be successful in achieving a Grade 12 or matriculation school leaving qualification. While many teachers code-switch or use translanguaging practices when they feel that they are not being understood, they do so with the belief that this practice is illegitimate.

Cape Town

A case study was done by Guzula, McKinney and Tyler (2016) in Cape Town, Khayelitsha with an after-school literacy club for grade 3 learners. Their research showed that monolingual ideologies have negative consequences for the positioning of SouthAfrican learners as well as for their participation in the curriculum. The focus of the study was on how learners' capacities are enabled when a heteroglossic (the juxtaposition of different languages) and multimodal orientation to language practices and meaningmaking is adopted.

The results of the study revealed learners as resourceful, and thereby able to use their linguistic capacities in translanguaging and multimodal meaning-making activities. The analysis of the study refers to processes observed as "trans-semiotising" (languages as entangled with many other semiotics such as visuals, gestures and bodily movement) and meaning making.

Another case study was conducted by Krause (2016) at a school located in Khayelitsha, a residential area of Cape Town. Krause's intention was to take a translanguaging perspective to examine teaching in schools where heteroglossic language practices in classrooms encounter less fluid language ideologies in educational policy and assessment strategies. The researcher spent one month observing outside the classroom and engaging in conversation with teachers and staff. The second phase of her study records language use in selected intermediate phase classrooms where the official medium of instruction was English.

The school followed the early transition language policy with isiXhosa as the language of learning and teaching (LoLT) from grade 1 to 3, with a switch to English from

grade 4. The school subscribed to a separatist language policy and ideology that supported a monolingual environment in which English served as the language of instruction. However, it was found that in the classroom, patterns of translanguaging practices are taking place undercover at the school. While the teachers did not explicitly address ideas about how language is deployed in school operations, they nonetheless sustained and supported translanguaging in classroom practice.

Krause's (2016) findings illuminate the reality that translanguaging as it is currently being presented in the literature as an advance on restrictive monolingual teaching strategies, is common practice in township schools. She confirmed that there is no shortage of teachers applying the language resources at their disposal to assist learners to understand the subject content.

Eastern Cape

A second case study by Guzula et al. (2016) was conducted in the rural Eastern Cape. This one involved a mathematics holiday programme for grade 11 high school learners. The purpose of this study too was to focus on, and to demonstrate the effects on learners when they are engaged as resourceful agents in the classroom. The enquiry revealed how this approach to teaching and learning is achieved in a translanguaging space, and how learners can use multimodal and multilingual meaning-making resources for working on understanding in a content subject.

The results for both cases confirmed that much can be achieved when teacher and learners share linguistic repertoires. It is indicative of translanguaging being used as an intellectual, social and linguistic resource which enhances multilingual and multimodal meaning-making.

Additionally, translanguaging is seen as a tool for accessing socio-cultural resources, for eliciting prior knowledge and for ensuring deep understanding. Furthermore, it is an intellectual and academic tool that teaches, strengthens and ensures understanding while providing learners with, for example, story writing resources.

In each of these cases, it is argued that translanguaging and multimodal strategies offer new pedagogical strategies for meaning-making that challenge the dominant monolingual orientation.

In Kepe's study (2019) of a multiracial school in the Eastern Province of South Africa, the focus fell on how English First Additional Language (EFAL) learners might be taught through translanguaging pedagogy in the culturally diverse classrooms of a South African School.

The academic achievement gap between English native and EFAL learners is still evident today and may have been widened by the significant number of EFAL learners with limited vocabularies who suffer from communication breakdown when using English as a learning medium. The study deduces that translanguaging as an unorthodox approach, may bring a lasting solution to the continuous dilemma of a negative cycle of failed language acquisition outcomes and academic underperformance in South African schools.

Generally, their data showed the need for multimodal approaches to teaching and learning. The findings drew attention to the fact that currently there are two major proposals concerning the use of dual language teaching and learning (Afrikaans and English) as stipulated in South African language policy. The policy supports the idea that learners should learn in their home languages from grade R to grade 4, and in English or Afrikaans thereafter. By contrast, the study by Kepe (2019) presented an unorthodox option for translanguaging revealing that despite the fact that participants (teachers) were not particularly overt about side-lining languages other than English and Afrikaans, they did seem to be in support of this dual medium option for instruction.

What emerged is that although teachers are not obligated to know all the different languages of learners, they ought to initiate a dialogue about integrating these, and be open to exploring opportunities for translingualism (Kepe, 2019).

2.11 Translanguaging theory

The role of translanguaging in the educational process is very important. According to Nikula and Moore (2016), the prefix "trans" refers to moving from one instance to another. Translanguaging shows the need and capacity individuals have to change the languages they use in communication. To illuminate this, teachers can provide opportunities for learners to expand their vocabulary. For example, the teacher can use a problem-solving question and utilise a brainstorming strategy. Specifically, they can ask the learners to express their thoughts about the problem.

According to Lin and He (2017) and Nikula and Moore (2016), multilingualism is an abstract noun that suggests activity in a variety of languages: doing, learning, using and showing in different contexts. Hence translanguaging is a teaching procedure that should be understood as a way to express oneself through different languages and linguistic idioms. Educators can use the notion of translanguaging as a teaching tool in multilingual and multicultural classes by allowing students to express themselves in their home languages as far as intelligibly possible when they explain mathematics or give feedback, and not restrict them to the dominant spoken language. The aim of the strategy is to broaden awareness, link the languages and assist learners to use their repertoires as a part of a normal way of communication (Castles, 2014; Heugh, 2015; Nikula & Moore, 2016).

Garcia-Mateus and Palmer (2017) comment that although translanguaging plays a vital role in the educational process, many teachers do not subscribe to the strategy and hence desist from using it. These teachers promote the idea that learners should use only the dominant language, spoken at a specific place and time.

However, some teachers consider translanguaging as a useful method that can offer much in the learning of mathematics. Firstly, it can be used as a tool to help learners understand the ideas they are being taught. Secondly, translanguaging can be seen as a positive and constructive tool to support a bilingual discourse. Thirdly, translanguaging offers learners cognitive and cultural enrichment and development in a multilingual mathematics class (Heugh, 2015).

The comprehension of mathematical concepts, procedures and principles influences the attitudes of students, their appreciation of mathematics and their selfefficacy (NCTM, 2000). This in turn has the potential to facilitate improvement in mathematical performance.

Babaci-Wilhite (2016) observed that engaging in the home language and drawing on local knowledge are necessary ways to facilitate the teaching and learning process. According to Dlodlo (1999), African languages need not be isolated from English when it comes to teaching mathematics, but should be incorporated through the process of translanguaging. Those in favour of teaching mathematics in African languages argue that learners' comprehension is better when they are taught in their home languages.

Mbiri-Hungwe and Hungwe (2018) conducted research on the use of translanguaging in a multilingual second-year Computer Science class at a South African

University. The research indicated that students considered translanguaging as a helpful learning strategy which should be adopted by the whole faculty.

Various researchers (Babaci-Wilhite 2016; Dlodlo, 1999; Setati, 2008; Setati & Adler, 2000) share the common view that African languages should be used in the teaching and learning of African learners. This perspective is underwritten by policies such as The Western Cape Education Department's (WCED's) Language Transformation Plan (2007). However, the problem is that much of the associated research is based on opinion, unsupported by practical schemata. Hence, while African languages might coexist in contexts where English is dominant, efforts arguing for their equal status are stymied due to negative attitudes towards African languages.

Asabere-Ameyaw and Ayelsoma (2012) emphasize the importance of vocabulary, tenses and sentence structure as these elements affect the learner's understanding in a teaching-learning encounter. Babachi-Wilhite's (2016) statement serves to contextualize their view as her point of departure is home language teaching and learning. She proposes that home language consolidation provides grounds for new innovative learning as the home language of the learners is the best instructional tool in teaching and learning. Asabere-Ameyaw and Ayelsoma (2012) argue that for learners to comprehend concepts and to communicate effectively, they must first understand the language of instruction, because the language that is used determines the success in learning mathematics.

Until recent times, translanguaging was only of benefit in limited contexts. Indeed, it has only recently been discussed on a larger scale although it was put forward twenty years ago. As the changes brought about by the current era make terms such as translanguaging difficult to ignore, it can be argued that the growing transparency between national borders is manifest in teaching and learning environments too.

According to Garcia (2009), translanguaging goes beyond traditional notions of bi/multilingualism. Its strong advocacy of second language learning and teaching as the driving factor is built on a heteroglossic conception of bi/multilingualism, the term referring to the ability to flexibly operate between languages available to learners. Heteroglossia is linked to translanguaging because it refers to operating in different social discourses found in a diversity of social languages in a community (Lemke, 1998). Based on the heteroglossic conception of bilingualism, teachers can use translanguaging in education to promote a deeper understanding of the subject matter and to assist and

encourage learners to improve their written and oral communication skills in all languages by allowing dynamic shifts from one language to the other for educational purposes.

Learners with different home languages, cultural backgrounds, nationalities and different 'races' come together in the classroom with a common goal. Classrooms were not as diverse in the past as they are today, thus it did not present a big problem to cater for the diversity amongst learners. Currently, the monolingual or bilingual classrooms of the past are being replaced by multilingual classrooms and this increase in diversity and multilinguality have challenged the idealized status of native speakers. According to Flores and Aneja (2017), the goal of language development is for learners to strategically use elements of their communicative repertoire in ways that are reflective of their bi/multilingual identities, and not just for them to attain 'native-like' proficiency.

Essentially translanguaging is an interpretation of bilingualism and multilingualism. According to Duarte (2018), translanguaging was introduced as a tool to enable the use of several languages in multilingual classrooms. Translanguaging presents a distinct theoretical insight into bi-and multilingualism, according to Vogel and Garcia (2017).

As proposed in Cummins' (2008) "two solitudes" critique, languages are used separately and learners' home languages are considered as having the lesser value. Translanguaging on the other hand promotes the use of various languages interchangeably, including learners' home language, and regards each language equally as it is used in the classroom. Translanguaging aims to create a single linguistic repertoire that uses the first and second language and other languages that are represented in the class. This is in contradiction to the common belief held by strong advocates for the use of the target language during class who also restrict the use of the learners' home languages.

Translanguaging promotes the use of home languages amongst individuals, and accepts that instead of competing, different languages can work well together with the help of educators. Through translanguaging, learners are entitled to use different languages in the classroom, which actually enhances learning. There has thus been a gradual acknowledgement of the benefits in allowing individuals to use all their linguistic resources to achieve their goals. Contrasted with the *number* of languages they are able to use, this insight is now more frequently emphasized (Conteh, 2018). Vogel and Garcia

(2017) as cited in Erdin and Sali (2020, p3), emphasize three basic assumptions underpinning translanguaging theory as follows:

i. Translanguaging posits that individuals select and deploy features from a unitary linguistic repertoire to communicate.

ii. Translanguaging takes up a respective on bi-and multilingualism that privileges speakers' own dynamic linguistic and semiotic practices above the named languages of nations and states.

iii. Translanguaging still recognises the material effects of socially constructed named language categories and structuralist language ideologies, especially for minority language speakers. These notions are aimed at opposing the segregationist stance of bilingualism and multilingualism, which states that languages develop separately (Vogel & Garcia, 2017 as cited in Erdin & Sali, 2020, p.3).

2.12 Theoretical framework

According to Adom (2018), theoretical frameworks are used to inform data collection activities and data analyses activities. The theoretical framework also summarizes concepts and theories in the relevant field to serve as a map that guides the researcher through the research process.

Grant and Osanloo (2014) explain that a theoretical framework refers to the selected theory or theories which undergird one's thinking with reference to how you understand and plan to research a topic, including the concepts and definitions from that theory relevant to the topic.

Based on the information provided, the theoretical framework of this study draws on Cummins' (1984) concept entitled Common Underlying Proficiency (CUP). This model involves using the entire linguistic repertoires of the learners. Cummins advocates that CUP encourages learners' usage of their first language along with the second language. He advises that incorporating instruction in both languages has greater beneficial effects on academic outcomes.

Additionally, the theoretical framework supporting this thesis incorporates the Theory of Action, devised and formulated by Lopez, Turkan and Guzman-Orth (2017).

Their theory encompasses ways in which the two translanguaging principles in content assessment may be incorporated into evaluation, which in this case was centred around the problem-solving activity worksheet on perimeter and area.

Translanguaging as previously described, refers to two languages being used in a planned and systematic manner. This chapter grounds its theoretical framework in theories of translanguaging. To this end, the chapter also discusses Cummins' (1984) Common Underlying Proficiency (CUP) model, the two principles of translanguaging in content assessment and the theory of action that form the basis of the conceptual framework.

2.13 Cummins' Theory (Common Underlying Proficiency)

Cummins (1981) introduced the idea of a Common Underlying Proficiency (CUP) model that describes a potential mechanism by which cross-language transfer can take place. According to the CUP model, proficiencies in the First language (L1) and Second language (L2) are not separate abilities. Although on the surface each language may have distinct features, they are intrinsically connected. As proficiency in one language develops, so does the language independent knowledge (common underlying proficiency) that supports the development of skills in both languages. The CUP will develop with exposure to either L1 or L2, which may allow learners to transfer knowledge across languages.

Although this model is based on evidence of the transferability of language independent skills, Cummins argued that even when a task seems relatively languagespecific (for example, spelling), strong relations will be found between L1 and L2 because of the common underlying proficiency. Support for the CUP model stems from studies indicating that educational curricula which incorporate instruction in both languages have greater effects on academic outcomes than curricula which provide exclusive instruction in L2 (Cheung & Slavin, 2012).

However, before exploring the features of CUP which produce the aforesaid positive effects, it is necessary to describe Cummins' attempts to expose the ineffectiveness of approaches to additional language acquisition which are based on separating it from home- or other languages known to the learner. This endeavour Cummins refers to as 'The Discredited Hypothesis'.

The 'Discredited Hypothesis' postulates that languages are stored in different compartments or containers inside the brain, an image which exposes why Cummins (1984) coined the term 'Separate Underlying Proficiency (SUP), not to advocate it, but to debunk it. This hypothesis suggests that languages exist in different balloons inside the brain. As one inflates, the other deflates. The image is used to say there is neither a link nor any transfer between first language and second language. Each language functions independently because limited storage space in the brain limits retainable information, causing one language to diminish reference to the other.

The Discredited Hypothesis suggests that proficiency in a second language is achieved only through instruction and exposure to that language, and that using the first language should be restricted to instruction. According to Baker and Jones (1998), there is no research to support the point of view that languages function independently. On the contrary, research shows that there is a considerable amount of cognitive interaction between first and the second language and that the interaction happens easily (Baker & Jones. 1998).

By contrast, according to Canagarajah (2011a), proponents of translanguaging state that multilingual individuals process different languages in their repertoire synchronously. Coined by Cummins (1984), Common Underlying Proficiency (CUP) draws on the idea that when a person produces output, languages operate separately, but cognitively, they function interdependently, meaning that knowledge of the first language influences the acquisition of the second language. Translanguaging draws on the latter model, that is, CUP, because it connects first and second language and advocates that the use of the first language contributes to the development of the second language.

CUP develops via four language skills: listening, speaking, reading and writing, practiced in first and second languages. The theory explains why it is easier to learn an additional language once a second language has been acquired. Referring to the balloon metaphor in SUP, Cummins (1984) uses the image of an iceberg to explain CUP: on the surface a person seems to perform multiple languages, but at the bottom lies CUP, the entire linguistic repertoire that makes communication through various languages possible.

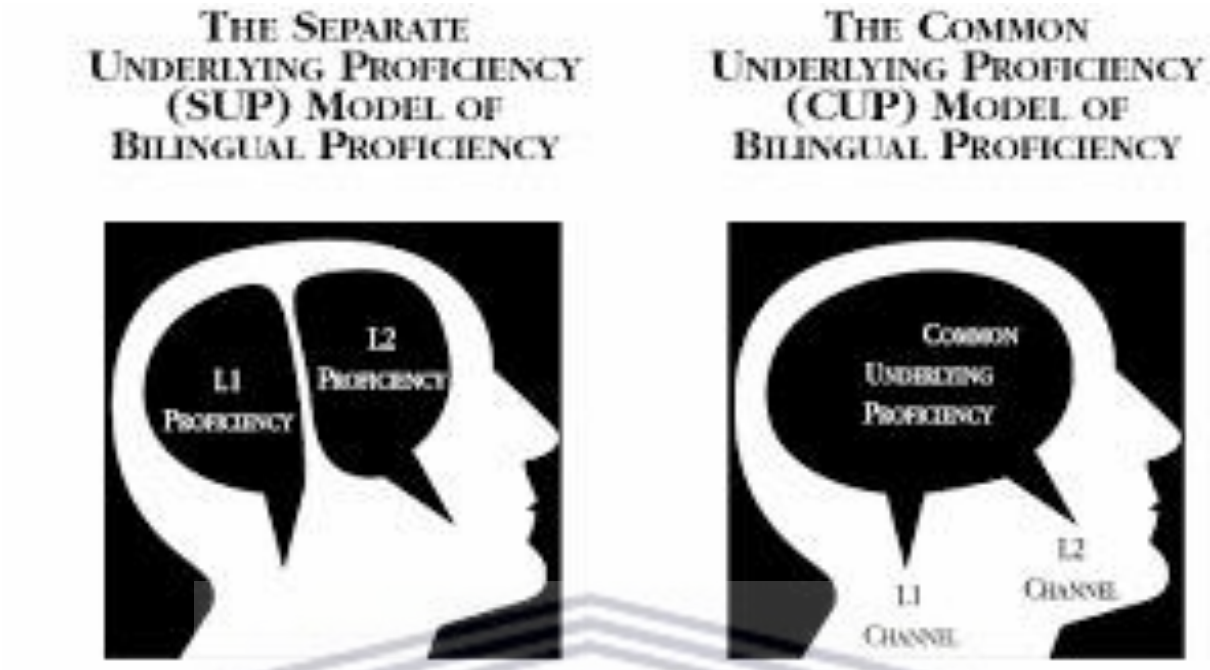


Figure 2.1: Cummins' (1984, p.36-37) SUP and CUP model of bilingual proficiency

Garcia and Wei (2014) believe that the process of translanguaging is natural and inevitable. Translanguaging will manifest regardless of restrictions and will occur, one way or another. Even if only the target language is used in the classroom, the learner will mix their first and second languages outside the classroom, thus to ensure that translanguaging benefits the learners it is best to practice this interchange systematically rather than to relegate it to the disorderly linguistic expression which may occur outside the classroom.

According to Garcia and Wei (2014) as cited in Cummins (2017), the key elements of translanguaging can be maintained by recognizing that the boundaries between languages are fluid and socially constructed. The points that follow indicate related processes.

- As bilinguals gain access to and develop their two languages, these languages combine into one system (Common Underlying Proficiency).
- Languages and languaging are sites that are socially contested and meet where the legitimacy of cultures and identities are negotiated.
- School programs helping or catering for multilingual students should link with students' linguistic background and conceptual knowledge and teach for transfer and better incorporation across languages.

2.14 Conceptualizing the use of translanguaging in content assessment

Translanguaging is an opportunity for bi-/multilingual learners to use new and complex language practices within the context of assessment (Garcia, 2009). It is a flexible manner by which to assess bi-/multilingual learners, giving the learners the opportunity to use complex and fluid discursive practices to show their content knowledge and skills. The idea is not to separate languages as suggested by the SUP model of bilingual proficiency as it has been done in the past, but to develop linguistically adaptive bilingual practices within an assessment context.

There are two important principles at issue when incorporating translanguaging into assessment. The first principle provides opportunities for bi-/multilingual learners to draw on all the resources in their linguistic repertoires. The second principle provides opportunities for learner-to-learner or learner-to-teacher interactions to enable spaces for interactive moments of translanguaging in the assessment of classroom contexts.

2.14.1 Principle 1: Draw on learners' entire linguistic repertoires

According to Hornberger and Link (2012), assessment that uses translanguaging is designed from the perspective that bi-/multilingualism is a resource and it provides learners with the opportunity to use their entire linguistic repertoires to demonstrate their knowledge and skills in a content area such as mathematics. Translanguaging is rooted in the principle that language practices are dynamic and fluid, and presupposes that bi-/multilingual speakers have a single integrated language system from which they select features to communicate strategically and effectively. Translanguaging thus allows learners to perform bilingually by switching between a second language and their home language in different modalities (oral and spoken language). Meaningful assessment opportunities are created when translanguaging is used in content assessment that assesses the learners' abilities to perform in a second language, their home language, or a combination of both. Learners use any language they wish in the assessment approach to show their knowledge and skill in the content area.

2.14.2 Principle 2: Engage learners in interaction through translanguaging

In addition to Principle 1, translanguaging in content assessment also seeks to develop a safe translanguaging space for bi-/multilingual learners, to use all their bi/multilingual resources and discursive practices within an assessment context. Translanguaging provides opportunities for learner-to-teacher or learner-to-learner

interactions to create a space for interactive moments of translanguaging. The teacher takes the role of a mediator in an assessment context that incorporates translanguaging. This implies that the bi-/multilingual learner and the teacher will work together to negotiate and create meaning. As Kohler (2015) states, mediation can be defined as a set of practices that help build connections between what the learners know in both their home language and their second language.

Thus, the interaction between the teacher and the bi-/multilingual learner is reflective of the complex translanguaging practices common amongst today's bi/multilingual learners. According to Kohler (2015), translanguaging between the teacher and learner allows the language in assessment to be flexible, and mediates the understanding of the language and the completion of a task by using the language most accessible in the learner's repertoire. Through mediation, the teacher allows the learner to navigate through all their linguistic resources and the relationships between all the languages in their repertoire.

Many schools or classrooms have language practices that prevent bi-/multilingual learners from using their full linguistic repertoires, however, the teachers should encourage bi-/multilingual learners to utilize all their languages, including mixing them, if need be, to demonstrate their knowledge in a content area. Kress (2003) explains that although the teacher and learner work together to negotiate teaching and learning in multiple languages, the negotiation is not limited to the use of languages but is also multimodal. This means that the teacher and learner use different modes for example, written language, oral language, visual or numeric representations and mixed modes when necessary.

2.14.3 Theory of Action

According to Lopez et al. (2017), when it comes to conceptualizing how to incorporate translanguaging into content assessment for bi-/multilingual learners, it is important to visualize how the translanguaging principles and bilingual assessment features work together to give these learners an opportunity to show their knowledge and skills in a content area.

Figure 2.2 summarizes the theory of action, showing how the translanguaging principles and bilingual assessment resources interact to give the learners an assessment that is flexible, in which they are allowed to demonstrate their knowledge in a content area in different ways.

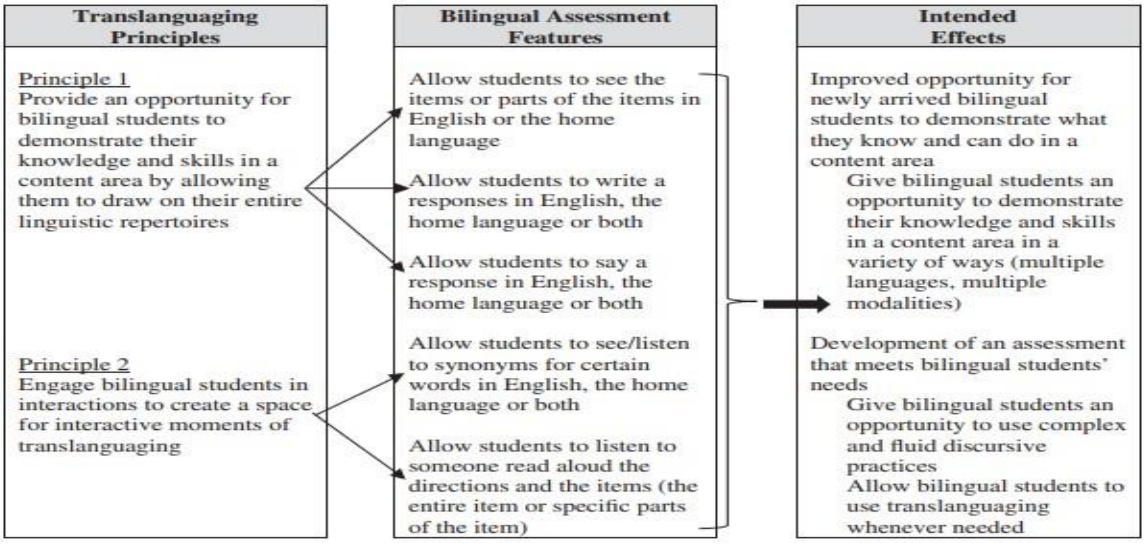


Figure 2.2: Theory of action for allowing the use of translanguaging in content assessment (Lopez et al., 2017, p. 5)

Figure 2.2 illustrates the theory of action and underlying premises for the conceptualization of translanguaging in content assessment for bi-/multilingual learners. Following the guiding principles, the arrows show the direct link with each of the proposed bilingual assessment resources. Lopez et al. explain that "bilingual assessment resources are directly linked to the perceived outcomes that can be gathered from the use of assessment that allows the use of translanguaging embedded into the system" (Lopez et al., 2017, p. 5).

What emerges is the linkage between bilingual assessment resources and the intended effects, which ultimately supports bi-/multilingual learners to show what they know and can do. These resources also assist teachers in getting to know and understand new learners' skills and the areas where improvement is necessary.

2.15 Conclusion

This chapter focused on literature that highlights the importance of language in the classroom, especially as it pertains to a mathematics classroom. It also highlighted the use of translanguaging practices around the world, Africa and South Africa, noting the importance for schools in the 21st century to incorporate translanguaging practices in the classroom. This is particularly necessary due to the growing number of multilingual learners. Translanguaging practices can be achieved by reading and writing activities that allow students to express themselves in their home languages.

The literature also reveals how previous language policies caused inequalities and how African languages have become marginalised. However, several studies support the use and maintenance of learners' home languages within the educational system. This is understood to form part of a democratic approach that should be followed as educational language planning includes all official languages, or the full spectrum of SA scholars.

In this chapter the theory of translanguaging and what it encompasses was also highlighted. Part of the rationale is that translanguaging is difficult to ignore due to current global changes and increasing manifestations of diversity in communities. In terms of language, culture and background, classrooms have inevitably come to represent these trends. Thus this chapter showed how the use of different languages through translanguaging may create a fresh linguistic repertoire within the classroom.

The Common Underlying Proficiency (CUP) model by Cummins presents the idea that proficiencies in the first language and second language are not separate, but intrinsically connected. The CUP model debunks the Separate Underlying Proficiency (SUP) model which states that languages exist in different balloons within the brain, assuming there is no link between first and second language. Cummins probematizes this arguing against the notion that instruction should only be provided in the second language and restrictions should be placed on the use of first language instruction.

Translanguaging draws on the CUP model because it advocates the use of the first language to develop the second language. The two principles of translanguaging in assessment were also highlighted. The first principle draws on the entire linguistic repertoire of the learners to allow them to demonstrate their knowledge and skills in a content area. The second principle focuses on engaging learners in interaction through translanguaging, thereby providing opportunities for learner-to-learner- and learner-toteacher interactions. In this paradigm the teacher takes the role of mediator as teacher and learners use a wide range of modes (as needed) to ensure effective use of the learners' full linguistic repertoires.

The theory of action outlined in the chapter incorporates the two translanguaging principles in content assessment, and shows how bilingual assessment resources and strategies that permit translanguaging are directly linked to positive outcomes.

Chapter 3- The research methodology

3.1 Introduction

This chapter outlines the research approach and method which guided the data collection, the analysis, and interpretation. According to Yin (2009), a research method is a logical plan that allows the researcher to find answers to the research questions established to probe the research problem. This chapter presents the research design, sampling and data collection for the study followed by a discussion relating to issues of validity and reliability as well as ethical considerations.

3.2 The research approach

This study employed the qualitative research approach which involves exploration, with the aim of gaining an understanding of the reasons, opinions and motivation for a given research theme by analysing participants' responses, experiences and views.

According to Sitorus (2013), qualitative research seeks to provide an understanding of the experiences of people, their perceptions, motivation, intentions and behaviour. It is based on description and observation, using a naturalistic interpretive approach to a subject and its contextual setting. According to Denzin and Lincoln (2011), when one talks about description in qualitative research, one does not refer to a superficial treatment of data, but to a more thorough understanding of the action, its context or motivation, its process, its results, and subsequent evolution. Context is crucial in description because it is linked to the creation of meaning, since action makes sense if one understands its location and context.

Mbekwa (2002) explains that in a qualitative study, the researcher meets with the research subject to understand the issue in question.

The aim of the researchers when using a qualitative research approach is to appreciate and understand the situation under investigation from the participants' points of view as opposed to their own. The researcher becomes the primary instrument for data collection due to the focus on the participants as the source of data (Hancock & Algozzinne, 2016). When qualitative research is used, trends in thoughts and opinions

are uncovered from the sample. The sample size is usually small and participants are chosen to fulfil a given quota to explore and investigate the subject matter.

In qualitative research, the researcher identifies a particular phenomenon in society, isolates it and after studying the phenomenon, they describe it together with its occurrence. They analyse it and then provide an interpretation of the phenomenon.

According to Mbekwa (2002), qualitative research is always characterised by a description of the situation in which an action occurs. In educational classroom research, the focus is on what the individuals in the classroom say and do.

This study occurred in a multilingual grade 6 mathematics classroom. In terms of qualitative research, the study is not limited only to the situation, but includes the action, why the action happened and the implications thereof.

3.3 Motivation for a qualitative approach

Research can take various approaches depending on the type of study and research question(s). According to Mouton (2001), the research approach is a blueprint for how the researcher intends to conduct the study. Henning's (2004) description is in line with Mouton's, both of which refer to a research approach as a reflection of the methodological requirements of the research question that determines the type of data to be collected and how the data will be processed. A research approach is a plan or structure guiding the researcher to obtain information or evidence to answer research question(s).

This study is located within the realm of qualitative research in terms of the definitions of qualitative research outlined in the foregoing section. Miles and Huberman (1994; 6-7) propose several key features of qualitative research, some of which I used as motivation for the choice of the methodological approach to this study. Miles and Huberman (1994) capture several of these recurrent features as follows:

1. Qualitative research is conducted through an intense/or prolonged contact with a "field" or life situation. These situations are typically "banal" or normal ones, reflective of the everyday life of individuals or groups, societies, and organisations.

2. The researcher's role is to gain a "holistic" (systemic, encompassing, integrated) overview of the context under study: its logic, its arrangements, and its explicit and implicit rules.

3. A main task is to explicate the ways people in particular settings come to understand, account for, take action, and otherwise manage their day-to-day situations.

4. Many interpretations of this material are possible, but some are more compelling for theoretical reasons or on grounds of internal consistency.

5. Relatively little standardised instrumentation is used at the outset. The researcher is the main "measurement device" in the study.

6. Most analysis is done with words. The words can be assembled, sub-clustered, broken into semiotic segments. They can be organised to permit the researcher to contrast, compare, analyse, and bestow patterns upon them.

The focus of this study was on translanguaging practices within a multilingual grade 6 mathematics classroom. The intention was to obtain a holistic picture of how translanguaging practices occur in a mathematics classroom that is so linguistically diverse. The nature of the interaction between research subjects necessitated that the data be collected on site. The research subjects were involved in doing mathematics with reference to problem solving focusing on Perimeter and Area. The researcher had to observe the teacher and learners interacting with one another, as they tried to make sense of the mathematics worksheet incorporating their home languages.

The researcher set out to gather data on the research subjects doing mathematics, analyse the data, interpret it and then give a holistic description of the data. Based on the definitions of qualitative approach outlined in the earlier section, and on Miles and Huberman's (1994) suggestions, a qualitative research approach was considered appropriate for this study.

3.4 Research Participants and Sampling

The research participants in this study comprised one teacher along with their grade 6 class consisting of 34 learners between the ages of 12-14 years. The learners had different cultural backgrounds and the following home languages: English, Afrikaans, IsiXhosa, IsiZulu and Sesotho.

According to Babbie and Mouton (2014), sampling refers to the extraction of a representative population of data or respondents for a general population of people with the purpose of obtaining information. Various sampling techniques exist. In qualitative research, sampling can take place in several stages. It can happen at the stage of collecting the data, and while interpreting and reporting on it. In this study purposive sampling was used.

According to Bertram and Christiansen (2014), purposive sampling means that the researcher makes specific choices about which people, groups or objects to include in the sample. The word "purposive" indicates that the sample is chosen for a particular purpose. Purposive sampling is mostly used by the researcher using case studies in the interpretive and critical paradigms, ethnographic, life history or action research styles of research. Purposive sampling finds expression when the participants are grouped according to preselected criteria relevant to a particular question. Purposive sampling indicates that the researcher sees sampling as a series of strategic choices concerning with whom, where and how the study is to be done.

For this investigation, the researcher chose purposive sampling, having made a specific choice about the group of learners for the study. As indicated, the participants chosen for this study were bi-/multilingual grade 6 learners with different cultural backgrounds and home languages along with their mathematics teacher. The samples were small and only representative of the school at which the research was conducted. Since the study uses a case study approach, purposive sampling served as the best motivation for the selection.

3.5 Data collection

Data collection refers to the process of gathering information related to the research which involves identifying sources of data and selection methods. According McMillian and Schumacher (2010), data collection occurs at different stages, namely planning, beginning the data collection, closing data collection and completion.

As the study followed a qualitative approach, I employed triangulation by collecting data from different sources and by using different methods. Firstly, data collection spanned a period of two weeks. In the first week, I conducted classroom observations that included video recordings to note whether translanguaging practices

between the teacher and the learners and amongst the learners themselves were taking place in mathematics lessons. In the second week the learners were given a problem solving assessment consisting of two questions for the section on Perimeter and two questions for the section on Area. Due to Covid-9 and the 1.5m distance rule, the learners were paired to solve the questions instead of working in larger groups. The learners were encouraged to use their home languages or any languages they felt comfortable with to tackle the problem-solving questions.

After the completion of the problem-solving assessment in the second week of data collection, six participants with different home languages were interviewed to establish how they felt about the use of their home languages in the mathematics classroom, and whether they preferred the teacher to switch more frequently between their home languages and the language of instruction.

I also interviewed the teacher to establish:

- what his experiences were in teaching in a language that is not the home language of the majority of the learners;
- what his personal feelings were about the incorporation of the learners' home languages into the teaching and learning of mathematics; and
- whether the use of learners' home languages would enable or constrain mathematical learning.

Additional data was collected through informal conversations with the teacher and learners.

3.6 Data collection techniques

In Table 3.1 following, the data collection techniques and activities used in the study are reflected.

Data gathering techniques	Activity
Observations	• Grade 6 mathematics lessons • Video recordings of mathematics lessons and classroom interactions • Writing field notes
Problem-solving assessment	Problem-solving assessment was administered to the grade 6 class.

Focus group interviews	Interviews with the teacher and six grade 6 learners who participated in the study were conducted.
Informal conversations	A research diary was kept of information collected through informal discussions and conversations with participants.

3.6.1 Classroom observations

Observations are used as a frequent source of information. They require a great deal of skill and persistence because the researcher creates their version of what is "there" and creates a situation to observe. According to Hancock and Algozzine (2016), using observation techniques the researcher as a participatory observer tracks the learners' initial impressions and interpretations of the activities, their successes, challenges, errors and mistakes.

During the first week, I made observations to gather information in class in order to understand whether and if so, how translanguaging practices take place in the mathematics classroom. The main focus of my observations was to note whether and if so, how the teacher uses the learners' home languages to ensure that the content is understood.

I observed the teacher's mathematics lessons noting the responses and engagement of the learners with the teacher and their work. As a participant observer, on a few occasions I found myself helping with some of the mathematics work.

As a back-up to classroom observations, I used video recordings in the classroom to record mathematics lessons taught through the medium of English. The purpose of the recordings was to capture how the teacher and learners interact during the mathematics lessons and how the learners' home languages were used for translanguaging purposes.

In short, classroom observations allowed me to see the realities pertaining to the teaching and learning of mathematics through the medium of English in the intermediate phase. I began to get some insights as I continued with observations. Sometimes the information was limited to only certain research questions. To accommodate this I employed other research strategies in order to delve deeper to gain clarity on issues relating to the teaching and learning of mathematics. I also used interviews to get more information from the subjects of the study.

3.6.2 Focus group interviews

Focus group interviews constitute a common data collection instrument in qualitative research methods. This form of data collection allows the researcher to obtain rich, personalized information (Hancock & Algozzine, 2006). Interviews may be structured, semi-structured or unstructured. Semi-structured interviews are suitable for case study research because they allow the researcher to pose predetermined questions and to ask follow-up questions, a process which encourages the interviewees to express their experiential knowledge of the world from the perspective of their experience and not that of the researcher's.

In this study, semi-structured interviews were used to probe responses from the teacher and learners concerning their experiences of and feelings about translanguaging practices. The aim of the interviews was to find out how the teacher and learners felt about the use of home languages in teaching and how the learners responded to the use of their home languages in mathematics classes.

Interviews were conducted with the teacher and a total of six learners with different home languages. The teacher and the learners were briefed about the purpose of the interview and were assured of confidentiality regarding their responses. I asked the teacher for permission to voice record his responses and the learners' responses were recorded manually in a research diary.

As stated, the interviews were semi-structured, and some questions were open-ended to allow the interviewees to elaborate on their responses to the questions, and on their thoughts, feelings and experiences.

3.6.2.1 Learner interviews

The interviews were conducted with six Grade 6 learners regarding their feelings about receiving instruction in their home languages. They were asked whether they would want the teacher to use translanguaging practices when teaching mathematics.

The intention was not to disrupt the teaching program of the school, therefore to conduct the interviews, dates and times were negotiated. The average age of the learners interviewed was 12. The learners were asked to be free and honest in their responses.

3.6.2.2 Teacher interviews

The interview was conducted with the teacher of the class about their experience of teaching in a language which is not the home language for some/most of the learners. They were also asked what their personal views were about incorporating the learners' home languages into teaching and learning. In addition, the teacher was asked whether they think the use of learners' home languages enabled or constrained learning and achievement in mathematics. The teacher gave permission for his responses to be recorded and was made aware of the purpose of the interview. He was assured that his identity would remain anonymous; he was thus encouraged to be free and honest in his responses.

3.6.3 Assessment

An assessment/activity worksheet on Perimeter and Area in the language of instruction was distributed to the learners. The assessment aimed at establishing how the learners interacted with the mathematical content when they were allowed to use their home languages to interact with one another to make sense of the problem solving questions. In this regard the teacher acted as a mediator and the researcher as a participant observer. The assessment was administered by the researcher in the presence of the teacher.

3.6.4 Research diary

A research diary was kept in order to retain a record of my observations. Field notes were written after the class observations to protect the teacher from feeling uncomfortable during his lessons. In some instances the important points were written down in the presence of the teacher to ensure these were being recorded.

It was important to keep a diary of all the information obtained informally from the learners and the teacher, also from other teachers who were not directly involved in the study.

3.7 Reliability and Validity

Validity in research refers to the accuracy and truthfulness of scientific findings according to Le Comple and Goetz (1982). A valid study should always show what actually exists and a valid instrument or measure should measure what it is supposed to

measure. There are many types of validity checks. Campbell and Stanley (1966) have defined two major forms of validity assurance by referring to "internal" and "external" validity.

Internal validity refers to the extent to which research findings are a true reflection or representation of reality as opposed to being the effects of extraneous variables.

External validity refers to the degree or extent to which representations, reflections or the appearance of a reality can legitimately be applied across groups.

Reliability is concerned with consistency, stability and repeatability of the informant's account as well as the ability of the researcher to collect and record information accurately. It refers to the capacity of a tested research method to provide the same results over repeated periods (Drost, 2011). It depends on the consistent responses or habits the researcher develops in using a method, the rating of the results and the factors relating to the subject and testing procedures to prevent problems with measurement (Leininger, 1999).

According to Mouton (2001), triangulation is a means by which to increase reliability in research. The use of different data collection methods which complement each other reduces inaccuracy that may affect research data.

Thus to ensure the validity and reliability of the study, different data collection methods were used. Triangulation was exercised to limit inaccuracy and inconsistency. Most of the data was collected through observations and the participant interviews. In addition to the interviews and the observations, forms of assessment were also administered for data collection.

With regard to validity testing, the data collection was driven by research questions and the theoretical framework underpinning this study. This means that a variety of data collection techniques and various sources of data constitute the substantive framework of which the study is constructed, thereby fortifying its reliability and validity.

Within the paradigm of a qualitative research approach, a peer review system was used to validate my findings, to make sure that the observations were reliable and fair, and that they address the research questions being investigated through a technique of triangulation. This was achieved by allowing a peer to help with the data collection

process, and through discussion, by comparing aspects of the process and the outcome of the data that was collected. The objective was to ensure that fairness and reliability of the data were fundamental to a meticulously conducted research study.

3.8 Ethical Considerations

The protection of subjects through the application of the correct ethical principles is very important in any research study. Ethics has to do with the right or wrong behaviour and is an essential consideration in research, especially with research that involves humans or animals.

Bertram and Christiansen (2014) explain that there are certain ethical principles that all research studies must follow. These principles are: autonomy, non-malfeasance and beneficence.

Autonomy implies that the researcher must respect the autonomy of everyone participating in the research and should thus get the consent of each individual participant. Every individual should agree to participate voluntarily in the study, and be allowed to withdraw at any time. Consent means that every individual who agrees to participate in the research receives a clear explanation about its objectives as well as what is expected of them. This will allow the potential and actual participants to make clear informed decisions.

Non-malfeasance implies that the research should effect no harm on the participants or any other individuals. Researchers have to ensure that the study will not cause any physical, emotional, social or other harm to anyone. It is also necessary that participants know how the information will be made public. This simply means that all participants are assured that the information supplied by them remains confidential. Therefore the researcher must protect the identities of the participants once results are published. It is not sufficient to change the names only; it may be necessary to change the description of the schools and the participants.

Beneficence means that the research should benefit the research participants directly, other researchers more broadly, and society more generally. In other words beneficence implies that the study must be beneficial. It is therefore rare for researchers to conduct research if they do not believe it will lead to change in a positive way, even if only in the long term. The researcher should consider making changes that would

increase the beneficence of the study even if at times the benefits to the research participants are less obvious.

Given the state of the country with regard to Covid-19, all the protocols and regulations initiated at schools were adhered to. The safety of all the participants in this study was of utmost importance and thus strict protocols were followed in the classroom where the data was collected.

Permission and approval for this study was obtained from the Western Cape Education Department (WCED). To secure their participation in the research project written consent forms were completed by the principal, the school governing body, the teachers and the parents of the learners (participants). Parental consent was very important because the learners participating in the study were minors.

The details of the research project will be made available to the WCED, the school and educators when requested. They were under no obligation to participate in the study, thus participation was voluntary and participants and the parents of the learners participating in the study were allowed to withdraw their children at any time they wished.

Consent forms were signed by parents who were willing to allow their children to participate in the project.

Due to the protection of human subjects, the researcher ensured the privacy of the learners through anonymity, confidentiality and suitable storing of data (McMillan & Schumaker, 2010). Data is kept in a safe environment that can be accessed by the researcher and any other competent person especially those from whom permission was sought for this study.

The anonymity of the learners and teacher is guaranteed in the research report. Any digital information on the study will not be circulated to the public. The rights of all participants are taken into consideration and respected.

3.9 Limitations

The results of this study are based on one school and one multilingual grade 6 mathematics classroom only, therefore the study does not represent a general overview of Western Cape schools.

As the study involved teaching and learning of mathematics, only academic support could be provided for the teacher and the learners. The cultural and socioeconomic factors that could have influenced the study were not controlled.

Due to Covid-19 protocols, the number of learners in the class and the number who were able to participate in the study could not be controlled as safety measures at the school and health measures had to be adhered to.

Some of the interviewees participating in the study might have given responses that were not reflective of their true feelings, and the influence this may have on the study cannot be overlooked.

3.10 Conclusion

This chapter presented the methodology that had been adopted for the study and explained the research processes employed for its duration. The methodology of the research is the blueprint that helps the researcher in providing answers to the research questions and therefore is a very important aspect. The chapter also provided details of the sampling techniques, the data collection methods, the means whereby validity and reliability were ensured as well as a statement of ethics that served to guide the manner in which the research was conducted.

Chapter 4- Data Analysis, Interpretation and Presentation of findings

4.1 Introduction

The previous chapter outlined the various research approaches and techniques that were used to collect data for this study. In this chapter the raw data is presented in categories that relate to the research questions and the objectives of the study. Qualitative content analysis was used by the researcher to analyse and make sense of the learners' responses to the problem-solving questions in the task-based activity worksheet. The data obtained from the audio- and video recordings of the interviews was transcribed and thoughts and insights arising from the data were analysed.

Firstly, this chapter presents data which was collected by means of an activity worksheet, interviews and classroom observations – all influenced by the triangulation process of data collection. This chapter is structured in a way which attempts to answer the research questions as outlined in Chapter 1, while providing authentic data samples captured by means of various data collection strategies.

Data from the activity worksheet is presented first. This is followed by data from interviews (teacher and learners), obtained to gain a better understanding of participants' thoughts and feelings regarding the use of translanguaging practices in the mathematics classroom. The last section of the chapter presents data that surfaced from the classroom observations and interactions.

4.2 Qualitative Content Analysis and Interpretation

According to Creswell (2003), content analysis refers to various procedures for analysing and interpreting data gathered from the examination of documents and records pertaining to a particular study.

The researcher used a problem-solving worksheet consisting of four word problems, two questions on Perimeter and two questions on Area, for the grade 6 mathematics class. The learners worked on the problem-solving assessment activity provided by the researcher. In pairs they were to discuss the problem-solving questions,

using their home languages and the languages they were most comfortable in speaking. Due to Covid-19 and the social distance rules, larger groups between the learners could not be formed, thus the researcher opted to allow them to work in pairs and recorded their interactions. The work of the learners was kept and analysed to obtain further information.

Classroom observations and semi-structured focus-group interviews with the teacher and the learners were also completed. An analysis of the data from observations and semi-structured focus-groups helped me to gain a better understanding of the participants' thoughts and feelings, and also to interpret the findings of the study.

A holistic rubric was used to classify learners' responses to the problem-solving questions on Perimeter and Area. Their responses were classified into four types: No response, incorrect response, partially correct response and correct response, and their responses to solving the questions were recorded.

4.3 Activity Worksheet

A problem-solving assessment was given to the grade 6 mathematics learners. The activity covered problem-solving questions on Perimeter and Area. The learners were to read the questions and were allowed to communicate with their peers and utilize their home languages to ensure that they understood both the questions, and how to solve the problems.

Their responses and their answers to the problem-solving questions were recorded. Examples of their answers for the respective questions are presented in the next section.

The assessment worksheet comprised four questions: Two questions for the Perimeter section and two questions for the Area section. Examples of the Perimeter problem-solving questions answered by the learners are presented first, followed by examples of the Area problem solving questions.

To classify learners' responses to the set of problem-solving questions in the assessment worksheet, a holistic rubric was used. Learners' responses were categorized per problem into four response options: Correct response, Partially correct response,

Incorrect response and No response. Interpretations of the solutions provided by the learners are explained and some interpreted. The detail is captured in Table 4.1 as follows:

Table 4.1: Holistic Rubric used to classify Learners' responses to the problem solving questions

Type of response	Description of response
Correct response	The responses carried out are complete and correct.
Partially correct response	Responses show some understanding of the mathematical problem. Responses are incomplete and/or contain some error.
Incorrect response	Responses have major errors and/or exclude important parts.
No response	No proof of any written attempt is evident.

4.3.1 Learners' performance in Problem 1a

The first problem, on the perimeter section, reads as follows:

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

To solve this problem, the lengths of the sides of the quadrilateral have to be added to determine how long the fence will have to be in total. The learners were free to use any method of addition to solve the problem.

An expected solution to Problem 1a is as follows:

S + S +S + S

357m + 434m + 289m + 383m = 1463m

The fence will be 1463m long in total.

Problem 1a focused on the perimeter of a quadrilateral, and required calculating the total length of a fence that must be built around the school grounds on the edges of a plot of land in the shape of a quadrilateral. The holistic rubric as described in **Table 4.1** was used to classify each of the 34 learners' responses to the problem-solving questions into the respective categories.

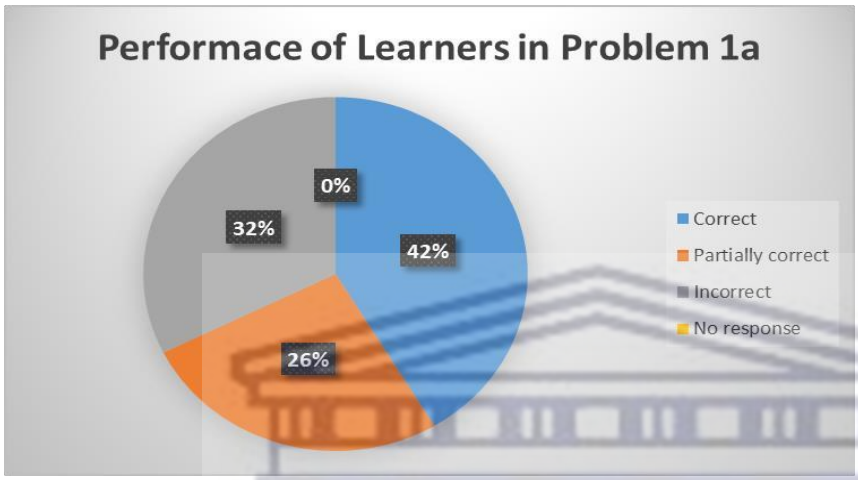


Figure 4.1: Levels of Performance of learners for Problem 1a - Perimeter

Figure 4.1 indicates that a total of 14 out of the 34 learners (42%) managed to arrive at the correct answer for problem 1a. A total of 9 out of the 34 learners (26%) provided a partially correct answer for problem 1a. A total of 11 out of the 34 learners (32%) arrived at an incorrect answer for problem 1a and 0 or none of the learners submitted an incomplete written response for problem 1a.

Exemplification of problem-solving competencies by learners who provided the correct answers for Problem 1a of the Perimeter problem-solving question

As per Figure 4.1, a total of 4 learners (42%) produced a correct answer for Problem 1a of the perimeter section. The learners made use of three different methods of addition to solve the problem: Standard Algorithm, Regrouping and Expanded notation form. Three learners' examples of how they calculated and arrived at the answer are shown in the section to follow. The remainder of the 12 learners who arrived at the correct answer also used one of the three different methods of addition to solve the problem.

All three learners were able to recognize that it was a problem that should be solved using the addition operation, and by doing so they added the lengths of the sides of the quadrilateral; some learners' explanations were recorded and interpreted.

Example A

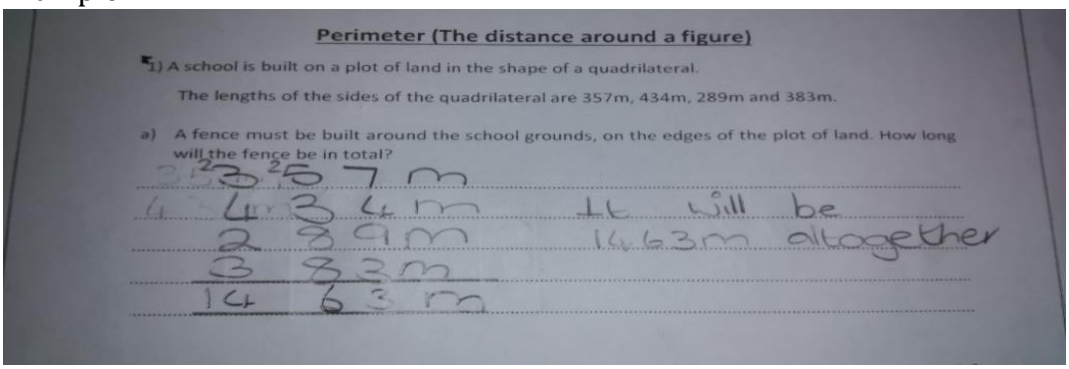


Figure 4.1.1: Example of a learner's solution to Problem 1a (Perimeter)

Learner's voice:

357m, 434m, 289m and 383m. Bhala phantsi uqale apha (uyabonisa phi). Kufuneka uzibhale kumgca nganye, emvakoko uphele kwisithathu. Kufuneka uzibhale phantsi uquala apha uphele kwisithatu.

Translation:

357m, 434m, 289m and 383m. You must write them down starting from here (Indicating where). You must write it on each line, then you must end by the three. You must write them down from here and end by the three.

In example A, the learner explained to his peers how to go about solving the problem in their home language (Xhosa). When question 1 was explained to the class in the language of instruction, some of the learners failed to fully understand what needed to be done. However, in the foregoing example, the learners incorporated their first language to make sense of the question and approaches to the solution. When the way to proceed to answer problem 1 was established in their home language, the learners came up with the solution that is to follow. The sequence is indicative of the statement by Klein (1998) that to allow thinking, mathematics communicated in one language might need to be translated into another language. By allowing the learners to incorporate their home languages into the mathematics lesson, they were able to utilize it in a manner that facilitated their thinking.

In Example A, the learner used the standard algorithm form to calculate how long the fence will be in total. The side measurements of the quadrilateral are written down vertically, one below the other by matching the place values with the calculation starting from the units place all the way through to the hundreds. By doing so they were able to correctly calculate the total length of the fence.

The learner calculated the units by adding 7+4+9+3=23, writing down the three and carrying over the 2, which represents 20. They proceeded to calculate the tens as 2+5+3+8+8=26, but it is added as 20+50+30+80+80=260. They proceeded to write down the 6, representing 60, carrying over the 2 representing 200. Then they calculated the hundreds as 2+3+4+2+3=14 when actually it is counted as 200+300+400+200+300=1400. The total length of the fence is then determined to be 1463m.

Example B

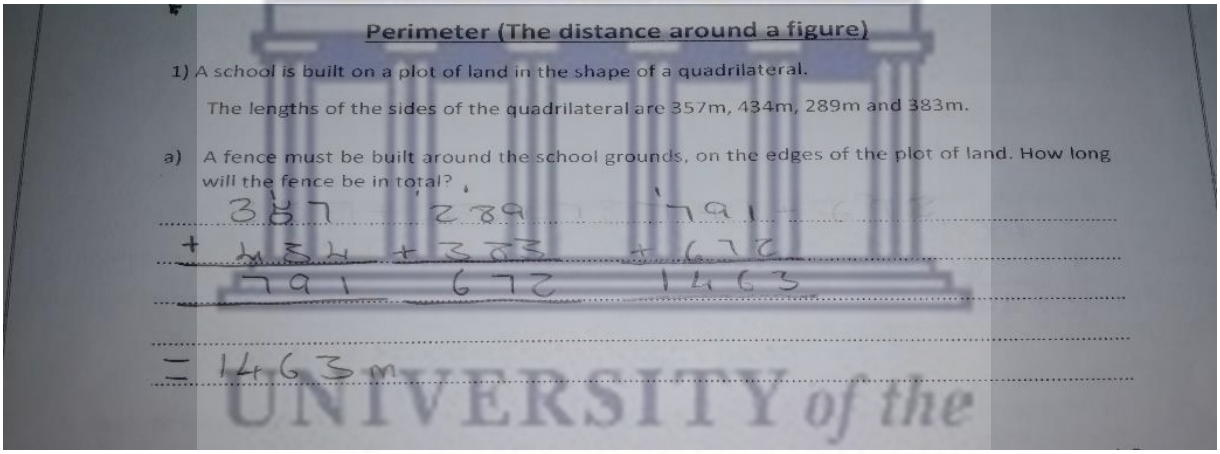


Figure 4.1.2: Example of a learner's solution to Problem 1a (Perimeter)

In example B, the learner used the grouping method to solve the problem. Instead of writing all the sides vertically, one below the other according to their place values as in Example A, the learner chose to group and calculate the first two sides of the quadrilateral as 387+434=791. One can see that the standard algorithm method was also applied in this example.

The learner calculated the units first through to the hundreds as follows:

7+4=11, writing down the 1 first and carrying over the 1 representing the 10 to the tens place value. Secondly, they calculated the tens values as 1+5+3=9 or in actuality as 10+50+30=90. Lastly, they calculated the hundreds place values as 3+4=7 representing 300+400=700.

The total for the first two sides was determined to be 791.

The learner proceeded to group and calculate the last two sides of the quadrilateral as 289+383=672. They proceeded to start calculating the units all the way through to the hundreds as follows: 9 +3=12, writing down the 2 and carrying over the 1 representing 10. They then calculated the tens as 1+8+8=17 representing 10+80+80=170. The learner proceeded to write down the 7 carrying over the 1 to the hundreds. The hundreds were calculated as 1+2+3=6 which represents 100+200+300=600. The total for the last two sides was determined to be 672. Since the learner had the total lengths of the first two sides and the last two sides, they simply calculated the total length of the fence by adding these two totals:

791+672 = 1463m in total, having followed the same rules as above.

Example C

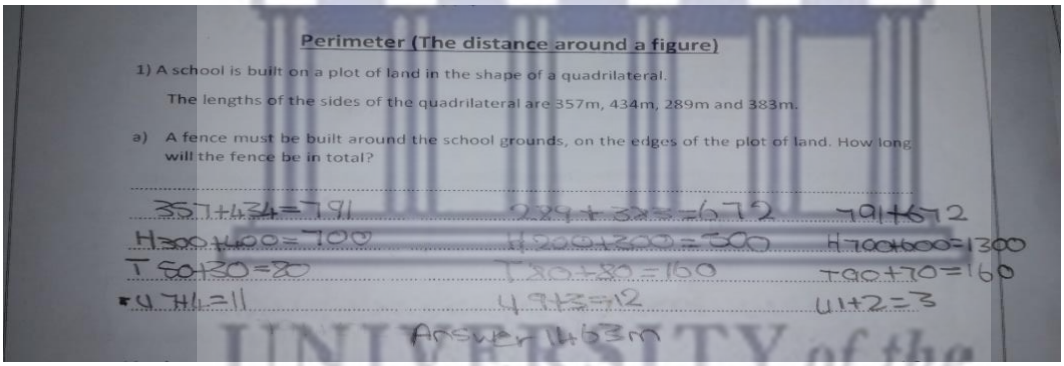


Figure 4.1.3: Example of a learner's solution to Problem 1a (Perimeter)

In example C, the learner used the expanded notion form to solve the problem. They proceeded to group the sides of the quadrilateral in the same way as in Example C by calculating the first two sides of the quadrilateral first to get the total length; then calculating the last two sides of the quadrilateral to get the total lengths; and then adding the two total lengths to determine how long the fence will be in total.

The learner proceeded to calculate the first two sides 357+434 by expanding and calculating according to their place values, starting with the hundreds down to the units as follows:

357+433

Hundreds are calculated as 300+400=700, the tens are calculated as 50+30=80 and the units are calculated 7+4=11. The learner continued to add the totals of the hundreds, tens and units as 700+80+11 to get the total lengths for the two sides as 791.

The learner proceeded to calculate the last two sides of the quadrilateral 289+383 by also expanding and calculating them according to their place values starting with the hundreds down to the units as follows:

289+383

Hundreds are calculated as 200+300=500, the tens are calculated as 80+80=160 and the units are calculated as 9+3=12. The total values of each are then added as 500+160+12 to get the total lengths of the last two sides as 672.

The learner proceeded to calculate the total length of the fence by taking the total of the first two sides and the second two sides and adding them in the same expansion manner by calculating them according to their place values:

791+672

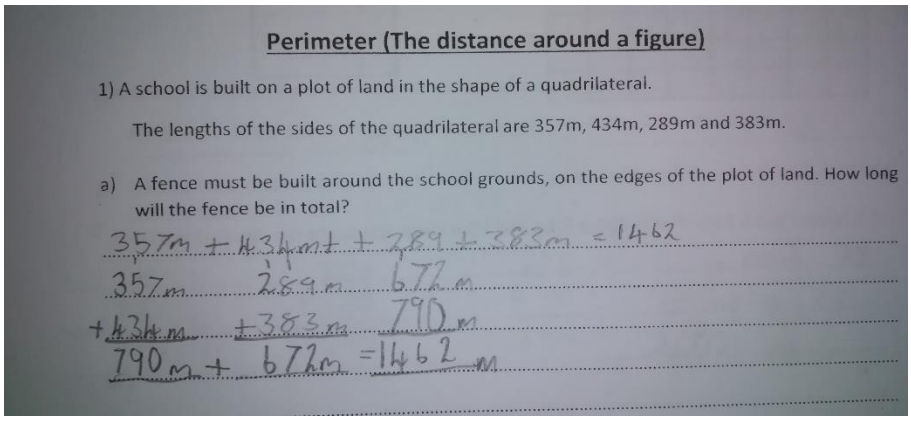
The hundreds were calculated as 700+600=1300, the tens as 90+70=160 and the units as 1+2=3.

The total length of the fence was then calculated as 1300+160+3=1463m

Exemplifications of problem-solving competencies by the learners that provided a partially correct answer for question 1a of the problem-solving question

As indicated in Figure 4.1, a total of nine learners (26%) provided a partially correct answer. Three learners' examples of how they calculated and derived an answer is presented below. These learners also made use of the different methods of addition to calculate the total lengths of the fence.

Example D


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

357m + 434m + 289 + 383m = 1462

357m 289m 672m

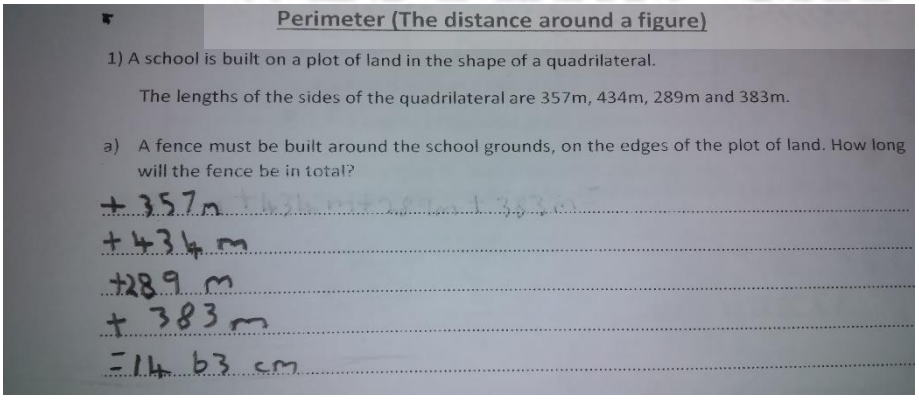
+434m +383m 790m

790m + 672m = 1462 m

Figure 4.1.4: Example of a learner's solution to Problem 1a (Perimeter)

In Example D, the learner chose to solve the equation using the grouping method. As explained in Example B, the learner proceeded to calculate the lengths of the first two sides 357m+434m starting with the units. The learner miscalculated the units by calculating that 7+4=10 and not as 7+4=11. This miscalculation influenced the final answer that represents the total length of the fence. They continued to calculate the tens correctly as 1+5+3=9 (10+50+30=90) and the hundreds as 3+4=7 (300+400=700), having the total lengths of the two sides add up to 790 instead of 791. They proceeded to calculate the length of the last two sides of the quadrilateral as 289m + 383m correctly with the total length of 672m. Because the length of the first two sides was calculated incorrectly, the total length of the whole fence was calculated as 672m+790m = 1462m.

Example E


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

+ 357m

+ 434m

+289 m

+ 383m

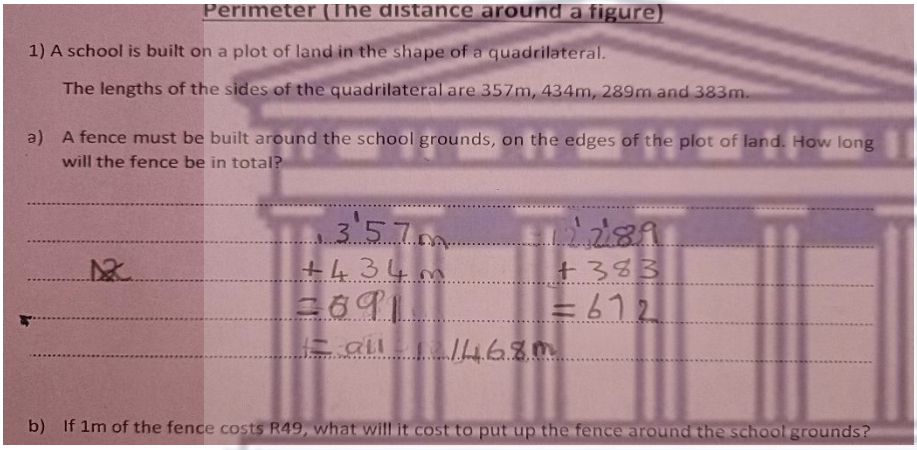
=1463 cm

Figure 4.1.5: Example of a learner's solution to problem 1a (Perimeter)

In Example E, the learner solved the question using the Standard algorithm for addition. They placed the sides of the quadrilateral vertically one below the other

according to their place values. The calculations for the questions were correct and the learner was able to recognize it as a problem that should be solved using addition. In the final answer however, the learner made a mistake with the total length of the fence. Instead of calculating the fence to be 1463m in total, the learner calculated the fence to be 1463cm in total, which is significantly shorter than what the actual length of the fence should be. The steps and calculations indicate that the learner understood what needed to be done in order to solve the question; they simply made an error with the measurement of the total length of the fence.

Example F


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

357m + 434m = 691
289 + 383 = 672
= all = 1468m

b) If 1m of the fence costs R49, what will it cost to put up the fence around the school grounds?

Figure 4.1.6: Example of a learner's solution to Problem 1a (Perimeter).

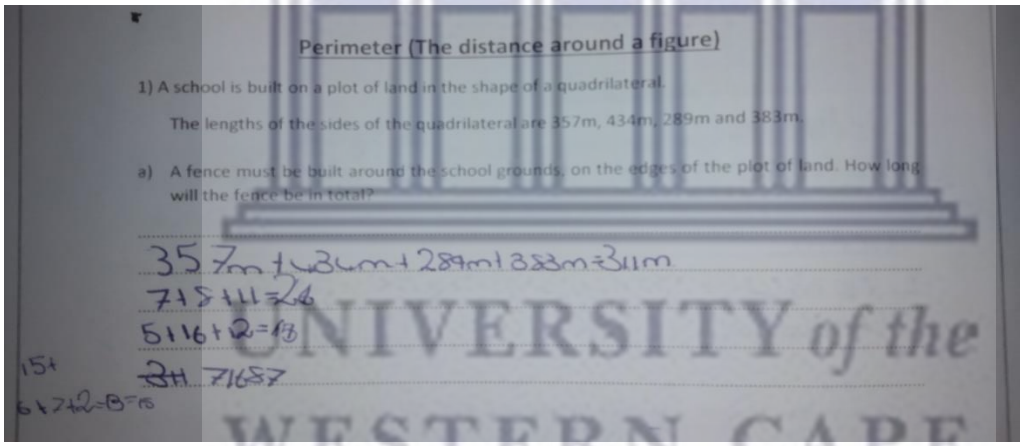
In Example E, the learner calculated the total length of the fence in the same manner as the learner in Example D. The learner also recognised that the problem could be solved by adding the first two sides of the quadrilateral and finding the total length of the first two sides, then adding the last two sides of the quadrilateral, to find the total length. By adding the first two sides of the quadrilateral, the learner made a calculation error that influenced the measurement of the total length of the fence. The learner started by adding the units first, calculating 7+4=11, carrying over the 1 to the tens place value. They continued to calculate the tens as 1+5+3=9 (10+50+30=90). The learner calculated the hundreds incorrectly by stating that 3+4=6 (300+400=600) when the correct calculation was 3+4=7 (300+400=700). Due to this error the learner calculated the first two lengths as 357m+434m=691m when the correct calculation should have been 357m+434m=791m. The last two lengths of 289m and 383m were calculated correctly

as 289m+383m=672m. The total length of the fence the was then calculated as the sum of the first answer of 691m and the second answer of 672, resulting in the total length of the fence being calculated to be 1468m in total instead of 1463m. Again, the learner showed an understanding of how to solve the problem. Their minor calculation mistake merely influenced the final answer regarding the total length of the fence.

Exemplification of problem-solving competencies by learners who provided the incorrect answers for question 1a of the Perimeter problem-solving question

As indicated by Figure 4.1, a total of 11 learners (34%) provided an incorrect answer. Three learners' examples are presented in the section that follows, showing how they calculated and derived an answer.

Example G


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

357m + 434m + 289m + 383m = 311m

715 + 111 = 26

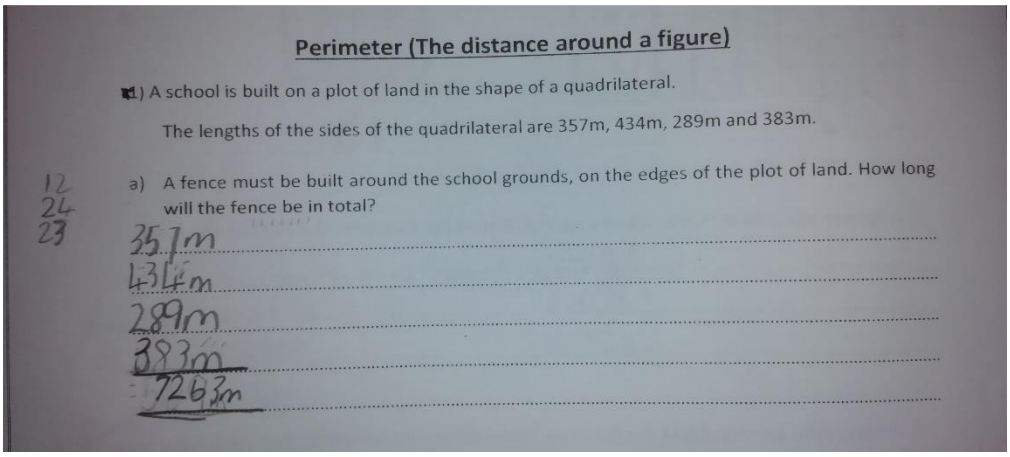
5116 + 2 = 13

3H 71687

Figure 4.1.7: Example of a learner's solution to Problem 1a (Perimeter)

In Example G, the learner seemed to show some understanding of how to solve the equation as they indicated that all the sides of the quadrilateral had to be added. Further calculations reveal that the learner had little understanding of how to calculate the total length of the fence. It seems that the learner attempted to calculate the length of the fence using the expanded method, however the calculations and the final answer are incorrect and the learner failed to show any understanding beyond the first calculation.

Example H


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

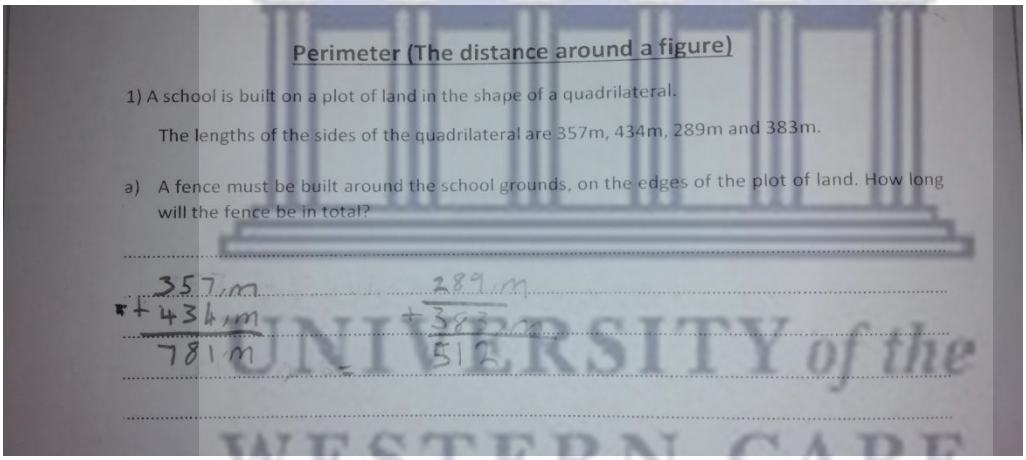
a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

12
24
23

357m
434m
289m
383m
1263m

Figure 4.1.8: Example of a learner's solution to Problem 1a (Perimeter)

In Example H, the learner attempted to calculate the total length of the fence using the Standard algorithm method. Little calculation was shown in solving the problem and the learner derived an answer that was calculated incorrectly. **Example I**


Perimeter (The distance around a figure)

1) A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

357m
+434m
781m

289m
+383
512

Figure 4.1.9: Example of a learner's solution to Problem 1a (Perimeter)

In Example I, the learner attempted to solve the problem using the grouping method by calculating the total length of the first two sides of the quadrilateral, followed by calculating the total lengths of the last two sides of the quadrilateral. In calculating the first two sides of the quadrilateral, the learner made an error by calculating 357+434=781 instead of 357+434=791. There was also an error in calculating the last two sides of the quadrilateral as 289+383=521 instead of 289+383=672. The learner also neglected to calculate the total length of the fence, resulting in an incorrect answer.

4.3.2 Learners' performance in Problem 1b

Question 1b for the Perimeter section was as follows:

1b) If 1m of the fence costs R49, what will it cost to put up the fence around the school grounds?

To solve this question, the total length of the fence in question 1a which was 1463m has to be multiplied by R49 which is the amount for 1m of the fence. The learners were free to use any method of multiplication.

An expected solution for problem 1b is as follows:

Solution

Since 1m = R49

1463m X R49 = R71687,00

It will cost R71687,00 to put up the fence around the school grounds.

Problem 1b focused on the amount per rand that it will cost to put up a fence around the school and tested the learners' multiplication skills. The learners' responses to question 1b of the perimeter section were classified according to the holistic rubric in Table 4.1.

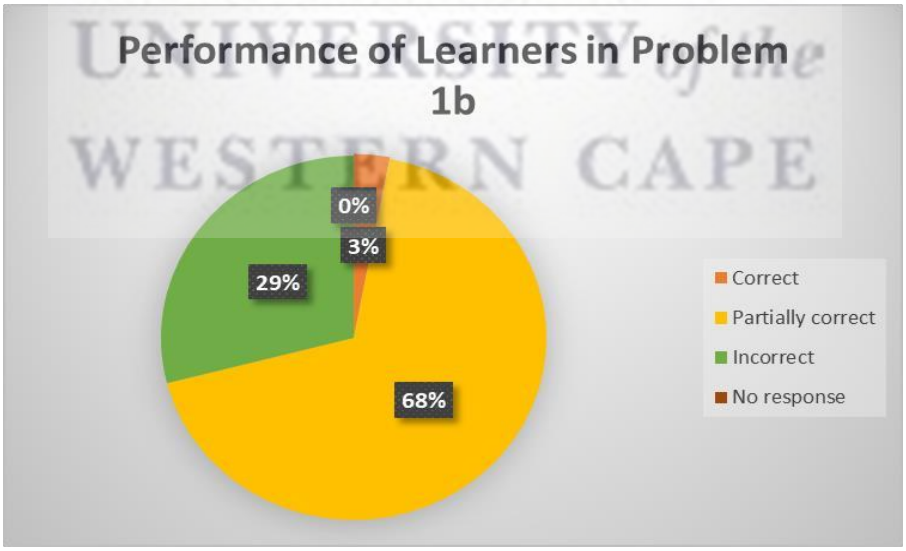


Figure 4.2: Performances levels of learners in Problem 1b- Perimeter

Figure 4.2 indicates that only one learner (3%) managed to arrive at the correct answer to problem 1b. The majority of the learners (68%) provided a partially correct answer,

while (29%) provided an incorrect answer. None of the learners submitted no response for question 1b.

Exemplification of problem-solving competencies by learners who provided the correct answers for Problem 1b of the Perimeter problem-solving question

As indicated by Figure 4.2, one learner provided a correct response to question 1b. Their response is presented below.

Example J

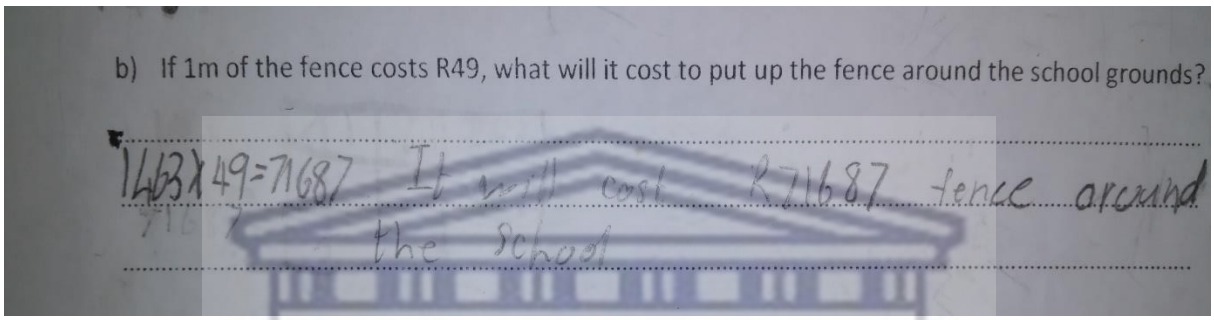


Figure 4.2.1: Example of a learner's solution to Problem 1b (Perimeter)

In the foregoing response, the learner showed an understanding that in order to calculate what the cost of the fence around the school grounds will be, they had to multiply the total length of the fence with the amount of R49 (per meter). No calculations were shown to indicate that the learner used a calculator; however, the learner arrived at the correct answer of R71687: Thus it will cost R71687 to put up a fence around the school grounds.

Multiplication still proved to be a challenge for most learners in the class, therefore the teacher acted as mediator and assisted the class with question 1b using the language of instruction (English) only – as represented next.

The teacher and the learners interacted with the question in the following way:

Teacher: **What was the answer for the first question?**

Learners: **1463m**

Teacher: **We are going to times that by R49**

Teacher proceeds to draw multiplication block

Teacher: **Okay let's see if you know your tables. What is four times one?**

Learners: **Four**

Teacher: **So we're going to write it as 0 and 4 in the block. What is four times four?**

Learners: **Eight**

Teacher: **(Asks again) What is four TIMES four?**

Learners: **Sixteen**

Teacher**: Sixteen, so it's going to be 1 and 6. What is four times six?**

Learners**: (Silent)**

Teacher**: Four times six, you have your times-table in front of your books**

Learners**: 24**

Teacher**: 24, lovely! What is four times three?**

One learner**: 16**

Teacher**: (Asks again) What is four times three?**

Learners**: 12**

Teacher**: What is nine times one?**

Learners**: 9**

Teacher**: 9, I am going to write it as 0 and 9. What is nine times four?**

One learner**: 24...no, 27!**

Teacher**: Are you sure?**

Learners: **(Silent)**

Teacher: **Oooh people don't know their times-table. What is nine times four?**

Learners: **(After silence)..36**

Teacher: **36. What is nine times six?**

One learner: **54. What is nine times three?**

One learner: **27**

Teacher: **Okay now you need to look carefully. Now you have all your answers in your block. That's not the final answer. Now you going to add all of it diagonally.**

What do you have in this block?

Learners: **7**

Teacher: **What is 2 + 2 + 4?**

Learners: **8**

Teacher: **What is 5 +5 + 6?**

Learners: **16**

Teacher: **So I write down the 6 and I carry over the 1. What is 2+1?**

Learners: **3**

Teacher: **3+6?**

Learners: **9**

Teacher: **9+3?**

Learners: **12**

Teacher: **12+9?**

Learners: **21**

Teacher: **21. I write down the 1 and carry over the…?**

Learners: **2**

Teacher: **What is 2+1?**

Learners: **3**

Teacher: **+4?**

Learners: **7**

Teacher: **7 + 0?**

Learners: **7**

Teacher: **And what is 0+0?**

Learners: **0**

Teacher: **There's my final answer of R 71 687**

So it will cost R71 687 to put up a fence around the school grounds.

In the foregoing example, the teacher used only English to assist the learners with the solution to the problem for question 1b – for two reasons. Reason one is that the teacher himself was limited in the language he could speak because he is proficient in only two languages, Afrikaans being his home language and English, his second language. Reason two is that since the majority of the learners' home language is isiXhosa, the only way the teacher could explain the question and the answer was in English, which serves as the second language for the majority in class. The teacher wanted to ensure that all the learners understood what to do, and should he have explained the question in Afrikaans, only 2 of the learners would have understood what to do. In this instance, the teacher and the learners engaged with the question in English and the teacher incorporated the buddy system in instances where the learners still did not understand what to do.

Exemplification of problem-solving competencies by the learners that provided a partially correct answer to Problem 1b of the problem-solving question

As indicated by the Figure 4.2, the majority of the learners (68%) presented a partially correct response using the Lattice multiplication method, as did the majority of the learners. Two of the learners' responses are presented below.

Example K

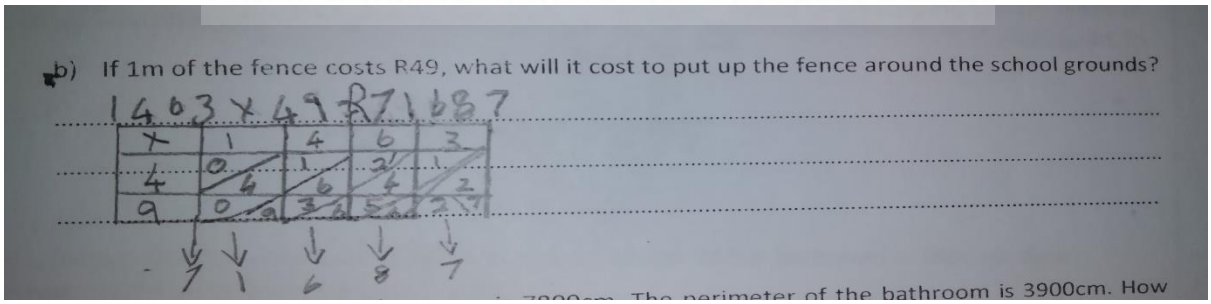


Figure 4.2.2: Example of a learner's solution to Problem 1b (Perimeter)

Example L

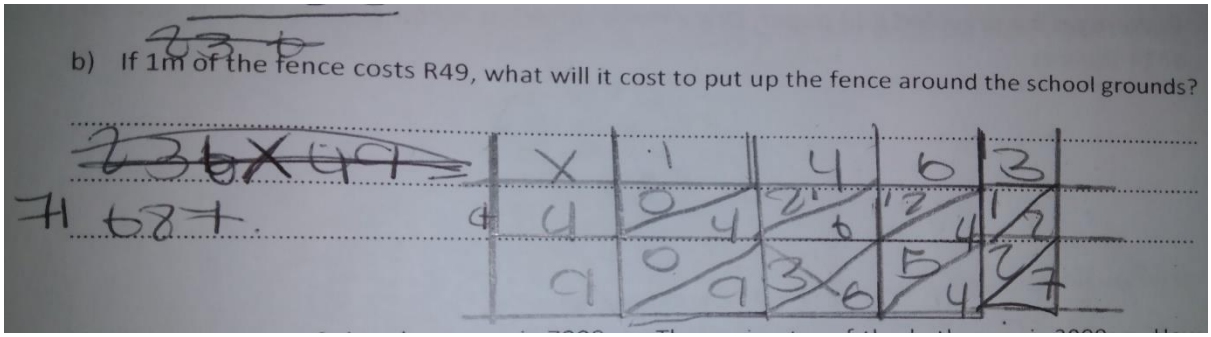


Figure 4.2.3: Example of a learner's solution to Problem 1b (Perimeter)

In Example K and L, learners used the Lattice grid to solve the problem. The learners constructed the 3 by 2 grid. The products of the single digits are indicated in each of the smaller boxes of the lattice. The digits of the answers are the sum of the digits in the lattice down along the diagonals starting from the lower right corner. Although the learners were free to use any method to solve the question, the teacher acted as a mediator and assisted the learners with the question and the solution.

The learners, with the assistance of the teacher, calculated the total costs to put up the fence correctly. Most of the learners gave a partial response in their written work by neglecting to say in words how much the total cost would be, as can be seen in Example J. Most learners only calculated the total of the sum in the lattice grid as can be seen in Example L without indicating the amount in Rands.

Exemplification of problem-solving competencies by learners who provided the incorrect answers to question 1b of the Perimeter problem-solving question

As indicated by Figure 4.2, a total (29%) of learners provided an incorrect response for question 1b. Two of the learners' responses are presented below. **Example M**

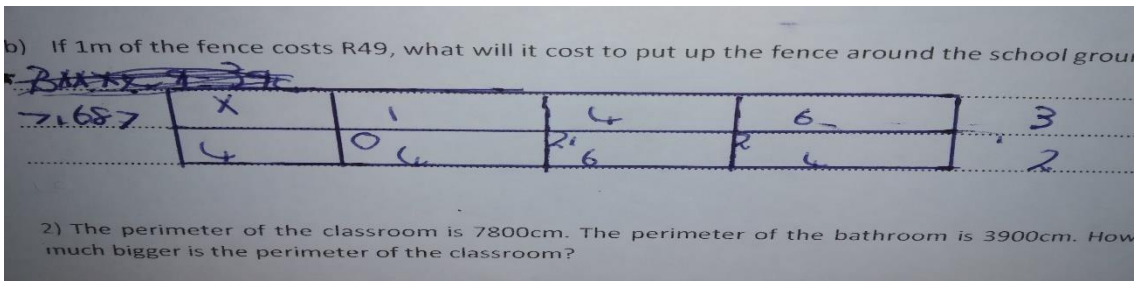


Figure 4.2.4: Example of a learner's solution to Problem 1b (Perimeter)

In Example M, although the learners were allowed to use any method to solve the problem, the learner attempted to solve the problem using the Lattice method as it was explained by the teacher. The learner failed to draw the lattice grid correctly as well as to insert the values for calculation in the correct grids. The learner simply wrote the final correct answer down without showing the correct calculations.

Example N

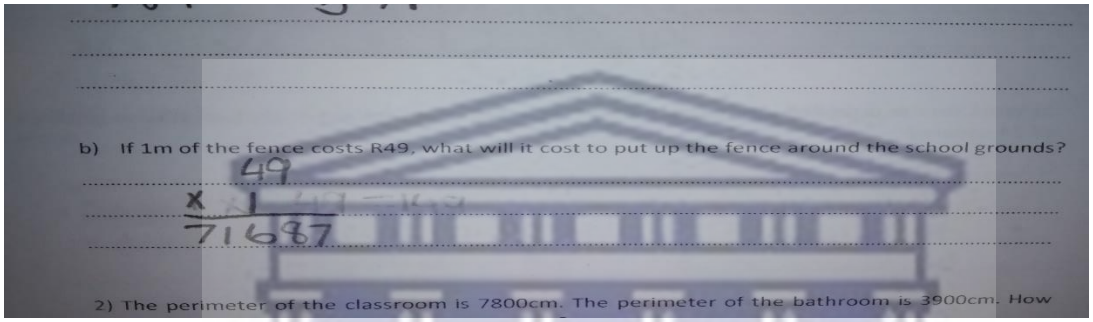


Figure 4.2.5: Example of a learner's solution to Problem 1b (Perimeter)

In Example N, the learner also shows no calculations and failed to express that the problem could be solved by multiplying 1463 by R49. However, the learner multiplied 1 which represents the 1m in the question with the cost per meter. The response to this question indicated that the learner misunderstood what needed to be done and simply wrote down the answer based on the solution that was arrived at with the assistance of the teacher.

4.3.3 Learners' performance in Problem 2

Question 2 for the Perimeter section ran as follows:

The Perimeter of a classroom is 7800cm. The Perimeter of the bathroom is 3900cm. How much bigger is the perimeter of the classroom?

To solve this question, you need to find the difference between the perimeter of the classroom and the perimeter of the bathroom. The difference will indicate how much bigger the classroom is than the bathroom. The learners could have calculated the difference using any method.

An expected solution for problem 2 is as follows:

Solution:

Perimeter of the classroom – Perimeter of the bathroom

7800cm – 3900cm = 3900cm

The perimeter of the classroom is 3900cm bigger than the perimeter of the bathroom.

The learners' responses to question 2 of the perimeter section were classified according to the holistic rubric in Table 4.1.

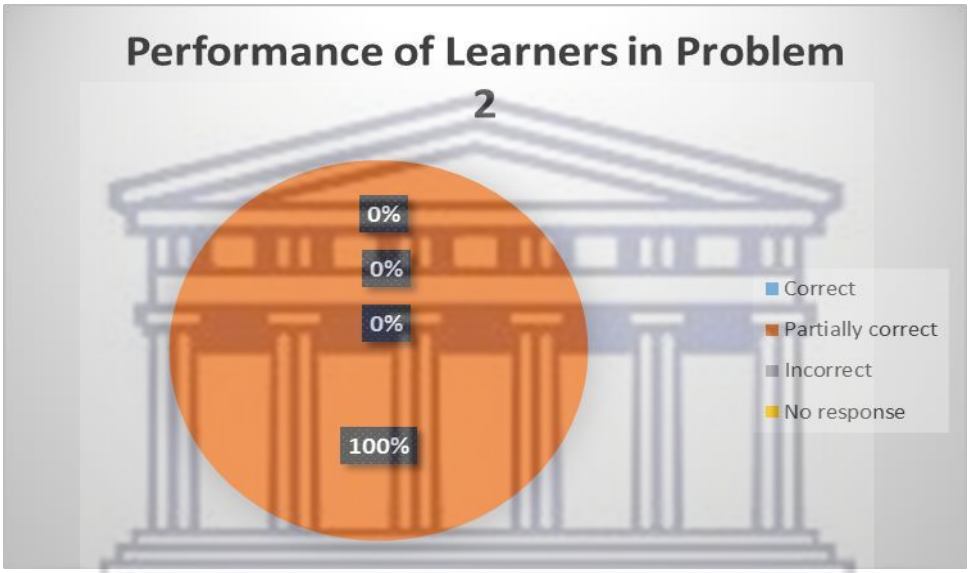


Figure 4.3: Performance Levels of Learners for Problem 2 – Perimeter

Figure 4.3 shows that all 34 learners submitted a partially correct response to question 2 of the perimeter section. No learner submitted a complete correct response, an incorrect response or no response.

Exemplification of problem-solving competencies by learners who provided the partially correct answers for Problem 2 of the Perimeter problem-solving question

A partially correct response is presented below, showing the method used by the learners in the class to solve question 2.

Example O

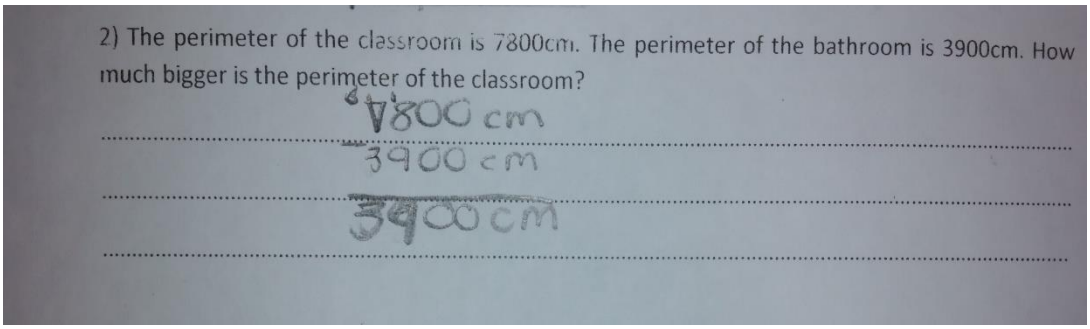


Figure 4.3.1: Example of a learner's response to Problem 2 (Perimeter)

As represented in Figure 4.3, all the learners submitted a partially correct response to question 2, as seen in Example O. After agreeing as a class that the way to solve the problem was to find the difference between the perimeter of the classroom and the perimeter of the bathroom to establish how much bigger the classroom is, the learners were given an opportunity to look at the question and to consult with their peers before one learner (a volunteer) was called to the front to show how they had solved the problem. There they were assisted by the class.

Learner's voice

Learner: *Kwi qanda uthabathe iqanda*

Kulingana ne qanda uphinde uthabathe iqanda. Kwi qanda kulingana ne qanda ngoba kukho amaqanda ama bini.

Isibhoz…(umfundi ubhidekile uyathintitha)

Translation

Zero minus zero is equal to zero. And then zero minus zero is equal to zero again because there are two zeros.

Eight….(Learner confused and stuttering)

Other learner: *(ukhwaza) ngu nye*

(Shouts) It's one

The class: *Hayi awukwazi. Ayikwazeki ukwenzeka elohlobo.*

No you can't. It's impossible to do it like that.

Female learner: *(ukhwaza) xhaxha. Xhaxha isixhenxe ufake unye.*

Cancel. Cancel 7 and replace it with 6 and then put one.

Learner proceeds with the calculation on the board

Learner: (Switches to English) *And then 18 minus 9 equals 9 and then 6 minus 3 equals 3.*

The learners were able to work together to solve the problem by incorporating their home languages. The majority in the class were able to understand the explanation and engage with the learner explaining on the board, except for those learners whose home language was not the same as the language the learner was using to explain the solution. At the end of the learner's explanation, he switched to English and this is consistent with Lewis' (2012) statement that the use of one language reinforces the other in order to expand understanding and to increase the learner's activity in both languages. To read and discuss a topic in one language and then to write about it in another language, means that the subject matter had to have been processed and digested.

The learners forgot to say at the end how much bigger the classroom is compared to the bathroom and simply stopped at the calculations, but were nonetheless able to make the correct calculations to solve the problem together by incorporating their home languages.

4.4 Summary of Findings with Respect to Problems 1 and 2 of the Perimeter section

i. All 34 learners attempted problem 1a where the majority of them (42%) developed a correct solution (See Figure 4.1, which shows 14 out of the 34 learners).

ii. Of the 34 learners (26%), 9 developed a partially correct solution for problem 1a and 11 learners (34%) developed an incorrect solution.

iii. The majority recognized that the problem could be solved by using addition and utilizing different methods of addition to do so.

iv. The majority of learners used the Standard Algorithm method to solve the problem as can be seen in Examples A, E and H, while others chose to solve the problem using the grouping method as can be seen in Examples B, D and H as well as the expanded notation method as indicated by Example C and F.

v. Many learners were able to calculate the total length of the fence in metres however, there were learners who made the mistake of calculating the total length of the fence in centimetres, as can be seen in Example E.

vi. In instances where learners provided a partially correct solution, they made minor calculation errors, as can be seen in Examples D and F, thereby affecting their final answers.

vii. In instances where learners provided a totally incorrect solution, they failed to understand how to calculate correctly using their respective methods, as can be seen in Examples H and I.

viii. With regard to question 1b, the majority of learners provided a partially correct response with the assistance of the teacher who engaged with the learners in the language of instruction.

ix. The learners incorporated their home languages for communication with their peers in an attempt to solve the questions, as can be seen in Examples A and O.

x. One learner (Example A), using a calculator, provided a correct response and stipulated in words how much it will cost to fence the school grounds. The majority (68%) provided a partial response because they did the calculation only and neglected to stipulate in Rands how much it would cost to fence the school grounds, as can be seen in Examples L, M and N.

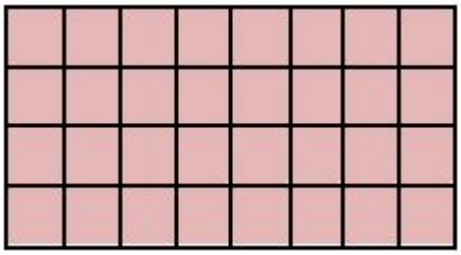
xi. The majority used the Lattice multiplication grid with the help of the teacher to solve problem1b. Certain learners were able to use this method of multiplication correctly, as can be seen in Examples K and L, while others found it challenging to use this method although they were free to use any other method, as can be seen in Example M. **xii.** In general, the learners seemed to show a better understanding when the teacher acted as mediator.

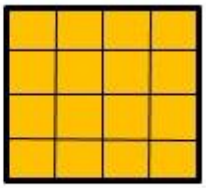
xiii. The learners were able to work and correct each other when one of the learners attempted to explain the solution to question 2 on the board, using their home languages

4.5 Learners' performance in Problems 1 and 2 Of the Area section

The first problem in the Area problem-solving section reads as follows:

1) When a figure is divided into equal squares, we can easily determine the Area by just counting the squares. How many squares can you count in the two figures?





To solve the question, the learners simply had to count the squares and write down the answer.

Solution

First block- 32 squares

Second block- 16 squares

All 34 learners produced the correct answer for question 1.

The second problem-solving question for Area reads as follows:

2) A farmer has a field that is 400m long and 80m wide. Calculate the Area of the field.

The learners had to multiply the length of the field with the width to get the Area of the field in square metres.

Solution:

400m X 80m

= 32000m^2

The Area of the field is 32000m^2

The learners' responses to problems 1 and 2 of the Area section were classified according to the holistic rubric in Table 4.1.

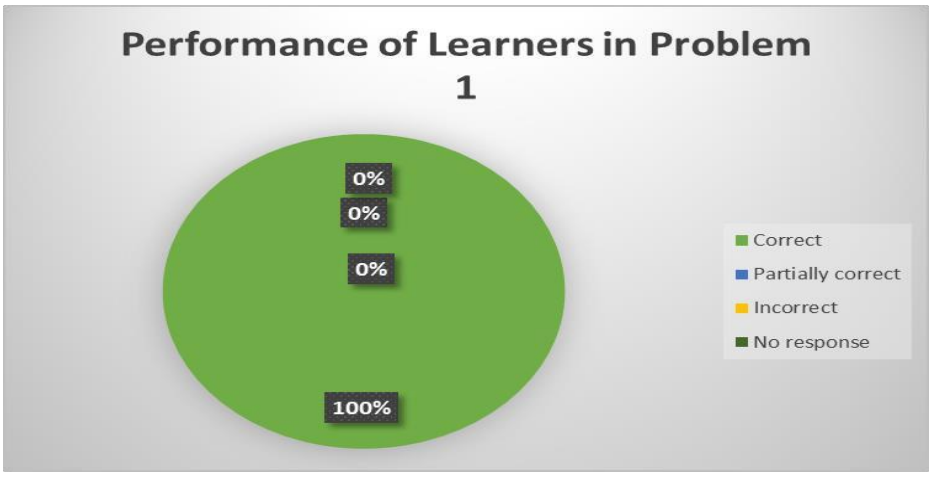


Figure 4.4: Performance levels of learners in Problem 1 - Area

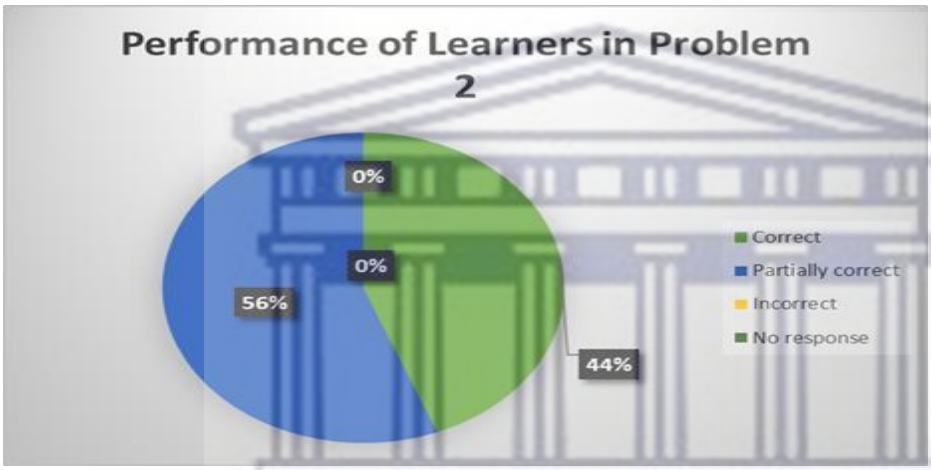


Figure 4.5: Performance levels of learners in Problem 2- Area

Figure 4.4 shows that all the learners provided the correct answers for question 1 in the Area section. Figure 4.5 shows that 15 of the 34 (44%) learners provided the correct answer to question 2, and that 19 learners (56%) provided a partially correct answer to question 2 of the Area section.

Exemplification of problem-solving competencies by learners who provided the correct answers for problem 1 of the Area problem-solving question Example A

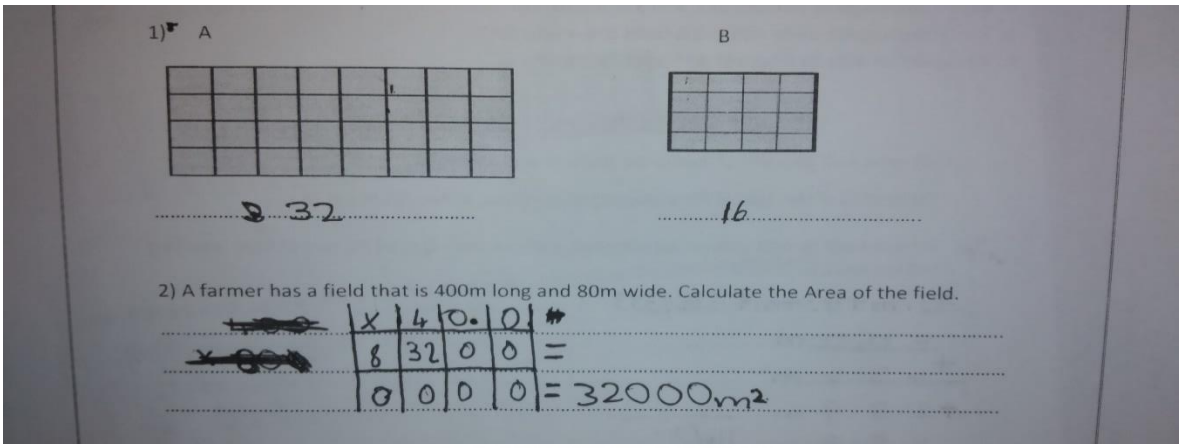


Figure 4.5.1: Example of a learner's solution to Problems 1 and 2 (Area)

In Example A of the Area section, the learner could determine that the solution to the problem was to multiply the length of the field with the width of the field using the lattice method of multiplication. They drew a three by two grid and multiplied the values with each other. They proceeded to add the values in a diagonal manner to derive the answer of 32000m^2

Example B

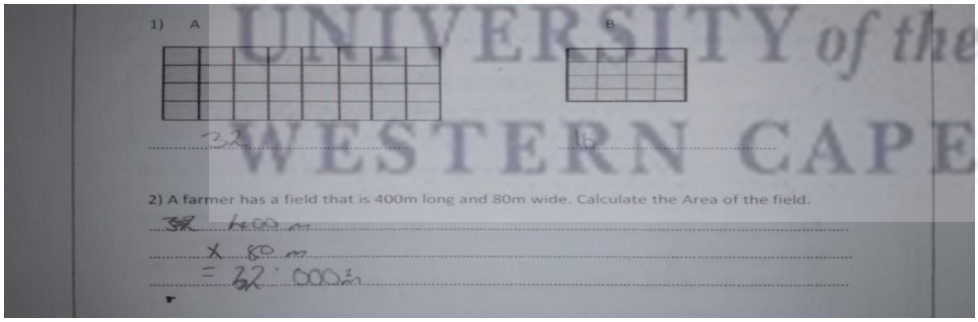


Figure 4.5.2: Example of a learner's solution to Problems 1 and 2 (Area)

In Example B of the Area section, the learner used a calculator to solve the problem. The learner could however determine that the solution to the problem was to multiply the length with the width.

Exemplification of problem-solving competencies by learners who provided partially correct answers for question 1 of the Area problem-solving question Example C

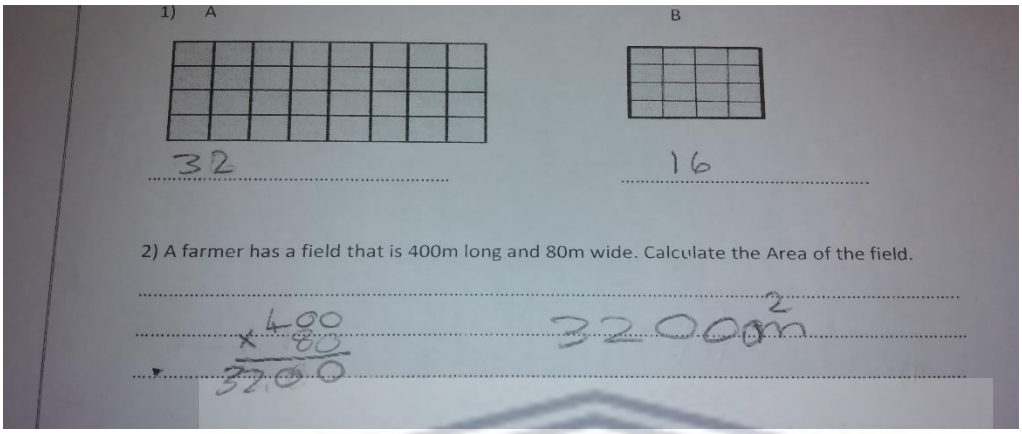


Figure 4.5.3: Example of a learner's solution to Problems 1 and 2 (Area)

In Example C, the learner attempted to solve the problem by providing the following explanation to his peers:

Learner' voice

> Learner: *Kufuneka uphindaphinde isibhozo yabo. Phindaphinda iqanda nge qanda kulingana neqanda. Emvakoko uphindaphinde isibhozo.*
>
> *Kuba kane impendulo ibe ngama shumi amathu anesi bini. Emvakoko ufake amaqa amabini ekugqibeleni.*

Translation

> **You must multiply 8 neh. You must multiply zero by zero and then it's equal to zero. Then you must multiply 8 by 4 and then you get 32. And then you must put the two zeros at the end.**

The learner could determine that the solution to the problem was mutiplication. The learner attempted to explain to his peers how to go about solving the problem using their home languages. In the attempt to explain to his peers to what to do, the learner's method resulted in a partial error, because they failed to place an extra zero which served as a place holder, resulting in $3200m^2$ as the final answer instead of $32000m^2$.

Example D

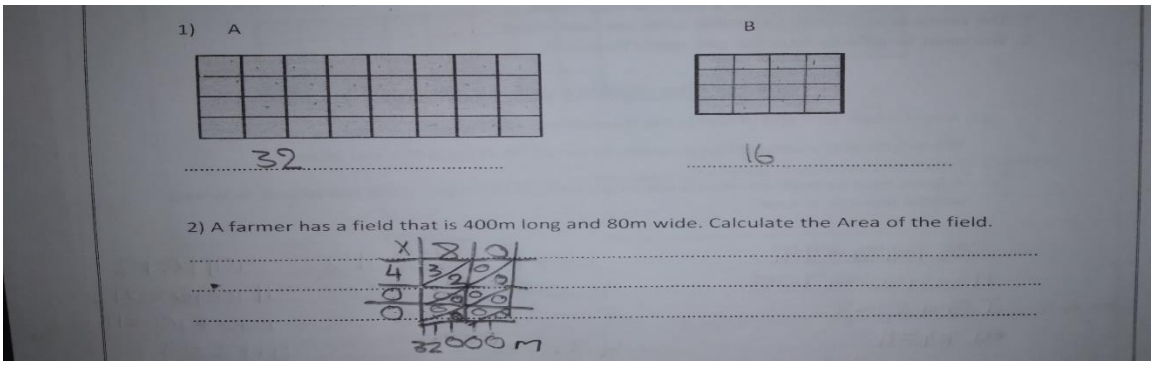


Figure 4.5.4: Example of a learner's solution to Problems 1 and 2 (Area)

In Example D, the learner attempted to solve the problem also using the lattice multiplication method by drawing a 2 by 3 grid. The calculations were done correctly from the multplication to the diagonal additonal and the answer. The only mistake made was in calculating the Area in metres and not square metres.

4.6 Summary of Findings with Respect to Problems 1 and 2 of the Area section

I. As indicated by Figure 4.4, all 34 learners provided the correct answer to question 1.

II. Question 1 only required the learners to count the number of squares in Figure A and Figure B.

III. In example C, using their home languages the learner attempted to explain to his peers how to go about solving the problem. In this attempt a minor error was made which resulted in a partially correct answer for question 2 of the Area section.

IV. As indicated by Figure 4.5, 44% of the learners provided a correct answer for question 2, and 56% provided a partially correct answer for question 2. **V.** No learner provided an entirely incorrect answer for question 2.

VI. The learners used different methods to calculate the solution to question 2.

VII. Minor errors were made by the majority where they forgot that Area is calculated in square meters as can be seen in Example D.

VIII. Some learners also provided a partially incorrect answer by neglecting to place an extra zero as a place holder.

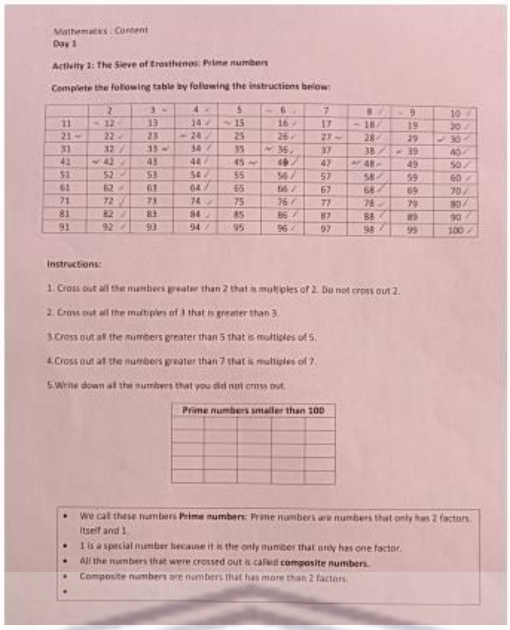
4.7 Classroom Observations

Data relating to the teaching and learning of mathematics through translanguaging practices was collected by means of observations, where I observed how the teacher and the learners interacted with each other in the mathematics classroom. My observations focused on how the teacher facilitated and/or mediated mathematics learning by using the learners' home languages through translanguaging practices. Such observations could not overlook the situational factors which influenced teaching and learning, the resources used in mathematics teaching and learning, and the languages used to facilitate teaching and learning in the study. In order to understand why and how the teacher and learners interacted in various ways, I also took note of the classroom atmosphere.

In my observations I noted that the atmosphere in the mathematics class was always silent when the teacher was present in class. The teacher was soft spoken most of the time, accessible to the learners, but also displayed an authoritative personality when the learners would neglect to listen at times. The learners were very participative in classroom activities and eager to learn.

During my observations I noticed that there were very few teaching and learning resources in the classroom. Some learners had not received their books and there was no fixed mathematics classroom. The learners along with the teacher had to move every day to find an empty classroom in which to do their lessons.

Over the course of the first two days of observations, the teacher handed out two activity worksheets on prime numbers, products and multiples which the learners had to complete as can be seen in Figure 4.6 and Figure 4.7 as follows:



Mathematics : Content
Day 1

Activity 1: The Sieve of Eratosthenes: Prime numbers

Complete the following table by following the instructions below:

	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

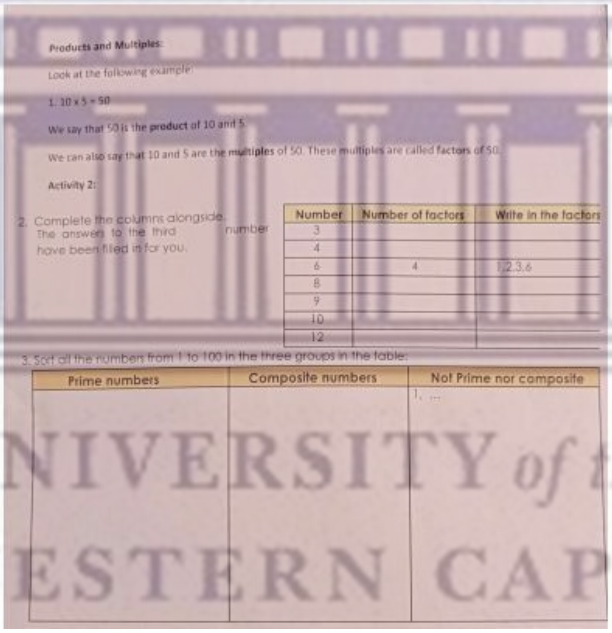
Instructions:

1. Cross out all the numbers greater than 2 that is multiples of 2. Do not cross out 2.
2. Cross out all the multiples of 3 that is greater than 3.
3. Cross out all the numbers greater than 5 that is multiples of 5.
4. Cross out all the numbers greater than 7 that is multiples of 7.
5. Write down all the numbers that you did not cross out.

Prime numbers smaller than 100				

- We call these numbers **Prime numbers**: Prime numbers are numbers that only has 2 factors. Itself and 1.
- 1 is a special number because it is the only number that only has one factor.
- All the numbers that were crossed out is called **composite numbers.**
- Composite numbers are numbers that has more than 2 factors.
-

Figure 4.6: Activity worksheets on Prime Numbers, products and multiples



Products and Multiples:

Look at the following example:

1. $10 \times 5 = 50$

We say that 50 is the **product** of 10 and 5.

We can also say that 10 and 5 are the **multiples** of 50. These multiples are called **factors** of 50.

Activity 2:

2. Complete the columns alongside. The answers to the third number have been filled in for you.

Number	Number of factors	Write in the factors
3		
4		
6	4	1;2;3;6
8		
9		
10		
12		

3. Sort all the numbers from 1 to 100 in the three groups in the table:

Prime numbers	Composite numbers	Not Prime nor composite
		1, ...

Figure 4.7: Activity worksheets on Prime Numbers, products and multiples

During the lessons and explanations of the worksheet, I noticed the teacher did not use any translanguaging approaches in his lessons and this could possibly be because the class was very diverse in terms of languages. Also, and the teacher had a limited proficiency in all these languages. The teacher was only fluent in two languages, Afrikaans and English, English being his second language. The home languages of the learners are indicated in Table 4.2 which follows.

Table 4.2: Home languages of the learners in the Grade 6 mathematics class

Languages	Number of learners
Afrikaans	2
English	3
IsiXhosa	27
IsiZulu	1
Ndebele	1

Due to the limited proficiency in the languages of the teacher, I observed that the learners would use a buddy system whereby they would explain the content of the work to one another to ensure that they understood what was expected. In cases where they failed to understand properly, the teacher would explain the work again, providing examples on the board. Even once the teacher had provided examples on the board, the learners would continue to use the buddy system by explaining the work to one another in the languages they were most comfortable with.

4.8 Interviews

As previously stated, different techniques of data collection were used, including interviews. To ensure a better understanding of the interaction between the teacher and the learners, and the learners amongst themselves, I interviewed the teacher and some of the learners. The data presented in the section that follows captures what was collected from the teacher and the learners by means of observations. The aim of the interviews was to add meaning to this. That is, interviews were conducted to examine in greater depth some of the information gathered from classroom observations and the worksheet activity.

4.8.1 Learner Interviews

In addition to classroom data, I wanted to probe learners' feelings and thoughts about the use of their home languages in the mathematics classroom. I anticipated that the learners' perceptions of English only as the language of instruction would correlate with how they interacted with each other in the mathematics classroom, how they interacted with the teacher and how they performed in mathematics assessments.

A total of six (6) learners were interviewed, each with a different home language. In the interview the 6 were asked two questions, which are as follows:

Q1: How do you feel about learning mathematics in your home language?

Q2: Would you want the teacher to switch more between languages or just use the language of instruction (English) when teaching mathematics?

The responses of the learners to question 1 are presented below:

Learner 1 whose home language is Afrikaans felt that learning mathematics is easier in English than in Afrikaans although he understands Afrikaans better.

Learner 2 whose home language is Ndebele and Zulu also stated that he prefers learning mathematics in English because he and his classmates understand the work better in English and because he would find it difficult to understand certain mathematics work in his home languages.

Learner 3 whose home language is IsiXhosa felt that learning mathematics in English is the best way. Their option to learn mathematics in English is based on the belief that in order to survive, you need English.

Learner 4 whose home language is also IsiXhosa feels that they are more confident about learning mathematics in English than in their home language because they always speak English at school.

Learner 5 who speaks Afrikaans at home feels that they are not as good in learning mathematics in Afrikaans as they are in English. They feel that even when they do not understand the work, they can always ask the teacher who will then respond in English.

Learner 6 whose home languages are Sotho and IsiXhosa, feels that their home languages should be used more often in the mathematics class because they are fluent in these. Sometimes they do not understand the work in English, but in IsiXhosa they understand it better when friends explain the work, using their home language.

The learners had the following responses to question 2:

Learner 1 said that they would want the teacher to teach in their home language (Afrikaans).

Learner 2 said that they prefer the teacher to teach in English only because they would struggle if the teacher switched between languages, as there are likely to be certain words they would not understand in their home language.

Learner 3 would want the teacher to switch between languages because then they think they will be able to do better in mathematics.

Learner 4 would like the teacher to switch between languages as well because they would be able to get a higher mark for mathematics if their home language is used.

Learner 5 prefers that the teacher teaches in English only because their Afrikaans is not that good when it comes to learning mathematics.

Learner 6 would prefer the teacher to switch between languages, since mathematics is their favourite subject and they think they will understand the work better if the teacher can speak his home language too.

4.8.2 Teacher interview

The teacher who was interviewed has more than twenty years' teaching experience, with Afrikaans as a home language and English as a second language. For the purpose of the interview, the teacher was asked three questions. The questions were open questions to allow the teacher to elaborate on their thoughts and feelings regarding translanguaging practices and the use of the learners' home languages in the mathematics classroom. The teacher had the following responses to the interview questions:

Question 1: What has your experience been like teaching in a language that is not the home language for some/most of the learners?

Teacher's voice:

> **...Om kinders in hulle home language alles te laat doen, dan kan die kinders switch hierso na graad 7 hulle en goedte, dank an hulle Engels toe gaan..maar dis bitter moeilik vir hulle om van onder af in graad 1 te kom, heeltyd praat hy Xhosa by die huis of hy praat Sotho of hy praat Zulu of enige een van die ander tale en nou kom hy en sommer flush in sy gesig word hy geface met English now..en dit create agterstande want daardie kind gaan baie langer vat om op te tel as die kind wat in sy moedertaal onderrig kry.. en dis maar ongelukkig 'n problem wat ons mee sit. Ons kan dit nie wegwens nie, ons probeer maar employ..die buddy system, meer differentiation, al daardie sort goed, maar dis nogsteeds baie moeilik..en dis vir hulle, as dit vir**

my moeilik is as onderwyser, dan is dit vir hulle mos nog moeiliker as die kinders wat hierdie goedte moet aanleer.

Translation:

To make children do everything in their home language, then the children can switch here and there to grade 7 them and stuff, then they can go to English..but it is very difficult for them to get from the bottom in grade 1, all the time he speaks Xhosa at home or he speaks Sotho or he speaks Zulu or any of the other languages and now he comes and just flush in his face he is faced with English now.. and it creates backlogs because that child is going to take much longer to pick up as the child who is taught in his mother tongue..and that's unfortunately a problem we face. We cannot wish it away, we try to employ..the buddy system, more differentiation, all that sort of stuff, but it's still very difficult..and it's for them, if it's difficult for me as a teacher, then it's for them are even more difficult than the children who have to learn these things.

Question 2: What is your personal opinion/feeling about incorporating the learners' home languages into teaching and learning?

Teacher's voice:

Dit is baie moeilik om..man, dis baie moeilik want om 'n konsep te verduidelik in 'n taal wat nie my eie is nie aan kinders wie se taal dit ook nie hulle eerste taal is nie, is baie moeilik. My vrees is dat partykeer praat ek al die goedte en dan het daardie kind nie 'n snaars besef wat ek gesê het nie. Dis hoekom ons maar sover as moontlik met eke verduideliking die praktiese gedeelte ook doen.

Translation:

It's very difficult to..man, it's very difficult because explaining a concept in a language that is not my own to children whose language is not their first language is very difficult. My fear is that sometimes I talk all the good and then that child did not realize what I was saying. That's why we do the practical part with as much explanation as possible.

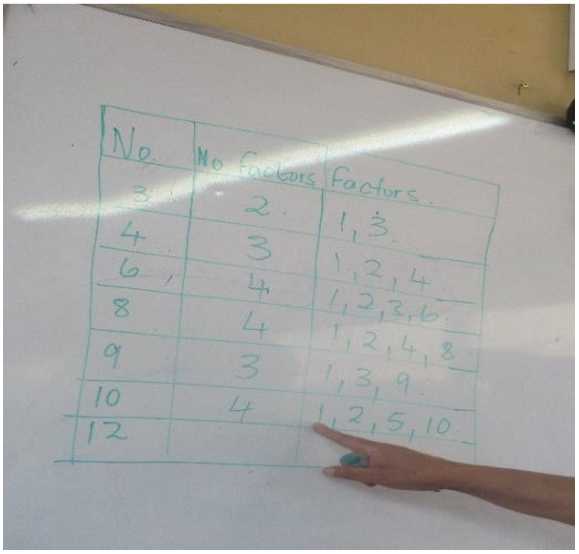


Figure 4.8: Practical explanation shown by the teacher on the board

Question 3: Do you think that the use of the learners' home languages in mathematics would enable or constrain mathematical learning and achievement?

Teacher's voice:

> **Nee 100% enable. Jy's Afrikaans neh?..jy gaan baie beter vaar as jy wiskunde in Afrikaans kry as wat jy sou vaar as jy dit in Engels sou kry. So as dit van my afgehang het, sou ek gesê het moedertaal onderrig tenminste vir die hele primêre fase en dan kan die kinders volgens my verander na die language of instruction (Engels).**

Translation:

> No 100% enable. You're Afrikaans neh?.. you will do much better if you get mathematics in Afrikaans than you would if you got it in English. So if it depended on me, I would have said mother tongue instruction at least for the whole primary phase and then the children can in my opinion change to the language of instruction (English).

The teacher's responses confirmed what I observed in the mathematics classroom taught through the medium of English. My own observations discussed in Section 4.7, were that the teacher used very few to no translanguaging practices in the classroom and used English most of the time because he was limited in the languages he is able to speak. The teacher also emphasized how difficult it was teaching in a language that is not his

first language, and how even more challenging it must be for the learners to learn mathematics in a language that is not their first language.

4.9 Summary of the findings with respect to the observations and the Learner and Teacher Interviews

I. During the observation period, it was noted that few translanguaging practices were used in interaction between the teacher and the learners.

II. The learners and the teacher would employ a buddy system whereby learners would explain work to one another using their home languages.

III. The teacher was limited in the number of languages he could speak and therefore strictly used the language of instruction to teach.

IV. Of the 6 learners who were interviewed, only one (Learner 6) favoured more frequent use of their home languages in the mathematics classroom.

V. The majority showed positive attitudes towards the language of instruction (English), which can be attributed to the fact that they felt more comfortable understanding mathematics in English than in their home languages, due to certain words or terms they would not be able to understand.

VI. Three learners (Learner 3, Learner 4 and Learner 6) interviewed were in favour of the teacher switching between their home languages and the language of instruction because they believed that it would result in better understanding and a better mathematics mark.

VII. Two learners (Learner 2 and Learner 5) preferred the teacher to teach in the language of instruction (English), only. They explained this was because learning mathematics in their home languages would be a struggle and there may be certain words they would fail to understand in their home languages.

VIII. One learner (Learner 1) wanted the teacher to teach in their home language (Afrikaans). When he was asked why he would want the teacher to teach in Afrikaans and why he was in the English class if he preferred Afrikaans, the learner responded by saying that his parents wanted him to be in the English class even though they speak Afrikaans at home.

4.10 Conclusion

This chapter presented data collected by means of an assessment worksheet, interviews and classroom observations. Data from the assessment worksheet was presented first, followed by the data from interviews with the teacher and the learners. The objective was to gain a better understanding of their thoughts and feelings about the use of translanguaging practices in the mathematics classroom. The chapter concluded with the data which had surfaced in the observations and the learner and teacher interactions.

CHAPTER 5- DISCUSSION AND CONCLUSION

5.1 Introduction

The findings of the study are discussed in this chapter in relation to each of the stipulated research questions. This chapter also discusses the limitations of the study and provides the conclusion and recommendations.

5.2 Discussion of findings in relation to Research Question 1

Research Question 1: *What is the purpose of translanguaging in a grade 6 mathematics classroom?*

The Common Underlying Proficiency (CUP) model by Cummins (1984) and the Theory of Action for the conceptual use of translanguaging in content assessment forms the basis for this discussion on the purpose of translanguaging in a grade 6 mathematics classroom.

Contrary to the traditional belief that the use of home languages in the classroom hinders the acquisition of the second language, the study found that translanguaging helped improve the learners' linguistic repertoire and their understanding of the problem-solving questions. Similar to the findings of Rasman's (2018) study of an ESL class in Indonesia, translanguaging practices in the grade 6 mathematics classroom were strengthened through scaffolding, peer interaction and classroom communication.

Problem-solving assessment was administered to the grade 6 learners and it was communicated to them that they were free to use their home languages to communicate with their peers to solve the problems. This revealed translanguaging practices not only enhanced the classroom communication amongst learners, but the teacher-learner relationship too. The teacher, with his limited proficiency was however able to engage with the learners by acting as the mediator. He also provided scaffolding (an educational practice where the teacher gradually removes guidance and support for learners to take a more active role in their learning) activities in which learners were free to utilise their home languages in explaining the work to one another and on the board. This kind of outcome is also evident in Wang's (2016) study which involved administering a

questionnaire to Chinese students to show their attitudes towards the use of multiple languages in the classroom.

As previously stated, the purpose of translanguaging is to encourage and allow bi/multilinguals to use their full linguistic repertoire – their semiotic, social and cognitive resources to construct meaning. As explained by French (2017) in Diagram 2.1, for academic reasons translanguaging can be used collaboratively if learners use different languages to help each other understand the content.

The global concern about the performance of learners in mathematics makes the focus on language and the role it plays in the comprehension of mathematics imperative. Language facilitates thinking and the language used for thinking is most likely the first language, hence, translanguaging practices in a mathematics class are fundamentally important at grade 6 level. To allow classroom interaction to stimulate cognitive engagement, mathematics communicated in one language may have to be translated into another language.

Debates about language and its link to mathematics are not new. More recently, they have brought translanguaging practices into sharper focus. In this thesis these practices were investigated in the grade 6 mathematics classroom as potentially important indicators regarding the low performance in mathematics, a misfortune attributable to language.

On an international level, South Africa has participated in a number of large-scale assessments, such as the Trends in International Mathematics and Science study (TIMMS). And as indicated earlier, results showed that South Africa was amongst the lowest performing countries for mathematics in the years 1995, 1999, 2003, 2011, 2015 and 2019.

Results from the Annual National Assessment (ANA) for Grade 6 level serve to highlight the importance of investigating the benefits of translanguaging. As the ANA for mathematics and languages has been conducted since 2002, test results help schools to identify areas for improvement. They enable the Western Cape Education Department to identify areas of the curriculum that require additional support. The results from the ANA assessments indicate a low performance in mathematics at National level, and identify a number of factors that contribute to the low performance, such as language.

The CUP model strongly emphasises the use of the first language and the intrinsic connection it has with the second language and the theory of action shows how the use of the first and second language can be used in assessment. The CUP model supports the theory that educational curricula which incorporate instruction in both first and second language have greater effects on academic outcomes than curricula which provide instruction solely in learners' second language.

5.2.1 The CUP Model and the Theory of Action

In relation to the first principle: Draw on learners' entire linguistic repertoires (Cummins, 1984), the grade 6 mathematics class was allowed/encouraged to use their full linguistic repertoires to explain and work through the problem-solving questions on Perimeter and Area. The principle allows learners to perform bilingually by switching between their home language and a second language in different modalities (oral and spoken language), as can be seen in Example O where one learner explained Question 2 of the Perimeter section to the class. The learner started with his home language and then switched to the second language. In this manner, the learner performed bilingually to explain the solution to the problem, indicating that language facilitates thinking and that in all probability thinking happens in the first language.

This principle also draws on the idea that meaningful assessment opportunities are created when translanguaging is used in content assessment that assesses the ability of the learners to perform in a second language, their home language, or a combination of both. Learners use any language they wish in the assessment approach to show their knowledge and skill in the content area.

Consequently, as the assessment was set up in the second language of the majority, learners were free to use any language they wished in the assessment approach. As can be seen in Example A, the learner explains to his peers in his home language and as can be seen in Example O again, the learner explains, starting with his home language, then switching to the second language. The learners who assisted their peer also did so by using their home languages. Instead of having to stick to the language of instruction, the learners were able to, and chose to solve the problem by expressing themselves in their home languages.

In relation to Principle 2: Engage learners in interaction through translanguaging in content assessment, the learners were allowed and encouraged to interact with one another (peer to peer interaction) and with the teacher (learner to learner interaction).

This principle emphasises that space be made for interactive moments of translanguaging where the teacher takes the role of the mediator in the assessment context and, together with the bi-/multilingual learner, the teacher works to negotiate and create meaning. Such an example can be seen in Example K of question 1b of the Perimeter problemsolving question. The learners were free to consult with their peers, but the teacher acted as the mediator and assisted the learners with the solution to the problem because the learners still found multiplication challenging.

Due to the teacher's limited proficiency in languages other than Afrikaans and English, the teacher only offered explanations in the language of instruction (English). In instances when some of the learners failed to understand, the buddy system was used as peers explained to one another.

In relation to the bilingual assessment features, the learners were given the assessment in English, their responses were written in English, but they were allowed to give their responses verbally in English, their home languages or both. Evidence of this can be seen in Example A where the learner provides an explanation in their home language, in Examples K and L where the teacher and the learners use the language of instruction to solve the problem, and in Example O where the learner switches between the home language and the second language to explain to the class.

As outlined earlier, the instructions were read aloud and explained to the learners in English, and in instances where they did not understand the instructions, they were allowed and encouraged to explain these to one another in their home languages.

With regard to the intended effects, the learners were given an opportunity to show their knowledge and skills in mathematics verbally and in the written task: they were free to use translanguaging whenever they needed to. The link that can be found between bilingual assessment resources and the intended effects is that bi-/multilingual learners are allowed to show what they know and do. When teachers use bilingual assessment resources, they too are supported with a knowledge and understanding of new learners' skills and areas for improvement.

5.3 Discussion of findings of Research Questions 2

***Research Question 2**: What are the dynamics of translanguaging in the mathematics classroom?*

As shown in Table 4.2, the home languages of the learners in the grade 6 mathematics classroom are very diverse. The dynamics of translanguaging in the mathematics classroom are discussed in the section that follows.

Limited language proficiency

Much of the translanguaging that happened in the classroom was learner-directed. The teacher used no translanguaging in the classroom because as shown in Table 4, only 6% (2 learners) speak the same home language as the teacher, only 9% (3 learners) have the same home language as the language of instruction and the majority speak IsiXhosa, a language the teacher neither speaks nor understands.

Translanguaging practices occurred mostly amongst the learners in what the teacher would call the "buddy system". All mathematics lessons were thus taught solely in English. If the teacher used translanguaging practices in the spoken form, it would have been in Afrikaans and would have only been beneficial to 6% of the learners, hence the teacher teaches in English only, so that he can reach all the learners equally and allow for a buddy system approach where he is unable to reach.

Buddy System

The purpose of implementing a buddy system is to increase social interaction in teaching and learning. A peer buddy allows one learner to help another who has challenges with transitions, or with remembering rules and procedures of routines. It also helps to promote better support of schoolwork. In the instance of the grade 6 mathematics class, the buddy system was used to assist the learners in understanding the work in their home languages when they were unable to understand the content in the language of instruction.

Formal education environments globally tend to uphold a structuralist notion of language use. According to Lewis, Jones and Baker (2012B), much of the translanguaging that happens in classrooms is learner-directed, where learners use translanguaging to mediate, construct meaning between themselves, include and exclude others, and show knowledge, among other functions.

5.4 Discussion of findings of Research Question 3

Research Question 3: *What are the teacher's and learners' perceptions and experiences of translanguaging in the mathematics classroom?*

Classroom observations and teacher and learner interviews guided the discussion of the aforementioned question.

As noted in Chapter 4, in total, 6 learners were interviewed, each with a different home language. All 6 learners were asked 2 questions:

Q1: How do you feel about learning mathematics in your home language?

Q2: Would you want the teacher to switch more between languages or just use the language of instruction (English) when teaching mathematics?

Of the 6 learners interviewed, results showed that 5 of the learners felt that learning mathematics in English is better than learning it in their home languages. Various reasons were cited, such being unable to understand certain mathematical terms in their home languages; that mathematics is better in English because they always speak English at school; and that English is needed for survival therefore it is better to learn mathematics in English.

When the learners were asked whether they wanted the teacher to switch more frequently between languages, responses varied. Three (Learner 3, Learner 4 and Learner 6) wanted the teacher to switch more often between their home languages and the language of instruction; two (Learner 2 and Learner 5) preferred the teacher to teach mathematics in English only; and one learner (Learner 1) preferred the teacher to teach mathematics only in their home language (Afrikaans).

Based on the learners' perceptions and experiences with regard to the first questions it is clear that the majority chose to be taught mathematics in the language of instruction (English), as opposed to their home languages. This could be because in the classroom, few to no translanguaging practices on the part of the teacher were used during mathematics lesson. Learners thus felt comfortable, or accepting of the fact that they were learning mathematics in English. Another reason could be that they thought that, given the option, they would do better in mathematics if it was taught in English because they have had more exposure to it in the classroom than they had to taking mathematics in their home language.

However, with regard to question 2, when the learners were asked if they would want the mathematics teacher to switch between their home languages and the language of instruction or choose only the LOLT, instead of only one of these scenarios, the majority indicated that they would want the teacher to switch between languages when teaching mathematics. They reasoned that this would make it easier for them to understand the work and they might get higher marks if their home languages are incorporated into the study of mathematics.

Only one learner favoured learning mathematics in their home language while the rest favoured learning mathematics in both the language of instruction and in their home languages. Two learners favoured mathematics only as the language of instruction– to avert becoming confused.

Based on the response of the teacher to the interview question, his perceptions about translanguaging and the use thereof is positive although he himself finds it difficult to incorporate translanguaging practices into his mathematics lessons since the majority of his class are fluent in a home language that he cannot speak or understand. The learners who share a home language with the teacher comprise too low a percentage for him to use translanguaging practices in the class, thus he uses the language of instruction only when teaching mathematics.

Based on the observations it was clear that the teacher did not use any translanguaging practices and when he was asked as to why he does not, he further explained that he found it very difficult to incorporate all the learners' home languages into the teaching of mathematics because of his limited linguistic proficiency. He also expressed the fear that learners may have no idea what he is talking about sometimes, when he uses mathematical terms in a language that is not their first language.

When the teacher was asked whether he thought that the use of the learners' home languages in mathematics would enable or constrain mathematical learning and achievement, he strongly agreed. He stated it would definitely enable learning because they would perform better if their home languages are included. His utterances were similar to those aired by the majority of learners. These views also find expression in Li Wei and Zhu Hua's (2013) explanation when they say that in mathematics, translanguaging becomes more individualized. They argue that thinking about concepts between languages helps with the problem-solving aspects of maths as well as comprehension of written texts.

In a nutshell Baker (2011) states that translanguaging helps learners in making meaning, gaining understanding and acquiring knowledge.

Although the teacher has a positive perception about the use of translanguaging practices in the mathematics classroom, his experiences with it however constitute a more difficult reality. Attempting to explain mathematics in a language that is neither his home language nor the home language of the learner's makes learning and teaching more challenging. The concern of the teacher was that if he found it challenging to teach mathematics in a language that is not his home language, how much more challenging it must be for the learners to learn mathematics in a language that is not their home language. He felt that this is something he unfortunately cannot change although it creates backlogs.

5.5 Acknowledgement of the limitations of the study

As explained at the beginning, the data collection process proceeded during the Covid-19 pandemic when many schools were compelled to follow a phased-in approach to classes. The Grade 6 class in this study attended school only twice to three times a week, which was a limiting factor for data collection.

Overall, ineffective time management at the school was also a limiting factor in the study. The teacher of the class also served as the principal of the school at the time and had to attend to administrative duties before he could attend to his classes, which resulted in short periods for observation time and data collection.

The scope of this study was limited to one Primary school in the Western Cape. Hence, the findings of this study cannot be representative of all Grade 6 learners in South African schools.

5.6 Recommendations

This research recommends a further study which would expand the target group to enrich data analysis and interpretation.

A recommended study is one that would focus on how much more effective translanguaging practices in a Grade 6 mathematics class might be if the teacher were to be competent in all the home languages of the learners in the class.

5.7 Conclusion

As stated at the beginning of this study, the Education system of South Africa underwent profound changes after the 1994 democratic elections. It called for the promotion of language equality and equity in education. An important principle that informed the Language-in-Education policy document was that learners were to receive equal access to the curriculum and that this might be best achieved through a national system of additive bilingual or multilingual education, meaning that the learners' first language continues to be used and developed while they are learning a second language. However, Afrikaans and English remain the dominant languages of knowledge production and circulation in education even though more than 76% of South Africans speak African languages. Since language is linked to understanding mathematics, the global concern about the performance of learners in mathematics is considered to be the language of instruction (notably, too often not the same as learners' home languages).

This study sought to explore translanguaging practices in a multilingual grade 6 mathematics classroom with the goal of encouraging the use of learners' home language in a mathematical problem exercise. It attempts to raise awareness about the benefits of translanguaging practices amongst policy makers, departmental officials and parents who need to be convinced of the merits of translanguaging, especially in contexts in which home languages are not used for schooling.

The findings of this study show that a limited number of translanguaging practices occurred in the mathematics classroom between the teacher and the learners, due to the teacher's limited language proficiency in all the home languages of the learners. In the interviews the teacher acknowledged the benefits translanguaging practices may have on the performance and academic achievement of the learners in the mathematics classroom. However, the best way he could ensure that these were to take place to ensure that learners understood the content, was by using practical examples on the board, and by relying on the "buddy system".

In the problem solving activity, it became evident that although the learners had little exposure to their home languages in the mathematics class, they made use of their home languages to engage in the activity. As the assessment was set in the language of instruction (English), a second language for the majority of the learners, they accessed the task by using their home languages to: explain things to one another, to make sense of the problem and to arrive at the solutions.

In the interviews, learner responses concerning question 1, revealed that the majority favoured the use of English for learning as opposed to the use of their home languages. This attitude can be attributed to the fact that they felt more comfortable learning mathematics in English as they have been more exposed to this language in the mathematics class than they have to their own home languages.

Based on their responses to question 2, the majority expressed an eagerness for the teacher to switch between their home languages and the language of instruction in order for them to understand the work better and to improve their marks.

In conclusion, it is concerning that very few teachers are sufficiently well trained to assist learners to master mathematics through the medium of their second language. The majority of learners in South African schools are in this position. It thus stands to reason that the Education Department should ensure that teachers are linguistically trained to help learners' master mathematics in a language that is not their home language. Adequate resources have to be invested in and allocated to schools to help learners and teachers learn and teach in a language that serves as their second language so that they might ensure that the use of the learners' home languages are incorporated and used. To combat the dismal performance of learners, it becomes clear that more support for the use of learners' home language is required so that translanguaging practices may take place in the mathematics classroom..

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APPENDICES

Appendix A-Background information Sheet

University of the Western Cape

Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet:

Researcher: Leona Claasen

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. I would like to invite you to take part in my research project. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting a lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on perimeter and area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why are the participants being invited to participate in a focus group?

The participants are being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the Main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected.

What will participants be expected to do in the study?

The learners in the study will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place over a period of two weeks, during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take audio and video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that he researcher will ensure that audio and video recordings do not hinder any classes.** A group of learners will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing the learners to the research in the classroom environment with an educator that they are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The teacher and the children's identities will be kept anonymous throughout the study and no method of identifying the teacher and the learners will be revealed in the writing up of this study either. The teacher and children participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from the teacher, the children's guardians and the school principal, ensuring that the teacher and children are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.

- Alcohol based hand sanitizers to be available at all times to disinfect hands.
- Consulting a healthcare facility if there suspected Covid-19 infections.
- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can participants do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

The teacher and the learners in the focus group will also be encouraged not to share the identities of their peers in the focus group and the information they shared to outside sources. The privacy and anonymity of all participants will and should be respected at all times.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing my personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to my personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will my personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will my personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understand what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise

Appendix B - Information Sheet (WCED)

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet: Western Cape Education Department (WCED)

Researcher: Leona Claasen

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. I would like to request permission to conduct research at a public school in the Western Cape. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting a lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on perimeter and area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why are the participants being invited to participate in a focus group?

The participants are being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the Main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected.

What will participants be expected to do in the study?

The learners in the study will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place over a period of two weeks, during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take audio and video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that he researcher will ensure that audio and video recordings do not hinder any classes.** A grade 6 teacher and a group of learners will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing the learners to the research in the classroom environment with an educator that they are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The teacher and the children's identities will be kept anonymous throughout the study and no method of identifying the teacher and the learners will be revealed in the writing up of this study either. The teacher and children participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from the teacher, the children's guardians and the school principal, ensuring that the teacher and children are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.
- Alcohol based hand sanitizers to be available at all times to disinfect hands.
- Consulting a healthcare facility if there suspected Covid-19 infections.

- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can participants do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

The teacher and the learners in the focus group will also be encouraged not to share the identities of their peers in the focus group and the information they shared to outside sources. The privacy and anonymity of all participants will and should be respected at all times.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing my personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to the personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will the personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will the personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understand what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise.

Permission letter to the Western Cape Education Department

Directorate: Research

Audrey.wyngaard2@pgwc.gov.za

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

wced.wcape.gov.za

APPLICATION TO CONDUCT RESEARCH IN PUBLIC SCHOOLS WITHIN THE WESTERN CAPE Note

- This application has been designed with students in mind.
- If a question does not apply to you indicate with a N/A
- The information is stored in our database to keep track of all studies that have been conducted on the WCED. It is therefore important to provide as much information as is possible

1 APPLICANT INFORMATION

1.1 Personal Details		
1.1.1	Title (Prof / Dr / Mr/ Mrs/Ms)	Ms
1.1.2	Surname	Claasen
1.1.3	Name (s)	Leona Minolize
1.1.4	Student Number (If applicable)	3332962

1.2 Contact Details		
1.2.1	Postal Address	20 Mozart Street, Belhar

1.2.2	Telephone number	082 649 3659
1.2.3	Cell number	082 649 3659
1.2.4	Fax number	
1.2.5	E-mail Address	3332962@myuwc.ac.za / claasenleona@gmail.com
1.2.6	Year of registration	2020
1.2.7	Year of completion	2023

3 DETAILS OF THE STUDY

2.1 Details of the degree or project		
2.1.1	Name of the institution	University of the Western Cape
2.1.2	Degree / Qualification registered for	MEd (By thesis)
2.1.3	Faculty and Discipline / Area of study	Education
2.1.4	Name of Supervisor / Promoter / Project leader	Prof Mbekwa
2.1.5	Telephone number of Supervisor / Promoter	076 905 4853
2.1.6	E-mail address of Supervisor / Promoter	mmbekwa@uwc.ac.za

2.1.7	Title of the study
EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.	

2.1.8	What is the research question, aim and objectives of the study
Main Research questions:	

To what extent do teachers and learners use translanguaging practices in a multilingual grade 6 mathematics classroom?

Sub Questions:

1) What is the purpose of translanguaging in a grade 6 mathematics classroom?
2) What are the dynamics of translanguaging in the mathematics classroom?
3) What are the perceptions of the teacher and learners of their experiences of translanguaging in the mathematics classroom?

The aim of the study:

The aim of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The study is structured in such a way that the researcher will observe a teacher conducting a lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on perimeter and area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

Objectives of the study:

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

2.1.9	Name (s) of education institutions (schools)
-	

2.1.10	Research period in education institutions (Schools)	
2.1.11	Start date	01 March 2023

2.1.12	End date	10 March 2023

Appendix C- Information Sheet (Principal)

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet: Principal

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

Researcher: Leona Claasen

Dear Principal

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. With your permission, I would like to invite one Grade 6 teacher and their grade 6 mathematics class to take part in my research project. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting lessons, also a particular lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on Perimeter and Area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why are the participants of your school being invited to participate this focus group?

The teacher and his/her learners are being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the Main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected. The researcher also wants to ensure that the learners engage with a teacher they are familiar with and that no interruption to the normal school programme is caused.

What will the participants be expected to do in this study?

The teacher and the learners will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take audio and video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that the researcher will ensure that audio and video recordings do not hinder any classes.** A group of learners and the teacher will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing the learners and the teacher to the research in the classroom environment with an educator that they are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The teacher and the learner's identities will be kept anonymous throughout the study and no method of identifying the teacher and the learners will be revealed in the writing up of this study either. The teacher and the learners participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher (the researcher) will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from the children's guardians and the school principal, ensuring that the learners and the teacher are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.
- Alcohol based hand sanitizers to be available at all times to disinfect hands.
- Consulting a healthcare facility if there suspected Covid-19 infections.

- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can the participants do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing of the participants personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to the participant's personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will the participant's personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will the participant's personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understands what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise.

Appendix D- Information Sheet (Teacher)

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet: Teacher

Researcher: Leona Claasen

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

Dear Ma'am/Sir

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. I would like to invite you to take part in my research project. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is Translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting lessons, also a particular lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on Perimeter and Area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why are you being invited to participate this focus group?

The teacher and his/her learners are being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the Main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected. The researcher also wants to ensure that the learners engage with a teacher they are familiar with and that no interruption to the normal school programme is caused.

What will I be expected to do in this study?

The teacher and the learners will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place over a period of two weeks, during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take audio and video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that the researcher will ensure that audio and video recordings do not hinder any classes.** A group of learners and the teacher will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing the learners and the teacher to the research in the classroom environment with an educator that they are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The teacher and the learner's identities will be kept anonymous throughout the study and no method of identifying the teacher and the learners will be revealed in the writing up of this study either. The teacher and the learners participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher (the researcher) will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from the children's guardians and the school principal, ensuring that the learners and the teacher are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.

- Alcohol based hand sanitizers to be available at all times to disinfect hands.
- Consulting a healthcare facility if there suspected Covid-19 infections.
- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can I do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing my personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to my personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will my personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will my personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understands what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise.

Appendix E - Information Sheet (Parents)

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet: Parent

Researcher: Leona Claasen

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

Dear Ma'am/Sir

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. I would like to invite your child/children to take part in my research project. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

What is translanguaging?

Translanguaging can be understood as the integrated and coherent use of two languages to organise and mediate mental processes in learning. Simply put, translanguaging refers to the use of language, bilingualism and the education of bilinguals.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting a lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on perimeter and area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why is my child being invited to participate a focus group?

The learner is being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the Main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected.

What will my child be expected to do in the study?

The learner/s will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take audio and video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that he researcher will ensure that audio and video recordings do not hinder any classes.** A group of learners will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing the learners to the research in the classroom environment with an educator that they are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The children's identities will be kept anonymous throughout the study and no method of identifying learners will be revealed in the writing up of this study either. The children participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from the children's guardians and the school principal, ensuring that the children are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.
- Alcohol based hand sanitizers to be available at all times to disinfect hands.

- Consulting a healthcare facility if there suspected Covid-19 infections.
- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can my child do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

The learners in the focus group will also be encouraged not to share the identities of their peers in the focus group and the information they shared to outside sources. The privacy and anonymity of all participants will and should be respected at all times

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing my personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to my child's personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will my child's personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will my child's personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understand what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise.

Appendix F- Information Sheet (Children)

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Date

Information Sheet: Children

Researcher: Leona Claasen

Topic: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

Dear Learner

I, Leona Claasen, am pursuing my Master's degree in the Department of Education at the University of the Western Cape, South Africa. I would like to invite you to take part in my research project. Please take time to read the following information carefully, and please feel free to ask questions if anything you read is not clear to you or if you'd like more information.

What is the study about?

The purpose of the study is to explore the use of translanguaging practices in a multilingual grade 6 mathematics classroom.

In easier terms, I, the researcher want to look at how you use your home language and the language you are taught with in schools, in a mathematics classroom.

What is translanguaging?

Translanguaging refers to the use of two languages to make sense and organize our thoughts when it comes to learning.

The aim of this study is to explore teachers' and learners' use of translanguaging practices in a multilingual **(a classroom where learners speak different home languages**) grade 6 mathematics classroom with respect to mathematical problem solving.

The study is structured in such a way that the researcher will observe a teacher conducting a lesson on mathematical problem solving and then giving and providing the learners with an opportunity to solve a set of problems on Perimeter and Area using basic mathematical operations and then observing them solving these problems with the assistance of the teacher incorporating the use of their home languages. The researcher will observe and record these learners engaging with and discussing their approach and process of solving the problems with a view to making sense of their translanguaging and how this assists them to make sense of and solve the problems.

The objective of the study is to bring awareness of the benefits of translanguaging practices to policy makers, departmental officials and parents who needs to be convinced of the merits in contexts in which home languages are not used for schooling.

Why are you being invited to participate in a focus group?

You are being invited to participate in this study, because the researcher wants a linguistically diverse group of learners. To ensure that the data that will be collected speaks to the main research question and the subsidiary research question, the researcher implores a purposive sample to ensure that accurate and valuable data can be collected.

What will I be expected to do in the study?

You will be expected to solve a set of problem solving questions on Perimeter and Area using basic mathematical operations. This study will take place during normal school hours in the mathematics classroom ensuring that no interruptions will be made to the normal school programme. During the problem solving activity, the researcher will take video recordings of the learners and the teacher interacting with one another to solve the questions. **Please note that the researcher will ensure that audio and video recordings do not hinder any classes.** A group of learners will also be interviewed to determine what their views and feelings are towards the use of their home languages in the mathematics classroom.

Anonymity is ensured in the study, and data collected will only be used for the purposes of the study.

What are the potential risks involved in this study?

Please note that all interactions with minors are considered high risk. However, all possible risks will be reduced as far as possible by exposing you as the learner to the research in the classroom environment with an educator that you are familiar with. The researcher self has experience in the teaching profession and is familiar with working with learners.

The children's identities will be kept anonymous throughout the study and no method of identifying learners will be revealed in the writing up of this study either. The children participating in the interviews will do so in the classroom environment they are familiar with and an additional teacher will be present as well to make them feel more comfortable. Should they feel uncomfortable they will be allowed to leave the study at any time.

Additionally consent letters will be obtained from your parents/ guardians and the school principal, ensuring that the children are as comfortable as possible while participating in the study.

What are the potential benefits involved in this study?

This research hopes to bridge the gap that exists between policy and practice when it comes to using the learners' home languages in learning and teaching, especially in the mathematics classroom.

There is a huge concern about the performance of learners in mathematics. The language of instruction that is often not the learners' home language contributes to the poor mathematics performance of South African learners. People need convincing of the benefits of translanguaging practices used for schooling, which can help combat the dismal performance of learners in mathematics, since language plays a very important role in the understanding of mathematics.

What Covid 19 Protocols are in place? (If applicable)

- Depending on the protocols implemented at school, only half of the class will make up the sample for the sample.
- A physical distance of at least 1m with other will be maintained at all times - Direct contact with other will be avoided, e.g. shaking hands or hugging.
- Alcohol based hand sanitizers to be available at all times to disinfect hands.
- Consulting a healthcare facility if there suspected Covid-19 infections.

- Informing the school health team and education authorities immediately if a learner, educator, support staff or parent/caregiver has been in direct contact with an infected person or if they are diagnosed with Covid-19.

How is confidentiality managed in a Focus Group?

The nature of a focus group often makes it challenging to manage confidentially, however all the participants in the focus group will be informed not to repeat what is said in the focus group to others. The participants in the focus group will be informed about the procedures in place to maintain confidentiality of the research data.

What can I do to maintain confidentiality in a Focus Group?

The real names and surnames or other identifying information of the learners in the focus group will not be used. Recordings of focus group discussions will be held in a secure and locked area with access limited to designated researchers.

Should you participate in the focus group, you will be informed and encouraged not to share the identities of your peers in the focus group and the information they shared to outside sources. The privacy and anonymity of all participants will and should be respected at all times

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), please note additional information:

What type of personal information will be collected?

The only personal information that will be collected from the participants will be their names and surnames that will be required on the consent forms. The home languages of the learners will only be collected for statistics purposes. None of the personal information collected such as the names and surnames of the participants will be used in the study. Every participant will remain anonymous at all times.

Who at UWC is responsible for collecting and storing my personal information?

The researcher herself (details below) will be responsible for the collection and the storage of the data.

Who will have access to my personal information outside of UWC?

Only the researcher and a limited of designated researchers will have access to the data collected.

How long will my personal information be stored?

Electronic data will be kept on the researcher's/supervisors password protected computer for five years and deleted thereafter. Hard copies will be kept in a locked drawer for five years and deleted/discarded thereafter.

How will my personal information be processed?

The information on the consent forms will only be processed for participation purposes. Any participant not willing to participate in the study will be excluded and their personal information safely discarded. All the participants that are willing to participate in the study, their personal information will only be used as an indication that they are willingly agreeing to participate in the study and that they understand what the study is about and how data will be collected. Again, no mention of any personal information will be included in the writing up of the study self and after a period of 5 years, all the personal information of all the participants will be safely discarded.

Who do I contact for further information?

Should you have any require any further information, please do not hesitate to contact me Leona Claasen on my cell phone 082 649 3659 or via email claasenleona@gmail.com. Alternatively, may also contact my supervisor Prof Monde Mbekwa in the Department of Education, University of the Western Cape (UWC), mmbekwa@uwc.ac.za (cell- 076 905 4853)

If you have any issues related to the research, you may contact the Humanities and Social Science Research Ethics Committee (HSSREC), Research Development, of UWC by telephone at 021 959 4111 or by email: research-ethics@uwc.ac.za.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached consent form, you indicate that you understand the purpose of the exercise.

Appendix G- Consent Form (Principal)

Consent Form (Principal)

University of the Western Cape

Consent Form

Project Title: Exploring Translanguaging practices in a Multilingual Grade 6 Mathematics classroom

Researcher: Leona Claasen

Please tick the boxes to show your agreement and understanding of what is expected for this study.

1. I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that all participation is voluntary and that participants are free to withdraw at any time without

3. giving any reason and without there being any negative consequences. In addition, should the ☐

4. participants not wish to answer any particular question or questions, they are free to decline.

(If they wish to withdraw, they may contact the lead research at any time to do so).

5. I understand that all responses and personal data will be kept strictly confidential. ☐

6. I give permission for members of the research team to have access to the school and to record responses without revealing any part of the participant's identities. ☐

7. I understand that the participant's names will not be linked with the research materials, and they will not be identified or identifiable in the reports or publications that result from the research. ☐

8. I agree for the **anonymized** data to be collected at the school and am Informed that the data may be used in future research ☐

9. I hereby agree that audio recordings can be made in the assigned mathematics classroom for the purpose of this study.

(Circle the appropriate answer) Yes No

10. I hereby agree that video recordings can be made in the assigned mathematics classroom for the purpose of this study.

(Circle the appropriate answer) Yes No

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

☐ I hereby give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

☐ I do not give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

_____	_____	_____
Name of Participant (*or legal representative*)	Date	Signature
_____	_____	_____
Name of person taking consent *(If different from lead researcher)*	Date	Signature
_____	_____	_____
Supervisor	Date	Signature

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:

Name: Leona Claasen

Contact Number: 082 649 3659

Email: claasenleona@gmail.com

Supervisor:

Name: Prof Monde Mbekwa

Contact Number: 076 905 4853

Email: mmbekwa@uwc.ac.za

HOD:

Name: Prof Bhekumusa Khuzwayo

Contact Number: 074 894 1893

Email: bkhuzwayo@uwc.ac.za

Appendix H- Consent Form (Teacher)

Consent Form (Teacher) University of the Western Cape

Project Title: Exploring Translanguaging practices in a Multilingual Grade 6 Mathematics classroom

Researcher: Leona Claasen

Please tick the boxes to show your agreement and understanding of what is expected for this study.

1. I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐

(If I wish to withdraw, I may contact the lead research at any time to do so).

3. I understand my responses and personal data will be kept strictly confidential. ☐

4. I give permission for members of the research team to have access to my responses without revealing any of part of my identity. ☐

5. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result for the research. ☐

6. I agree for the **anonymized** data collected from me to be used in future research. ☐

7. I hereby agree that I may be audio recorded.

(Circle the appropriate answer) Yes No

8. I hereby agree that I may be video recorded.

(Circle the appropriate answer) Yes No

9. I hereby agree to participate in this study.

(Circle the appropriate answer) Yes No

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

☐ I hereby give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

☐ I do not give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

_____	_____	_____
Name of Participant (*or legal representative*)	Date	Signature
_____	_____	_____
Name of person taking consent *(If different from lead researcher)*	Date	Signature
_____	_____	_____
Supervisor	Date	Signature

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:

Name: Leona Claasen

Contact Number: 082 649 3659

Email: claasenleona@gmail.com

Supervisor:

Name: Prof Monde Mbekwa

Contact Number: 076 905 4853

Email: mmbekwa@uwc.ac.za

HOD:

Name: Prof Bhekumusa Khuzwayo

Contact Number: 074 894 1893

Email: bkhuzwayo@uwc.ac.za

Appendix I- Consent Form (Parent)

Consent Form (Parent/ Legal Guardian) University of the Western Cape

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Project Title: Exploring Translanguaging practices in a Multilingual Grade 6 Mathematics classroom

Researcher: Leona Claasen

Child's Full name: ……

Please tick the boxes to show your agreement and understanding of what is expected for this study.

1. I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my child's participation is voluntary and that I am free to withdraw my child at any time without giving any reason and without there being any negative consequences. In addition, should he/she not wish to answer any particular question or questions, he/she is free to decline.

(If I wish to withdraw my child, I may contact the lead research at any time to do so). ☐

3. I understand my child's responses and personal data will be kept strictly confidential. ☐

4. I give permission for members of the research team to have access to my child's responses without revealing any of part of his/her identity. ☐

5. I understand that my child's name will not be linked with the research materials, and he or she will not be identified or identifiable in the reports or publications that result for the research. ☐

6. I agree for the **anonymized** data collected from my child to be used in future research. ☐

7. I hereby agree that my child may be audio recorded.

(Circle the appropriate answer) Yes No

8. I hereby agree that my child may be video recorded.

(Circle the appropriate answer) Yes No

9. I hereby agree that my child may participate in this study.

(Circle the appropriate answer) Yes No

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

☐ I hereby give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

☐ I do not give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

_____	_____	_____
Name of Participant	Date	Signature

(*or legal representative*)

_____	_____	_____
Name of person taking consent	Date	Signature

(If different from lead researcher)

_____	_____	___ _____
Supervisor	Date	Signature

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:

Name: Leona Claasen

Contact Number: 082 649 3659
Email: claasenleona@gmail.com

Supervisor:

Name: Prof Monde Mbekwa

Contact Number: 076 905 4853
Email: mmbekwa@uwc.ac.za

HOD:

Name: Prof Bhekumusa Khuzwayo

Contact Number: 074 894 1893

Email: bkhuzwayo@uwc.ac.za

Appendix J- Informed Assent Form (Minors)

Research participant (children)

Assent Form

University of the Western Cape

Project Title: Exploring Translanguaging practices in a Multilingual Grade 6 Mathematics classroom.

Researcher: Leona Claasen

Please tick the boxes below to show your understanding of this project.

1. I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question I am free to decline.

   (If I wish to withdraw, I may contact the lead researcher at any time) ☐

   ☐

3. I understand my responses and personal data will be kept strictly confidential.

4. I give permission for members of the research team to have access to my responses without revealing any of part of my identity. ☐

5. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result for the research. ☐

   ☐

6. I agree for the anonymized data collected from me to be used in future research.

7. I agree to be audio recorded.
   (Circle your answer) Yes No

8. I agree to be video recorded.
   (Circle your answer) Yes No

9. I hereby agree to partake in this research study.
   (Circle your answer) Yes No

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

☐ I hereby give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

☐ I do not give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

_____	_____	_____
Name of Participant (*or legal representative*)	Date	Signature
_____	_____	_____
Name of person taking consent *(If different from lead researcher)*	Date	Signature
_____	_____	_____
Supervisor	Date	Signature

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:

Name: Leona Claasen

Contact Number: 082 649 3659

Email: claasenleona@gmail.com

Supervisor:

Name: Prof Monde Mbekwa

Contact Number: 076 905 4853

Email: mmbekwa@uwc.ac.za

HOD:

Name: Prof Bhekumusa Khuzwayo

Contact Number: 074 894 1893

Email: bkhuzwayo@uwc.ac.za

Appendix K- Focus Group Confidentiality Binding Form

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

E-mail: claasenleona@gmail.com

FOCUS GROUP CONFIDENTIALITY BINDING FORM

PROJECT TITLE: EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM.

Please initial each box to show agreement with the following statements:

1. The study has been described to me in a language that I understand. ☐
2. Any questions I may have about the study have been answered. ☐
3. I understand what my participation entails and I agree to participate of my own choice and free will. ☐
4. I understand that my identity will not be disclosed to anyone by the researchers and that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits. ☐
5. I also understand that confidentiality is dependent on participants in the Focus Group maintaining confidentiality. ☐
6. **I hereby agree to uphold the confidentiality of the discussions in the focus group by not disclosing the identity of other participants or any aspects of their contributions to members outside of the group.** ☐
7. I agree to be audio-recorded. **(***Circle your answer)*. Yes / No

In terms of the requirements of the Protection of Personal Information Act (Act 4 of 2013), personal information will be collected and processed:

☐ I hereby give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

☐ I do not give consent for my personal information to be collected, stored, processed and shared as described in the information sheet.

Name_____

Signature_____

Date_____

_____	_____	_____
Name of Participant (*or legal representative*)	Date	Signature

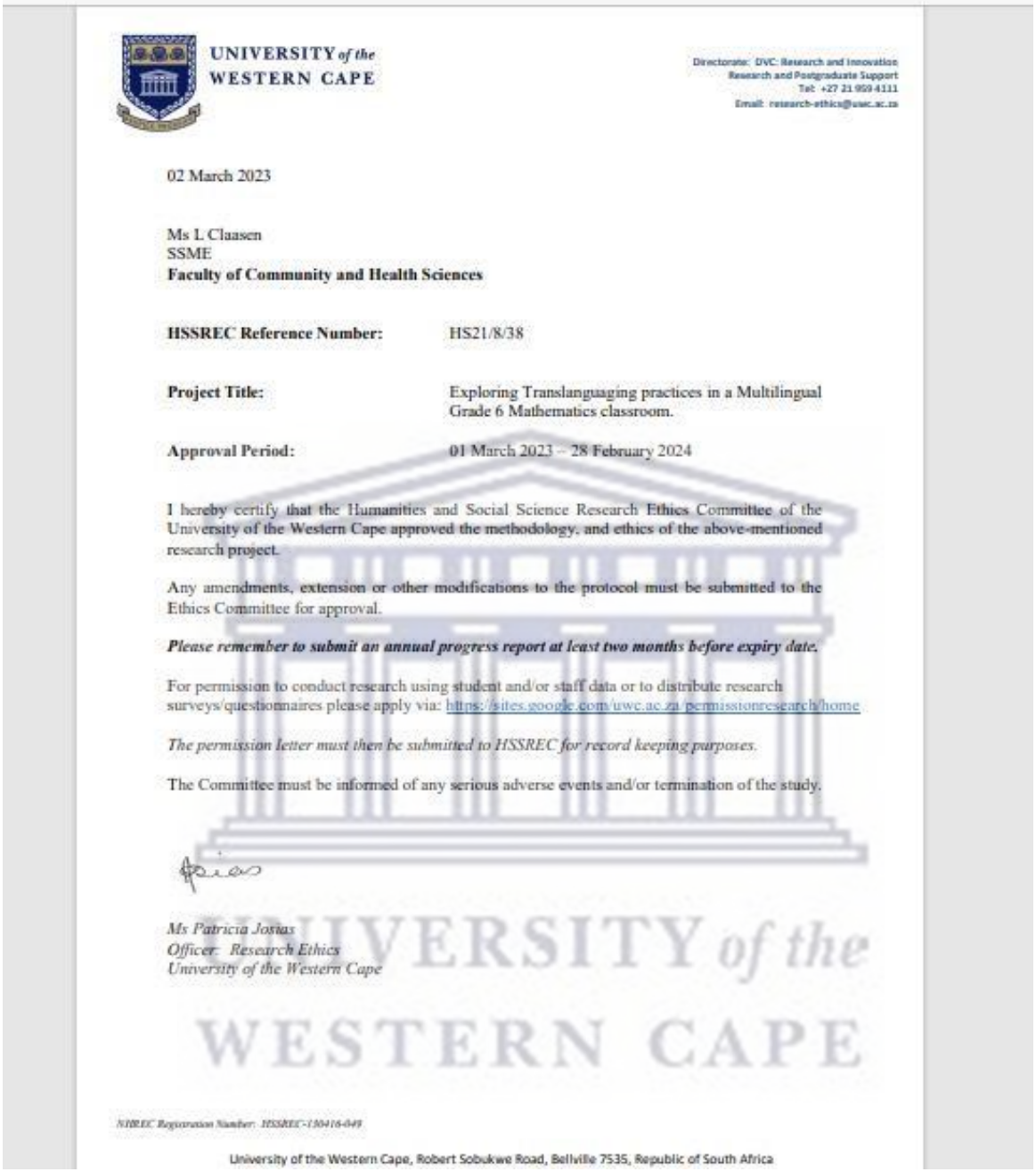
_____	_____	_____
Name of person taking consent *(If different from lead researcher)*	Date	Signature

_____	_____	_____
Supervisor	Date	Signature

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:	Supervisor:	HOD:
Name: Leona Claasen Contact number: 082 649 3659 Email: claasenleona@gmail.com	Name: Prof Monde Mbekwa Contact number: 076 905 4853 Email: mmbekwa@uwc.ac.za	Name: Prof Bhekumusa Khuzwayo Contact Number: 074 894 1893 Email: bkhuzwayo@uwc.ac.za

Appendix L- Ethical Clearance Certificate



UNIVERSITY of the WESTERN CAPE

Directorate: DVC: Research and Innovation
Research and Postgraduate Support
Tel: +27 21 959 4111
Email: research-ethics@uwc.ac.za

02 March 2023

Ms L Claasen
SSME
Faculty of Community and Health Sciences

HSSREC Reference Number: HS21/8/38

Project Title: Exploring Translanguaging practices in a Multilingual Grade 6 Mathematics classroom.

Approval Period: 01 March 2023 – 28 February 2024

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology, and ethics of the above-mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit an annual progress report at least two months before expiry date.

For permission to conduct research using student and/or staff data or to distribute research surveys/questionnaires please apply via: https://sites.google.com/uwc.ac.za/permissionresearch/home

The permission letter must then be submitted to HSSREC for record keeping purposes.

The Committee must be informed of any serious adverse events and/or termination of the study.

Ms Patricia Josias
Officer: Research Ethics
University of the Western Cape

NHREC Registration Number: HSSREC-130416-049

University of the Western Cape, Robert Sobukwe Road, Bellville 7535, Republic of South Africa

Appendix M- Transcriptions

University of the Western Cape
Faculty of Education, Private Bag X17, Bellville, South Africa

Transcriptions

Activity worksheet

Perimeter

1. A school is built on a plot of land in the shape of a quadrilateral.

The lengths of the sides of the quadrilateral are 357m, 434m, 289m and 383m.

a) A fence must be built around the school grounds, on the edges of the plot of land. How long will the fence be in total?

Learner explaining to other learner what to do:

Learner: **357m, 434m, 289m and 383m. Bhala phantsi uqale apha (uyabonisa phi).**
Kufuneka uzibhale kumgca nganye, emvakoko uphele kwisithathu.
Kufuneka uzibhale phantsi uquala apha uphele kwisithatu.
357m, 434m, 289m and 383m. You must write them down starting from here (indicating where). You must write it on each line, then you must end by the three.
You must write them down from here and end by the three.

b)) If 1m of the fence costs R49, what will it cost to put up the fence around the school grounds?

Teacher and learners do the problem together.
Teacher: **What was the answer for the first question?**
Learners: **1463m**
Teacher: **We are going to times that by R49**
Teacher proceeds to draw multiplication block
Teacher: **Okay let's see if you know your tables. What is four times one?**
Learners: **Four**

Teacher: **So we're going to write it as 0 and 4 in the block. What is four times four?**

Learners: **Eight**

Teacher: **(Asks again) What is four TIMES four?**

Learners: **Sixteen**

Teacher**: Sixteen, so it's going to be 1 and 6. What is four times six?**

Learners**: (Silent)**

Teacher**: Four times six, you have your timestable in front of your books**

Learners**: 24**

Teacher**: 24, lovely. What is four times three?**

One learner**: 16**

Teacher**: (Asks again) What is four times three?**

Learners**: 12**

Teacher**: What is nine times one?**

Learners**: 9**

Teacher**: 9, I am going to write it as 0 and 9. What is nine times four?**

One learner**: 24..no 27.**

Teacher**: Are you sure?**

Learners: **(Silent)**

Teacher: **Oooh people don't know their timestable. What is nine times four?**

Learners: **(After silence)..36**

Teacher: **36. What is nine times six?**

One learner: **54. What is nine times three?**

One learner: **27**

Teacher: **Okay now you need to look carefully. Now you have all your answers in your block. That's not the final answer. Now you going to add all of it diagonally What do you have in this block?**

Learners: **7**

Teacher: **What is 2 + 2 + 4?**

Learners: **8**

Teacher: **What is 5 +5 + 6?**

Learners: **16**

Teacher: **So I write down the 6 and I carry over the 1. What is 2+1?**

Learners: **3**

Teacher: **3+6?**

Learners: **9**

Teacher: **9+3?**

Learners: **12**

Teacher: **12+9?**

Learners: **21**

Teacher: **21. I write down the 1 and carry over the?**

Learners: **2**

Teacher: **What is 2+1?**

Learners: **3**

Teacher: **+4?**

Learners: **7**

Teacher: **7 + 0?**

Learners: **7**

Teacher: **And what is 0+0?**

Learners: **0**

Teacher: **There's my final answer..R 71 687**

So it will cost R71 687 to put up a fence around the school grounds.

2) *The perimeter of the classroom is 7800cm. The perimeter of the bathroom is 3900cm. How much bigger is the perimeter of the classroom?*

Learner explains to the class on the board.

Learner: **Kwi qanda uthabathe iqanda**

Kulingana ne qanda uphinde uthabathe iqanda. Kwi qanda kulingana ne qanda ngoba kukho amaqanda ama bini.

Isibhoz…(umfundi ubhidekile uyathintitha)

Zero minus zero is equal to zero. And then zero minus zero is equal to again because there are two zeros.

Eighh….(Learner confused and stuttering)

Other learner: **(ukhwaza) ngu nye**

(Shouts) It's one

The class: **Hayi awukwazi. Ayikwazeki ukwenzeka elohlobo.**

No you can't. It's impossible to do it like that.

Female learner: **(ukhwaza) xhaxha. Xhaxha isixhenxe ufake unye.**
Cancel. Cancel 7 and replace it with 6 and then put one.

Learner proceeds with the calculation on the board

Learner: (Switches to English) **And then 18 minus 9 equals 9 and then 6 minus 3 equals 3.**

Area

1) When a figure is divided into equal parts, we can easily determine the Area, by just counting the squares.

How many squares do you count in the two figures?

Learners count collectively and write down the answers

2. *A farmer has a field that is 400m long and 80m wide. Calculate the Area of the field.*

Learner explains to a group of learners what to do.

Learner: **Kufuneka uphindaphinde isibhozo yabo. Phindaphinda iqanda nge qanda kulingana neqanda. Emvakoko uphindaphinde isibhozo.**
Kuba kane impendulo ibe ngama shumi amathu anesi bini. Emvakoko ufake amaqa amabini ekugqibeleni.
You must multiply 8 neh. You must multiply zero by zero and then it's equal to zero. Then you must multiply 8 by 4 and then you get 32. And then you must put the two zeros at the end.

Learners**: Okay**

Interview with the teacher (Audio recordings)

Question 1: What has your experience been like teaching in a language that is not the language home language for some/most of the learners?

…Om kinders in hulle home language alles te laat doen, dan kan die kinders switch hierso na graad 7 hulle en goedte, dan kan hulle Engels toe gaan..maar dis bitter moeilik vir hulle om van onder af in graad 1 te kom, heeltyd praat hy Xhosa by die huis of hy praat Sotho of hy praat Zulu of enige een van die ander tale en nou kom hy en sommer flush in sy gesig word hy geface met English now..en dit create agterstande want daardie kind gaan baie langer vat om op te tel as die kind wat in sy moedertaal onderrig kry.. en dis

maar ongelukkig ‘n problem wat ons mee sit. Ons kan dit nie weg wens nie, ons probeer maar employ..die buddy system, meer differentiation, al daardie sort goed, maar dis nogsteeds baie moeilik..en dis vir hulle, as dit vir my moeilik is as onderwyser, dan is dit vir hulle mos nog moeiliker as die kinders wat hierdie goedte moet aanleer.

… To make children do everything in their home language, then the children can switch to grade 7 and stuff, then they can go to English..but it is very difficult for them to get from the bottom in grade 1, all the time he speaks Xhosa at home or he speaks Sotho or he speaks Zulu or any of the other languages and now he comes and just flush in his face he is faced with English now..and it creates backlogs because that child is going to take much longer to pick up as the child who is taught in his mother tongue .. and that's unfortunately a problem we face. We cannot wish it away, we try to employ..the buddy system, more differentiation, all that sort of stuff, but it's still very difficult..and it's for them, if it's difficult for me as a teacher, then it's more difficult for them as the children who have to learn these things.

Question 2: What is your personal opinion/ feeling about incorporating the learners’ home languages into teaching and learning? **Dit is baie moeilik om..man, dis baie moeilik want om ‘n konsep te verduidelik in ‘n taal wat nie my eie is nie aan kinders wie se taal dit ook nie hulle eerste taal is nie, is baie moeilik. My vrees is dat partykeer praat ek al die goedte en dan het daardie kind nie ‘n snaars besef wat ek gesê het nie. Dis hoekom ons maar sover as moontlik met elke verduideliking die praktiese gedeelte ook doen.**

It's very difficult to..man, it's very difficult because explaining a concept in a language that is not my own to children whose language is not their first language is very difficult. My fear is that sometimes I talk all these things and then that child did not realize what I was saying. That's why we do the practical part with as much explanation as possible.

Question 3: Do you think that the use of the learners’ home languages in mathematics would enable or constrain mathematical learning and achievement?

Nee 100% enable. Jy’s Afrikaans neh?..jy gaan baie beter vaar as jy wiskunde in Afrikaans kry as wat jy sou vaar as jy dit in Engels sou kry. So as dit van my afgehang het, sou ek gesê het moedertaal onderrig tenminste vir die hele primêre fase en dan kan die kinders volgens my verander na die language of instruction (Engels).

No 100% enable. You're Afrikaans neh?.. you will do much better if you get mathematics in Afrikaans than you would if you got it in English. So if it depended on me, I would have said mother tongue instruction at least for the whole primary phase and then the children can in my opinion change to the language of instruction (English).

Interviews with the learners (Research diary)

Question 1: How do you feel about learning mathematics in your home language?

Learner 1 whose home language is Afrikaans felt that **learning mathematics is easier in English than Afrikaans** although he understands Afrikaans more.

Learner 2 whose home language is Ndebele and Zulu also stated that he prefers learning mathematics in English because they **understand the work better in English** and because he would **find it difficult to understand certain mathematics work in his home languages.**

Learner 3 whose home language is IsiXhosa felt that **learning mathematics in English is the best way,** they choose to learn mathematics in English **because in order to survive, you need English.**

Learner 4 whose home language is also IsiXhosa feels that they are more **confident about learning mathematics in English** than their home language **because they always speak English at school.**

Learners 5 who speaks Afrikaans at home feels that they are **not so good in learning mathematics in Afrikaans** as they are in learning it in English. They feel that even at times **when they do not understand the work, they can always ask the teacher who will then respond in English.**

Learner 6 whose home languages are Sotho and IsiXhosa, feels that their **home languages should be used more in the mathematics class because they he is fluent in it**. Sometime he does not understand the work in English, but better in IsiXhosa when his **friends explain the work using his home language.**

Questions 2: Would you want the teacher to switch more between languages or just use the language of instruction (English) when teaching mathematics?

Learner 1 said that they would **want the teacher to teach in their home language** (Afrikaans).

Learner 2 said that they prefer the teacher to **only teach in English because they would struggle if the teacher switched between languages, because there would be certain words they would not understand in their home language.**

Learner 3 would want the teacher to switch between languages because then they will be able to do better in mathematics.

Learner 4 would like **the teacher to switch between languages as well because they will be able to get a higher mark for mathematics** if their home language is used.

Learner 5 prefers that the teacher **only teaches in English because her Afrikaans is not that good when it comes to learning mathematics.**

Learner 6 would prefer **the teacher to switch between languages**, since **mathematics is his favourite subject and says that he will understand the work more if the teacher can speak his home language too.**

Appendix N- Language Editing and Proofreading Certificate (Supervisor)

Certificate of Editing: Proof Reading and Formatting

Title : Exploring Translanguaging Practices in a Multilingual Grade 6 Mathematics classroom.

Document : Med. Full Thesis.

Author : Leona Minolize Claasen

Student Number : 3332962

Editor : Prof Monde Mbekwa (PhD)

Date : 17 May 2023

Please receive this Master's Thesis as confirmation of reading and complete editing, proof reading and formatting. I can attest that it is a much improved document than the initial draft. My reading of this document indicates that Ms Claasen has a good command of the English language and thus presents a well organised document characterised by much lucidity and readability. My evaluation of the linguistic integrity of the text and organisation of this document is that it is ready for examination submission.

Prof Monde Mbekwa (PhD).

Appendix O- Language Editing and Proofreading Certificate (Language Editor)

Dust Jacket
1 Village Square
16 Hampstead Road
Harfield Village
7708
4 March 2024

Dear Madam/ Sir

TEXT-EDIT OF THESIS ENTITLED: 'EXPLORING TRANSLANGUAGING PRACTICES IN A MULTILINGUAL GRADE 6 MATHEMATICS CLASSROOM'

This is to confirm that I have text-edited the aforesaid thesis for syntax, cohesion and fluency of expression. The text is authored by Ms Leona Claasen.

I trust that the thesis fulfils the required level of language proficiency as well as the formatting conventions for submission in fulfilment of the requirements for a Master's degree in Maths Education at the University of the Western Cape, Education Faculty.

Yours faithfully

Marilyn Braam
(M.A. specialising in Language, Literature and Modernity (UCT, 2015))