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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

WSoE Wits School of Education

Masters Research Dissertation

Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.

By

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Year: 2024

Declaration

I **Shalom Nokuthula Ndhlovana (2093652)**, hereby declare that this research project entitled ***Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg*** is my own work. It is being submitted as part of the Master's degree at the University of the Witwatersrand, Johannesburg. This dissertation has not been submitted for any other degree or examination at any other university. According to the APA style of citing, I have provided a comprehensive list of references that are in alphabetical order. I understand the consequences should the university discover that the work submitted is not my own or fail to acknowledge any of the sources or ideas which are not of my own.

S.N. Ndhlovana



7 January 2025

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Abstract

Increased trans-border movements as a result of the emergence of a global village have significantly influenced the diversity of cultures and languages in most South African schools. This strain is magnified by the latest 2019 Trends in International Mathematics and Science Study (TIMSS) and 2021 Progress in International Reading and Literacy Study (PIRLS) results which highlight the underachievement of learners in reading comprehension, Mathematics and Science. Analysts of both assessments have suggested that the low performance is caused, chiefly, by the misalignment between learners' home languages and the medium of instruction. Despite these suggestions, the pedagogical approach for these learners continues to adhere to a monolingual framework. Through a mixed-method approach, the current study sought to explore the transformative potential of translanguaging in the teaching and learning of Natural Science in a multilingual grade 4 classroom in Johannesburg. The mixed-method design involved both quantitative (3 tests- language proficiency test, Pre-and Post-tests) and qualitative (interviews) data to understand the phenomena of translanguaging and how it affects learners' academic performance. A sample of 40 learners were divided into two groups (the control and experimental) which were used to compare the results of the effects of translanguaging, and further insights were gathered from the teacher and the parents through interviews. Both groups participated in the English Proficiency test, the pre-and post-test tests to measure their academic progress in English. The experimental group received intervention through translanguaging pedagogical approaches. This approach deliberately intertwined learners' home languages with English in the learning process. R- computing software was used to analyse quantitative data, while interview responses were analysed through Glaser and Laudel's model of grounded theory. The paired t-test revealed statistically significant differences in post-test performance between the groups, favouring the experimental group. Data from classroom observations and semi-structured interviews with participants further exposed the personal thoughts of participants suggesting that the translanguaging intervention positively impacted learners' academic performance, providing them with a valuable bridge between their home languages and the language of instruction. This study's findings offer compelling evidence that when implemented in multilingual classrooms, translanguaging pedagogies enable educators can leverage learners' existing linguistic resources, fostering deeper understanding and ultimately improving academic outcomes.

Keywords: Academic achievement, Culturally responsive teaching, Intermediate phase, Language acquisition, Monolingual, Mother-tongue, multilingual, Translanguaging, Science education

Abbreviations

BICS……. Basic Interpersonal Communication Skills

CALP…….Cognitive Academic Language Proficiency

DBE……Department of Basic Education

DoE……. ...Department of Education

EFAL……. English First Additional Language

FAL……..……. First Additional Language

FoK…….……Funds of Knowledge

HL……..…… Home-Language

L1……..…….. First Language

L2…… Second Language

LiEP …..…….…… Language in Education Policy

LoLT …..…….……... Language of Learning and Teaching

MT……..…. Mother Tongue

NS……. …. Natural Science

NSC……National Senior Certificate

PIRLS……. Progress in International Reading Literacy Study

SASL…….. South African Sign Language

TIMSS…… Trends in International Mathematics and Science Study

ZPD……Zone of Proximal Development

PUBLICATIONS EMANATING FROM THIS STUDY

Journal articles: Published

1. Ndhlovana, S. N., & Charamba, E. (2023). The Efficacy of Translanguaging in Selected South African Mathematics and Science Intermediate Phase Classrooms. *Journal of Languages and Language Teaching*, *11*(3), 373-389.
2. Ndhlovana, S. N., & Charamba, E. (2023). Sink or Swim? Choosing to swim through translanguaging pedagogies in a culturally diverse Natural Sciences classroom. *Cross-Cultural Studies: Education and Science*, *8*(2), 65-73.'

Journal articles: On review

3. *Title*: Unleashing the Pedagogical Potential in Teacher Training: Translanguaging as an Epistemological Catalyst.

   Name of Journal: Noyam Journals to be published in the E-Journal of Humanities, Arts and Social Sciences (EHASS).
4. *Title*: Harnessing translanguaging in South African primary Mathematics classrooms.

   Name of journal: International Journal of Social Sciences and Educational Studies (IJSSES)
5. *Title*: Cultivating inclusive classrooms: Equipping pre-service teachers for indigenous language integration.

   Name of Journal: Teacher Education through Flexible Learning in Africa and other Developing Contexts (TETFLE).

Book Chapters on review

6. *Chapter Title*: Language kaleidoscope: Embracing the mosaic of multicultural voices in intermediate phase classrooms.

   Name of book: In Defence of a Nation's Language: Multilingual and Multicultural Perspectives.
7. *Chapter Title*: Embracing the melting pot in teacher training: Efficacy of translanguaging in multilingual contexts.

   Name of book: Inclusive Education in the South African Further and Higher Education: reflections on equity, access and Inclusion.

Book

8. Charamba, E., & Ndhlovana, S. N. (2025). Enablers, Barriers, and Challenges for Inclusive Curriculum. IGI Global Scientific Publishing. ISBN13: 9798337310008. EISBN13: 9798337310022.

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CHAPTER 1: ORIENTATION

1.1 Introduction and Background

Increased trans-border movements as a result of the emergence of a global village have significantly influenced the diversity of cultures and languages in South African schools (Charamba, 2020a) . Unquestionably, the educational system as a whole and particularly in the area of science education is under a great deal of strain due to this amalgamation of languages and cultures (Mavuru & Ramnarain, 2020). This presents significant challenges for learners, many of whom may have limited proficiency even in their home language. Despite these challenges, the integration of cultures and languages is thought to be a valuable teaching resource in the classroom (Makalela, 2019). It allows learners from diverse linguistic backgrounds to utilise their full linguistic repertoire in conceptualising scientific ideas.

Despite the widespread linguistic diversity in South African schools, monolingual pedagogies remain the standard instructional approach in most of the Natural Science (NS) classrooms (Abdulatief, 2022). Even though South Africa officially recognises eleven languages- isiSepedi, isiNdebele, Sesotho, siSwati, isiXhosa, Tshivenda, Afrikaans, isiZulu, English, Setswana, and Xitsonga- including South African Sign Language as permissible for teaching and learning under the Language in Education policy (LiEP) of 1997 (Department of Education (DoE), 1997), only English and Afrikaans are used for teaching NS. Despite the option to choose any of the eleven languages for instruction, English, the home language of approximately 19.7% of South Africa's population, is often favoured by school governing bodies due to its perceived prestige and exotic appeal to parents (Wunseh & Charamba, 2023). This has not only marginalised other learners but has most importantly negatively affected the assessment outcomes of most learners (Probyn, 2019).

A corpus of research on science education indicates that using a language of teaching other than the learners' native tongue is one of the main reasons why they perform poorly academically in the subject (see for example: Charamba, 2020a; Duarte, 2019; Ndhlovana & Charamba, 2023a; Somerville & Faltis, 2019). Learners often struggle to acquire scientific concepts if they lack the language proficiencies required in the language of instruction (Bonomi, 2020), which hinders their ability to demonstrate true comprehension (Garza & Arreguín-Anderson, 2018). As a result, science teachers sometimes overlook the acquisition of scientific knowledge and focus instead on the learners' reading and writing abilities (Charamba & Zano, 2019).

Scholars on the acquisition of languages contend that learners who can make use of their native tongue as a resource in contexts relating to their subject matter are more likely to acquire conceptual knowledge of the subject than those who do not (see for example: Meyerhöffer & Dreesmann, 2019; Ndhlovana & Charamba, 2023a) The Progress in International Reading Literacy Study (PIRLS) 2021 has also proven that 81% of South African learners struggle to comprehend what they read and yet are expected to understand some of the abstract scientific terms that are conveyed in English. PIRLS is an assessment conducted every five years to evaluate reading comprehension in fourth-grade learners worldwide.

Turning to South African national assessments, the past three years have shown what appears to be positive matric results at first glance. Matriculants are grade 12 learners who graduate from high school after writing end-of-year national examinations. They are generally around 19 years old and are disposed to tertiary education and other life ventures after having spent 12 years of schooling. The percentage of learners scoring above 50% for Physical Science has gradually improved from 26.3% in 2020, to 27.3% in 2021 and 30.4% in 2022 (Department of Basic Education (DBE), National Senior Certificate (NSC) School Subject Report, 2022). However, only 30% were able to accurately answer 50% of the scientific content. Although the minimum pass in science, as reported by the Department of Education (DoE) in South Africa, is 30%, one may wonder on the significance of a 30% grade. This situation is a true reflection of the poor foundation laid in primary schools, where learners do not fully grasp scientific concepts and carry misconceptions into higher levels. This is compounded by being taught in a language they may not fully understand. If this issue is not addressed, there is a risk of producing mediocre scientists as a nation, and we will continue to be a developing country without progress.

However, among all nine provinces (Gauteng, Limpopo, Mpumalanga, KwaZulu-Natal, North West, Northen Cape, Western Cape, Free State and Eastern Cape) in South Africa, Gauteng has maintained its second position for the past 3 years with a recent percentage of 84.4% overall performance of learners and 76.7% in physical science, with 34.9% learners achieving above 50% (DBE, NSC School Subject Report, 2022). This study was carried out in Johannesburg, a city in Gauteng colloquially known as ‘the city of gold’. Being a megacity and one of the top 100 largest urban areas globally, it is the most populous city in South Africa (Rogerson & Rogerson, 2021). With 14,167,000 residents, it ranks 26th in the world in terms of population

and is Gauteng's largest and capital city (Harrison & Todes, 2020). The highest court in South Africa and the South African Constitutional Court, has its headquarters in Johannesburg yet monolingual pedagogies that segregate other learner's epistemic access dominate most of its schools. Given the varied backgrounds of Johannesburg's residents, over thirty languages are spoken (Grinker, 2014). Thus, there is a high possibility that this diversity replicates in the classrooms, yet all but two languages are actively used and enforced.

In response to the aforementioned circumstances, the researcher believed that Johannesburg has the potential to improve its science performance by utilising the natural resources at its disposal, such as allowing learners to use their linguistic skills to enhance understanding. This heteroglossic perspective advocates for flexibility in language use. One might question how this seemingly vague approach can be implemented in an environment saturated with different languages and how the freedom of language use can be managed to promote effective communication. Therefore, the researcher intended to draw largely from literature to gather the necessary skill set that teachers can use in the implementation translanguaging pedagogies so that, despite their subject-specific knowledge, they can comprehend the discourse practices related to translanguaging. Cognizant of the fact that some schools are informally practicing translanguaging based on the conceptual study the researcher did in their honours project, it is relevant that they 'empowered' learners because they believed learners had great potential that needed to be unlocked by giving them power to confidently express themselves.

This current study aimed to explore the transformative potential of translanguaging in the learning and teaching of NS in the multilingual inner Johannesburg area. Previous studies have mainly focused on the outskirts of Johannesburg's inner city (see for example: Charamba, 2023; Omidire & Ayob, 2022; Sefotho, 2022), environments with a dominant language and or focus on the perceptions of teachers. This study focused on a language-rich classroom, which the researcher believed is a challenge, as teachers claimed not to know the learner's home language and therefore could not provide adequate support. The research aimed to fill this gap by empowering learners to draw from their entire linguistic resources to improve science instruction. The study also sought to help raise awareness to the teachers that they do not need to know all their learners' home languages. It specifically focused on how translanguaging in multilingual NS classrooms affected epistemic access and academic excellence. Of particular interest was the learning and teaching of NS content through an African language(s) and/or a trans-lingual amalgamated linguistic dispensation. Instead of viewing English and African

languages or mother tongues as independent systems, the researcher saw them as part of a multidimensional linguistic continuum that collectively empowered multilingual learners.

1.2 Problem statement

The recent PIRLS 2021 report highlights a significant gap in learners' reading comprehension. This is a cause of concern because if learners struggle to understand what they read, it raises questions about their ability to grasp abstract scientific concepts. As a country, we are confronted with a dilemma that impacts South African international standing. South Africa's performance in mathematics and science assessments places us at the bottom among all participating countries globally as shown in the Trends in International Mathematics and Science study (TIMSS) and Southern and Eastern Africa Consortium for Monitoring Education Quality.

The TIMSS is an international assessment of science and mathematics skills conducted on fourth and eighth-grade learners from a selection of counties. Unlike other countries, South Africa participates are fifth and ninth grades learners (Reddy et al., 2017). In 2015, South Africa ranked 39th out of 39 participating countries in the science examination for ninth graders. In the seventh assessment cycle, following the 2015 assessment administered in 64 nations, South African learners once again performed below average. To make matters worse, most learners in Johannesburg struggle to grasp scientific concepts from the get-go in foundation phase due to the abrupt introduction of English, as they come from multicultural and multilingual backgrounds within South Africa and abroad (Wunseh & Charamba, 2023). This places significant pressure on teachers to effectively teach scientific concepts to learners who often lack a strong English language foundation, and teachers themselves are not linguistically equipped for all the languages available in the class to extrapolate knowledge in language learners fully understand.

The researcher decided to explore how to best help teachers and learners who find themselves in such situations where their language is marginalised, particularly in grade 4. The aim was to empower learners to use their entire linguistic repertoire to fully understand scientific concepts. Most studies have focused on South African cities with a dominant mother tongue, leaving a gap for learners in some Johannesburg schools. The researcher believed that Johannesburg had a significant language gap because having studied in the inner city, their (the researcher's) classrooms comprised of more than 20 languages because there were learners who came from

different parts of South Africa and beyond yet only two languages were and are still enforced in most schools (Aung, 2021). The researcher saw this as a missed opportunity because with the many languages at our disposal and many multilingual learners who on everyday basis mingle with each other, using all these languages outside of the school environment, they can tap into their language skills to enhance their understanding more deeply in the class. If these funds of knowledge that learners bring in form of language can be used then, learners can express themselves in a language they are familiar to, a language they speak at home and fully understand, helping them understand the concepts.

The focus was specifically on how translanguaging could work as an emancipatory tool in multilingual science classrooms and a vehicle for epistemic access and academic excellence for such learners. This approach reduces pressure on both teachers and learners as they work together without language being a barrier to teaching and learning, but rather a valuable asset that benefits both parties, especially learners. This is important because it alleviates the prevalent pressure of being fluent in English in order to be deemed intelligent, allowing learners to better conceptualise the world behind the words. The researcher implemented the intervention by working with the teacher, parents, and learners, to understand their perspectives on translanguaging pedagogies. Subsequently, they observed how to effectively use the strategy, paying attention to the different languages present in the class. To ensure effectiveness, they incorporated group work activities in the class.

1.3 Significance of the study

This research project on the transformative potential of translanguaging could be beneficial in several ways. Firstly, it could benefit teachers by enhancing their understanding of translanguaging pedagogies, enabling them to identify underlying challenges and explore solutions by incorporating multiple languages in their classrooms to improve learners' comprehension and their teaching strategies. It would allow them to reflect on their practices and beliefs during or after the interviews. Secondly, this study contributed to improving the national and international rankings of science assessments, as the intervention could have a positive impact on learners. Thirdly, the school could particularly benefit from this as it may prompt them to work on their school language policies and conduct workshops for professional development on multilingualism and translanguaging. Fourthly, instead of disregarding the many languages encountered in the classroom, the Ministry of Education and Science may find this initiative valuable in developing professional development plans and curricula for teachers.

Finally, this research addressed a gap in educational research in the context of primary science education with multicultural learners in Johannesburg by highlighting the linguistic repertoire of learners, which has been overlooked. Furthermore, the study serves as a baseline for future research aimed at enhancing translanguaging education in Johannesburg.

1.4 Theoretical framework

This study was informed by two theories and one model: the Funds of Knowledge (FoK) by Gonzalez (Gonzalez et al., 2006), the sociocultural theory by Vygotsky (Vygotsky & Cole, 1978), and the linguistic interdependence model by Cummins (2009). These three concepts form the foundation of the study and are interlinked to understand learner's development as far as language is concerned.

1.4.1 Funds of Knowledge

In South African multicultural and multilingual classroom settings, translanguaging is practiced by both teachers and learners. However, there is a prevailing deficit theory in the educational system that fails to recognise the intrinsic complexity of languages in the classroom. This has been challenged by Gonzalez (Gonzalez et al., 2006) who coiled FoK hypothesis. According to Gonzalez, learners bring information from their prior experiences and social and cultural interactions with their family and the larger community to the classroom (Pun & Tai, 2021). This social approach to education enables learners to bring their own skills and experiences, including their language knowledge into science classrooms.

Furthermore, the concept of FoK emphasises the role that the family plays when it comes to child development. González and Moll (2002) state that the teacher and learner's family should establish a connection based on "confianza" (mutual trust) in order to: a) promote cooperative learning and build bridges that can reduce stereotypes and assumptions between the two settings of the activity, and b) connect the learner's lifestyle to the school curriculum and educational practice (McIntyre et al., 2001). This implies that there should be a relationship not only between the teacher and the learner, but also that the family should be considered a pertinent stakeholder in the learning of the child.

1.4.2 Social Cultural theory

According to Vygotsky's sociocultural theory, which forms the basis of the funds of knowledge, children acquire cultural beliefs, values, and problem-solving techniques through cooperative dialogues with more knowledgeable members of society. This process of social

mediation is how humans develop (Vygotsky & Cole, 1978). Vygotsky emphasises social interaction as the fundamental role in the development of cognition, strongly believing that meaning making is developed by the community. He argues that the child's learning is comprised of the Zone of Proximal Development (ZPD)- a distinction between what they can accomplish on their own and what they can achieve with support and guidance from a more experienced person.

According to Vygotsky, children develop in two phases: first, on the social level, which is interpsychologically, and then on the individual level, which is intrapsychological (Vygotsky & Cole, 1978) . He argues that through meaningful collaboration, a learner actively acquires new cognitive skills with the assistance of an adult in a language they can fully understand (Ameri, 2020). He contends that the learner's social interactions with diverse tools and materials lead to the development of a functioning didactic link between the learner and the societal setting. Consequently, the concept emphasises the importance of instructors' roles and their involvement in learners' social interactions to ensure that learners acquire the necessary skills and become proficient in jobs that will contribute to the advancement of society. The ZPD is a result of this mutual learning between teachers and learners, allowing teachers to promote learners' learning and development while also allowing learners to learn from each other (Polly et al., 2017).

The sociocultural perspective acknowledges both individual and cross-cultural differences in development. This was particularly important for the current study, as it focuses on language as a crucial pedagogical tool in South African classrooms. Vygotsky considered language to be a form of symbolic mediation that emerges from a particular culture. Therefore, language plays two important roles in development: 1) for communication with others, and 2) for constructing meaning. According to Vygotsky and Cole (1978) language is a powerful tool for cognitive development, assigning meaning during social interactions in a learning environment and also helps in the construction of understanding.

Vygotsky's theory emphasises the collaborative construction of knowledge among teachers and learners. Both parties contribute their experiences, interests, and abilities to create a diverse classroom community (Polly et al., 2017). Vygotsky described the interaction between teachers and learners as a cultural transmission, in which the values, customs, and beliefs of teachers are passed on, ultimately shaping their teaching methods and perspective (Polly et al., 2017). In a diverse, multicultural, and multilingual society like South Africa, where people's

interpretations of events can vary based on their cultural and linguistic backgrounds, Vygotsky's perspective becomes particularly relevant.

1.4.3 Linguistic interdependence model and the Translanguaging Theory

The relationship between first language (L1) acquisition and second language (L2) acquisition is the focus of Cummins' linguistic interdependence model (Cummins, 2009). He explains how mastery of one's mother tongue or L1, impacts the ability to learn L2. According to Cummins, it is important for learners to become proficient in their L1 before effectively studying L2. He emphasises that despite the apparent differences, L1 and L2 share some cognitive processes and academic skills that allow learners to transfer knowledge from one language to another (Cummins, 2009). Sierens et al. (2019) adds that learners with underdeveloped L1 skills are indeed likely to encounter obstacles in furthering their L1 acquisition, which can negatively affect their ability to learn L2. She argues that the ability of a learner to successfully acquire L2 is always influenced by their level of proficiency in L1.

Translanguaging is a theory that advocates for the surpassing of designated languages, transcending the confines of socially constructed linguistic categories. Coined in the 20th century, translanguaging is a term initially coined by Cen Williams (1996) in the Welsh language as ‘trawsieithu’, which encapsulates the practice whereby the teacher delivers reading instruction in Welsh, while students predominantly engage in response and discourse in English (Wei 2018). This term elucidated a pedagogical framework within educational institutions where Welsh served as the medium of learning and instruction; however, there existed no singular monolingual Welsh speaker within the English/Welsh bilingual classrooms thereby serving as evidence of the intermingling of languages during communicative exchanges.

The theoretical underpinnings of translanguaging have been elaborated upon by scholars such as García (2009), Makalela (2016), Creese and Blackledge (2015), Wei (2018), among numerous others. García (2019) posits that translanguaging embodies a phenomenon of language alternation wherein students leverage their comprehensive linguistic and cultural repertoires to derive meaning without necessitating the perception of possessing multiple or discrete languages (Creese & Blackledge, 2022). Translanguaging manifests as a pedagogy that empowers students to engage effectively with their learning and it constitutes a methodology that utilises the entirety of available linguistic resources to construct meaning (Hurst & Mona, 2017). It represents the collaborative utilisation of all multilingual individuals’

discursive, communicative, and linguistic assets (García 2009). Language is conceptualised as a continuum, rather than being compartmentalised into discrete linguistic categories or isolated systems.

The operational framework of the classroom is such that multilingual students possess a self-organised array of communicative systems cognitively, which forms an expanded code of systems from which they may select and adapt in accordance with the communicative exigencies of the social context (Makalela 2019). Translanguaging is particularly suited to heteroglossic environments wherein students are able to alternate between languages as a unified system in both the reception and production of textual content. Wei and García (2022) have argued that through the transcendence of designated languages, translanguaging is conceptualised as a decolonising endeavour, illuminating the manner in which bilingual individuals navigate a landscape characterised by diverse epistemological foundations and linguistic/cultural practices. This means that translanguaging is a cohesive repertoire that necessitates decolonial implications in the educational realm, as educators relinquish the emphasis on standardised named languages and fully immerse themselves in their students' extensive repertoire of features and significations.

1.4.4 Justification of theoretical framework

The researcher chose to work with these three frameworks because they were relevant to the study and offered insightful explanations of the nuances of language and instruction. The Linguistic Interdependence Model provided a valuable framework for understanding the complex relationships between languages in multilingual individuals. It explored language education policies, developing effective language teaching methods and allowed educators to understand cognitive benefits of multilingualism. The theories also emphasise that in order to maximise learning and support the learner's holistic development, the teacher and the family must collaborate effectively to empower multilingual learners in scientific classes. Vygotsky's ZPD also emphasises this growth, which centralises the learner in the learning process and enables them to push past their comfort zone to develop their own conceptual understanding. This makes learning a triple-dimensional activity where all parties should know their role and play their part effectively. By so doing, multilingual learners can be empowered, fostering high levels of academic excellence, a sense of self-efficacy, and enhanced communication between educators and families through the development of "*confianza*" (mutual trust) ties. It also gives them the ability to carry out curricular and instructional innovations where funds of knowledge

are fully incorporated with sufficient help from more knowledgeable others and self-confidence. By acknowledging and leveraging the funds of knowledge in multilingual communities, researchers and educators can value diversity, promote equity and enhance learning outcomes.

1.5 Research question

Does language have a transformative effect on the academic performance of grade 4 Natural Science learners in Johannesburg?

1.5.1 Sub questions

- How can translanguaging be transformatively used in a multilingual NS classroom?
- To what extent can translanguaging be used in a NS classroom with multiple languages?
- Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

1.6 Hypothesis

The research was guided by a specific hypothesis that aimed to be either accepted or rejected through the data analysis.

Research Hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.*

Null Hypothesis: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group.*

The study aimed to address these questions in order to provide nuanced insights into the broader discussion on language education. It also aimed to provide practical implications for educational policies and pedagogical approaches within the context of a rapidly changing and increasingly diverse educational environment.

1.7 Research aim

The study aimed to investigate the transformative potential of translanguaging in NS instruction of a multilingual Gr 4 classroom in Johannesburg.

1.7.1 Research objectives

- To investigate the transformative role translanguaging can play in the learning and teaching of NS in multilingual South African grade 4 classrooms.
- To explore how translanguaging can be used to help develop epistemic access and critical thinking skills required in a grade 4 NS classroom.

1.8 Definition of terms

Bilingualism and multilingualism: These terms can be used interchangeably to relate to having roughly the same level of competency in two or more languages and the capacity to communicate effectively in those languages (García & Wei, 2014). For the purposes of the study bilingualism will mean only 2 languages and multilingualism will refer to more than two.

Code-switching: is the process of changing instruction from one language to another while talking (Wunseh & Charamba, 2023). When speaking, speakers choose to switch between languages, and they are conscious of this choice. In this study the term will be taken to mean a systematic switch between different languages to adapt to different linguistic and cultural contexts.

Home language (HL): The language that a learner uses most often at home. This is also known in literature as a learner's primary language (Carrim & Nkomo, 2023). In this study, it will be taken to mean the learners' main language that they most often use at home.

Indigenous language: A language that originated in a specific place and is not brought to that place from elsewhere (Sefotho, 2022). Within the framework of this research, the phrase designates the official and non-official Indigenous languages of South Africa, for instance, Siswati, Tshivenda, Xitsonga, Khoekhoegowab, IsiNdebele, etc.

Language of learning and teaching (LoLT): it is the language that is utilised for instruction, communication, and evaluation in the classroom during the course of the school day (Charamba, 2021a). It might or might not be the same as the learners' home language, which is the tongue they speak most often at home. This could include any of the eleven official languages of South Africa as well as Braille, and South African Sign Language (SASL), which has been authorised by UMALUSI. For the purposes of this study, it will be taken to refer to English or Afrikaans.

Language repertoire: is the whole range of linguistic tools at a speaker's disposal (García, 2020). This includes multiple languages which the speaker may know whole or only in part. In this study this will mean all languages that a learner or learners know, be it fluently or not.

Mixed language use: refers to the practice of using two or more languages in a single communication, from a single sentence to another (Wunseh & Charamba, 2023). In the context of this study, it refers to a speaker who uses multiple languages when speaking as having mixed language use. This could include code-switching, translanguaging, or a combination of both words.

Monolingualism: it describes the ability to speak and write in only one language with fluency and skill (Makoko & Otlogetswe, 2020). In this study, it will mean speaking and understanding one language.

Pluralist language use: expressing of ideas through the employment of multiple languages in a free-flowing mixture (Ndlovu-Gatsheni, 2018). Because pluralist language use is in line with a heteroglossic language philosophy, the speaker uses the entirety of their language repertoire to express what they want to communicate. In this study this will mean recognising and embracing different language variations, dialects and informal expressions in the classroom.

Purist language use: the expression of ideas using a single, unadulterated language. The idea that a teacher in a class should use one language as the LoLT (Makalela, 2019). The speaker may be multilingual, but they exclusively use language in its purest form, never combining languages, because they think this is the best way to use language. In this study, this will mean the adherence to English use only, excluding variations, dialects and or informal expressions that are used by learners outside the school.

Translanguaging: refers to a fluid, adaptable use of language that is thought to be an internal tactic used by speakers to communicate using all their linguistic resources (Wei, 2018). To do this, speakers flexibly draw from their linguistic repertoire; they are not conscious of switching between languages while speaking. In this study it will be used to mean a language empowerment tool that is the use of language varieties and modalities to communicate meaning. It will emphasise the fluid and dynamic nature of language use where learners or teachers draw on their whole linguistic repertoire to effectively convey their thoughts and ideas.

1.9 Methodology

For the present research inquiry, the adoption of a mixed-methods approach was considered suitable, as it facilitated the amalgamation of both qualitative and quantitative data. This methodological approach proved particularly efficacious for the examination of intricate social phenomena.

In order to ascertain the challenges faced by multilingual learners within monolingual educational settings and effectively empower them, qualitative methodologies such as interviews and observations were implemented. These interviews yielded profound insights into the lived experiences of learners studying through an additional language. The objective of the study was to augment the researcher's comprehension of the environmental, cultural, and language-specific factors that affect the academic and social integration of multilingual learners (Creswell, 2021).

Quantitative methodologies, which involved the use of three assessments, were utilised to evaluate the overall academic performance levels of multilingual learners within monolingual classrooms. This quantitative approach also revealed correlations between linguistic proficiency and academic achievement. By collecting extensive datasets, this methodology facilitated the discernment of patterns and trends among a larger cohort of learners (McMillan & Schumacher, 2010).

The implementation of a mixed-methods approach permitted a thorough investigation into the transformative potential of translanguaging in classroom environments on the academic and social inclusion of multilingual learners in South Africa. This comprehensive approach took into account both individual experiences and overarching trends within a wider learner demographic, thereby affording a nuanced understanding of the research subject.

1.9.1 Research design

McMillan and Schumacher (2010) define a research design as a strategy for choosing the study's participants, location, methods of gathering data, and instruments for analysing that data in order to answer the research question. The design of the study specifies the time, location, and conditions of the investigation in addition to the subjects. It serves as an illustration of the research paradigm, research strategy, and research approach that will be used in the investigation (Polkinghorne & Given, 2021). A research design can therefore be thought

of as a comprehensive plan, structure, and strategy of investigation that is adopted with the goal of gaining solutions to research problems and questions through directed management of variables.

This study adopted the sequential explanatory design which started with the collecting and examination of quantitative data (from 3 tests which are the English proficiency test, the pre-test, and the post-test), proceeded to the gathering and examination of qualitative data (interviews with teachers, learners, and parents), and ended with an interpretation (Walker & Baxter, 2019). This design was chosen because it helped the researcher investigate the patterns and trends of the significance of language (Charamba, 2017) in the overall academic performance of grade 4 learners in the NS classroom.

Following this design, the triangulation design was used as it was the most optimal method for investigating elements linked to merging language instruction and NS teaching. McMillan (2010) define the triangulation technique as a method in which data is presented numerically and analysed verbally and statistically. This involved having different dimensions to which issues are viewed (Yuvayapan, 2019).

1.9.2 Research paradigm

A paradigm is a set a of ideas that has its etiology in a Greek word that means pattern. According to Kuhn (1962) a paradigm is a philosophical perspective. In educational research, it is used to describe a researcher's perspective (Yuvayapan, 2019). The interpretation or meaning-making of study findings is guided by this perspective, or shared set of beliefs. According to Polkinghorne and Given (2021), a paradigm is the conceptual lens that researchers use to evaluate the methodological aspects of their studies and select the methodologies that will be utilised for performing the research, collecting data, and conducting analysis. A paradigm was crucial to this research endeavour because it established beliefs and guidelines that determined how translanguaging should be studied, and how the results of the study should be understood.

The current study used a pragmatism paradigm to gather participant responses from a Johannesburg primary school regarding the significance of language in the learning and teaching of NS. Quantitative and qualitative research approaches were combined in a mixed method study strategy, that is it used both numbers and words to study the transformative

potential of translanguaging (Creswell, 2021). Since both qualitative and quantitative research approaches have flaws, the researcher decided to balance the two in order to obtain a more thorough understanding of translanguaging in science education. While qualitative research had biases and was less amenable to statistical analysis and generalisation (Charamba, 2020a), quantitative research lacked an awareness of the context or situation in which data was obtained (Creswell, 2021). Therefore, a pragmatism approach mitigated these drawbacks by allowing both exploration and analysis in the same study (Pun & Tai, 2021).

Qualitative data was more subjective and open-ended, allowing for the interpretation of observations and the voice of the participants to be heard, whereas quantitative data comprised of closed-end information that was statistically analysed and presented numerically (Pun & Tai, 2021). This allowed the researcher to collect a wide range of data through interviews, observations and even the notion of phenomenology where they got to understand and describe the lived experience of the participants. In essence, it enabled the researcher to explore how teachers and learners make sense of the world around them in turn uncovering the importance of language in the classroom. Since the researcher involved parents in this study, they conducted in-depth interviews that provided rich holistic descriptions and subjective experiences and perspectives of parties involved in empowering the learners.

1.9.3 Research strategy

In order to get results, the researcher gave all participating learners English proficiency, pre and post-tests. The pre- and post-tests were divided into: 1) using multilingual assessments and 2) in English (the tests had the same questions but different languages). To get reliable results on the effect of the intervention the researcher had two classes, one that acted as the control group and the other that was a beneficiary of the intervention. For all learners in the group that had translanguaging pedagogies, the researcher divided them into small groups based on their mother tongue or first language and give them an activity where they discussed in their languages and helped each other understand the scientific concepts. After the discussion they had reflections of what they discussed in English in order to allow all learners to understand. The researcher anticipating transliteration hence the teacher was asked to step in to make the corrections and alterations.

1.9.4 Sampling

Sampling involves selecting a subset (or sample) of individuals or items from a larger population. Researchers use this smaller group to make observations, estimations, or inferences

about the entire population and the choice of sampling method depends on the specific analysis being conducted. According to Khan (2014), when one wishes to learn more about a case without having to or wanting to generalise to all cases of that type, they can choose cases with a lot of information to examine through systematic sampling. It is important to note that there are different ways of sampling and of interest for this study was homogenous purposive sampling.

Homogenous purposive sampling as defined by Campbell et al. (2020) is a non-probabilistic technique commonly used in qualitative research, and seeks to produce a homogeneous sample, one whose units (people) have the same or nearly same qualities or traits . In this study it was learners with the same or similar home language. In this method, the researcher deliberately chose participants based on specific home languages, rather than relying on random selection. This method was chosen because the research question was specific to the traits of the particular group of interest that was being studied. It was particularly useful as the researcher focused on relatively small samples, unique cases, or information-rich contexts (Campbell et al., 2020).

In essence, the benefit of homogeneous purposive sampling was that it minimised variation within the selected sample, allowing for a simpler and more robust analysis. It allowed the researcher to delve deeply into the participants' characteristics, behaviours, and experiences. In conclusion, unlike random sampling, where not all participants possess the characteristic of interest, purposive sampling ensured that the chosen sample aligned with the research objectives. Consequently, minimising the margin of error.

1.10 Data collection

The data collection phase involved systematically gathering data through achievement tests, in-depth interviews, and classroom observations, followed by a rigorous examination using both qualitative thematic analysis and quantitative statistical methods.

Quantitative: The three written tests

Three written tests (the English proficiency, the pre- and post-tests) provided the quantitative data for this investigation. The researcher collaborated with the NS teacher at the school being studied to prepare the pre- and post NS tests. For validity and reliability checks, the researcher asked the head of the school's NS department to assess the tests and where necessary, modifications were made to comply with assessment requirements. The pre-test was written in the school's language of instruction (English) and the post-test was in either isiZulu or IsiXhosa

which were dominant in the class as well as in English. Each test had 15 multiple choice questions with 4 possible answers per question and the duration of each test was 30 minutes. This topic was according to the CAPS document meant to be taught grade 4s in term two. It covered 4 main topics namely: Materials around us, Solid materials, Strengthening materials and Strong frame structures (DoE, 2011).

Qualitative: Semi- structured interviews

After gathering quantitative data, qualitative data was collected through interviewing a selection of the participants in the experimental group, to get more specific information about the likely causes of the difference in their academic achievements between the two exams if there was any and to gather their perspectives on the intervention method. The researcher interviewed the parents/guardian, teacher and learners to get a holistic response. For learners, the researcher used research randomiser to select about 10 learners from the experimental group to eliminate biases for the interviews while for parents, it depended on availability. This gave that researcher a better comprehension of the findings. Each respondent was asked about 5 questions with each interview session lasting about 5 to 10 minutes. During the interview, the researcher asked for their permission to write down their response and tape-record concurrently in order to capture the data accurately for analytical purposes.

Qualitative: Observations

Observations were conducted in both experimental and control group classrooms during NS lessons over the period of the study. The researcher aimed to identify the frequency of behavioural infractions, expressions of confusion, disengagement, or zoning-out during lessons. This qualitative data provided insights into teacher competency in implementing translanguaging pedagogies in the experimental group and monolingual pedagogies in the control group. The observations also assessed the learners' attitudes and their potential impact on learning. The researcher maintained a journal for each observed lesson.

Validity and reliability of Quantitative data

The degree of trustworthiness associated with the research process and its outcomes determines the quality of a mixed method study. Zhou (2019) proposes ‘hands-on model’ to conducting the validation analysis. The model consist of five steps: (1) qualitative investigation, (2) mixing phase, (3) mixing validation (4) quantitative phase, and (5) quantitative validation (Zhou,

2019). Items that do not meet the requirements for item analysis in step (5) were taken back to step (3) for further validation and pilot testing.

In the first step, the researcher focused on qualitatively investigating the scale construct. In the mixing phase, which is the second step, an integration strategy was used. Here the qualitative findings that consist of quotes, codes, and themes in different layers, the quotes and codes were converted to scale items. Thirdly, to assess the content-based validity of the items, the researcher moved on to mixing validation. Here, data was sorted and computed as the quantitative techniques, whereas introspection, debriefing, and panel reviews were the primary qualitative ones. Lastly, a series of statistical analyses was run on the responses to search for evidence of construct-based validity, including internal reliability. This quantitative validation allowed the researcher to analyse item attributes and investigate construct validity evidence.

Trustworthiness of the qualitative data

The degree to which the study methodology and conclusions may be trusted determines the quality of qualitative research. Credibility, Dependability, Transferability, and Confirmability are the four criteria put forth by Bless, Smith and Kagee (2006) as suitable for determining a qualitative study's reliability.

Credibility: The researcher assessed the current study's credibility by deciding whether or not the findings conclusively address the research issues. This was accomplished by carefully and precisely analysing the gathered data.

Transferability: By providing a detailed explanation of the research background and the underlying assumptions, the researcher improved transferability (Khan, 2014). This will inform the reader, and they will be able to decide whether to apply the results to another setting.

Dependability: The researcher meticulously conceptualised the research, gathered the information, analysed it, and interpreted the findings to ensure the study's reliability.

Confirmability: By keeping track of the processes for double- and triple-checking the data throughout the entire study, the researcher increased confirmability.

1.11 Data analysis

The process of data analysis encompassed the examination, purification, transformation, and interpretation of the gathered data to extract pertinent information (Creswell, 2021). In this research study, a holistic methodology that integrated qualitative coding techniques alongside quantitative statistical evaluations was utilised. The objective was to assess the differences in outcomes between the control and experimental groups, employing a data triangulation framework that entailed distinct analyses of qualitative and quantitative data prior to their integration for comparative validation.

Quantitative data analysis

R-computing was used for the analysis of the quantitative data in this study. This programming language is widely used in scientific, data analytics, and statistical computing research. In order to clean, retrieve, visualise, analyse, and present data, statisticians, data analysts, and researchers frequently employ this language (Creswell, 2021). The researcher decided to utilise this programming due to its user-friendly interface and expressive syntax.

In order to evaluate cause and effect and draw conclusions between two variables—language use being the independent variable and learners' academic achievement and epistemic access being the dependent variable—descriptive statistics through univariate analysis was employed in the study. For each of the two tests, the mean, median, mode, and dispersion—measures of central tendency—were also computed and analysed.

Qualitative data analysis

Conversely, qualitative data was analysed using qualitative data analysis, a method based on Glӑser and Laudel's (2010) model that created a category-structured information base that was used to find patterns in the data and integrate those patterns into a methodical, theoretically embedded explanation (Glӑser & Laudel 2010). Five steps comprised the data analysis procedure that was employed: finding themes and subthemes; characterising the central and ancillary components of themes; creating code-books or theme hierarchies; applying themes, or tying them to specific passages of text; and establishing connections between themes and theoretical models. The study's themes came from the researcher's earlier theoretical understanding of the phenomenon being studied as well as from the data.

1.12 Research ethics

A researcher is obliged to safeguard their participants. McMillan and Schumacher (2010) assert that when there are worries about study participants' physiological or psychological discomfort,

harm, or risk, the researcher has an ethical obligation to protect their rights and welfare. This implies that the researcher's responsibility is to ensure that the proposed research is morally responsible and complies with accepted standards and values. Additionally, the participants' rights must be upheld and kept safe.

This shows that in the realm of research, ethics play a pivotal role in safeguarding the well-being of participants, particularly when involving vulnerable populations such as young children. Adherence to ethical principles then become paramount, with a focus on autonomy, nonmaleficence, and beneficence (McMillan & Schumacher, 2010). These principles dictate that participants should willingly engage in the study, possess the freedom to withdraw at any juncture, be shielded from harm, and that the research should contribute to beneficial changes.

Before embarking on the research journey, the University of the Witwatersrand Human Research Ethics Committee granted an ethical clearance certificate with the protocol number "H24/09/36". This initial step underscores the commitment to upholding ethical standards throughout the research process. The ensuing discussion sheds light on the key factors considered in ensuring ethical practices within the current study:

Voluntary participation

Voluntary participation according to (Khan, 2014) means that the participants in a research study have the right to decide whether they want to take part in the study or not. This is an important ethical consideration in research that involves human subjects, as it ensures that participants are not forced or unduly influenced in any way to participate. The participants were free to choose whether or not to engage in the research; participation was entirely optional. Additionally, the learners were given the option to chose whether to continue participating in the research until its conclusion or to stop at any point. This allowed participants to make an informed decision about whether or not to participate.

Confidentiality

According to Bos (2020), research confidentiality ensures that participants' identities cannot be inferred from their responses by researchers or readers of the study's findings. This means that confidentiality is a key ethical consideration in research that involves human subjects and it is important for building trust and safeguarding participants' privacy. Participants' privacy were therefore safeguarded by hiding their true identities. Passwords were used on the

computer/laptop to protect the data acquired, and access to the data was restricted to only the researcher. Participant anonymity was protected in this study by using either numbers or pseudonyms and the researcher also informed the participants about their data protection measures and assured them that their data will be kept confidential.

Anonymity

In order to maintain their anonymity and protect participants' identities during the study, the researcher assigned numbers to each learner before giving them the English proficiency test to complete, ranging from 1 to 40 according to the entire learner body of the school in grade 4. Pseudonyms were used for parents and the teacher. This is corroborated by McMillan and Schumacher (2010), who claim that secrecy can be achieved by requesting participants to use aliases or numbers, collecting data anonymously using a method that does not associate individuals with the data, and reporting only group findings rather than individual ones.

Informed consent

Before each participant took part in the study, they were all explicitly informed of its purpose. Additionally, the volunteers were informed that they are allowed to leave the study whenever they choose without worrying about being punished. After being made aware of and comprehending the potential hazards, participants provided written consent or information (Gay, 2010). The consent papers for the learners participating in this research were co-signed by their parents/guardians because they are minors (McMillan & Schumacher, 2010). This procedural step ensured that the participation of minors was contingent upon the explicit approval of their parents/guardians, safeguarding their rights and well-being.

Full disclosure

All participants received an upfront explanation from the researcher about the methodology of the study. Additionally, the volunteers were made aware of any potential dangers associated with participating in the study. Discomfort was the only risk that was predicted. Every participant was also informed of the research's goal (Thornberg et al., 2022). Therefore, throughout this study, volunteers were not be kept in the dark about the research. Maintaining transparency throughout the research process was of utmost importance. This dedication to comprehensive transparency not only adheres to moral standards but also guarantees that participants engage in the research with an explicit comprehension of its aims, possible hazards, and expected results.

Beneficence

This study intended to help learners by giving them the chance to speak in their native tongue during a science lesson, something they were not usually permitted to do. The researcher also intended to give them an opportunity to deepen their understanding in scientific concepts by exploring the transformative potential of translanguaging. It is also of great importance to ensure that all learners received the same tools and resources after the intervention to make sure that both groups were in sync. Therefore, after the intervention the control group received all the materials the experimental group had received and the same instruction was used to get them on par with the other group.

1.13 Limitations of study

The study focused on Grade 4 NS learners from the same school in Bellevue East, a suburb in Johannesburg. The study included 40 learners, which makes it a rather small sample. Owing to the school's ongoing initiatives, learners received extra instruction to avoid interfering with the study school's smooth operation. Since there were many languages in the classrooms, other learner's home languages were not used in the assessments since the researcher intended to work with the majority of languages also considering adequate resources. Additionally, since teachers are overloaded and probably had limited time, it could have been difficult to attend to interviews. This was avoided by planning the interviews properly in advance and selecting straightforward questions.

1.14 Ethical Clearance

University Approval: Securing approval from the University of the Witwatersrand Human Research Ethics Committee before commencing the research with the protocol number "H24/09/36". These considerations collectively underscore the commitment to ethical research practices, upholding the dignity and rights of the participants, and ensuring that the research aligns with principles that prioritise both individual autonomy and the broader welfare of the participants.

1.15 Chapter outline

Chapter 1

An introduction, the background of the topic being investigated, a problem statement, research questions, the aim of the study, the rationale for the study, and definitions of concepts used in the inquiry are all included in this chapter.

Chapter 2

The study's theoretical foundation—that is, the key ideas that guide the investigation—are covered in this chapter. This includes concepts of literacy, multilingualism, monolingualism and translanguaging. Further, it explains the relationship between language and academic performance using several existing studies to justify the importance of translanguaging in education. Examples of strategies teachers can use in multilingual classrooms are also be given.

Chapter 3

The study's methodology, which includes the research design, research paradigm, research site, research sampling, research tools, data collection and analysis techniques is presented in this chapter. The validity, reliability, and trustworthiness of research tools, data, data analysis, and ethical considerations are also set out.

Chapter 4

This chapter presents, analyse, and interpret the data that was gathered for the study. Furthermore, a discourse regarding the degree to which the scrutinised literature addressed the research quandary of the gathered data and the possibilities of translanguaging teaching is expanded upon.

Chapter 5

This chapter includes the researcher's suggestions, a description of the study, and study closing thoughts. It provides an overview of the findings of this research project, recommendations for practice and policy, and ideas for more research.

1.16 Conclusion

The setting of the research issue, the reason for the current inquiry, the theoretical framework supporting the study, the problem statement, the hypotheses, the research design, and the methodology were all thoroughly covered in this chapter. Chapter 1 included a statement on research ethics as well as the limitations of the current investigation. It also included definitions of some of the important terms used in the study for the sake of clarity. Overall, Chapter 1 served as a crucial starting point, setting the stage for the theoretical exploration, methodological insights, data analysis, and conclusive reflections that followed in the subsequent chapters. The conceptual framework for this study's relevant variables and its potential relationships between them are addressed in the next chapter.

CHAPTER 2: LITERATURE REVIEW

An introduction, the problem statement, research questions, the background of the subject under investigation, the purpose of the study, the justification for the study, and definitions of the terms used in the investigation were all included in the first chapter. In-depth assessments of earlier academic publications and research findings pertaining to the study's primary issue are provided in the literature review chapter. It establishes connections between the research problem under investigation and existing knowledge, provides a critical synthesis of current knowledge, and identifies gaps in the literature that need to be addressed. This section compiles information from a variety of sources, including books, journals, and government legislation.

2.1 Introduction

In many South African schools, learners encounter new scientific vocabulary (Hanna, 2022; Ndhlovana & Charamba, 2023b) and a new language used for teaching and learning science (Richards & Pun, 2022). This means that teachers need to develop effective strategies for teaching both the scientific language (Wong et al., 2023) and the language used for instruction. In so doing, science teachers in bilingual or multilingual classes face different challenges compared to English language teachers (de Jong & Gao, 2023). While English language teachers focus on fluency and accuracy in English, as argued by Spaull et al. (2020), the daunting challenge of consistently teaching science and English at the same time falls on science teachers.

In fact, in multilingual South African schools, it has been suggested that the biggest challenge for many teachers is assisting learners in moving from a level where they cannot understand English (Van Staden, 2023) to one where they can explain science in English (Hanna, 2022). This calls for a strong command of the medium of instruction (Charamba, 2023), but even though multilingualism is recognised and codified in the nation's language in education policy (DoE, 1997) and other regulations, monolingualism in the classroom has persisted in many South African schools (Dhokotera & Makalela, 2022). Many South African languages are intentionally left out of the language of instruction.

A conceptual framework for pertinent and recent research on the transformative potential of translanguaging in science education is presented in this chapter. The researcher gained a better understanding of the underlying causes of South Africa's low literacy rates, the role language plays in science education, and the ways translanguaging can help multilingual learners

develop the critical thinking abilities (Ndhlovana & Charamba, 2023a) needed in science classrooms at the intermediate phase by reviewing the literature. Data and research from around the world that examines the role of the mother tongue in science education, including monolingualism, multilingualism, and translanguaging, were used to discuss the literacy situation in South Africa. Thereafter, the researcher discussed how best schools can promote a language-friendly school where all learners feel included and confident to contribute during a science lesson.

2.2 The role Mother Tongue plays in the classroom

Unquestionably, language is essential for cognitive development. It gives people a way to ask questions, articulate their ideas, and comprehend the categories and concepts needed for thinking as well as the relationships between past and future events (Schleiermacher, 2021). Mother Tongue (MT) according to Beisenbayeva (2020) refers to the speaker's dominant and home language in addition to the language they learn from their mother, in other words, it's the first language in terms of importance and the speaker's capacity to master its linguistic and communicative elements, rather than just the first language in terms of acquisition time. In addition to expression and embodiment, language also symbolises the reality of cultures (Risager, 2020) and shapes one's thoughts, establishing certain boundaries and providing access to different worlds. Through language, people learn about each other, including their attitudes, values, beliefs, worldviews, traditions, and achievements (Zano & Mbirimi-Hungwe, 2023) among other things.

Following the end of apartheid in 1994, South Africa adopted one of the most inclusive language policies, encouraging the use of any of the 11 official languages: siSwati, Xitsonga, Setswana, Tshivenda, isiXhosa, English, Afrikaans, isiNdebele, isiZulu, Sesotho and Sepedi, as well as South African sign language. The goal was to conserve the learner's funds of knowledge, which included their expertise, experiences, and connections with cultural figures in their community, families, and daily life (Beisenbayeva, 2020; Moqbel, 2022). Today's learners have a variety of opportunities due to political and socioeconomic changes in the globalised society. As a result, in today's educational settings, multiple languages and cultures can coexist (Byram & Golubeva, 2020).

Language is crucial for learning and mental development. Emphasising the important role of language in generating concepts, providing learners with opportunities to use their MT could

help them improve their understanding of language and science (Charamba, 2023; Richards & Pun, 2022; Wong et al., 2023). Charamba (2021) argues that learners bring their language as part of their social connections and knowledge sources, known as their 'funds of knowledge.' Recognising the culturally coded information that learners bring to the classroom, as highlighted in funds of knowledge, and establishing multilingual spaces in science lessons (Reinders et al., 2022) are important for systematic inclusion of all learners.

A study conducted in India by Bouhlila and Hentati (2022) examined the impact of Arabic-speaking fourth-grade learners' MT on their science academic achievement. Through a propensity score technique and using TIMSS 2019 standardised tests, the study explored variations in science performance between two groups of young children who learnt in English and classical Arabic, respectively, within a context where Arabic dialects are predominant. Their findings indicate that disparities in performance are attributed to the language of instruction. The authors emphasise that while MT can yield positive outcomes in academic performance, its benefits are most pronounced when learners demonstrate proficiency in it. When applied to the South African context, this insight resonates with current practices in the foundation phase, where prioritising the learners' MT aims to develop proficiency before introducing a second language (L2) (Luvuno & Ajani, 2022). Furthermore, the study advocates that MT should not be phased out in Grade 3 but rather integrated into the intermediate phase curriculum to scaffold learners.

Similarly, Ganuza and Hedman (2019) investigated the impact of MT on the biliteracy proficiency of 120 Somali–Swedish young bilinguals in Grades 1–6 (ages 6–12 years) within a compulsory school in Sweden. The study assessed biliteracy through metrics including word decoding, reading comprehension, and the breadth and depth of vocabulary. Data was analysed using cross-sectional, longitudinal, and cross-linguistical approaches. The findings indicated that involvement in MT instruction improved the Somali reading comprehension scores of the participants and higher outcomes on similar tests in Swedish were associated with improved score in Somali. These findings suggests that MT instruction positively influences various aspects of literacy proficiency. Moreover, they imply that such instruction may indirectly enhance proficiency in the primary language of instruction. This perspective is supported by (Arif et al., 2021) who argues that utilising learners' MT can help marginalised minorities in comprehending both language and their surrounding world. For instance, allowing isiZulu to

support learners in science education might enhance their understanding as they connect concepts to their everyday experiences.

Additionally, Kumar, Nukapangu, and Hassan (2021) conducted a study examining the reasons why learners at three different schools in Astana, Kazakhstan, utilised their native language while learning English as a foreign language . Using an attitude scale model, they discovered that learners feel more comfortable using their MT in the classroom, which boosts their confidence to participate. However, the study also highlights that learners often refrain from using the foreign language they are studying due to lack of motivation, fear of correction from teachers, and the possibility of being teased by peers. Additionally, many learners struggle with self-doubt. This implies that, South African teachers should adopt more positive attitudes, foster a supportive learning environment, and incorporate the MT to scaffold and promote participation in the learning of a new language.

In a similar study conducted in Kenya, Mose (2020) found that MT could be effective for teaching science, given the common linguistic challenges in the country. This qualitative study examined the content of science topics in the foundation phase (grades 1-3) and argued that the science curriculum includes fundamental topics that learners encounter regularly. Through an analysis of textbooks and the curriculum, Mose discovered that both conceptual and technical vocabulary have corresponding terms in Ekegusii, the native language of Kenya. This suggests that, while the terms may not be exact translations, there are equivalent terms in the South African context that can be used effectively in science classrooms (Mbirimi-Hungwe, 2021). This approach could help scaffold learning and enhance epistemic access for learners.

A study by Naddumba and Athiemoolam (2022) explored the pedagogical strategies employed by Ugandan teachers to support early literacy acquisition among learners. Through classroom observation and in-depth interviews with twelve primary teachers and their learners, the findings revealed that teachers utilised a variety of methods, such as storytelling, music, poetry, demonstrations, and field trips, all of which significantly contributed to the development of functional literacy. The study concludes that socio-cultural learning, through the use of these methods and the integration of learners' prior language knowledge into classroom activities, is essential for effective literacy development. In the South African context, songs sung in local languages can serve as valuable tools in the classrooms. For example, the rain song in isiZulu can be used to explain the water cycle. This approach is engaging and familiar to many learners,

helping them connect their home knowledge to abstract concepts learned in school. As they master these processes, they are likely to remember the song, reinforcing their understanding.

Moreover, Phiri, Jita, and Jita (2024) conducted a recent mini-ethnographic case study examining the instructional methods for information and communication technology in a school in Bulawayo, Zimbabwe, specifically within the context of early childhood development. Through in-depth interviews and audio recordings, the study revealed that while the teacher firmly believed in the efficacy of using the MT as the medium of instruction for facilitating epistemic access, there is a notable lack of awareness regarding the integration of both English and MT in teaching science. This highlights the need for professional development for teachers in effectively using MT and implementing content in the classroom. Furthermore, it is worth noting that South Africa should extend the MT approach in the foundational phase to teacher training programs at the university level, as conducting workshops for in-service teachers disadvantages those who did not receive this training during their tertiary education.

Additionally, Mavuru and Ramnarain (2020) examined how teachers incorporate learners' MT when teaching science, focusing on the benefits and drawbacks of this approach. The researchers found that learners from diverse linguistic and cultural backgrounds often exhibit differences in their understanding of science. Many learners feel that science education is being imposed on them due to the variations in meanings, symbols, and practices associated with different languages (Nishanthi, 2020). Through observing fifteen lessons and conducting fifteen post-lesson interviews with Grade 9 teachers across three high schools in South Africa, they emphasise the importance of language in mediating thinking, which is essential for communication. In the context of English First Additional Language (EFAL) in primary classrooms, it becomes increasingly challenging for learners to grasp abstract scientific terms without prior contextual knowledge. Therefore, teachers must gain a deeper understanding of their learners to effectively connect classroom content with their real-life experiences.

This is in accordance with a study conducted by Zano and Mbirimi-Hungwe (2023) examining eight English First Additional Language (FAL) teachers across four South African districts in the Further Education and Training (FET) phase. Through phone interviews, the researchers found that a key element of language development for multilingual learners is the ability to draw upon and activate their existing knowledge. This means that, when learners are already

familiar with a topic, they are more likely to engage, understand new information, and remember it effectively. According to Jakobsson et al. (2024), learners are more inclined to connect with a topic if it has been discussed with them prior to its introduction in a language they fully understand. As a result, the study suggests that teachers should actively elicit learners' prior knowledge through oral exercises, as their understanding is influenced by the cultural context they are familiar with. This means that in order to enhance the quality of education and promote effective learning, it is essential to incorporate learners' existing knowledge into teaching and learning, along with group activities.

In the same vein, Charamba (2023) observed lessons in a South African elementary school and spoke with the teacher to better understand how she shaped the language used in the classroom. The findings revealed that using learners' MT allowed them to actively participate in developing and articulating scientific explanations in their own words, which in turn enhanced their academic achievement. This demonstrates a strong connection between academic success, the use of MT, and the process of knowledge creation (Cunningham & Little, 2023; Meyerhöffer & Dreesmann, 2019).

The studies above indicate that when English is utilised as the medium of instruction for EFAL learners, and they do not receive adequate language input to grasp the instructional language, their scientific knowledge and skills development may be compromised. Language embodies community ideals, morals, traditions, and customs and according to Alanazi and Alghamdi (2023), the scientific classroom serves as a space for learners' MT and cultural engagement with science culture, which is often presented through a Western perspective. Consequently, this creates a cultural clash in such classrooms, highlighting the necessity of employing MT to effectively support learners (Mbirimi-Hungwe, 2021). The topic of monolingual classrooms will be addressed next.

2.3 Unveiling the complexities of monolingualism: A multidimensional perspective

Monolingualism according to Makoko and Otlogetswe (2020) describes the ability to speak and write in only one language with fluency and skill. This has been enforced in most schools worldwide under the regime of "One Nation, One Language". To address the cognitive gap that has developed in schools as a result of robbing children of their MT, the South African education sector is frantically seeking specialists who are proficient in specific languages or comprehend particular cultures (Mukeredzi, 2021). This gap has been a result of many factors,

chief among these factors according to Jansen and Walters (2022) is that, many bicultural and bilingual children with linguistic talents have been, and often still are, pressured to abandon their own culture and language in favour of the dominant English or Afrikaans culture and language in order to fit in with their peers and the broader educational system. Throughout the colonial era, language policies in education have been used by white minority administrations as tools for political maneuvering. This issue is crucial for Africa's broader transformation goals and South Africa's specific agenda (Charamba, 2022b). However, monolingualism continues to prevail.

Undoubtedly, the monolingual and monocultural educational model has effectively eliminated opportunities for multilingual children in South Africa, even to the extent of outlawing the use of indigenous languages in the majority of educational settings (Mzangwa, 2019). This according to (Charamba, 2021b) has significant implications for the people's constitutionality and real freedom. The prevalent Eurocentric view to education that follow the one-language ideology of 'one nation, one language' is viewed as a form of oppression that encourages colonialism or imperialism and maintains social order in communities (Ndhlovu & Makalela, 2021). This implies that monolingual pedagogies not only strip away learners' home languages but act as tools for oppression. What is monolingualism?

Monolingualism, as argued by Masri and Amin (2023), is a multifaceted issue with significant implications across various social domains. It is commonly understood as the ability to speak only one language (Kircher & Kutlu, 2023), and for the purposes of this study, it will be defined as the capacity to speak and comprehend a single language. While this concept is often seen as typical in Western societies - where English is the predominant language - the application of such an ideology has been shown to have adverse effects in African contexts, particularly within the education sector, where learners are compelled to learn and converse in English.

According to (Makalela, 2018), English has been the dominant language in South Africa because colonists viewed it as a prestigious language during the apartheid era. Owing to its esteemed status, English was adopted widely in the legal, business, political, and educational sectors. Although the recognition of South Africa's twelve official languages was celebrated as a victory for the rights of African language speakers, (Charamba, 2020b) argues that real progress remains elusive in the educational sector, where effective learning is still hindered by the use of English as the medium of instruction. Furthermore, despite the South African

Department of Education's Language in Education Policy (DoE, 1997) allowing school governing bodies to choose their language of instruction, many continue to opt for Afrikaans or English, which reinforces the dominance of these languages.

Monolingual pedagogies have faced significant criticism for being detrimental to the education sector. The Global Education Monitoring in 2016 highlighted that approximately 40% of the global population receives education in a language they do not understand. This language barrier is a major contributor to learners' underachievement (García & Otheguy, 2020) and has mainly affected South African learners as their grades consistently rank among the lowest in international assessments such as TIMSS and PIRLS.

A longitudinal case study by Gundarina and Simpson (2022) highlights the detrimental effects of monolingual approaches in the United Kingdom, where learners are often prohibited from using their L1. Through participant-observation fieldnotes, visual artefacts, and interviews with primary learners, their parents and teacher, the researchers found that the learners' Russian home language was perceived as a hurdle and a threat (Zacks, 2020) rather than as an empowering tool for mediation. The study advocates for bilingualism and the incorporation of the learner's L1 in both teaching and learning. The researchers outline several implications for educators. This shows that, as a pedagogical strategy, monolingualism disadvantages learners in terms of subjective well-being (Pierson et al., 2023), academic achievement, epistemic access and cognitive development.

According to the claims mentioned above, Pierson et al. (2023) conducted a study in the United States that confirms a learner's proficiency in English, especially in the field of science education, significantly influences their performance. Through video recordings, classroom observations, and semi-structured interviews, teachers can gain insights into how to coordinate multiple representations to create more equitable learning environments. The study found that monoglossic practices hinder equitable understanding in elementary science by preventing learners from fully conceptualising the concepts. It is evident that teachers play a crucial role in fostering a supportive environment. Therefore, South African educators should embrace the diversity within their classrooms and leverage it as a tool to promote effective learning and collaboration.

Similarly, Masri and Amin (2023) conducted a study in Saudi Arabia to explore the hypothesis that language may influence how coherently early learners conceptualise the idea of force. Through structured interviews with three groups of primary school children aged 7 to 12 years, their results indicate that language significantly impacts the coherence of learner's ideas about force. They suggest that teachers should utilise learners' languages to clarify meanings, as these meanings may differ from what learners are accustomed to. They argue that monolingualism can be quite limiting, and therefore, specific conceptual change of instruction is necessary to address semantic differences across language contexts, as these differences can affect learners learning in various ways. This perspective aligns with Foster, Smith, and Spencer (2022), who assert that integrated instruction, which capitalises on domain may be decreased by integrated instruction that makes use of domain interconnectivity, can reduce redundancies in learning. Such an approach would greatly benefit multilingual learners in South Africa by helping them connect with scientific content, thus challenging the monolingual practices that often dominate classrooms.

Set, (2023) questions monolingual and monoglossic language practices in his recent study conducted in Namibia. He argues that these approaches often overlook or disregard the linguistic resources that learners bring to the classroom. Through photographs, field notes, and audio and video recordings of lessons, the study highlights the challenges posed by an English-only policy, which hinders the acquisition of science. Furthermore, it emphasises the importance of utilising the rich linguistic resources that learners already possess. These findings demonstrate that the adoption of diverse heteroglossic practices significantly enhances the meaning-making process in science, even in the context of learners' limited proficiency in English. The insights have important implication in the South African context, encouraging policymakers and curriculum planners to model heteroglossic practices and to equip teachers with the skills necessary to transition from monoglossic to heteroglossic pedagogies.

In like manner, Katukula, Set, and Nyambe (2023) conducted a qualitative case study in Namibian that highlights the tension between policy and practice. They note that the multi-ethnic and multilingual nature of Namibian society leads to ongoing debates about which language should be used as the medium of instruction. Through in-depth interviews they found that parents' choices significantly impact school enrolment, especially in schools that use MTs, resulting in many schools adopting monoglossic pedagogies. These findings reveal that both parents and teachers held monolingual beliefs that discouraged the use of mother tongue

languages on school premises, thus creating an environment that was predominantly English-speaking (Wilson, 2021). This aligns with the concept of the hegemonic position of the English language, which suggests that English is viewed as the sole pathway to success and deviations from this norm are met with negative repercussions. The findings of this study suggest increasing awareness among parents and teachers about the importance of embracing the heteroglossia of language practices. This aspect was addressed in this current study to enhance the interconnectedness between parents, teachers, and learners, which is a primary goal of this research.

To understand monolingualism, Makoko and Otlogetswe (2020) examined the extent to which learners in Botswana used dictionaries. They conducted a survey involving two junior secondary schools in Thamaga and Francistown. The results indicated that while most learners had used dictionaries in elementary school, teachers had not explicitly taught dictionary skills, as they had never received training on the subject. This suggests that even though there are resources available to assist learners in monolingual environments, teachers often lack the necessary skills to utilise these tools effectively. This issue is not confined to Botswana; it is also evident in the South African context, where teachers struggle to navigate a multilingual classroom environment. As a result, learners are disadvantaged, leading to underachievement that stems from the predominance of monolingualism in the classrooms.

In its various forms and manifestations, monolingualism poses significant challenges for communities and learners, and often leads to questionable and unethical practices. Speakers of languages other than the dominant ones - English or Afrikaans- are frequently perceived as lesser citizens: they are deemed less literate, legitimate, intelligent, authentic, competent, and qualified (Moodley, 2020). This reality is exemplified in the vignette presented by Hattingh et al. (2021), which describes a grade 4 science class in South Africa. It highlights the monoglossic nature of the classroom environment, where, despite the teacher sharing the isiXhosa home language with her learners, she predominantly uses English. Drawing from this vignette it is clear that learners are often socialised into rote learning methods, such as cued elicitation and choral responses, which hinder their comprehension of science and contribute to poor academic performance. The study advocates for teachers to incorporate more of the languages present in the classroom. If teachers lack proficiency in these languages, they should encourage learners to support each other in their learning.

In line with the aforementioned Botswana study, Nkomo (2021) offers a thorough examination and evaluation of the Shuters IsiChazi-magama SesiXhosa, the second monolingual dictionary in the history of isiXhosa in South Africa. This study analyses the dictionary in relation to other dictionaries in the language, particularly the first monolingual dictionary. Nkomo's analysis draws theoretical and methodological insights from the field of dictionary criticism, a branch of metalexicography. He found that the dictionary is less user-friendly because it has an uneven distribution of microstructural entries, and a disjointed front matter. This indicates that more needs to be done in both the development and implementation of language policies or pedagogies that fully include learners in the classroom. Currently, most materials are monoglossic which highlights the need to empower learners to utilise their languages as hidden resources for understanding concepts, as well as creating more inclusive textbooks.

To evaluate the receptive, expressive, and conceptual vocabulary of English-isiZulu and English-Afrikaans bilingual learners at a monolingual school, Jordaan, van Zyl and O'Brien (2021) conducted a study. This study took place in two primary schools in Johannesburg, Gauteng, the study was carried out using a comparative quantitative design, with English as the language of instruction starting in Grade 1. Thirty Grade 1 Afrikaans-English bilinguals and thirty Grade 2 IsiZulu-English bilinguals, along with their age-matched monolingual counterparts, underwent vocabulary assessments. The results indicated that both bilingual groups significantly outperformed their monolingual peers in the vocabulary tests. This echoes the ongoing argument that monolingualism negatively impacts learners' academic achievement and highlights the importance of considering the dual language proficiency of multilingual children and underscores the need to preserve, promote, and support all South African languages within the classroom.

2.4 Multilingualism: Embracing global linguistic diversity.

A lack of familiarity with instructional language has been identified as a significant factor contributing to lower academic performance in science (see for example: Charamba, 2021a; Gundarina & Simpson, 2022; Hattingh et al., 2021; Ndhlovana & Charamba, 2023a). In South Africa, many learners find themselves in science classrooms alongside peers from diverse cultural and linguistic backgrounds. These dialects and cultures interact and ultimately blend (Galante, 2022), resulting in a greater number of learners being exposed to multilingual and multicultural educational environments than in previous years. It is therefore essential for

science teachers and educational institutions to acknowledge and respect this diversity, as it reflects a growing reality in many societies around the world.

The term multilingualism stems from two Latin terms, ‘multi’ (meaning many or much) and ‘lingua’ (meaning tongue or language). According to Wei (2012. pg.26) multilingualism is the "coexistence, contact, and interaction of different languages" in a society or among people. Similarly, Benzehaf (2023) refers to it as the ability to use more than two languages. This implies the ability to communicate in multiple languages and enables people to understand each other better. This is to say multilingual people have at least one L1, which they have kept since childhood. This L1 (also known as the MT) is typically picked up in informal settings (Carrim & Nkomo, 2023) and through interaction. Multilingualism can be understood as a complex set of specific resources that challenges monolingualism and embraces heteroglossic language ideologies (García & Otheguy, 2020) since multilingual speakers often mix, merge, and borrow from different languages. This indicates that multilingualism is a societal phenomenon involving the coexistence of multiple languages within a community.

Given the 11 official languages in South Africa, a significant amount of research (see for example: Charamba, 2023; McKinney, 2022; Omidire & Ayob, 2022) has been conducted on multilingualism in the educational setting and the function of learners' first language. Even though diversity justifies multilingual education and should be the norm in educational settings, multilingualism is not always seen as a resource. Only a small percentage of schools around the world provide multilingual education programs that consider all the languages in learners' linguistic repertoires and perceive multilingualism as a natural phenomenon while the majority are stuck with monolingualism. Therefore, for the purposes of this study, multilingualism will be defined as ability to use or proficiency in more than two languages. Multilingualism as argued by (Makalela, 2019) is often advantageous when one of the languages is employed as the language of instruction and can also involve the preservation of multiple languages in specific contexts. This implies that the idea of language contact transcends dialectal frontiers and is concerned with the co-existence of languages in a particular context.

Multilingual education presupposes several facets beyond just teachers’ proficiency in multiple languages. Key elements include their knowledge and understanding of language acquisition processes, theoretical and pedagogical models and approaches designed to develop multilingual competence (Cenoz & Gorter, 2021). Additionally, effective teaching strategies,

integration of language and content (Zano, 2020) as well as language policies and ideologies related to language teaching and usage are crucial (Brigui, 2022).

Over a billion people worldwide are believed to speak multiple languages (Sunbula, Bakhodurovna, & Norboyevna, 2022). This growth in multilingual speakers is likely attributed to the concepts of regionalism and internationalism that are currently being embraced by many countries. This accentuation of multilingual speakers highlights the need for effective communication in both personal and professional settings (Benzehaf, 2023). Given that this study focuses on empowering multilingual learners within the South African context, it is essential to identify the best systems for maintaining, preserving and promoting all languages in the country, as well as utilise them in a multilingual manner.

Magangxa and Geduld (2023) argue that South Africa‘s education systemic fails to effectively engage with the linguistic and knowledge repertoires of its learners. Though this is concerning, South Africa is not alone in its lack of relevant policy in this context as revealed by Cunningham and Little (2023) in their England study. By adopting a sociocultural approach, their research employed semi-structured interviews to gather primary teachers’ narratives, explore their attitudes and beliefs while encouraging reflection and deeper engagement with the questions posed. The findings indicate that while teachers generally expressed a positive attitude towards multilingualism, this perspective might have been superficial or imposed. This highlights an urgent need to allow and empower learners to draw on their full linguistic repertoire in order to succeed. It also calls for teachers to move beyond a state of enforced inert benevolence, which includes both conscious and subconscious barriers, to a position where they can actively respond to the growing demand for recognising multilingualism in schools as a social justice issue. This will not only benefit multilingual learners but will also help prepare all learners to live and thrive in a multilingual world.

Talukder, Green, and Mamun-ur-Rashid (2021) conducted a study on learning, teaching and assessment practices in primary science classroom in Bangladesh. Using a mixed method research design that incorporated both quantitative (descriptive statistics) and qualitative (interviews) approaches for data collection and analyses, with a sample of 150 primary science teachers and 60 learners in grade 5 (10 years), their findings indicated that there were many poor practices of learning and teaching science. These included predominant monolingual teacher-centred pedagogies, a lack of active learner participation and discussion, among other

issues. A significant barrier identified by the researchers was the inadequate skills of teachers to effectively teach in a multilingual environment. To address this, they recommend that teachers leverage learner's linguistic repertoires to facilitate discussions and enhance understanding. Karpava (2022) also concurs and adds that multilingualism promotes inclusive education, equity, and equality in instructional strategies, methodologies, classroom management, and resources, all of which can enhance science education.

Similarly, Jakobsson and Kouns (2023) explored the benefits of small-group science work for improving the subject language and meaning-making among multilingual learners in primary schools through language-oriented activities. The study, conducted in two public primary schools in an urban area of Southern Sweden, involved learners in grades 4-6 (ages 10–12) whose home languages differed from the language of instruction. They gathered data using audio and video recordings, field notes, images of learner's written work, and various instructional resources. The researchers emphasised that dialogical settings are essential for helping learners articulate their scientific ideas and thoughts clearly. This then suggests that incorporating learner's linguistic repertoires in science classrooms is vital, particularly for multilingual learners.

Carbonara, Scibetta, and Torregrossa (2024) examined two groups of emergent bilingual learners from immigrant families who attended an Italian public primary school in the fourth and fifth grades. They found that exposure to multilingual pedagogies necessitates the use of more mental state terminology in their narratives compared to monoglossic pedagogies. The qualitative analysis of the narratives showed a dynamic relationship between the languages spoken at home and school highlighting how multilingual pedagogies enhance the literacy skills of emergent bilinguals by enabling them to utilise a broader range of abilities from all the languages they speak.

Beside multilingualism being effective in other continents, we also see its positive effects in Africa as highlighted in a study conducted by Ojoo and Moyi (2022) in Nigeria. Data was collected from 36 public primary schools in two geopolitical zones-North-east and North-west-with at least 30 randomly selected learners. Using a case study research approach and guided by the theoretical framework of the Sapir-Whorf hypothesis, which asserts that different languages influence thought processes, the researchers used questionnaires, oral interviews, and casual interactions to gather information. The study revealed that speaking multiple

languages is a natural means for individuals to communicate, think, and express themselves within their communities thus offers numerous emancipatory opportunities. This suggests that embracing multilingualism has the potential to transform the learners' experiences, allowing them to express themselves more freely.

To better understand how teachers and learners navigate the dual language reality of a rural Kenyan fourth-grade classroom, as well as the monolingual instructional regulations, Kiramba (2019) employed sociocultural theories of language development. He emphasised the importance of sociocultural factors in communicative activities and noted that learners' communicative repertoires must be utilised to create meaning within the context of foreign language training. During science classes, audio recordings and observations of communicative practices were conducted. The study's results revealed how the science teacher used heteroglossic methods to enhance learner's literacy access and improve their understanding of both language and subject matter. Kiramba argued that both the teacher and the learners preferred a more flexible use of language to comprehend their multilingual environment, rather than adhering to a monolingual perspective dictated by the language policy. Therefore, using heteroglossic practices in multilingual classrooms alleviates the cognitive burden for English language learners when acquiring a second language. This underscores the importance of validating fluid language practices in multilingual settings to facilitate language learning and prepare teachers for a diverse linguistic environment.

In a transformative emancipatory paradigm, a case study was conducted involving twenty fifth-grade science and technology learners at a rural primary school in Gutu, Zimbabwe by Charamba (2021a). Three learner-written examinations demonstrated the critical role of multilingual practices in evaluations, particularly in science and technology classrooms that cater to multilingual learners. Charamba strongly argues that teachers need to know and understand the connections between language and assessments, as this understanding enhances learner's performance in science. This is echoed by Nyamayedenga (2022) in his qualitative study in Zimbabwe and adds that when multilingual pedagogies are used, learners become proficient communicators and effective collaborators, making it an excellent approach to employ as a resource in a multilingual classroom. Cognisant of the fact that the current classrooms includes learners from Zimbabwe, this study is of paramount importance as it sheds light on how we can support Zimbabwean learners by allowing them to use their native languages.

It is clear that teachers play a crucial role in translating language rules into practice through their actions, which can either facilitate or obstruct classroom learning. In Norro's (2022) ethnographic study, he examined the activities of mainstream primary teachers in Namibia within a bilingual setting using focus groups, questionnaires, interviews, and classroom observations. The findings revealed that multilingual activities significantly supported learners' identity development and their acquisition of both language and content. This was achived through techniques such as peer translation, explaining concepts in learner's MTs, and using visual aids that allowed learners to articulate their thoughts in their MT. As previously mentioned, there are equivalent terms in South African languages, and teachers or peers often assist one another by translating. With the help of visual aids, learners could identify objects in their MT, which enable them to communicate effectively as others translate.

South Africa is often referred to as a "*rainbow nation*" due to its rich diversity, encompassing multiracial and multicultural populations. It is home to individuals from varoius backgrounds, religions, and languages (Wunseh & Charamba, 2023). In this context, McKinney (2022) highlights how language ideologies significantly influence and constrain the use of language as a resource for learning in multilingual or linguistically diverse classrooms. Despite the presence of multilingual learners, monoglossic practices were prevalent, based on her analysis of pedagogical practices in a grade 4 NS class at a primary school in Khayelisha. Her intervention aimed to help bilingual isiXhosa/English learners learn Science by enabling them to draw on various resources from their semiotic repertoires, thereby liberating them from restrictive language ideologies. McKinney's research demonstrates that instead of adhering to a single language code, both teachers and learners can make use of their full linguistic repertoires. They can achieve this by employing trans-semiotising strategies (McKinney & Tyler, 2019), which allow for the disinvention and reconstitution of language for learning Science, as well as fostering heteroglossia language policies.

In a similar vein, Sibanda (2019) defined lok'shin lingua as a dialect used by children in Kagiso, a multilingual township in South Africa, in their daily interactions. By conducting a qualitative study that involved interviews with parents and teachers at a primary school in Kagiso, he found significant disparities between the languages that learners used outside of school and the language of instruction within the school. From this study we are introduced to the complexities of language within the South African context. Lok'shin lingua is a blend of various languages

present in the township and has evolved into a predominant language of communication resulting from multilingualism in South Africa. This highlights the fact that MTs are becoming increasingly ambiguous and diluted due to both rural-urban migration and globalisation. This therefore calls for the recognition of all learners' linguistic repertoires without strictly naming or categorising languages. This study has enhanced my understanding of learners from townships, emphasising that education should focus not just on MTs but the language spoken within specific geographic locations. This approach will, indeed, help incorporate local languages in the area of the study.

Charamba and Nkomo (2022) examined the role of language in online learning, focusing on how multilingualism can be utilised as a teaching and learning resource by teachers in South Africa. They argue that the COVID-19 pandemic led to a rapid transition from contact classes to online learning, significantly deprived learners of essential physical support from teachers. This is particularly challenging for learners who were being taught in a language they did not fully understand, as they often required clear and straightforward explanation from their teachers and peers. The authors emphasise that embracing multilingualism represent a socially just approach that fosters academic excellence, embodies the spirit of *ubuntu* (oneness) (Makalela, 2019), and challenges dominant monolingual pedagogies that often exclude or marginalise learners. By embracing multilingualism, we encourage a sense of unity rooted in Africanism and incorporate the African mentality embedded within these languages.

Furthermore, Mavuru and Ramnarain (2020) carried out a qualitative case-study involving ninth-grade learners from three high schools in South Africa. The analysis of fifteen lesson observations and fifteen post-lesson teacher interviews revealed four major themes. Notably, while the findings aligned with previous studies, they underscore the challenges of that multilingualism in the classroom. Specifically, when teachers utilise learners' MTs in science lessons, they often encounter pedagogical difficulties. This shows that teachers possess a limited vocabulary in African languages for scientific concepts. As a result, this current study aimed to equip teachers with essential tools for effectively implementing multilingual or translingual pedagogies.

It is clear that multilingualism in education has become a significant global trend, influencing learners learning in various ways. This section has pointed out key findings related to multilingualism, revealing that learners often arrive in classrooms with limited proficiency in

the language of instruction and multilingualism can be beneficial, as it enables them to leverage their home language skills while acquiring the dominant language. Scholars have criticised schools that predominantly employ a language that differs from the learners' home language and argue that embracing multilingualism can foster creativity, social adaptation, and a greater appreciation for local languages. While this approach offers several advantages, it is crucial to balance language proficiency with other educational objectives, such as integration, and to adopt pedagogical strategies that cater to the diverse needs of learners as far as language is concerned.

2.5 Pedagogical translanguaging in multilingual classrooms.

Since the dawn of time, multilingual individuals have used various languages in their daily interactions (Charamba, 2021a). However, translanguaging gained traction in the 20th century when Williams and his colleagues explored effective methods for encouraging their learners to use two languages during an educational engagement. To express the process in which learners read or listen in one language, such as English, and then write about or express their understanding through another, such as isiZulu (in the South African context), or vice versa, they developed the term "*trawsieithu*". Later, Baker (2011) renamed this concept "*translanguaging*" to better reflect the fluidity of language use (Prada, 2021; Wei, 2024). For many scholars and educators, this marked a significant paradigm shift, moving away from traditional linguistic notions and challenging the idea of distinct, separate language systems.

According to García and Kleifgen (2020), translanguaging is a dynamic process in which multilingual individuals strategically use various semiotic resources to navigate complex social and cognitive tasks. This means that by employing multiple languages simultaneously, multilingual speakers can effectively address challenging social and cognitive issues. Ingram (2023) notea that speaking multiple languages enables individuals to shift between them as if they were part of a single cohesive language. Theoretically, translanguaging offers a unique viewpoint on bilingualism and multilingualism. Pontier and Deroo (2023) argues that, contrary to traditional beliefs, all language users—whether bilinguals or multilinguals—choose and employ specific features from a shared linguistic repertoire (Ndhlovana & Charamba, 2023b) to make sense of and navigate various communicative contexts. This suggests that teaching languages in a manner that recognises and leverages on learners' diverse and dynamic linguistic practices is referred to as translanguaging.

Translanguaging holds a linguist's belief that learning L2 never aims to make one forget their L1 (Wei & García, 2022). Instead, the goal is to become multilingual as opposed to transitioning to another monolingual language (Wei, 2018). A key feature of translanguaging is its focus on cognitive function and language production instead of just form, emphasising communication and practical use (Lewis, Jones, & Baker, 2012). It enhances the linguistic resources of both teachers and learners, facilitating knowledge production and problem-solving. Translanguaging necessitates a change in power dynamics between the teacher and the learner (Ingram, 2023).

Unlike code-switching, where languages act as separate entities, translanguaging views named languages- such as isiZulu, isiNdebele, isiXhosa, Afrikaans or English - as social fabrications that are an innate part of the language user. It differs from code-switching in that it is more inclusive and does not adhere to stereotypes associated to monolingualism that have marginalised bilinguals (García & Otheguy, 2020). To capture the distinctive character more accurately, translanguaging portrays the coherent language system within a language user as an idiolect or linguistic repertoire. In essence, translanguaging allows speakers to freely switch between languages and communicate in a more informal and relaxed manner without being constrained by linguistic boundaries. Additionally, it creates a comfortable space for the bilingual speakers to use language.

In defining translanguaging for this study, drawing from the above definitions, it is combining linguistic resources from multiple languages while minimising attention to the boundaries of named languages (Charamba, 2023). This approach integrates elements from each language through the fluid interaction in the classroom, enhancing communication. It allows learners to explore ideas, expand their knowledge, connect diverse concepts, and gain the confidence to speak up in front of others (Ndhlovana & Charamba, 2023b). Essentially, translanguaging makes use of all linguistic resources, allowing languages that were previously separated by linguistic and cultural barriers merge, thereby improving learner’s mastery of the topics (Makalela, 2019).

A body of research on translanguaging has increased exponentially in recent years (see for example: Ingram, 2023; Lemmi & Pérez, 2024; Ndhlovana & Charamba, 2023a; Paulsrud et al., 2021; Pontier & Deroo, 2023) with more evidence of successful classroom practices reported worldwide (sees for example: Charamba, 2020b; Lemmi & Pérez, 2024; Leonet & Saragueta, 2023; Spencer-Smith & Hardman, 2022). Following the emergent of such a concept,

the development of science literacy in English, which is the second language of more than 80% of learners and teachers in SA, also received the majority of attention. Bilingual learners' science achievement has been discussed at various levels, including adaptability in science teaching. Today's expanding multicultural learners body has led to new communication hurdles for both teachers and learners (Ndhlovana & Charamba, 2023b), calling for the use of instructional materials written in home languages and allowing translanguaging practices in the classroom in order to improve learners' performance (Dinh, 2023) in science tests. Translanguaging brings into focus experienced mutual intelligibility and classrooms as microcosms of social cohesion.

Pedagogical translanguaging is an instructional approach with multilingualism as its cornerstone (Driouch, 2022). It is useful in educational environments and aims to make learning easier by providing resources in several languages. Language production, efficient communication, the purpose of language, and the mental processes underlying language use are all topics covered by pedagogical translanguaging. It puts into reality the usage of a multilingual, multisemiotic, multisensory, multimodal resource that people in the classroom utilise to think and share their ideas. The instructor uses strategies that promote pupils using their entire language repertoire in a thoughtful and planned manner (Dhokotera & Makalela, 2022). Tai and Wong (2023) refer to this process as "*creating translanguaging spaces*."

There has been a plethora of studies where translanguaging pedagogies have been practiced in classroom settings to empower learning. Atta and Naqvi (2022) conducted an experimental intervention study in Pakistani where they used field notes from classroom observations, video recordings, and interviews with teachers and learners to gather data. The results showed that learners drew upon their linguistic repertoire to negotiate meaning, increase their awareness of metalanguage, and speak confidently in various contexts. This suggests that pedagogical translanguaging allows learners to connect their language skills and enhance their understanding (Iliescu-Gheorghiu, 2022), facilitating a more organic approach to using all available languages to support learning. Parkash et al. (2021) asserts and that translanguaging facilitates learners' acquisition of scientific content and emphasises that learners should be encouraged to collaborate and discuss in groups and or pairs.

Lemmi and Pérez (2024) noted that translanguaging happened naturally and reflected the multilingual microenvironment of Texas in fourth-grade science classrooms where the learners explored electrical circuits. Although Spanish served as the primary language of instruction,

translanguaging manifested in various ways throughout the lesson. This implies that translanguaging should be regarded as a significant contribution to science education, as it promotes learner participation and allows learners to ask for clarity on their misunderstandings which mitigates the frustrations in the science classrooms. Bringing this notion closer home, there is a high level of frustration in the science classrooms, and sometimes learners fail to articulate their thoughts in a language they are comfortable with, as this conflicts with the strictly enforced language policies in schools. The current study aimed to emancipate learners in that aspect so that learners could fully learn from each other and have their questions and misconceptions cleared.

Leonet and Saragueta (2023) explored the pedagogical validity of translanguaging through a qualitative study involving 72 primary school learners in Spain. Data was collected through observations and written responses of five open-ended questions. The findings revealed that learners found pedagogical translanguaging beneficial as it facilitated language comparison and provided scaffolding for understanding and foreign language learning. If this aspect is brought to the South African context, it is promising that learners could also benefit, given the diversity within the classrooms, where every learner has a potential to enhance their academic performance.

Similarly, Suárez (2020) conducted a study in the United States at Dexter, focusing on how a group of emergent bilingual primary school learners employed translanguaging while exploring electrical phenomena. He discovered that through problematising these phenomena and co-constructing knowledge with both the teacher and other learners, learners engaged in a variety of translanguaging activities captured on camera, supplemental audio recordings, and learner-made artifacts. This proved that the teacher's pedagogical choices and personal translanguaging practices provided learners with implicit cues about when and how to engage in translanguaging activities. This emphasises the necessity of moving away from instructional methods that impose discursive boundaries, which can hinder effective communication strategies for emerging bilingual learners in the scientific domain. This implies that for science learning environments to be equitable, they must welcome and value diverse languages and gestures, (Lu & So, 2023) allowing developing bilingual learners to use their entire semiotic repertoires for meaning-making.

In like manner, Nhongo and Tshotsho (2019) conducted a study in Zimbabwe where they collaborated with four secondary schools in Zimbabwe—two in Bulawayo and the other two

in the region of Matabeleland South—two urban and two rural. They explored translanguaging as a pedagogical strategy in science education in English L2 classroom contexts. Through interviews with eight teachers, they found that teachers consistently used translanguaging pedagogies despite the fact that they were ignorant of the differences between translanguaging and other teaching methods. The employment of translanguaging pedagogies in bilingual classroom settings enhances learners' conceptual comprehension and helps their cognitive development, as the article's conclusion emphasises.

In another study in Zimbabwe, Charamba (2020b) investigated the significance of language in the performance Grade 4 learners in Science and Technology. He employed a mixed-method approach with forty learners, randomly assigning them to the experimental group—who received translanguaging-informed intervention—and the control group—who received the conventional monolingual approach. Post-test results showed a statistically significant difference between the two research groups' academic achievement, indicating the effectiveness of translanguaging in science. He further states that translanguaging enhanced learners' understanding of scientific concepts and also promoted interaction in the classroom which echoes Nhongo and Tshotsho (2019) findings.

In Morocco, Driouch (2022) studied how translanguaging can be used as an inclusive strategy in early education with 39 learners aged between 3 and 6 and their 5 teachers. He concurred that translanguaging pedagogies triggered more learner participation than traditional monolingual pedagogies and it offered both teachers and learners opportunities to include better and construct learners' knowledge. Based on these findings, making use of every learner's language capacity in the classroom significantly helps to engage younger learners in class activities, increases participation, and enhances the enjoyment of learning activities.

Kganetso et al. (2023) recently examined two categories of informative texts that maintain culture written by grade 2 learners in Botswana. The researchers contend that writing experiences in the classroom, especially in Botswana's public schools, differ greatly from learners' real-world experiences; for this reason, they employed culturally relevant themes and gathered data using writing samples that were gathered for the pre- and post-assessments. In the post-assessment, many learners wrote their texts entirely in Setswana or with a code that mixed Setswana and English, despite the fact that English is the primary language of

instruction. This indicates that translanguaging can be an effective pedagogy that supports learners' comprehension and complete expression in writing.

Since South Africa is a rainbow nation with eleven official languages, the DoE (1997) acknowledged that most of the learners are bilingual (Ndhlovana & Charamba, 2023b). Schoeman et al. (2023) conducted an intriguing study on the impact of pedagogical translanguaging in a primary classroom at a private South African school. They discovered through design-based research that teachers used pedagogical translanguaging for epistemological, symbolic, and scaffolding purposes. They noted that though no direct academic benefit was achieved, learners' participation and confidence improved immensely, and teachers deemed pedagogical translanguaging appropriate to their context.

Furthermore, Hattingh et al. (2021) assert that pedagogical translanguaging increase opportunities for science learning and they prove this through the use of vignettes particularly the second and third where they present 2 different science classes one from Gauteng and the other from Eastern Cape. These vignettes serve as examples of how language practices of learners in small groups facilitate the efficient use of linguistic resources for discussion of scientific ideas. They also assert, based on their observations, that the use of translanguaging techniques in teacher-led whole-class discussions encourage learners to create meaning and supports learning across the mode continuum. Finally, they emphasise how learners might strengthen their conceptual understandings through written translation tasks.

Another recent study carried out by Charamba (2022a) in a sixth-grade NS classroom at a primary school in the Free State province, South Africa reveals that translanguaging plays a key role in necessitating academic achievement. Through a mixed method approach where in depth interviews were carried out and learners got to write pre and post-test, the study reveals that using translanguaging pedagogies allowed the teacher and learners to extend meaning beyond the English language that was used in the classroom. In line with the findings above, the study also proved that translanguaging has a variety of instructional uses and advantages especially to learners as they get to benefit more, not just in discussions but application of concepts in tests which boost their achievement and self-esteem. This study brings to our attention that translanguaging pedagogy is not only concerned with the cognitive development or interrelations between third and fourth parties, but it also proves to be concerned with the intrinsic aspect of learners which is their self-esteem and how they perceive themselves. This

is such a holistic pedagogy that could result holistic citizens in the future who are not bound by the colonial mentality as argued to by Ndhlovu and Makalela (2021) but have been fully emancipated and empowered to be the best they can be.

2.6 Translanguaging for inclusive and decolonisation education in South Africa

South Africa, a multilingual nation, has faced significant language barriers stemming from apartheid legislation. According to Maseko (2014) this is particularly evident in the language used within educational institutions and has roots in the country's colonial past. In pre-colonial era, education was imparted in the mother tongue and was integrated into the socialisation of youth in order to create capable and accountable adults (Ndhlovu & Makalela, 2021). This educational approach introduced learners to a wide range of social, cultural, economic, linguistic, and other foundational knowledge traditions. As the main method of knowledge transfer, language proficiency was crucial for enabling this socialisation process.

In 1910, colonial domination led to the enforcement of English as a cultured language due to the prevalent asymmetrical power relations and the language's prestige in it being a European language. Following this directive, the Afrikaners gained the right to an education in Afrikaans in 1925. Thirty years later, the colonial administration enacted a policy mandating a 50/50 split between Afrikaans and English instruction (Maseko, 2014). Since then, both English and Afrikaans have remained the preferred languages in education, despite the decision to mandate Afrikaans as the primary language of instruction in South African schools in 1976. This decision triggered massive youth riots, during which 176 students were killed, and over 1000 were injured due to the harsh suppression of the riots (Simpson, 2021). Nearly 50 years later, these two languages still dominate, and all the efforts for linguistic emancipation seem forgotten. Cognisance of the fact that from grade R through 3, learners in some schools are taught in their MT in addition to English or Afrikaans (Ndhlovana & Charamba, 2023b), most learners residing in Johannesburg miss out on such privileges and are faced with the harsh conditions of monolingual pedagogies. Carrim and Nkomo (2023) also contend and adds that less time is allocated to teach English first additional language in foundation phase.

There is a profound influence of translanguaging in igniting the pedagogical capabilities of educators. In the quest to decolonise education, the use of multiple languages can spark new insights and deepen learning experiences of learners particularly those in multilingual communities (Charamba, 2021a). In this respect, Rafi and Morgan (2022) share the same

sentiments as other scholars that translanguaging is particularly useful in a context where there are multiple languages in a classroom. They discovered that translanguaging promotes a more learner-centered approach that develops skills necessary to assess the appropriateness of content. They further highlight that teachers need to be provided pedagogies required to enable active involvement, thus, translanguaging in their context allowed teachers to establish a more welcoming and stimulating learning atmosphere.

Furthermore, in a recent study conducted by Ponzio and Deroo (2023) on the influence of translanguaging pedagogies in an online course at an institution in Midwest U.S., they found that translanguaging enables multilingual speakers to use various discursive methods to create a single meaning and it views a person's linguistic repertoire as an interconnected system that is constantly changing as they engage in different contexts. This insinuates that translanguaging enables intentional use of the learners' linguistic repertoire in an integrated form for communication and learning purposes. Therefore, by embracing translanguaging, the researcher believe that even South African teachers can foster stronger relationships with learners and linguistically emancipate them, facilitating a more effective transfer of knowledge.

Based on the study conducted by McKinney (2022), the right of learners to use their entire linguistic repertoire is threatened by the continued use of monolingual instructional practices decades after democracy. Charamba (2021b) further accentuates this notion by highlighting that since 1994, the decolonisation of education has been a divisive topic in South African history. The 2015 learners' protests, which went under the hashtags #RhodesMustFall and #FeesMustFall, have only served to intensify this debate. During these demonstrations, university students demanded a shift in the curriculum from a colonial to an Africanised one, as well as an acknowledgement of the value of their languages and cultures in all higher education institutions (Becker, 2020). According to a study by Sefotho (2022), the separatist viewpoint is no longer relevant for language instruction and the advancement of literacy in the twenty-first century. He shows how confluent, fluid, and porous languages have become, which clarifies how the notion of translanguaging fits in to explain complex multilingual encounters and decolonise the prevailing imbalances causing poor performance of learners in science.

Clearly, translanguaging holds immense potential for fostering inclusive and decolonised education in South African primary schools. It acknowledges that learners bring their entire linguistic repertoire to the classroom, including home languages, dialects, and English. This form of education practice as advocated by Omidire and Ayob (2022) embraces diversity,

allowing learners to use their languages as valuable resources for learning. It also encourages teachers to create a language-rich environment where learners can freely switch between languages, promoting meaning-making by allowing learners to draw on their linguistic resources to understand concepts. Lastly as argued by the scholars above, translanguaging aligns with decolonisation efforts by valuing local languages and cultural identities, empowering learners by validating their linguistic heritage and promoting a sense of belonging.

2.7 Chapter summary

Achievement in science is closely linked to various learner characteristics. The above research indicates that academic performance is negatively affected by the mismatch between learner's home language and the school's language of instruction, particularly in primary NS classes. This language barrier can hinder learners' understanding of fundamental scientific concepts in primary school, which subsequently impacts their performance in high school and even at the university level. Therefore, NS teacher in the modern era should recognise the diversity of their learners and strive to accommodate all languages and cultures in their teaching. The reviewed research shows that monolingual ideas and practices are inefficient in today's heterogeneous educational settings. This is due to the fact that monolingual environments do not offer the kind of stimulating learning environments that multilingual learners require in order to achieve high academic standards. It also points out some of the tools that are used in the classrooms like dictionaries which are too monoglossic and fail to scaffold learners in a meaningful manner.

Given the issues of the 21st century demand that citizens be knowledgeable about science, it is critical that all learners studying natural science in the classroom have the greatest possible understanding of scientific principles. One of the primary reasons for poorer academic achievement in natural science is a lack of optimal exposure to and acquisition of the language of instruction. Teachers are consequently urged to develop pedagogies, activities, and materials that illustrate multilingualism in order to provide learners with the skills they need to succeed in NS and demonstrate the transformational power of translanguaging. This study therefore aimed at equipping learners with the necessary skills needed to prevail in the 21st century.

2.8 Conclusion

In South African multilingual classrooms, multilingualism has become the norm. This implies that translanguaging must be promoted more widely in an unstructured or structured way. The previously mentioned research indicates that translanguaging has a far higher success rate than

individual language involvement. According to Tai and Wong (2023) translanguaging as a transformational pedagogy aims to provide alternative educational models to those that stigmatise and exclude minority languages from learners' real-world experiences. This demonstrates how important language is for conceptualisation and scientific problem-solving abilities, particularly in the primary grades when learners are first exposed to abstract scientific ideas. By analysing the connection between learners' academic performance and the language of instruction in primary NS classes, the current study hoped to further the body of research in this area. It particularly tested the transformative power of translanguaging in a language saturated area of Johannesburg and in turn empower multilingual learners in a NS classroom.

Conclusively, from the extensive literature reviewed globally on relevant and current studies on the transformative power of translanguaging, in a classroom diverse learners, teachers should aim to improve academic attainment by fostering an environment that supports learners' needs for effective communication and learning. One strategy to ensure that the environments are designed with the multifaceted process of language development and the various cultural backgrounds of each learner in mind is to integrate the learners' native language into science teaching. Reviewing these existing studies provided a better understanding of the underlying issues related to low levels of literacy in South Africa as well as how translanguaging can be used to help develop critical thinking skills required in intermediate phase NS classrooms. Concerns regarding the language of instruction in the educational system are prevalent in the research, which suggests that pedagogical practices need to be altered and more training for teachers needs to be done.

As highlighted in the problem statement, there is a dilemma in South African classrooms particularly in Johannesburg where science teachers are faced with linguistically diverse classrooms and learners struggle to grasp the concepts as a result of language barriers. Thus, by adopting these theoretical frameworks. The study aimed to incorporate a holistic approach this problem where the solution does not lie with the teacher not the students but the community at large where families are involved, and learners' prior knowledge and home languages are incorporated in the meaning making of learners.

The research design and methodology will be covered in the following chapter. This covers the methodology that was used for collecting and analysing data, the sample strategies employed, and the study ethics statement.

CHAPTER 3: METHODOLOGY AND RESEARCH DESIGN

The previous chapter which was on literature review thoroughly analysed previous scholarly works and research findings related to the main topics that are in relation to the study. It established connections between the research problem under investigation and existing knowledge, provided a critical synthesis of current knowledge, and identified gaps in the literature that need to be addressed. Chapter 2 compiled information from a variety of sources, including books, journals, and government legislation. The researcher outlines the methodologies and research strategy used in this study in this chapter. It should be noted that this study used a mixed method approach, which means that both qualitative and quantitative techniques were used to collect data.

3.1 Introduction.

The objective of this chapter is to provide a critical assessment of the study's overall validity and dependability while outlining the precise processes or approaches that were utilised to identify, select, process, (Charamba, 2017) and evaluate material regarding the empowerment of multilingual learners through exploring the transformative potential of translanguaging in the learning and teaching of Natural Science (NS) in a Johannesburg grade 4 classroom. It responds to two key questions: How was the data collected or produced? How was it be examined?

In order to successfully accomplish the research objectives and respond to the research questions stated in the first chapter, the researcher begins by unpacking the philosophical underpinnings that informed the choice of the methodology by discussing the research's paradigm, research design, data collection techniques as well as the sampling methods used in this study. Thereafter, justifies the methodology supporting this study. Finally, outlines the data analysis techniques, study quality, and ethical considerations.

3.2 Research design

Research design, as was previously discussed in Chapter 1, refers to the decisions the researcher makes to achieve the goals of the study (Snyder, 2019). It is a strategy for choosing the participants, collecting and analysing data that helps answer the research topic (McMillan, 2010). According to Kumar et al. (2019), a research design outlines precisely who was examined, when they were investigated, where they were studied, and under what conditions. It also serves as a method for addressing the research objectives of the study utilising empirical

data. The ultimate objective of this research was to produce findings that can be regarded as reasonable, dependable, and accurate (McMillan & Schumacher, 2010) thus, the study was designed using a sequential explanatory methodology, this started with the collecting and examination of quantitative data, proceeded to the gathering and examination of qualitative data, and ended with an interpretation (Walker & Baxter, 2019). This design was chosen because it was a causal research design that helped the researcher investigate the patterns and trends in the significance of language in the overall performance of grade 4 learners in the NS classroom. Following this design, the triangulation methodology was used in accordance with this design.

Triangulation was the most optimal method for investigating elements linked to merging language instruction and NS teaching. McMillan and Schumacher (2010) define the triangulation technique as a method in which data is presented numerically and analysed verbally and statistically. This involved having different dimensions to which language was viewed (Yuvayapan, 2019). The data collected during this study was both qualitative (interviews with teachers, learners, and parents) and quantitative (from 3 tests which are the NS pre-test, English proficiency test, and the NS post-test). The interviews gave researchers the chance to learn more about how participants viewed their place in this situation (Hamilton & Finley, 2019). In this research design section, the following will be discussed: research paradigm, methodology, strategy and the research intervention.

3.3 Research paradigm

The term paradigm has its etiology in a Greeks word that means pattern. A paradigm is a philosophical perspective, according to Kuhn (1962), and it is mainly used to characterise the worldviews of the researcher (Polkinghorne & Given, 2021) in educational research. This implies that the research paradigm was the perspective or set of widely held beliefs that directed the interpretation or meaning making of research findings. Stated differently, a paradigm is the conceptual framework that researchers employ to evaluate the methodological aspects of their investigations (Galante, 2020) and select the methods employed for conducting the study, collecting the data, and doing the analysis.

The current research adopted the pragmatism (mixed methods) paradigm to generate responses from the participants at a grade 4 classroom in Johannesburg on the significance of language in the learning and teaching of NS. Mixed methods is according to Ivankova et al. (2006) an

approach that incorporates both qualitative and quantitative data collection and analysis with the sole goal to deeply understand the research phenomena. This paradigm was crucial to this research endeavour because it established beliefs and guidelines that determined how multilingual learners would be empowered through exploring the transformative potential of translanguaging in the teaching and learning of NS and how the results of the study should be understood (Anand et al., 2020). The choice of this paradigm emanated from the fact that the current study sought to incorporate pragmatic judgments based on what would work best in order to provide solutions to the research topics examined and the gathering of both quantitative and qualitative data was used to accomplish this.

Gathering both quantitative and qualitative data helps mitigate the drawbacks of each type of data (Charamba, 2020c) thus the pragmatic research paradigm was pertinent to the current study. This enabled the researcher to incorporate both objective and subjective viewpoints during the data collecting and analysis process. Additionally, the pragmatism paradigm was ideal for the current study because it created a thorough evaluation and interpretation of the study's results and helped in drawing conclusions (Charamba, 2017). This most certainly provided the study findings more credibility and validity, painted a clearer picture of the research challenge, and gave the researcher the opportunity to examine other approaches to comprehending the problem.

3.4 Research methodology

In order to exhaustively answer the research questions, a mixed method approach was used in order to both identify existing learner, teacher and parental language ideologies and gain a more in-depth understanding of the relationship between language and academic performance. The mixed method approach used both numbers and words (Creswell, 2021). The researcher chose the mixed method approach because it allowed them to gain more comprehensive understanding of the topic and since both quantitative and qualitative research methodologies have weaknesses, it necessitated balance between the two and ensued that both designs complemented each other (Toyon, 2021). The researcher was able to both qualitatively comprehend complicated occurrences and provide a basic statistical analysis, chart, and numerical explanation for the phenomena. It enabled the researcher to assess the effectiveness of the intervention while at the same time observing the way in which the teacher and learners used language in understanding scientific concepts during lessons.

The mixed method approach was a beneficial strategy because it counteracted the drawbacks of both quantitative and qualitative approaches. While qualitative research may contain biases and is less amenable to statistical analysis and generalisation, quantitative research lacks a knowledge of the context or situation in which data is obtained (Creswell, 2021). In investigating the transformative potential of translanguaging in the grade 4 NS classroom, the researcher was able to validate the findings provided by each approach through evidence produced by the other approach. As suggested by Mallawarachchi and Dharmarathna (2022), the design offered the strength of statistical results drawn from quantitative data analyses, along with deep structure explanatory descriptions that were drawn from qualitative analyses.

The quantitative phase during this research explored the relationships between language use and academic performance and the sequential steps to be followed (Mallawarachchi & Dharmarathna, 2022). Quantitative data consisted of closed-ended information that was statistically evaluated to produce a numerical representation, whereas qualitative data was more subjective and open-ended, enabling the interpretation of observations and the voice of the participants to be heard (Toyon, 2021). This allowed the researcher to collect a wide range of data through interviews, observations and even the notion of phenomenology where they got to understand and describe the lived experience of the participants. The researcher also explored how teachers and learners make sense of the world around them in turn uncovering the essence of language in the classroom. In-depth interviews were also used and they provided rich descriptions and subjective experiences and perspectives of all parties which helped to empower the learners.

3.4.1 Research strategy

In order to get results, the sequential explanatory design made it possible for both designs explained above to be gathered and analysed in two phases (Ivankova et al., 2006). The triangulation method, which the researcher used involved presenting data as numbers and analysing it using words and statistics (McMillan & Schumacher, 2010). The researcher then observed the problem from several angles, which took into account the various participants, data gathering techniques, and theoretical triangulation (Gay, 2010).

In order to prevent biases and errors, the researcher investigated all facets of the potential role that language may have in the academic achievement of Grade 4 NS learners. The first step of this study was to identify learners' proficiency in the English language through the English

Proficiency Test. The English proficiency test consisted of 15 multiple choice questions written by all learners (N=40) in approximately 20 minutes. This helped the researcher know the effectiveness of language learning and identified areas where learners needed additionally support. All learners were English second language learners and had a home language different from the language of instruction. The English proficiency was given in English as it was the medium of instruction learners were used to.

After the English proficiency test, all learners wrote the pre-test under the same conditions (written in English) in order to assess their NS knowledge on the topic before starting with the intervention. It also helped the researcher understand the baseline (which is the starting point or initial level of their knowledge) and tailored the learning experience. The pre-test was written in the school's medium of instruction (English only). Lastly, learners wrote the post-test as the researcher wanted to assess the effectiveness of the intervention and reveal the transformative potential of translanguaging. It is important to note that the post- test was in isiZulu or isiXhosa as well as English for the experimental group and solely in English for the control group.

Both tests that is the pre- and post-test had fifteen multiple choice questions with four possible answers per question and the duration of each test was 30 minutes. This is because the researcher intended to test learners' mastery of the content that was taught during the study. Questions for the test were derived from the topic Matter and materials in grade 4 (DBE, National Curriculum Statement CAPS Grades 4-6 NS and Technology, 2011). Learners were required to choose the most appropriate answer and circle the corresponding letter, for example: 3. C.

The second portion of the study consisted of face-to-face interviews with randomly selected learners from the experimental group, aimed at contextualising the results of the test and understanding how and why learners' language beliefs do or do not shape their academic performances. The interviews were extended to the teachers and parents in order to get their opinions and sentiments regarding the use of their home language in the learning and teaching of NS. The interview questions were asked in English and the researcher permitted learners, the teacher and parents to respond in a language they were comfortable in order to get a holistic response that was fully articulated. This helped the researcher compare the learners' answers from the interview with how they performed on the three tests. In order to study the essence of

a lived experience among chosen participants, how it was experienced, and the meanings that the participants (interviewees) attach to the experience, the researcher employed the phenomenological interview design technique for these interviews (McMillan & Schumacher, 2010). Cohen, Manion, and Morrison (2017) define phenomenological interviews as a type of open-ended, standardised qualitative interviewing. The specific questions to be asked during the interviews were decided by the researcher (McMillan & Schumacher, 2010), and they were fully open-ended (Creswell, 2021).

Interviewee responses were based on the same material, the questions were asked in the same way and in the same order, especially for learners and parents, which also made response analysis easier. Only members of the experimental group were interviewed since they were the ones receiving the intervention. Of the 20 learners in the experimental group, 10 were randomly selected to have a single, in-depth interview with the researcher; these interviews lasted roughly five to ten minutes each. With the learner's consent, the responses were tape recorded to guarantee the completeness of the verbal exchange and to offer information for reliability assessments (McMillan & Schumacher, 2010).

As previously mentioned, one group (the experimental group) in this study got the intervention in the form of home language lessons from the teacher and through group discussions during the lesson. The researcher assessed the success of the intervention based on how well the experimental group did in the post-test in comparison to the control group. The mixed method design enabled the researcher to combine the strengths of both traditional designs that is the qualitative and quantitative to get a holistic analysis.

In essence, empirical data was collected through giving all participating learners firstly an English proficiency test in order to measure the language proficiency, then a pre-test to measure their prior knowledge and lastly a post-tests that was divided into two: 1) using multilingual language alongside English and 2) in English (the tests had the same questions but different languages). Thereafter there were interviews with the learners, the teacher and the parents.

3.4.2 Intervention

To get reliable results on the effect of the intervention the researcher had learners divided into two classes, one that acted as the control group and the other that were beneficiaries of the intervention. For all learners in the experimental group that had translanguaging pedagogies,

the teacher taught them in isiZulu or isiXhosa alongside English and during the lesson they were divided into small groups based on their mother tongue or first language and given activities where they discussed in their languages and helped each other understand the scientific concepts. After the discussions they did reflections of what they had discussed in English in order to allow all learners in the class to understand. The researcher anticipated transliteration hence the researcher and or the teacher would step in to make the corrections and alterations on the language grammar to help other learners.

With this type of strategy, the dependent variable (academic performance) was measured first before the intervention was implemented and again after it was implemented. In the current study, participants were given a pre-test first, followed by the intervention for the experimental group and then a post-test at the end of the study as discussed above. Both groups wrote the same tests under the same conditions except that in the post test, the experimental group had it in multiple languages.

The learners were purposively sampled based on their home language. This was because, upon arrival to the school, the researcher found that though there were multiple languages in the classroom, most learners understood isiZulu and or isiXhosa hence those were the preferred languages. The two classes that took part in the current study were both taught NS by the same teacher who happened to share the same home language with some of these learners as it is a multiracial school. Consequently, these conditions improve the internal validity of the research since some of the confounding variables such as different teaching methods of the teachers, more motivated or gifted learners being in the same class, or different classroom environments are obliterated (Cohen et al., 2017).

In order to avoid the control group accessing the intervention multilingual learning materials given to the experimental group, the researcher and teacher made sure that learners in the experimental group did not take any of the materials outside of the classroom. Also, the two groups were taught one after the other ensuring limited interaction between the two groups. To collect qualitative data, during the intervention phase the researcher observed and recorded instances during which the participants were translanguaging. This was when the teacher was teaching, the discussion that learners had, as well as the presentations that were done. This was done through ethnography strategy, a situation in which the researcher immersed herself among the participants to observe their interactions up close (Pole & Morrison, 2003).

The researcher also documented any cases of challenges faced by the participants and the strategies used by the teacher in the implementation of translanguaging in the grade 4 NS classroom. At the end of the intervention phase all participants in both groups wrote the same post-test but with different affordance in terms of language. The control group had an English only test, while the experimental group had isiZulu or isiXhosa alongside English. The essence of the post- test was to compare the academic performance of participants from the two groups in order to evaluate the efficacy of the intervention.

3.5 Site, Population and Sampling

Presented below is the site, the population and the sampling techniques used in the study.

3.5.1 Site

Cohen et al. (2017) states that understanding the specific context in which a study takes place is crucial for appreciating its depth and implications. The study was carried out in a primary school located at Yeoville, a suburb in the inner city of Johannesburg in the province of Gauteng, South Africa. Yeoville is a small suburb widely known and celebrated for its diverse, pan-African population. It consists of a number of schools from elementary to high schools and serves approximately 1100 learners. Yeoville has faced challenges typical of inner-city areas and so have most schools around the area and these problems include overpopulation and a lack of adequate resources.

The school attracts learners from the surrounding community that is made up of multiracial, multinational and multicultural members. Though some learners are native South African learners, the schools enrols some learners who come from neighbouring countries like the Democratic Republic of Congo, Zimbabwe, Mozambique and other African states. The home language of most of the learners is different from the language of instruction which is English and ranges from the official South African languages to other African languages for example, isiShona, isiNdebele, Lingala, Chewa etc. This influx is due mostly to the geographical location of the school which attracts international learners as parents come from different countries to find refuge in Johannesburg.

As a result of this interculture combined with the often-unrealistic expectations of parents for their children's acquisition of English, this has left many Yeoville educators wondering how to mesh these families' linguistic and cultural goals with the demands of education standards,

assessments, and policies. The common belief among administrators and teachers is that, regardless of these families' linguistic backgrounds the school's main charge is to socialise learners into a "*typical*" South African classroom context, which includes acquisition of grade-level content and socioemotional skills.

Gauteng province, particularly in the city of Johannesburg was preferred for this study since the province has shown much resilience and maintained 'good' results. However, a few learners in the province score above 50% hence this transformative pedagogy might enhance their academic performance. The Gauteng province largely has a lot of potential and a lot of resources at its disposal that need to be unlocked. Furthermore, the urban school was considered for the study because the school seldom perform to their maximum capability according to the annual national assessment reports (see DBE, 2014) and need more support to enhance and advance quality education.

A noteworthy characteristic of the educational journey of the learners at these schools in the inner city is the introduction of English only as the primary medium of learning and teaching in Grade R or 1. This sudden linguistic emersion presents both challenges and opportunities in the educational paradigm, as learners must navigate the complexities of learning in a language that was previously unfamiliar to them. As the school consists of black African learners who are not exposed to English in their communities.

3.5.2 Population

A population according to Polkinghorne and Given (2021) is described as a particular group of people living in a specific area or region. Put differently it is a subset of the target population from which the study sample is chosen (Charamba, 2017). The target population for this current study were Grade 4 NS learners whose home language was different from the language of instruction at the school. In South Africa grade 4 is the first grade in the intermediate phase. The participants were 40 grade 4 learners at the school aged approximately 10 years and the study included all genders. Defining the population enables the researcher to establish boundary conditions that specify who should be included in the study (Gay, 2010).

3.5.3 Sampling

According to Khan (2014), qualitative sampling is selecting information-rich cases for study when one wants to understand something about those cases without needing or desiring to

generalise to all such cases. This is done to increase the utility of information obtained from small samples (Gay, 2010). In this research Grade 4 learners were preferred because they are a critical and probably the most challenging phase in education to non-English-speaking learners in South Africa according to Mgijima and Makalela (2021).

In order to divide them into two groups that is the experimental and control group, homogenous purposive sampling was used. Homogenous purposive sampling as defined by Campbell et al. (2020) is a non-probabilistic technique commonly used in qualitative research, and seeks to produce a homogeneous sample, one whose units (people) have the same or nearly same qualities or traits . In this study it was learners with the same or similar home language. The researcher deliberately chose participants based on specific home languages that is isiZulu and or isiXhosa to be in the experimental group and other language speakers were allocated to the control group. This method was chosen because the research question was specific to the traits of the particular group of interest that was being studied.

As argued by McMillan and Schumacher (2010), the strength and logic of qualitative sampling lies in the fact that a small number of carefully examined cases can reveal a great deal about a subject, as opposed to probability sampling, which relies on choosing a random or statistically representative sample to allow for generalisation to a larger population. Therefore, the current study considered all grade 4 NS learners in the selected school whose home language was not English, the schools' language of instruction. The researcher also considered their teacher and parents to get an in depth of the lived experiences of the learners. This was appropriate population for the present study and the essence of defining the population was to put the researcher in a position to establish boundary conditions that outline who should be included in the study (Campbell et al., 2020).

Since this study was exploratory and aimed to gather preliminary data on the transformative potential of translanguaging in a science classroom, it considered a relatively small sample size which allowed for in-depth examination of the phenomenon (McMillan & Schumacher, 2010). This also enabled in-depth insights into participants' experiences, perspectives, and language use in the science classroom allowing for a richer understanding of the transformative potential of translanguaging, despite the smaller sample size. Additionally, the study took place in a controlled environment, where the science instruction and language use can be carefully managed and observed. This control allowed for a more precise examination of the relationship

between language and academic performance. With 40 learners, the researchers wanted rich and detailed data, allowing for a comprehensive understanding of the transformative potential of translanguaging.

For the interviews only 10 learner participants were chosen from the 40 learners participating in the whole study. Only 10 learners were chosen because the researcher wanted to find out the perspective of the learners who got the intervention and the sample size of 20 learners was too big to interview all the learners. The 10 learners were chosen using random sampling focusing on the experimental group only. Random sampling for the interviews was preferred to minimise biases on the learners' experiences of the intervention.

The teacher was also asked to participate in the interviews to get her experience of how the intervention was and to give insight on the pedagogical benefits or struggles they might have encountered if any. Additionally, parents were also included in the interviews to get a deeper understanding of the linguistic nature of their home and their insights as far as language learning is concerned especially in science education. The inclusion criteria for parents/guardians was based solely on their willingness to participate as well as their availability. Only 4 parents/guardians were available for the interviews, and they shared some insights that was used in the analysis of the study.

3.6 Data collection and analysis

Presented below is the data collection and analysis processes that was adopted in the study.

3.6.1 Data collection

Since this study adopted the mixed-method design, the data was collected through both quantitative and qualitative approaches. These incorporated three written tests (the English proficiency test, NS pre-test as well as a post-test), interviews and classroom observations.

Quantitative data

The quantitative data for this study came from the three written tests. The first test was the English language proficiency test that was written by all 40 participating learners in the Grade 4 class. This test was aimed at understanding the English proficiency of the learners which was going to be helpful in the analysis of the NS tests and the role language plays in the academic performance of the learners. The English proficiency test was also aimed to understanding the

basic reading capability of learners and English grammar. The researcher also developed the pre- and post-tests in consultation with the NS teacher at the school under study. The researcher asked the Head of NS department at the school to moderate the tests for reliability and validity checks. The tests were administered to a group of learners of same educational level that is Grade 4 learners.

The pre-test was written in the school's language of instruction (English)for all learner participants. The post-test was in isiZulu and or isiXhosa as well as in English for the experimental group and it was in English only for the control group. Each test had 15 multiple choice questions with 4 possible answers per question and the duration of each test was 30 minutes. This is because the researcher intended to test learners' mastery of the content that was taught during the study. Questions for the test were derived from the topic Matter and materials in grade 4 (NCS, CAPS Grades 4-6 Natural Sciences and Technology, 2011). Learners were required to choose the most appropriate answer and write the corresponding letter, for example: 3. C.

Qualitative data

Qualitative data was gathered through interviewing a selection of the participants and classroom observations. Semi-structured interviews were conducted in both English and in rare cases the learners' home language to enhance understanding of the question to the learner, teacher or parent. Ten learners in the experimental group that is participants who got lessons in their home language alongside English were randomly selected for interviews. This was done to get more specific information about the likely causes of the difference in their academic achievements between the two exams if there were any and to gather their perspectives on the intervention method. Despite the potential influence of moods and emotions leading to biases in qualitative research, it offered invaluable insights into participants' lived experiences and perceptions.

The researcher also interviewed the parents and the teacher to get a holistic response. This was done by developing and following a clear interview protocol. To ensure transparency the researcher used open-ended questions to encourage participant responses, avoided leading questions or biased language and took detailed notes or recordings (with participant consent) having ensured that participants understood why they were being interviewed and that they could also ask questions. Parents offered insights on how they help develop the proficiency of

the learner's home language and how often they use it at home. Their participation depended on availability. The teachers on the other hand gave insights on their experience with teaching using translanguaging pedagogies. This gave the researcher a better comprehension of the findings. Each respondent was asked about 5 questions with each interview session lasting about 5 to 10 minutes. During the interview, the researcher asked the interviewee's permission to write down their response and tape-record concurrently in order to capture the data accurately for analytical purposes.

In addition to interviews, the research method incorporated observations to further enrich the qualitative data. The study involved observing the two groups of learners- the experimental group and the control group, during their NS lessons. Each day consisted of two to three NS lessons, depending on the day's schedule. The observations aimed to identify and understand potential language-related challenges, behavioural patterns, and overall classroom dynamics. The researcher focused on occurrences such as the frequency of behavioural infractions, expressions of confusion, disengagement, or zoning-out during lessons. This approach not only helped identify relationships with informants but also guided the formulation of appropriate questions for subsequent interviews.

Furthermore, the research delved into assessing teacher competency in delivering content in translanguaging pedagogies, shedding light on whether language of instruction or teaching proficiency posed potential challenges in the NS classroom. Simultaneously, the researcher keenly observed and documented learner attitudes in both classrooms, recognising their potential impact on the overall learning environment. The chosen topics of Matter and Material served as specific points of focus during these observations, allowing for a nuanced examination of the teaching and learning dynamics in both settings. Journal entries were meticulously crafted, providing a detailed and reflective record of observed behaviours, challenges, and interactions within the multilingual and monolingual educational contexts

3.6.2 Data Analysis

The procedure of examining, cleansing, converting, and elucidating the collected data, with the objective of unearthing valuable insights informed the methodological framework for data analysis in this investigation. Both qualitative coding techniques and quantitative statistical methodologies were utilised to meticulously analyse the data in a comprehensive manner.

The research employed statistical approaches to juxtapose the outcomes between the control and experimental groups, thereby providing a quantitative framework for evaluating the effects of tools and resources on the learning experience. To guarantee a thorough and rigorous analysis, a data triangulation framework was employed. This framework entailed the distinct collection, examination, and interpretation of both qualitative and quantitative data, which were subsequently integrated to facilitate a comparison and validation of findings from both methodological perspectives. The justification for this strategy was to promote an objective assessment of the influence of tools and resources on the educational process, thereby ensuring a comprehensive comprehension of the study's conclusions.

Quantitative data analysis

Quantitative data for this study was analysed using R-computing. This is a software programming language commonly used in statistical computing, scientific and data analytics research. It is one of the most popular languages used by statisticians, data analysts and researchers to clean, retrieve, visualise, analyse, and present data (Creswell, 2021). The researcher chose this programming because it was an expressively syntax and easy-to-use interface. Descriptive statistics through univariate analysis were also used as the study sought to measure cause and effect to draw conclusion between two variables, language use being the independent variable and learners' epistemic access and academic performance being the dependent variable. Measures of central tendency namely the mean, median and mode and dispersion for each of the two tests were also calculated and analysed. These provided an overview of learners' academic performance and the comparison of the control group to the experimental group.

This analysis method was most suitable as the current study worked with numbers and helped to interpret the data collected accurately. The tests were written to test for understanding and to see how academic performance in science is linked to language. The researcher had a written record of the progress of the learners from both the control and experimental group English proficiency test till the post-test. Learners either scored one for every correct answer or zero for every incorrect answer, and every blank answer space was left open to indicate this. Thereafter, the researcher included an excel spreadsheet which was labelled 'Natural Science grade 4 test' since it was an efficient way to collect and identify where the common incorrect points were and where the common correct points were.

The researcher conducted a comparative analysis of frequencies, effect size indices, p-values, learning gains, and means derived from various assessments administered to the participating learners. This comprehensive examination entailed the development of a frequency distribution table to depict the incidence of each response per question (McMillan & Schumacher, 2010). This analysis facilitated a detailed exploration of the interrelationships and disparities among variables, thereby providing an in-depth understanding of the outcomes of the study. Employing this methodological approach enabled the researcher to juxtapose the two sets of results effectively. Additionally, the patterns observed from the assessments were documented to elucidate the prevalent errors made by learners during the examinations, which subsequently aided in pinpointing specific areas where the majority of learners struggled to comprehend the material, whether the direct translanguaging utilised in the experimental group proved beneficial, and where there was consistency or divergence within the test results; thus, the researcher deemed the t-test as an appropriate statistical tool for this data analysis.

Qualitative data analysis

Despite the fact that there are numerous approaches to analysing the findings of a qualitative study, including content analysis, grounded theory analysis, discourse analysis, narrative analysis, global analysis (Khan, 2014), conversation and ethno-methodological analysis, and computer-aided qualitative data analysis (McMillan & Schumacher, 2010), the qualitative data in this study was analysed using Glaser & Laudel's model (Gläser & Laudel, 2010). This is because this model was ideal for the content analysis of transcripts of semi structured interviews where the content ranged from sentences to paragraphs. The data analysis process that was used involved five steps: (1) transcription; (2) coding; (3) categorisation; (4) conceptualisation; and (5) theorisation. Themes in this study were derived both from data (an inductive approach) and from the researcher’s prior theoretical understanding of the phenomenon under study. The emerging themes are presented and analysed in Chapter 4.

In the first step, the researcher transcribed the interviews. This was done by taking notes during the interview and or by recording and then transcribing later. The sentences were then read from the interviews and determine whether they contained any pertinent information and, if so, to which category. Short descriptive statements regarding the values in the dimensions were created in order to retrieve the pertinent information. A single word or a sentence was found in each dimension (Gläser & Laudel, 2010).

In the second step, the researcher identified codes in the transcripts. A code according to Gläser and Laudel (2010) is a shorthand representation of some more complex set of ideas. This implies that this extracted raw data was processed so as to further consolidate the information base of the research that is describing the core and peripheral elements of themes. Coding helped to achieve the goal of data management and data reduction as themes and subthemes were discovered.

In the third step, the researcher categorised the themes that is build hierarchies of themes or codes. Here similar codes were categorised as it helped in identifying patterns across the interviews. In this step the quality of the data was improved by summarising scattered information and eliminating redundancies as the core and peripheral elements of themes were described (Gläser & Laudel, 2010).

In the fourth step, the themes were applied to chunks of actual text. This is according to Gläser and Laudel (2010) conceptualisation where the researcher apply themes, attaching them to chunks of actual text. This step developed concepts from the categories. Concepts as explained by Gläser and Laudel (2010) are more abstract than categories and help to explain data. This implies that the researcher linked the data to the concept of translanguaging and other phenomena that arose.

Lastly the themes were linked into theoretical models. Here theories were developed from the concepts. Gläser and Laudel (2010) defines theories as explanations that help to understand the data in a broader context. This implies that the researcher linked the themes to theoretical model that is the theoretical framework of this study which are namely the FoK by Gonzalez (2005), the social cultural theory by Vygotsky and the linguistic interdependence model by Cummins (2009). Together these three formed the basis of the study and were interlinked to understand learner's development as far as language was concerned.

Trustworthiness of qualitative data

The degree to which the research process and results may be trusted determines the quality of qualitative research (Charamba, 2017). Four criteria—credibility, dependability, transferability, and confirmability—are suggested by Bless et al. (2006) as suitable for qualitative research that should demonstrate the reliability of the findings.

Credibility: refers to the establishment of the results of the research that are believable. According to Bless et al. (2006) it determines whether the research measured what it proposed to measure and seeks to establish the truthfulness of the research findings. The researcher assessed the current study's credibility by deciding whether or not the findings conclusively address the research issues. This was accomplished by carefully and precisely analysing the study's data that was gathered. They also employed proper research methodologies and strategies to strengthen the validity of the current investigation (Lincoln & Guba, 1985) and did not stop the respondents throughout lesson observations, allowing them to express their ideas uninterruptedly, coherently, and naturally. Moreover, the triangulation of data from semi-structured interviews and document analysis for each of the study topics assured trustworthiness (Charamba, 2017). The lessons were also audio recorded and transcribed later especially during group discussions of learners.

Transferability: tackles the fundamental question of how far a researcher may make claims for a general applicability of their theory and refers to the degree to which the reader can extrapolate the results of a study to their own situation (Bless et al., 2006). The researcher enhanced transferability by thoroughly describing the research context and the assumptions that are central to the research (Creswell, 2021). This would inform the reader and they will be able to decide whether or not to apply the results to another setting or their setting. Additionally, to have a comprehensive understanding and to address the research questions effectively, the researcher analysed and presented both quantitative and qualitative data separately. With the aid of the triangulation process, the findings were compared and contrast before reaching conclusive interpretations. Thus, providing an in- depth description of the phenomena under study was prioritised to ensure the transferability of qualitative data in the study. This approach aimed to enhance the reliability and credibility of the study's findings by considering multiple perspectives and sources of information.

Dependability: deals with the core issue that the way in which a study is conducted should be consistent across time, researchers, and analysis techniques (Bless et al., 2006). The researcher meticulously conceptualised the study, gathering the data, analysing the data, and interpreting the findings to ensure the study's reliability. More than one method was used for data collection, which include a written test, interviews and observations.

Confirmability: is based on the acknowledgment that research is never objective. By keeping track of the processes for double- and triple-checking the data throughout the entire study, the researcher increased confirmability.

3.7 Validity and reliability

The quality of a mixed method research depends on how much trust can be attached to the research process and the findings. According to its definition, validity is concerned with whether the conclusions drawn from the assessment results are relevant, practical, and meaningful (Bless et al., 2006). Therefore, to a certain extent, validity is the degree to which the reality of a situation under investigation is captured and the research tools used to measure what they are supposed to.

Zhou (2019) proposes a 'hands-on model' to conducting the validation analysis. This proposed model was adopted by this study because it is adapted from Creswell and Clark (2011)'s exploratory instrument design making it reliable. The five steps: (1) qualitative investigation, (2) mixing phase, (3) mixing validation (4) quantitative phase, and (5) quantitative validation.

The first step focused on qualitatively investigating the scale construct. Zhou (2019) argues that besides having a literature review, this step explores the scale construct and enables the researcher to collect detailed information. For this study the central phenomenon was empowering multilingual learners in a science class using translanguaging. This phenomenon was clearly defined in Chapter 1 and all research questions relating to it were identified with an in-depth exploration to how the phenomena has worked in diverse contexts as presented in Chapter 2. After data was collected, a purposeful sample of learners was selected to provide their perspectives on the translanguaging intervention in their learning and the teacher was also given a chance to reflect on the progress of the learners and their teaching.

Having this central phenomenon for my study is done for two reasons: 1) due to the identical research goal, comparable research questions, and samples used throughout the scale development process, it provides the framework for comparing and connecting qualitative findings with quantitative item answers in a scale development study and 2) it gives support for the new scale's content validity because the items were developed based on the qualitative findings. As a result, the initial qualitative inquiry included a validation approach to give the scale items of interest the content-related information.

In the mixing phase, an integration strategy was used where qualitative findings were converted to scale items. After having the qualitative findings that consist of quotes, codes, and themes in different layers from the interviews, the quotes and codes were converted into items, and themes to scales. Thereafter, the researcher determined the format of item responses and visually displayed them in graphs and tables. This enables the determination of statistical analysis of the format of interview responses. In short, this step show how qualitative and quantitative data are integrated.

The third step comprised of conducting mixing validation to review items' content-based validity. The main qualitative approaches here included reflection on the data while the quantitative methods include sorting and calculation. Drawing from Zhou (2019) illustration, the researcher first defined the scale construct to be measured that is the effect of language on academic performance. This reflection provided evidence for content validity of the new scale.

Furthermore, when debriefing, the researcher discussed the relationship between language and the academic performance. By discussing the structure of the new scale, they generated the hypothesised model between items and the latent construct and was later tested via factor analysis. The fourth step was analysing tests and collect the responses (Khan, 2014). Lastly, the researcher conducted a quantitative validation in order to analyse item properties and to examine construct validity evidence. The responses were analysed through a series of statistical analysis for evidence of construct-based validity, including internal reliability.

3.8 Ethical considerations

A researcher is obliged to safeguard their participants. According to McMillan and Schumacher (2010), the researcher has an ethical duty to uphold the rights and welfare of study participants, especially where there are concerns about bodily or psychological discomfort, harm, or risk. This implies that it is the researcher's duty to guarantee that the proposed research is morally responsible and complies with accepted standards and values. Additionally, one must make sure that the participants' rights are upheld and that they are safe.

Beliefs regarding what will be morally right or incorrect were the focus of the research ethics that were noticed in this study (Booyse et al., 2011). Regardless of the potential effects on the study, individuals who met the requirements were free to decline participation or to leave the study at any time (Gay, 2010). Informed consent, confidentiality and anonymity, voluntary

involvement, complete transparency, and beneficence are among the ethical rights of study participants that were upheld (Bos, 2020).

Informed consent

All participants, including students, teachers, parents, guardians, and other stakeholders, were fully informed of the research's purpose prior to their involvement. An informed consent form and information about their freedom to leave the study at any time without fear of retaliation were given to each participant. After being made aware of the potential risks, participants were required to provide written consent or information (Gay, 2010). The consent forms had to be co-signed by the parents of the students who participated in this study because they were minors (McMillan & Schumacher, 2010).

Confidentiality

Since the researcher was in contact with people, confidentiality of the participants was protected. This was done by hiding the participants' true identities. Passwords were used to protect the data acquired on the researcher's computer, and access to the data was restricted. According to Bos (2020), confidentiality in research means that participants' identities cannot be ascertained from their responses by those who are reading or reviewing the study's findings. This means that by representing individuals with numbers and pseudonyms to maintain anonymity, confidentiality in this study was also guaranteed.

Anonymity

Before handing out the pre-tests for learners to write, they were assigned numbers from 1 to 40 which was because in the Grade 4 class there were 40 learners. These numbers were used in place of their names during the course of the study for anonymity and protection of their identities. Then the teacher and parents were given pseudonyms. In support of this, McMillan and Schumacher (2010) contend that anonymity can be achieved by gathering data in an anonymous manner using a system that does not associate names with the data obtained, such as requiring participants to use aliases or numbers and only reporting group findings rather than individual ones.

Voluntary participation

The participants in this study were free to choose whether or not to participate; participation was entirely optional. Since they could not be forced or pressured to participate, the students

also made the decision to continue with the research to its conclusion or to discontinue it at any point.

Full disclosure

All participants were informed in advance by the researcher about the methodology of the study. Additionally, the participants were made aware of any potential dangers associated with participating in the study. The only danger that was predictable was discomfort. All participants were also informed of the research's goal (Thornberg et al., 2022). Participants in this study were not denied access to any information about it.

Beneficence

This study intended to benefit learners by permitting them the opportunity to use their home language during a science lesson, something they were not usually permitted to do and also give them an opportunity to deepen their understanding in scientific concepts if the perceived transformative power of translanguaging was activated and in turn enhance their academic achievement.

Feedback

Once the study is concluded, participants had the option to receive a summary of the findings, allowing them to understand the outcomes and implications of the research they contributed to.

Avoidance of Plagiarism

The researcher ensured that all sources of information, including literature and data, are properly cited and credited. This maintains the integrity of the research process.

Approval from Institutional Review Board (IRB):

Before starting the research, approval was sought from the University of Witwatersrand review board to ensure that all ethical guidelines are being adhered to, with the protocol number "H24/09/36".

Limitations

Firstly, the study focused only on Grade 4 NS learners from one school in Bellevue East, a suburb in Johannesburg. It comprised of 40 learners, which makes it a rather small sample and it might have reduced statistical power. Secondly, owing to the school's ongoing initiatives, learners received extra instruction to avoid interfering with the study school's smooth

operation. Thirdly, since there were many languages in the classrooms, other learner's home languages were not used in the assessments because the researcher intended to work with the majority of languages also considering adequate resources. Lastly, the research put into consideration that the teacher was overloaded and had limited time, hence some interviews were only done when she was free and with her free time. This however did not disrupt any proceedings if the study as the researcher planned the interviews properly in advance and selecting straightforward questions.

3.9 Chapter Summary

To gather information from a sample of primary NS learners about the transformative power of translanguaging, the impact of language on their academic performance in the subject, and their opinions about the use of their home language as a language of instruction in the NS class, the study used a mixed method approach. The equipment used to collect the data have been validated worldwide. The South African national curriculum was used to create the pre- and post-test, with minor modifications made as necessary. The purpose of the study, the risks involved, confidentiality issues, full transparency, and informed consent were all explained to the participants.

3.10 Conclusion

By using homogenous purposive sampling, the researcher assumed a straightforward experimental design in which students were divided into two groups: the experimental group and the control group. For privacy and anonymity, the students were identified by their numbers. The English language competency test, a pre-test, and a post-test were used to gather the data. Ten students in the experimental group were chosen at random, and interviews with the instructor and parents were also conducted. The learners were instructed by the same teacher in their native tongues on the same subject so as not to disadvantage the members of the control group. next collection, the data was analysed, presented, and interpreted in the next chapter. The next chapter details data collection, interpretation, analysis as well as conclusions arising from the data that was collected and analysed.

CHAPTER 4: DATA PRESENTATION, INTERPRETATION AND ANALYSIS.

Chapter 3 presented the methodological aspect of the study. These included research design, participants, research instruments, and the methods used for data collection and analysis. This chapter details the data collected during the study, how it was analysed by the researcher as well as the results that emanated from the analysis.

4.1 Introduction

The present study aimed to investigate the transformative potential of translanguaging in NS instruction of a multilingual grade 4 classroom in Johannesburg. This made it possible to critically analyse the nuances of South African linguistically diverse educational environment. Understanding the effects of such dynamics becomes crucial for educational practitioners and policymakers as countries worldwide witness an influx of learners entering classrooms with home languages different from the language of instruction.

This study was positioned within the intermediate phase educational setting, to specifically delve into the experiences of grade 4 learners with the home languages isiZulu, isiXhosa and other African languages, who learn in a language different from their home language, English. The investigation encompassed the administration of three tests, namely, an English Language Proficiency test, a NS pre-and post-test, classroom observations and interviews with the learners, the teacher and parents, capturing learners' academic progress over the intervention period. The results were then meticulously recorded and organised, providing a rich foundation for in-depth quantitative analyses and qualitative insights.

The researcher made use of R-computing to unravel patterns and trends within the quantitative data, employing a comprehensive array of statistical measures, including mean scores, pass rates, standard deviations, learning gains, effect size indices, and p-values for each test. The presentation of findings through performance tables, bar graphs, and charts facilitated a clear visualisation of the academic trajectory of learners subjected to distinct pedagogical approaches.

Beyond numerical assessments, the study incorporated qualitative dimensions by conducting classroom observations from both the experimental and control groups and interviews with learners from the experimental group, their teacher and parents. These interviews aimed to unearth the learners' and teacher’s perspectives on the intervention they experienced during the study. The combination of written responses, tape-recorded reflections, and subsequent

transcription and analysis provides a holistic understanding of the nuanced factors influencing learners' and teacher's experiences in monolingual classrooms and help explore the transformative potential that translanguaging have in different contexts.

In carrying out the study, the researcher wanted to address the following questions:

1. Does language have a transformative effect on the academic performance of grade 4 NS learners in Johannesburg?
2. How can translanguaging be transformatively used in a multilingual NS classroom?
3. To what extent can translanguaging be used in a NS classroom with multiple languages?
4. Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

The research was guided by a specific hypothesis that aimed to be either accepted or rejected through the data analysis.

Research Hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.*

Null Hypothesis: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group.*

The study intended to address these questions in order to provide nuanced insights into the larger conversation on language education, with practical implications for educational policies and pedagogical approaches within the particular framework of a rapidly changing and increasingly diverse educational environment.

4.2 Data presentation and analysis.

The analysis of data within this study was meticulously executed using a two-pronged approach that seamlessly integrated quantitative and qualitative analyses. Quantitatively, the study drew upon the outcomes of the three tests directed to participants, offering a quantitative lens through which to gauge the learners' English Language proficiency and their academic performance and discern measurable learning outcomes. Concurrently, a qualitative dimension was introduced through a multifaceted approach. In-depth interviews were conducted with participants from the experimental group, providing a nuanced exploration of their perspectives on the interventions and pedagogical strategies experienced during the study. Additionally, valuable insights were derived from 30 classroom observations, affording a reasonable lens into interactions, instructional methodologies, and learner engagement within the classroom setting.

4.2.1 The socio-demographic characteristics of the learners

Demographic data was collected from 40 learners: 15 boys and 25 girls in a Grade 4 classroom of a private school in a suburb of Johannesburg central. Through the assistance of the teacher, the researcher was able to get hold of the necessary information concerning the age and gender of the participants. Additionally, consent was sent to the parents requesting them to permit the learners as one of the interview questions asked the participants' home language. Their socio-demographic characteristics indicate their gender, age and their home language (whether English or not). The learners were between the ages of 9 and 11, most having a home language that is different from the language of instruction (English). Gender and age are not the main focus of this study hence they will not be discussed further. The detailed demographic information is given in Table 4:1

TABLE 4:1 SOCIO-DEMOGRAPHICS OF THE LEARNERS

Variable	Category	Number of participants	% of participants
Gender	Boys	15	37.5
	Girls	25	62.5
	Total	40	100
Home language	English	1	2.5
	Not English	39	97.5
Age	9-11 years	40	100

Table 4:1 presents a detailed socio-demography of the learner participants. It is apparent that of the 40 participants, the majority were girls being 62.5% (25 out of 40) and there were only 37.5% (15 out of 40) boys. These participants ranged from the ages of 9 years to 11 and according to the South African Department of Basic Education standards they were within the standardised age range to be in the 4th grade (Charamba, 2017). A significant number of 97.5% of the learners had a home language different from the language of instruction and indicated that English was not their home language. Only one learner indicated that English was her home language. This shows that these participants were a perfect match for the study as the research wanted to work with learners whose home language is different from the language of instruction.

4.2.2 Quantitative Analysis

In analysing statistical procedures for quantitative data, a t-test is commonly used. A t-test according to McMillan and Schumacher (2010) is a statistical test used to compare the means of two groups. It is commonly employed in hypothesis testing to determine whether a treatment has an effect on a population of interest or if two groups differ from each other. There are different types of t-tests: One-sample t-test, which compares a sample mean to a hypothesised or target value, two-sample t-test, which compares the means of two separate groups and paired t-test, which is used within-subjects designs, such as measuring before and after an experimental treatment (Ali & Bhaskar, 2016). For instance, if one wishes to know whether the mean academic achievement of learners differs based on their home languages, they can use a t-test to compare the two groups.

In the context of this study, the researcher chose the two-sample t-test, also known as the independent samples t-test (Ali & Bhaskar, 2016). The main objective of employing this statistical tool was to ascertain if a statistically significant difference existed in the dependent variable between the two groups under investigation (McMillan & Schumacher, 2010). To execute the analysis, R-computing was used to calculate the mean and standard deviation for each sample. Subsequently, these values were employed to compute the t-statistic, representing the difference between the sample means divided by the standard error of the mean (McMillan & Schumacher, 2010). The researcher used a comparison between this computed value and theoretical t-values in the t-table distribution to ascertain the significance level (McMillan & Schumacher, 2010). The researcher utilised the table to find two numbers: the intended level of significance and the degrees of freedom (df).

After writing the pre-test learners were purposively sampled to be in the experimental and control group. The fact that all learners were fourth grade and almost all of them had a home language different from the language of instruction was the basis for this kind of sample. With the aforementioned in mind, homogenous sampling was specifically chosen in order to select learners with shared characteristics since learners came from various language backgrounds. Homogeneous purposive sampling was used because the researcher wanted to intentionally select specific individuals who could at least understand isiZulu and or isiXhosa as these were the dominant languages in the classroom. It also allowed the researcher to focus in-depth on small samples. Given that the majority of learners had a home language different from the language of instruction, the researcher took a closer multiple languages the learners had and isiZulu and isiXhosa were ideal for specific subsets of the population. Cognisant of the biases

this could bring up, the researcher gave the participants a choice to either be taught in English only or in isiZulu and or isiXhosa alongside English.

The experimental group was the treatment group receiving lessons in their home language alongside English while the control group received lessons solely in English. For every test that was completed by the two study groups, the means, standard deviations, degrees of freedom, effect size index, and learning gain were determined and compared. The probabilities (whether their performance is the same or different) were articulated through formal statements that underwent testing; these statements are commonly known as hypotheses (Rubin & Donkin, 2024). The research hypothesis in this study was conceptualised as the prediction being investigated. The researcher alluded to probability within the context of sampling and measurement errors, utilising a declaration known as the statistical hypothesis. Statistical hypotheses are articulated in either null or alternative form (McMillan & Schumacher, 2010).

4.2.2.1 Null hypothesis

The null hypothesis (H_0) posited in the study asserted the absence of a significant difference in the academic performance means of the two groups post intervention (Ivankova et al., 2006). Essentially, it presumed that the population means were the same. To ascertain the likelihood that the null hypothesis was incorrect, the researcher employed an inferential statistical test (Bos, 2020). A rejection of the null hypothesis would suggest a heightened probability of a discernible difference between the compared groups (McMillan & Schumacher, 2010). The rationale behind the utilisation of null hypotheses in conjunction with inferential statistics within this study stemmed from the researcher's objective not to affirm the truth of the hypothesis but rather to refute it, aligning with the perspective elucidated by McMillan and Schumacher (2010).

4.2.2.2 Alternative hypothesis.

Cognisant of the fact that the H_0 is a claim that there is no effect in the population and that if the sample provides enough evidence against this claim, we can reject the null hypothesis. The alternative hypothesis (H_a or H_1) as articulated by Khan (2014) asserts that there is an effect in the population. It is the contrair of the null hypothesis and encapsulates the research or experimental proposition within the statistical framework. This alternative hypothesis may manifest as either directional or nondirectional.

In the context of a directional hypothesis, McMillan and Schumacher (2010) have delineated one population mean as being either higher or lower than the other population mean. Given its singular projection, a directional alternative hypothesis is commonly referred to as one-tailed or one-sided. Conversely, the nondirectional alternative hypothesis, postulating potential differences in either direction, is labelled as a two-tailed or two-sided hypothesis (McMillan & Schumacher, 2010). Whether directional or nondirectional, the alternative hypothesis plays a crucial role in the determination of whether the null hypothesis can be rejected, as underscored by Cohen et al. (2017).

In this study, the research hypothesis posited '*translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom*.' Conversely, the H_0 articulated *the absence of any significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group*. In assessing the veracity of the H_0, the researcher made use of the R-computing software, employing the two-sample t-test with independent groups formula to calculate the means for all tests undertaken by the two groups. This was done to get the t-value which is a statistical measure used in hypothesis testing (Ali & Bhaskar, 2016). It quantifies the difference between the mean of two sample sets relative to the variation within those sets. Specifically, the t-value represents the calculated difference in units of standard error (McMillan & Schumacher, 2010). The larger the magnitude of the t-value, the stronger the evidence against the null hypothesis. In contrast, a t-value close to 0 suggests that there isn't a significant difference between the means.

Thereafter, the researcher determined the degrees of freedom. Degrees of freedom denoted as (df) represent the number of independent pieces of information used to calculate a statistic (McMillan & Schumacher, 2010). This was calculated as the sample size minus one. The computed value was juxtaposed against corresponding values on the distribution of a t-table to ascertain whether to accept or reject the H_0.

Subsequently, the researcher computed the p-value, which is the level of probability, expressed as a decimal and denoting the likelihood of the researcher making an error in rejecting the H_0, assuming it is true. If the p-value is equal to or less than 0.05 ($p \leq 0.05$), the researcher rejects the null hypothesis, signifying a statistically significant difference. This decision is grounded in the understanding that there is a high probability of the observed results occurring by chance. In cases where the P-value is between 0.05 and 0.10, it is generally considered marginally

significant, while anything exceeding 0.10 is deemed a non-significant difference (McMillan & Schumacher, 2010).

Qualitative data analysis adopted Glăser and Laudel's (2010) model. The researcher undergone a reduction process where they generated categories and codes from the interview responses. The transcribed textual data were segmented into codes, which were successively condensed until the researcher could amalgamate them into three overarching themes. This process of data reduction yielded four main themes during the thematic discussion of findings.

4.3 English Language Proficiency test

The English Language Proficiency test had fifteen (15) question. These were broken down into four(4) sections. The first section had eight (8) questions, six (6) of which required the participants to read a short passage and answer the questions, choosing from the provided choices, and two (2) which tested their general understanding of the text. There were four possible answers for all 15 questions and the participants had to choose the most appropriate one, see Appendix J: English Proficiency test.

For the second section the participants had to choose the correct preposition for the given sentence and this section comprised of two (2) questions, for example:

Question (9)

Press the dressing _____ the wound.

A from

B to

C onto

D by

The third section had one (1) question in which the participants were given an incomplete sentence and had to choose the correct adjective to complete the sentence, for example:

Question (11)

The boys also used _____ gloves to protect themselves.

A clean

B poor

C exciting

D honest

The fourth section had two (2) parts with the first part having 2 questions that required the participants to choose the opposite word in the meaning of the underlined word and the other two (2) questions which assessed the learner's knowledge of plurals and spellings, for example:

Question (13)

The elephant had a very short trunk.

A big

B tall

C fat

D long

Question (15)

One dish but many _____.

A dishes

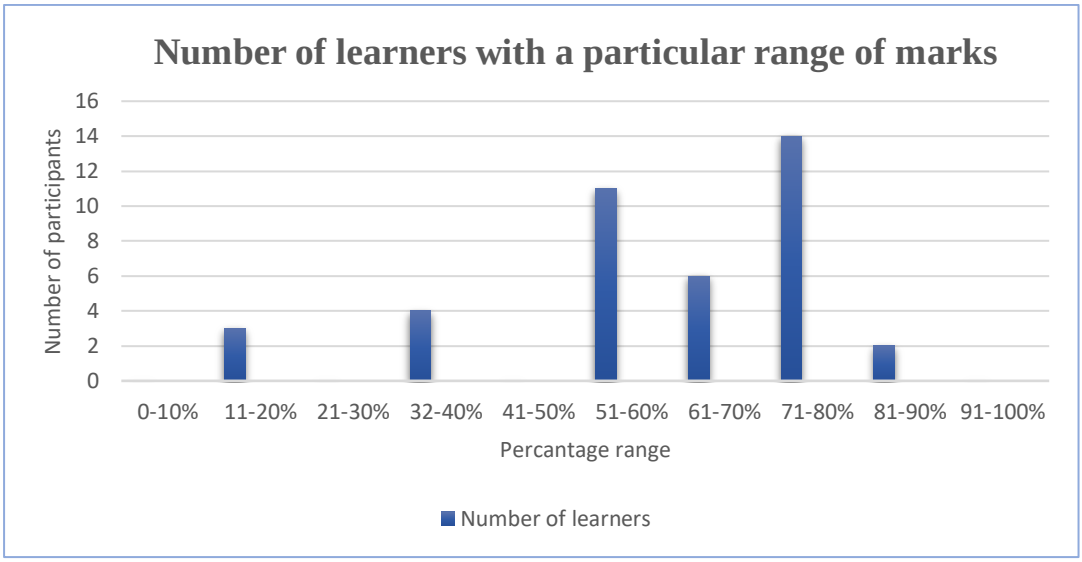
B dishs

C dishis

D disheese

All forty (40) grade four learners wrote the English Language Proficiency test. Before they could write the test they were given numbers by which they would be referred to during the course of the study. The numbers ranged from 1 to 40. Their performance (in percentage) in the English Language proficiency test was as follows:

FIGURE 4:1 NUMBER OF LEARNERS WITH A PARTICULAR RANGE OF MARKS



From Figure 4:1 it is clear that most learners managed to score between 71%-80%. This reveals a good proficiency among learners giving them a mean score of 62.33% in the

English Proficiency test. The pass rate stood at 87.5%, meaning 87.5%, that is 35 learners out of the 40 participants managed to achieve a mark of 40% or better in the English Language Proficiency test. However, 82.5% of the participants achieved a mark of 50% and above. This is proof that most learners have an adequate or rather good proficiency in the language. Only 5 participants got a mark below 4 and it is safe to say this was really impressive. Marks (in percentage) of the individual participants who wrote the proficiency test are represented in the following graphs:

FIGURE 4:2 PROFICIENCY TEST MARKS FOR THE 40 LEARNERS

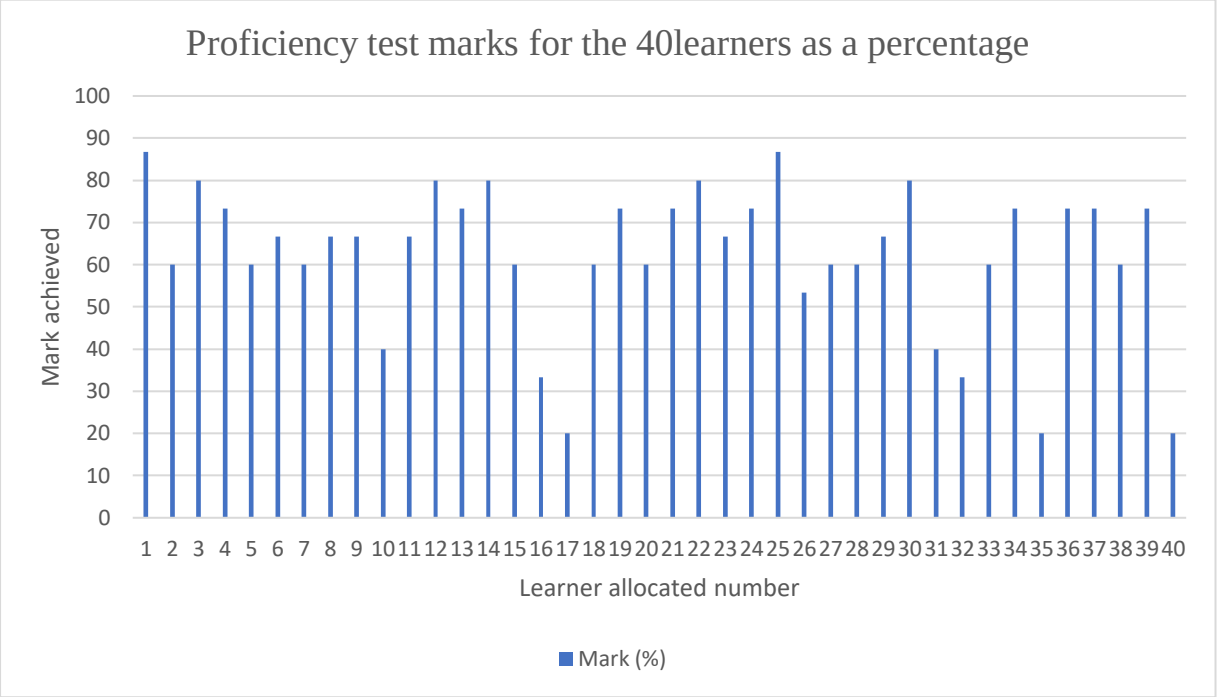
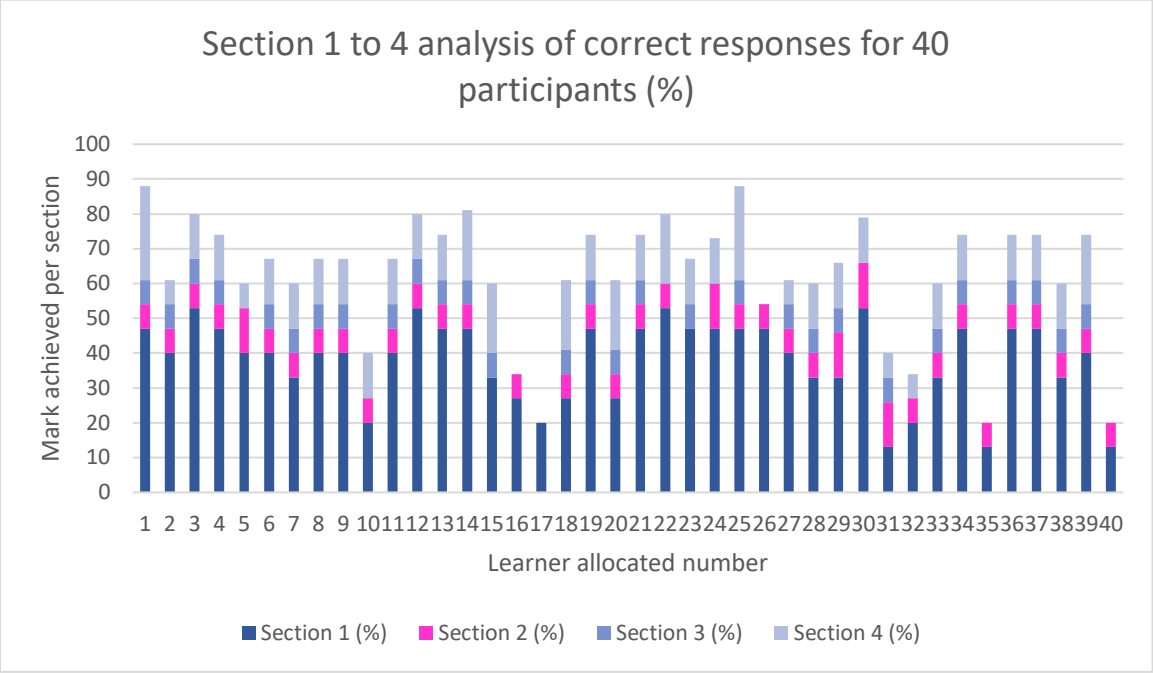


Figure 4:2 presents a clear illustration of the marks, showing that the learners have a general proficiency of English language with only 5 of the 40 learners who wrote the proficiency test attaining a mark below 40%. This meant that a majority of the learners passed the test according to Department of Education standards where 40% is regarded a pass (DoE, 2011) for additional languages. These results set a steady foundation of the study as there has been studies conducted, alluding to the fact that learners with higher English language proficiency tend to perform better. This also helped the researchers tailor instructional content and strategies based on the remarkable results of this test.

Figure 4:3 below presents a detailed performance per section:

FIGURE 4:3 SECTION 1 TO 4 ANALYSIS OF CORRECT RESPONSES FOR 40 PARTICIPANTS



To further analyse the results of the proficiency test, the researcher subsequently computed the individual pass per section. This helped in determining which section the learners had answered correctly the most. Their individual performance per section are plotted in Figure 4:3 drawing from Figure 4:2 above. The vertical axis of the graph represents the number of correct responses per section while the horizontal component of the graph represents the learners.

The first section had eight (8) questions, six (6) of which required the participants to read a short passage and answer the questions, choosing from the provided choices, and two (2) which tested their general understanding of the text. This section weighed 53% of the entire paper and from Figure 4:3 most learners attempted this section and were able to score some points. The researcher made this section weigh a more because they wanted to get a sense of the learner's level of comprehension since learners had to read a passage and answer the questions that required their understanding. The average score for this section was 71% as presented in Table 4:2 below. This suggests a good level of English proficiency among learners.

For the second section the participants had to choose the correct preposition for the given sentence and this section comprised of two (2) questions weighing 13% of the total question paper. This section was adequately done with an average of 53% and as depicted in Figure 4:3 most learners only got 1 out of the 2 questions and other got zero making the mean score drop from the first section.

The third section had one (1) question in which the participants were given an incomplete sentence and had to choose the correct adjective to complete the sentence. This section was included to get a general sense of the learners' understanding of adjectives and it is the highest achieved section with 73%. This validates the fact that the participants do have a good grasp of the English language. However, a closer look into the Figure 4:3 shows that other learners did not manage to answer this question correctly accounting for the 27%.

The fourth and last section had two (2) parts with the first part having 2 questions that required the participants to choose the opposite word in the meaning of the underlined word and the other two (2) questions which assessed the learner's knowledge of plurals and spellings. This section was not quite well done. It was the least of all 4 sections with an average of 47% and it weighed 27% of the entire question paper. This gave the researcher an interesting opening to the learner's ability. They could not spell. Majority of the learners failed to choose the correct answer for the last two questions. This raised the researcher's curiosity to investigate deeper into the abilities of the participants as far as language is concerned.

FIGURE 4:4 AVERAGE PERCENTAGE PER SECTION

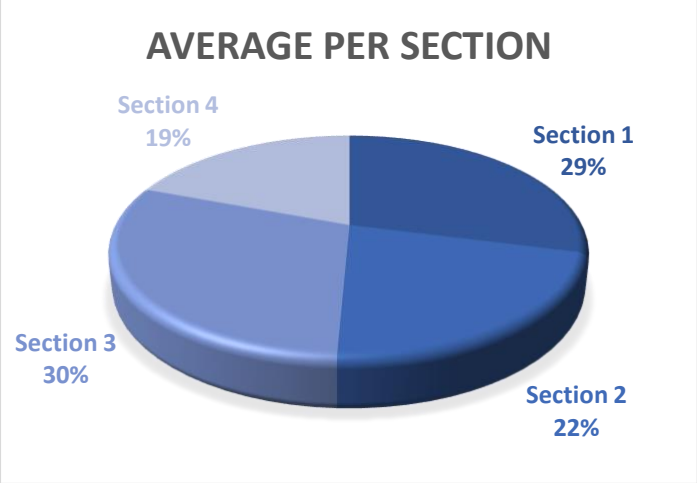


TABLE 4:2 AVERAGE PER SECTION

Section	Average
1	71%
2	53%
3	73%
4	47%

As highlighted above, Figure 4:4 and Table 4:2 represent the average performances of the 40 participants. The researcher calculated the average for each section as presented in Table 4:2, thereafter, the data was presented in a pie chart to see the overall performance of learners. It is evident that Sections 1 and 3 were done well while section 2 and 4 were not so pleasing. For section 4 the lowest mark was 0% and other learners showed confusion in answering the questions. They chose multiple answers and still their final answer was wrong. From the pie chart in Figure 4:4 it is clear that all sections were overly fairly done.

Furthermore, the researcher went on to compare the performance of learners assigned to the two groups (Experimental and control). The graph below shows the individual mark each learner got in comparison to the experimental and control group.

FIGURE 4:5 CONTROL AND EXPERIMENTAL ENGLISH PROFICIENCY MARKS.

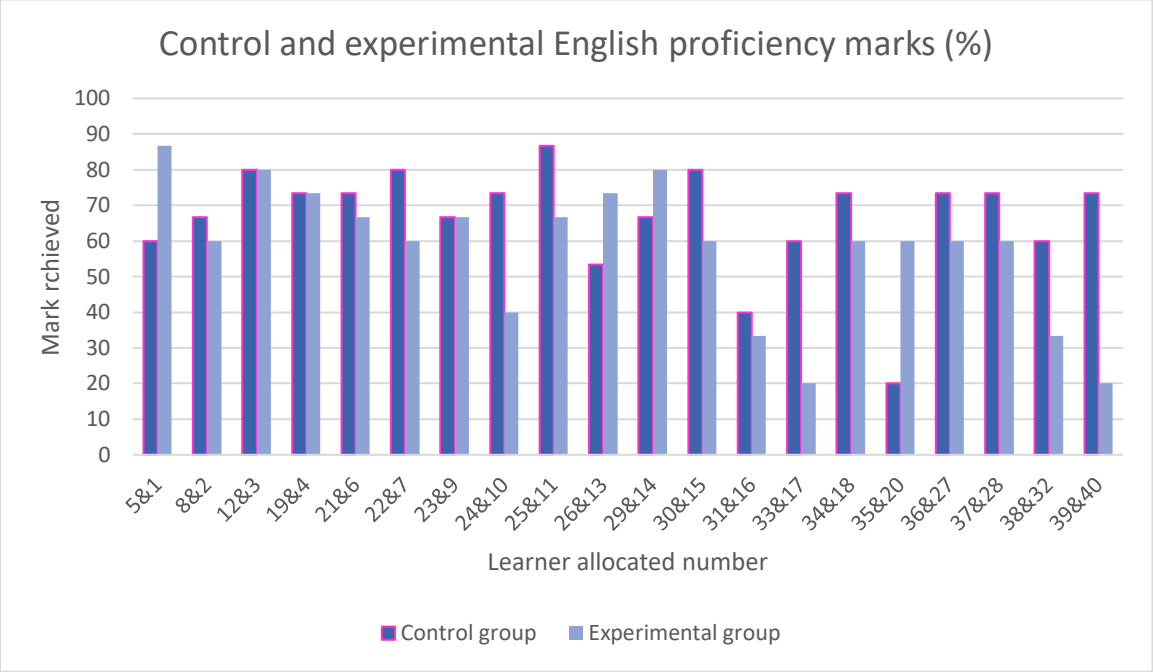


Figure 4:5 presents a graphic presentation of the English proficiency marks, colour coded as per the control or the experimental group. As earlier mentioned, most learners did well and the research wanted to see the different variations among the two groups. In both groups the highest mark was 87% and a lowest of 20%. This shows a fair distribution in terms of cognitive abilities as far as the English language proficiency test is concerned. The control group had an average of 66.67%, 8.67% higher than the average of the experimental group which is at 58%. This shows that learners in the control group had a better grasp of the language than those in the experimental group even though they both showed a pleasing performance. Moreover, the average indicates room for improvement as there is a huge gap between the highest and the lowest achiever in each instance. It also suggests an exploration of different pedagogical strategies that cater for the individual needs of all learners. To get a more statistical analysis, Table 4:3 below presents the mean of both the control and the experimental group, their standard deviation, the p-value, the effect size and the gain.

Null hypothesis: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group.*

TABLE 4:3 STATISTICAL ANALYSIS OF EXPERIMENTAL GROUP AND CONTROL GROUP

Test	Group	Mean	Sd	p-value	Effect size	Gain
English Language Proficiency	**Experimental**	58%	19%	0,0498	-0.511	0.00
	Control	66,67%	14.907%			

Table 4:3 reveal statistical data calculated using R- computing. These values reveal a somewhat significant difference in the performance of the Control and the Experimental group. Considering the means and standard deviations of the two groups, it is evident that there was a difference of 8.67% in their means and 4.09% in the standard deviations. There was a 0.00 learning gain as no intervention was given for English Language proficiency. From the mean and the standard deviation, the researcher was able to calculate the effect size. According to (McMillan & Schumacher, 2010) an effect size quantifies the difference between two groups, a larger effect size indicates a more a meaningful relationship while a smaller effect size suggests limited practical applications. In this instance a value of negative 0.511 was found indicating limited practical applications of the language. However, since there was no intervention prior the English language proficiency the relation is not significant. In like manner, there is a p-value of 0,0491 which approximately 0.05 therefore the researcher rejects the null hypothesis, signifying a statistically significant difference. This entails that language has an impact in the academic performance of learners and thus enhances their academic performance. However, these finding are not conclusive yet as more analysis into the pre-and post-test is yet to unfold.

4.4 Pre-test Analysis.

Null Hypothesis: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group.*

As aforementioned, purposive sampling was utilised to select participants, drawing upon the language that the learner was most comfortable with and could easily understand. The control group are the learners who chose English as their preferred language and the experimental group could understand isiZulu or isiXhosa. Given the shared characteristics of these groups, that is fluency in English. All participants were then given a pre-test that assessed their knowledge of Natural Science under the topic: Matter and Material.

Figure 4:6 below is a graph that shows the 40 participants' performance:

FIGURE 4:6 PRE-TEST MARKS FOR ALL 40 PARTICIPANTS

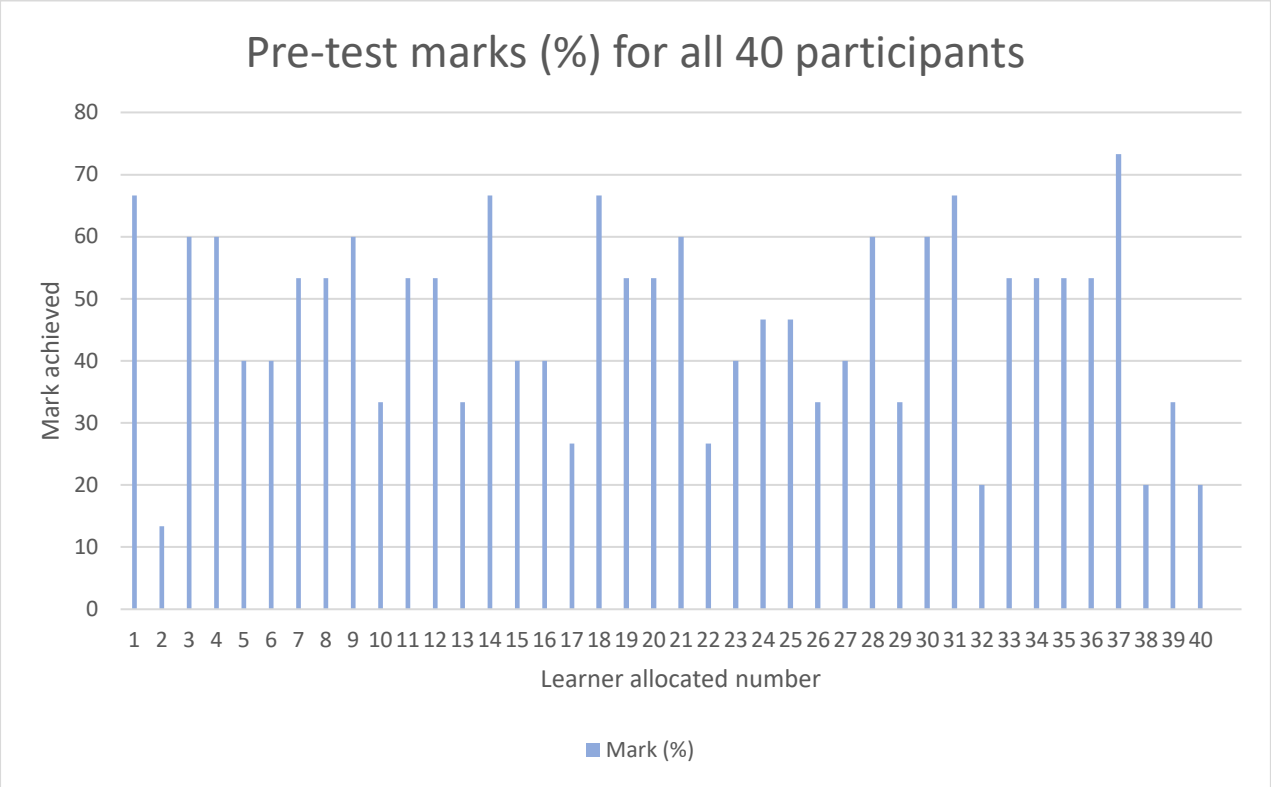


Figure 4:6 depicts a concerning disparity in performance across the 40 participants. 72.5% of the learners (29) managed to meet the minimum passing score of 40% and above as per CAPS grade 4 promotion requirements (DBE, 2016). Only 52.5% of the 40 participants exceeded the 50% mark. This disparity is further highlighted by the wide range of scores, with only a one learner achieving a meritorious mark of between 70% -79% and none of the learners achieved an outstanding mark which is according to DBE (2016), 80% and above. From the data, the highest learner scored 73% and the lowest learner scored 13% which is 2/15. Overall, the participants had an average of 46.5% slightly exceeding the minimum pass requirement of 40%. This implies that the teaching strategy might not be meeting the various demands of each learner. To comprehend the elements causing this discrepancy, more research is required. This could also provide focused interventions to enhance learning results for learners who are struggling as displayed in Figure 4:6.

After writing the pre-test, the learners were then separated into two groups, the experimental group and the control group. There was a wide range of scores within the control group, with

some learners achieving high scores while others scored very low. Figure 4:7 below indicates the performance of the control group in the pre-test.

FIGURE 4:7 PRE-TEST MARKS FOR THE CONTROL GROUP (N=20)

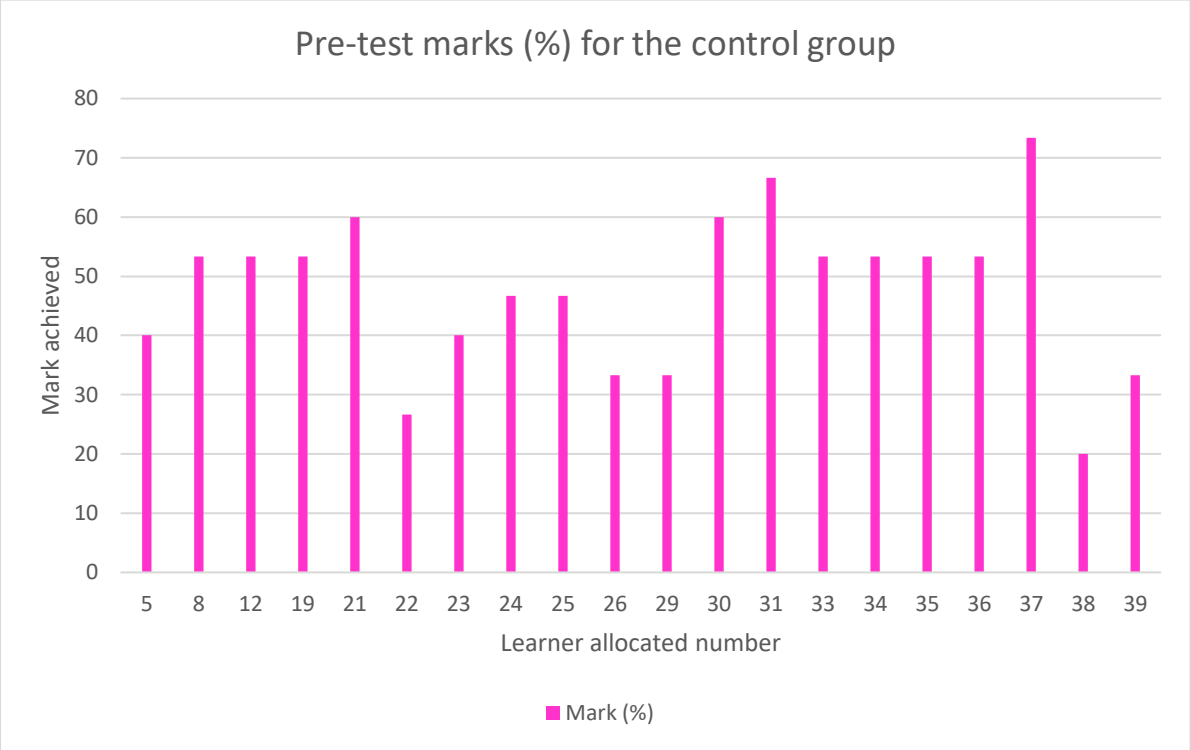
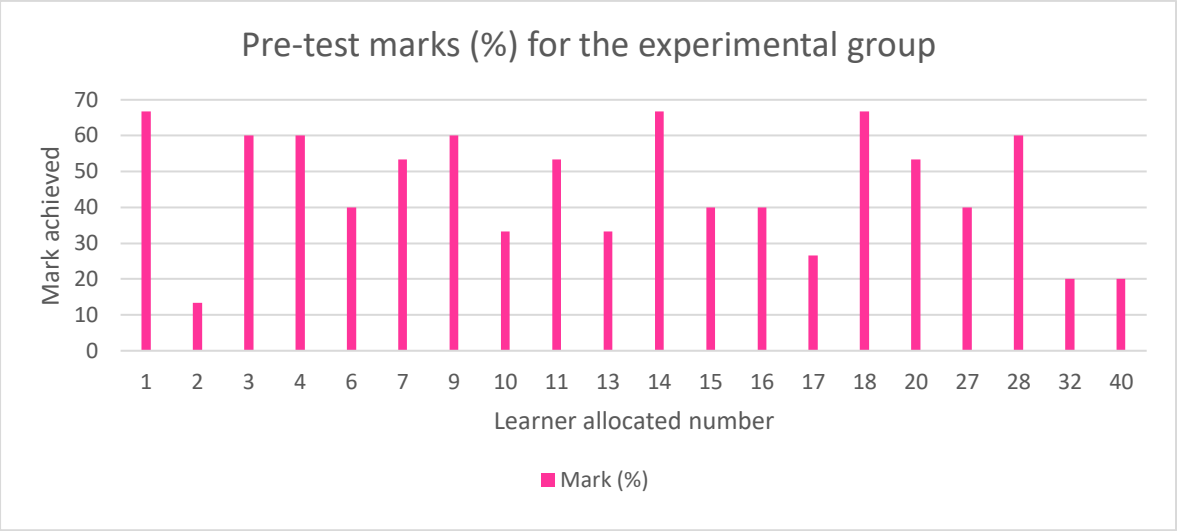


Figure 4:7 above depicts a somewhat pleasing performance. 75% of the learners (15) achieved the minimum pass mark of 40% as stipulated in the CAPS while 25% struggled with scratching the 40%. Of the 75%, only 55% managed to score above 50% and this resulted in the control group having a mean score of 47.67% with a standard deviation of 13.21%. The highest in this group had 73% while the lowest had 20%. This indicates that in order to close the performance difference and encourage improved learner accomplishment, there may be a need for additional research and focused interventions within the control group.

A closer look into Figure 4:7 also reveals a wide range of score with some learners managing to score above average even though their marks are not exceptional and others really struggling way below the average. This suggests that perhaps the instructional pedagogies employed to the learners, do not cater to their diverse needs and further investigation is needed.

Figure 4:8 below shows the pre-test marks of the experimental group.

FIGURE 4:8 PRE-TEST MARKS FOR THE EXPERIMENTAL GROUP (N=20)



An analysis of Figure 4:8 above reveals that 6 of the 20 learners (30%) in the experimental group attained a mark below 40% while a majority of learners that is 70% met the minimum pass requirement of 40% and above as stipulated by CAPS requirements for grade 4 (DBE, 2016). 50% of the learners in this group surpassed the 50% mark. Notably, the experimental group demonstrated a slightly lower average score of 45.33% with 2.34% difference from the control group's average. The experimental group had a standard deviation of 16.55%. The highest score in the group was 67% and the lowest in the experimental group was 13% which is 2 out of 15 marks. The observed disparity in the group's performance calls for additional research to determine the possible causes affecting the experimental group's learning results.

FIGURE 4:9 PRE-TEST MARKS FOR BOTH THE CONTROL AND EXPERIMENTAL GROUP (N=40)

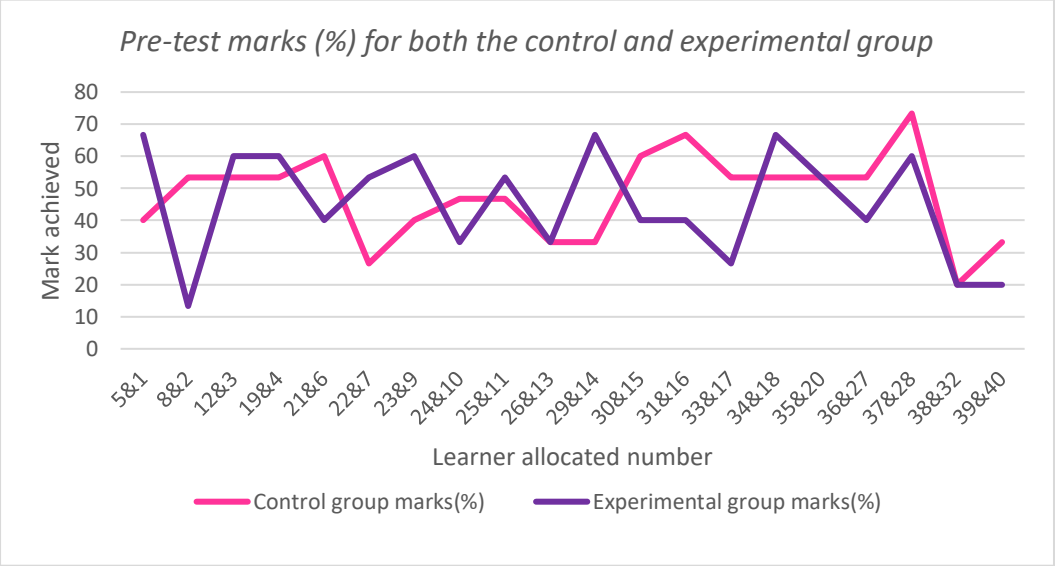


Figure 4:9 above shows the comparison of the pre- test marks obtained by learners in both the experimental group and control group.

A detailed picture of the pre-test's effects is shown by analysing the data between the two groups as represented in Figure 4:9. Though the experimental group fell behind with an average of 45.33%, the control group was 2.34% above it with a mean of 47.67%. This in turn necessitated an overall mean score of 46.5% for all the 40 participants. Only 50% of learners in the experimental group reached the 50% mark compared to 55% in the control group. Following more analysis, it was shown that both groups had significant score variety, ranging from relatively high scores to struggling learners, underscoring the necessity of diverse educational strategies. Further examinations that include pre-test data and learner viewpoints may clarify the complex effects of the intervention and provide guidance for future improvements aimed at the exploration of the translanguaging pedagogy and enhancing its effectiveness.

TABLE 4:4 STATISTICAL ANALYSIS OF PRE-TEST RESULTS FOR THE EXPERIMENTAL AND CONTROL GROUP

Test	Group	Mean	Sd	p-value	Effect size	Gain
Natural Science Pre-test	**Experimental**	45.33%	16.55%	0,30474	0.4	0.00
	Control	47.67%	13.21%			

The statistical analysis presented in Table 4:4 for both the experimental and control group reveals minimal differences in performance between the two groups. This aligns with the observed means and standard deviations, which showed a negligible difference of 2.34% in means and 3.34% in standard deviations. Notably, the control group, achieved a slightly higher mean score (47.67%) and standard deviation (13.21%) compared to the experimental group performance of 45.33% and 16.55% respectively. These statistical analyses were performed using R- computing software.

Based on the aforementioned standards, if the p-value exceeds 0.10 ($p > 0.10$) it is deemed a non-significant difference (McMillan & Schumacher, 2010). Thus, in this instance where the p-value is 0.30474 the researcher accepted the null hypothesis. This suggests that the translanguaging intervention to be implemented in the experimental group might not produce a statistically significant impact on learning outcomes compared to the traditional English-only approach employed in the control group. Even if the null hypothesis is to be accepted, it is crucial to consider the study's sample size, design, and potential constraints when interpreting the results. Additional insights may be revealed by conducting more research, such as

examining particular subgroups or breaking down the data according to each learner's language background and intervention.

4.5 Intervention.

After the learner participants had written the pre-test and were separated into the control and experimental group, the experimental group participated in a multilingual intervention. In the intervention, they were taught Natural Science under the topic: Matter and Materials. These lessons were conducted in both English, IsiZulu and IsiXhosa. The intervention employed a translanguaging pedagogy - seamlessly integrating the three languages, to support meaningful engagement, comprehension, knowledge construction and to emphasise important concepts and explaining meanings of difficult words.

In the experimental group, translingual communication was utilised. Learners and the teacher were dynamically translingual seamlessly moving between the different languages in order to optimise comprehension and enhance learner participation. The teacher strategically connected the learners to their home languages and would even translate some of the words and questions that would arise so as to give clarity to the learners. This at times took the form of make use of examples that learners were familiar to from their home or community, cultural resources and examples that resonated with their cultural backgrounds and experiences. By enabling learners to use their whole language repertoire and promoting a more inclusive learning environment, this dynamic and adaptable strategy sought to maximise the linguistic richness of the classroom.

Contrary to this form of instruction, the control group followed the English-only instruction where they adhered to the school's medium of instruction. This meant that though they were taught by the same teacher and learning the same topic, all lessons and interactions were conducted solely in English, without incorporating the other languages or any translanguaging strategy. An extensive assessment of the precise impacts of the multilingual intervention on learners' learning results was made possible by the comparison between the two groups. In order to shed light on the possible advantages of implementing multilingual techniques in classrooms with various linguistic backgrounds, the study looked for variations in academic performance, engagement, and language development between the groups.

4.6 Post-test analysis

A synchronised post-test covering the same material domain was given to both groups in order to assess their learning outcomes. On the other hand, the control group's post-test was in English only, while the experimental group's test instrument included bilingual presentation of both English and isiZulu and English and IsiXhosa to match the learners' learning environment.

The post-test comprised of 15 multiple choice questions and was written in 20 minutes. This was the same test they wrote as the pre-test and it was done to guarantee that learning outcomes are consistently assessed during the course of the study's two stages. Recognising the potential influence of question order on learning outcome assessments.

4.6.1 Test reliability

To examine the reliability of the post-test for both the control and experimental groups, the researcher made use of the Cronbach's alpha. Cronbach's alpha is a statistical measure used to assess the internal consistency of a test. Specifically, it quantifies the reliability of a collection of test questions that measure the same characteristic. It is widely used in psychological test construction and interpretation, and it ranges from 0 to 1. Higher values indicate greater agreement between items, suggesting consistent measurements thus supporting the reliability of the measurement. Low values imply that the items do not reliably measure the same property, suggesting that the items may not assess the same construct reliably. Test reliability deductions were made by contrasting the computed alpha values with accepted interpretation standards, like:

$\alpha \geq 0.90$ excellent test

$0.80 \leq \alpha < 0.90$ Good test

$0.70 \leq \alpha < 0.80$ Acceptable

$0.60 \leq \alpha < 0.70$ Questionable

$0.50 \leq \alpha < 0.60$ Poor

$\alpha < 0.50$ Unacceptable (Creswell, 2021; McMillan & Schumacher, 2010).

To calculate the Cronbach's alpha for the control group's post-test:

$$\alpha = \frac{15}{14}\left(1 - \frac{3.36}{9.91}\right)$$
$$\alpha = 0.71$$

According to tabulated international standard values, the above alpha estimate (0.71) is indicative of an acceptable test given to the learners.

To calculate the Cronbach's alpha for the experimental group the following was done:

$$\alpha = \frac{15}{14}\left(1 - \frac{3.24}{11.66}\right)$$
$$\alpha = 0.77$$

Similarly, as per the international standard values, the above alpha estimate (0.77) is indicative of an acceptable test given to the learners.

4.6.2 Post test marks analysis

Figure 4:10 below shows the post-test performance of all participants that is both the experimental and control groups:

FIGURE 4:10 POST-TEST MARKS FOR ALL PARTICIPANTS (N=40)

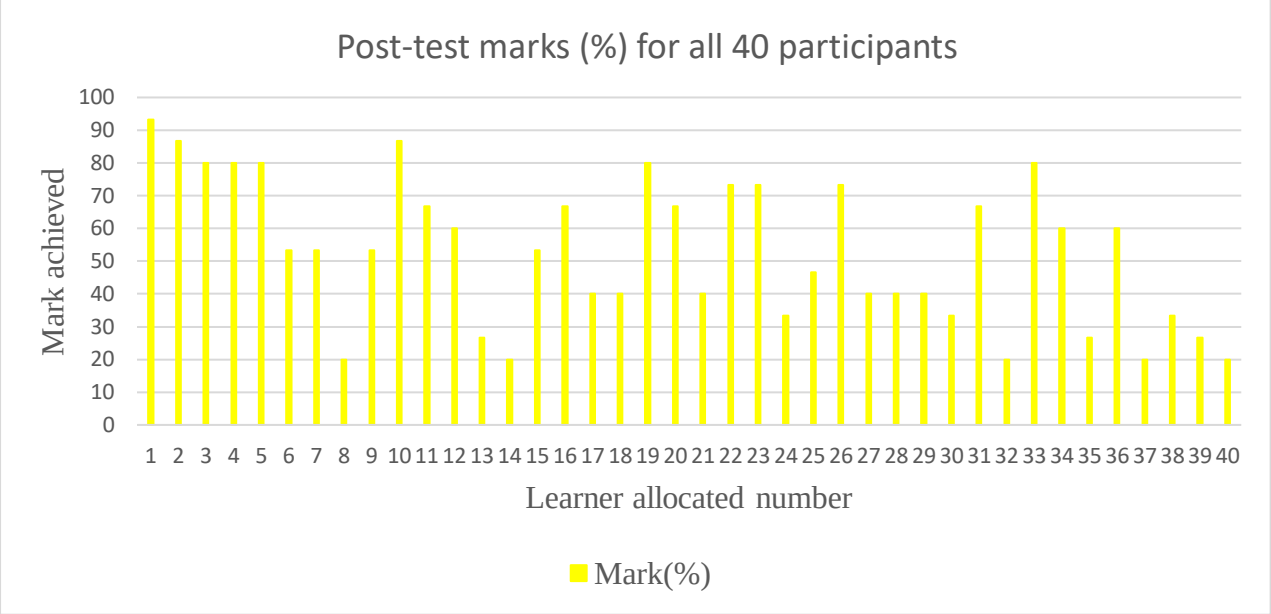
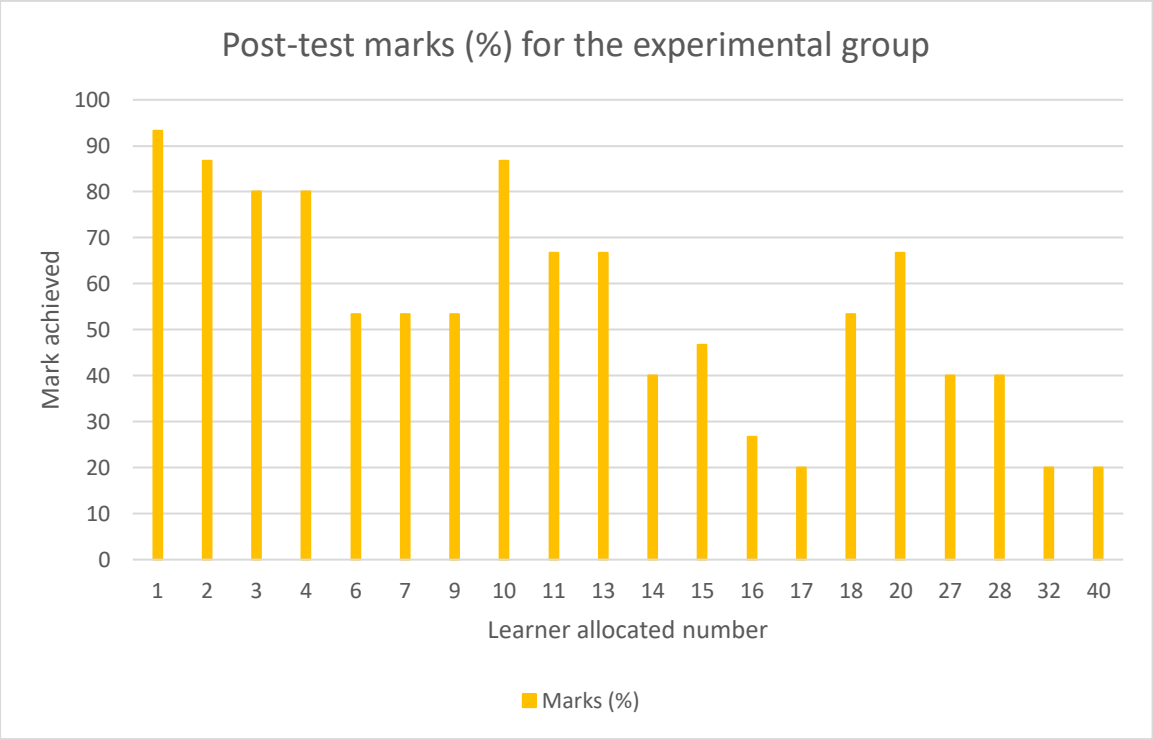


Figure 4:10 shows a graphical representation of the post-test performance across the 40 participants. 72.5% of the learners (29) managed to meet the minimum passing score of 40% and above as per CAPS grade 4 promotion requirements (DBE, 2016). Only 55% that is 22 of the 40 participants surpassed the 50% mark. There is a wide disparity of the performance as highlighted by the wide range of scores. Unlike the pre-test, the post-test has 8 learners who met the outstanding mark which is according to DBE (2016), 80% and above yet in the post test there was none. From the data, the highest learner scored 93% (14/15) and the lowest learner scored 20% which is 2/15. Overall, the participants had an average of 52.8%. This implies that there was an improvement which will be delved on in the subsequent paragraphs.

Figure 4:11 below will look into the performance of the experimental group.

FIGURE 4:11 POST-TEST MARKS FOR THE EXPERIMENTAL GROUP (N=20)



An analysis of Figure 4:11 above reveals a pleasing performance where only 4 of the 20 learners (20%) in the experimental group attained a mark below 40% while a majority of learners that is 80% met the minimum pass requirement of 40% and above as stipulated by CAPS requirements for grade 4 (DBE, 2016). 60% of the learners (12) in this group surpassed the 50% mark. Notably, the experimental group demonstrated a higher average score of 54.67% with 3.3% difference from the control group's average. The highest score in the experimental group is an outstanding 93%. This pleasing feat exemplifies the impact of the intervention in enhancing learner performance and promoting mastery among high-performing learners.

Without taking into account the significant upheaval to their learning environment—namely, the sudden switch from an English-only setting to the translanguaging and a multilingual classroom—it would be oversimplified to attribute this change exclusively to learner performance. Numerous indications point to the possibility that this change in the surroundings had a major impact on the observed score fluctuation. The dynamic use of different languages during learning, or translanguaging, can be a very effective strategy for fostering cognitive growth and scaffolding comprehension yet at the same time causing a cultural shock to learners. Although there is an improvement in the performance of learners, a closer look into the data reveals a stark contrast at the other end of the spectrum. Some learners seem to be scoring lower than what they previously scored in the pre-test while others keep a constant score. This

highlights the need for individualised support and targeted interventions to cater to the diverse needs of learners

To delve deeper in the impact of the intervention the researcher provides a side-by-side analysis of the pre- and post-test results for the experimental group. Figure 4:12 below presents this contrast.

FIGURE 4:12 PRE AND POST-TEST MARKS FOR THE EXPERIMENTAL GROUP (N=20)

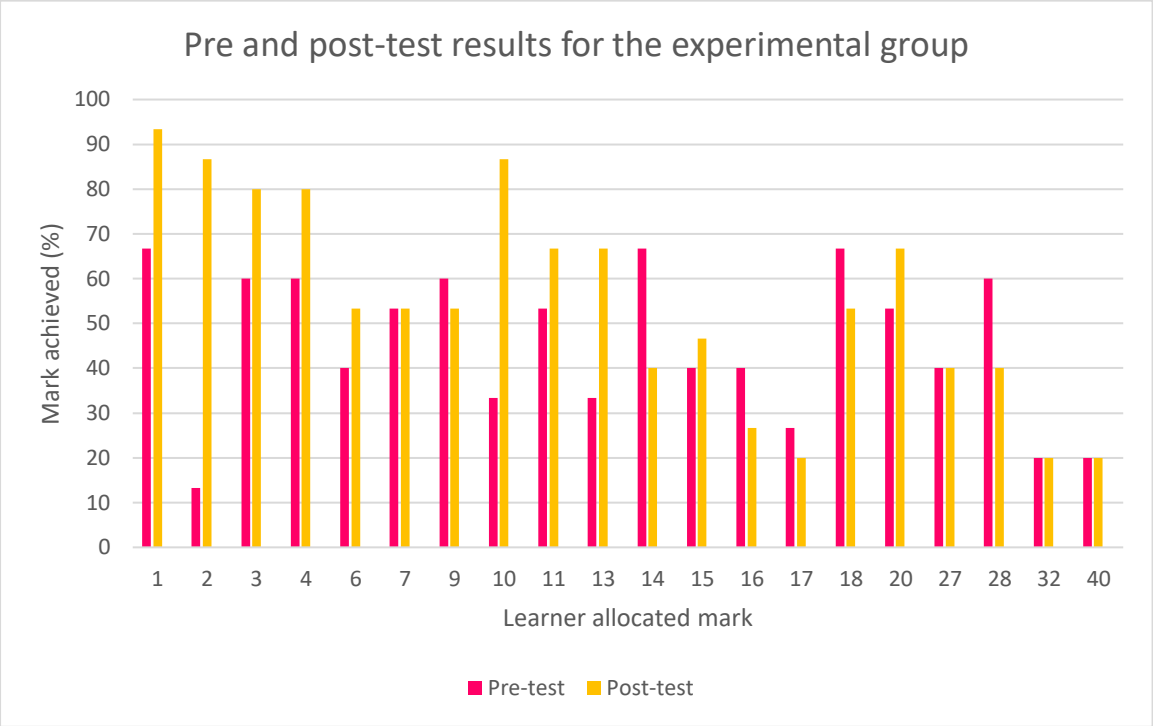


Figure 4:12 presents a juxtaposed analysis of the pre-and post-test marks for the experimental group. There is a noticeable surge in performance following the intervention as some learners show a robust improvement as indicated in the graphical representation in Figure 4:12. The average score moved from 45.33% in the pre-test to 54.67% in the post test, meaning there is a 9.34% difference. This shows that though there is still room for improvement, most learners managed to improve and master some of the concepts, indicating the effectiveness of the intervention.

Delving deeper into the distribution of scores, 50% of the learners had a higher post-test score than their pre-test score, 20 % kept the same score and 30% dropped from the pre-test score to the post-test score. This means that 70% of the learners positively benefited from the intervention with some having a full grasp of concepts, others having a solidified understanding and really presenting an impressive feat showing that the intervention propelled them towards a higher level of proficiency in NS.

It is worth noting that 30 % of the 20 participants in the experimental group reveal a complex dynamic that the researcher observed among the participants during the study. It presented the researcher with an opportunity for further investigation as far as the translanguaging pedagogy in the NS instruction is concerned. This will be delved on in detail in section 4.7.

TABLE 4:5 STATISTICAL ANALYSIS OF PRE AND POST-TEST RESULTS FOR THE EXPERIMENTAL GROUP

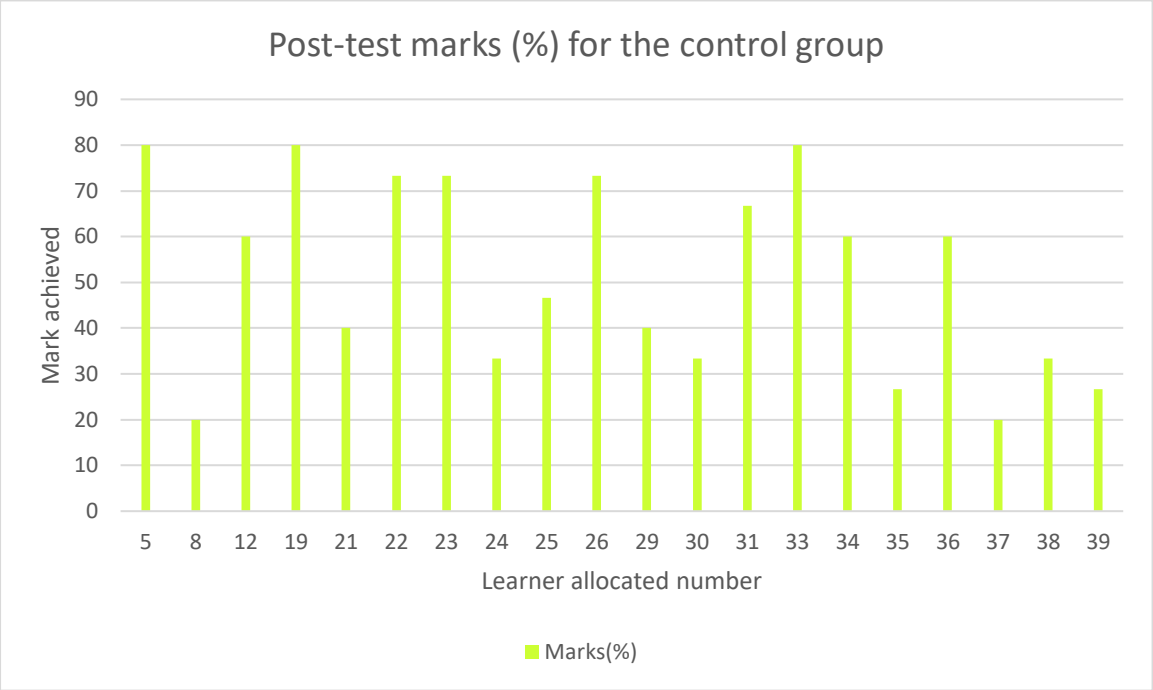
Experimental group	**Mean**	**SD**	**P-value**	**Effect size**	**Gain**
Pre-test	45.33%	16.5	0.05	0.48	9.34
Post-test	54.67	22.8			

A further critical examination of results presented the researcher with a p-value of 0.05. This value holds profound implications for the study, as it decisively rejects the null hypothesis which posited that: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group*. This means that the null hypothesis claimed the absence of any meaningful relationship between language and academic performance of learners. However, with a p-value of 0.05 the researcher accepts the alternative hypothesis which is a contrair of the null hypothesis and encapsulates the research or experimental proposition within the statistical framework. This then highlights the fact that there is indeed a significant relationship between language and the academic performance of learners, carrying a substantial weight for the research. It implies that the conclusions drawn from the research are not just coincidental but rather the result of real patterns or relationships found in the data. This finding validates the research and gives the theoretical framework and research topic more weight.

It is important to keep in mind, nevertheless, that statistical significance is not the same as practical relevance. Although a statistically significant association or difference is confirmed by the p-value, this does not always imply a significant or real-world impact. Therefore, in order to fully evaluate the results of the study, additional scrutiny of the effect size and its consequences is essential. The research quest has reached a key milestone with the computed p-value of 0.05. It indicates the existence of a statistically significant link or difference between the variables under study and categorically rejects the null hypothesis, giving the alternative hypothesis credibility. This result opens up new avenues for investigating the observed occurrence and its ramifications in relation to the theoretical framework and research goals.

Figure 4:13 below shows the performance of the control group:

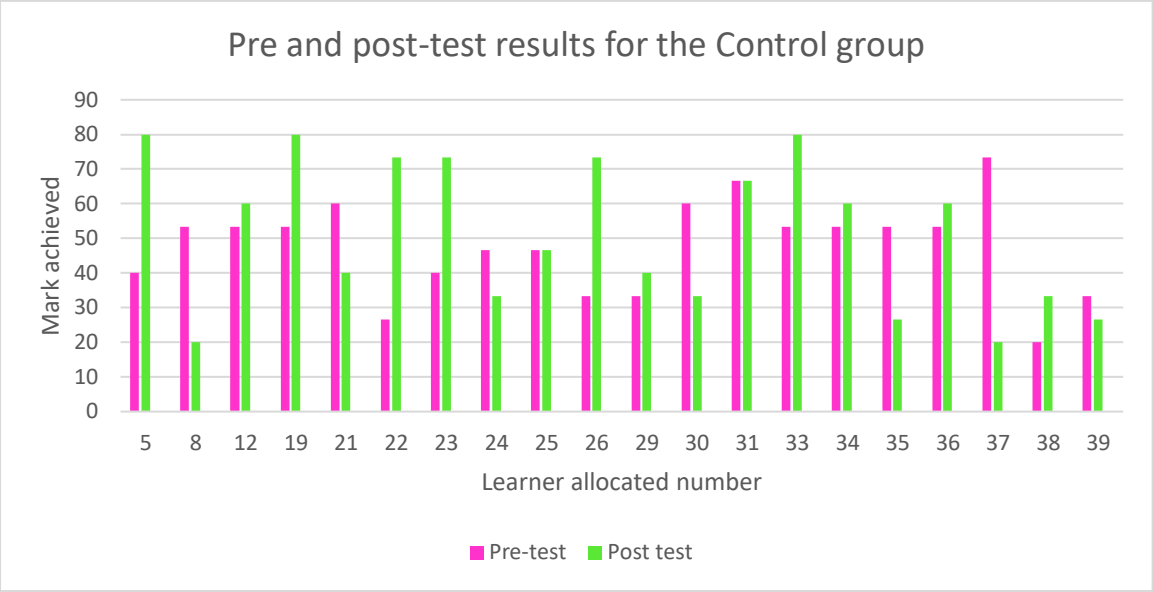
FIGURE 4:13 POST-TEST MARKS FOR THE CONTROL GROUP (N=20)



An examination of the control group's post-test results provides a more nuanced view of the learners' performance, highlighting both areas of relative strength and possible areas that need to be addressed further. The group average score of 51.33% also depicts a pleasing performance of learners in the control group. A closer look into the distribution of scores reveal that 7 of the 20 learners in this group attained a mark below 40 (35% of the participants in the control group) meaning 65% of the learners passed the minimum 40% benchmark stipulated by the CAPS. A commendable 50% of the learners secured a 50% and above in the post test and shown in the graphical representation in Figure 4:13. This means that there is generally a satisfactory level of English proficiency among learners.

It is important to note that though there are learners who seem to have an adequate grasp of the English language, a deeper look into the individual needs of learners reveal a concerning insight. Of the 7 learners who scored below 40, the researcher noted some learning obstacles that require tailored interventions as there are other underlying factors hindering their understanding. The control group results in Figure 4:13 reveal that standardised curriculum components are necessary, but adaptable teaching strategies and focused support can meet the needs of a wide range of learners and guarantee that they all have the chance to realise their potential. A detailed picture of the post-test's effects is shown by analysing the data between the two groups.

FIGURE 4:14 PRE AND POST-TEST MARKS FOR THE CONTROL GROUP (N=20)



Although the average score for the control group increased, from 47.67% to 51.33%, when comparing the pre- and post-test results, a closer look reveals a more complex picture. Cognisant of the fact that the learners in this group had opted for an English only mode of instruction, this average increase was somehow anticipated by the researcher as the learners had proficiency in the language. 50% of the learners as shown in Figure 4:14 managed to get a higher score in the post test than their pre-test.

It is indeed crucial to acknowledge the positive trend within the control group as it showcases continued learning and progress. However, there is a significant number of learners whose pre-test mark is way above their post-test showing a decline in comprehension. This present the researcher with new curiosity as to how this was made possible. Thus, understanding the control group's performance necessitates a more complex analysis than just focusing on score variations. Any relevant analysis must take into account the significant contextual background of each learner and its possible effects on language access and learning processes.

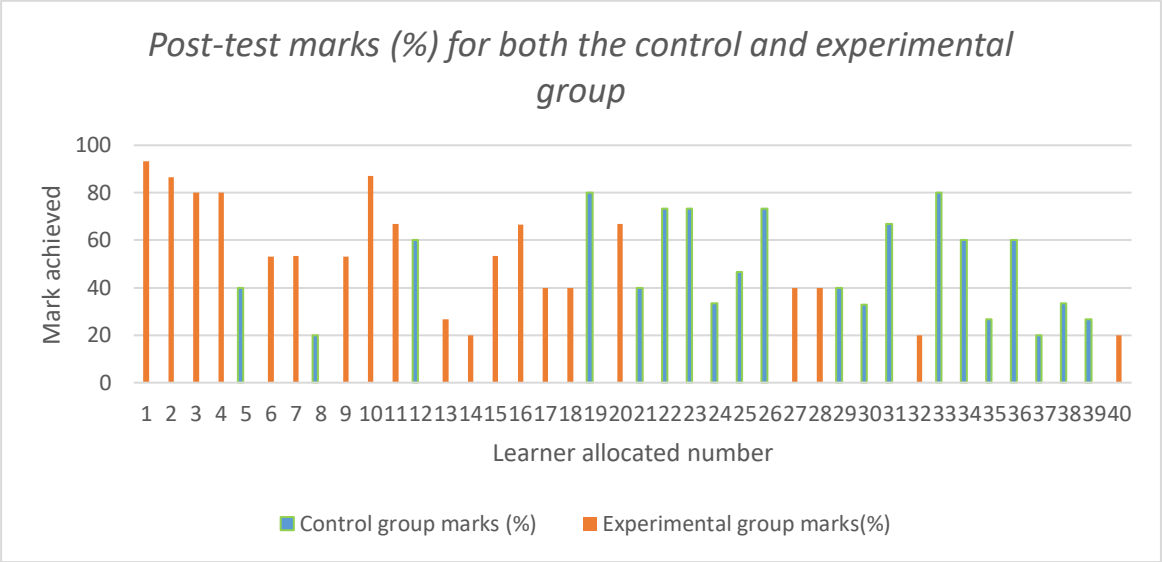
Table 4:6 below provides a statistical analysis of the control group's pre and post test results:

TABLE 4:6 STATISTICAL ANALYSIS OF PRE AND POST-TEST RESULTS FOR THE CONTROL GROUP

Control group	**Mean**	**SD**	**P-value**	**Effect size**	**Gain**
Pre-test	47.67	13.2	0.28	0.21	3.66
Post-test	51.33	21.0			

This t-test statistical analysis presented in Table 4:6 yielded a p-value of 0,27645 which is approximately 0.3. When juxtaposed against the predetermined significance level of 0.05, the p-value is not statistically significant because it is well below the threshold. As such, the researcher lacks the confidence to reject the null hypothesis. According to McMillan and Schumacher (2010) anything exceeding 0.10 is deemed a non-significant difference. In essence, the control group's data does not provide compelling evidence to support the existence of a statistically significant effect within the parameters of the investigation. Cognisant of the fact that no intervention was offered in this group, the hypothesis cannot be definitively proven making it reasonable to expect no substantial change in the performance of learners.

FIGURE 4:15 POST-TEST MARKS FOR BOTH THE CONTROL AND EXPERIMENTAL GROUP (N=40)



Upon doing a comprehensive examination of the post-test results, it becomes evident that the experimental and control groups' learning outcomes differ significantly. The experimental group, exposed to the intervention employing multilingual and translanguaging pedagogies, achieved a pleasing average score of 54.67%, surpassing the control group's average of 51.33%. This difference of 3.34% paints a somewhat compelling picture of the effectiveness of the intervention, that is the translanguaging approaches in fostering deeper understanding and comprehension. The contrast becomes even more evident when we examine the performance of learners falling below the expected benchmark. In the experimental group, only four (4) learners scored below 40% compared to seven (7) in the control group, demonstrating the intervention's success in raising the flow of understanding and ensuring near universal engagement with the material and the potential limitations of adhering strictly to CAPS recommendations without considering the diverse linguistic realities of learners.

These results offer convincing evidence for the hypothesis that learners who use translanguaging and other multilingual pedagogies comprehend more than those who are limited to monolingual learning contexts. By leveraging their existing linguistic repertoires, learners in the experimental group were able to comprehend and master NS concepts and engage effectively in class in order to get a more nuanced understanding of the different concepts. It is important to acknowledge that these findings are based on a single study and warrant further investigation to solidify the generalizability of these results. Nevertheless, the observed statistically significant difference in performance between the two groups provides a somewhat compelling argument for reconsidering the prevailing monolingual pedagogical models and exploring the transformative potential of translanguaging and multilingual pedagogical practices in contemporary educational settings.

TABLE 4:7 STATISTICAL ANALYSIS OF RESULTS FOR THE CONTROL AND EXPERIMENTAL GROUP

Test	Group	Mean	Sd	p-value	Effect size	Gain
Natural Science Post-test	**Experimental**	54.67%	22.76%	0,312	0.15	3.34
	Control	51.33%	20.99%			

The statistical analysis presented in Table 4:7 for both the experimental and control group reveals minimal differences in performance between the two groups. This aligns with the observed means and standard deviations, which showed a negligible difference of 3.34% in means and 1.77% in standard deviations. Notably, the experimental group, achieved a slightly higher mean score (54.67%) and standard deviation (22.76%) compared to the control group performance of 51.33% and 20.99% respectively.

Based on the aforementioned standards, if the P-value exceeds 0.10 ($p > 0.10$) it is deemed a non-significant difference (McMillan & Schumacher, 2010). Thus, in this instance where the p-value surpassed 0.10 ($p > 0.10$) and is 0.312 the researcher accepted the null hypothesis. This suggests that the translanguaging intervention that was implemented in the experimental group did not produce a statistically significant impact on learning outcomes compared to the traditional English-only approach employed in the control group.

4.6.3 Question by question analysis of learners' responses

To get a deeper and microscopic understanding of the learner's performance, the researcher analysed their responses to all the questions as presented in the tables below (Table 4:8 - Table 4:19).

TABLE 4:8 PRE-TEST AND POST-TEST RESULTS FOR THE EXPERIMENTAL GROUP (QUESTIONS 1-4)

Question 1 Pre-test			Question 1 Post-test			Question 2 Pre-test			Question 2 Post-test			Question 3 Pre-test			Question 3 Post-test			Question 4 Pre-test			Question 4 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	2	10	A	0	0	A	11	55	A	13	65	A	3	15	A	2	10	A	5	25	A	0	0
B	1	5	B	3	15	B	5	25	B	1	5	B	1	5	B	4	20	B	5	25	B	4	20
C	17	85	C	17	85	C	3	15	C	6	30	C	16	80	C	14	70	C	4	20	C	12	60
D	0	0	D	0	0	D	1	5	D	0	0	D	0	0	D	0	0	D	6	30	D	4	20
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

An in-depth examination of Questions 1 to 4 in Table 4:8 above reveals intriguing patterns of learning gain within the experimental group. The frequency is the number of learners who chose a particular option while the valid column is the percentage of the learners in the particular option. The test was written by 20 learners, and they had to choose one option from the four given per question.

In Question 1 most learners had a good understanding of matter especially the qualities of liquids. This is showed by 85% of learners in the pre-test choosing the correct answer and with a slight improvement in terms of the logic behind liquids in the post test where instead of choosing material, those that had erred in the pre-test managed to choose "*type*" (option B) though it was not the correct answer but it shows a somewhat improvement in terms of understanding what the question requires of them. This suggests that the intervention helped clear out some misconceptions as far as the states of matter are concerned.

Question 2 presents a significant portion of learners (45%) in the pre-test who erred, opting for different options that is 25% opted for B ("*condenses*") while 15% opted for C ("*solids*") and one learner opting for D ("*bottle*") instead of the correct answer A ("*space*"). This suggests a potential confusion as learners associated the first word to different familiar words that they

have heard in relation to gases. Surprisingly, the post-test paints a somewhat justification to the confusion because instead of a majority of the learners who had missed it the pre-test getting the correct answer, they still opt for option C which is a state of matter and not really an answer to the question. However, the intervention evidently impacted the learners understanding as the performance slightly improved from 55% in the pre-test to 65% in the post test.

Considering Question 3, the majority (80%) of learners in the experimental group chose the correct answer. However, in the post test the number dropped to 70% of learners with an increase in option B from 5% to 20%. This shows that there was a built up of a misconception among learners as they had related certain words to specific processes take for instance; heating was overly related to evaporation which might be the reason why some of them opted for B instead of the correct answer C. This performance gradually introduces us to the prevalent commotion that learners face as far as language is concerned, it shows that though the intervention helped the learners understand the process, the application of it is still lagging.

Question 4 exhibits a different, yet equally informative trend. While a majority of learners (80%) in the pre-test selected the wrong answers, the post-test saw a noticeable jump in accuracy. For instance, the number of correct responses for question 4 surged from 20% in the pre-test to 60% in the post-test, demonstrating a clear gain in proficiency.

This detailed examination of a particular question's performance provides insightful information on the kind and scope of learning improvements brought about by the intervention. It also helps in addressing specific misconceptions (as seen in question 3) and solidifying existing knowledge (as seen in Question 1 and 2). By exploring individual questions, the researcher gained a nuanced understanding of the learning process and the targeted impact of the intervention.

To understand the identified confusion that is prevalent in the experimental group, the researcher saw it fit to look into the performance of the control group as well in order to get a general sense of what might be happening. The table below present data collected form the pre and post test of the control group and it is arranged in the same way that the experimental group data is arranged in Table 4:8

TABLE 4:9 PRE-AND POST-TEST RESULTS FOR THE CONTROL GROUP (QUESTIONS 1-4)

Question 1 Pre-test			Question 1 Post-test			Question 2 Pre-test			Question 2 Post-test			Question 3 Pre-test			Question 3 Post-test			Question 4 Pre-test			Question 4 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	
A	0	0	A	2	10	A	12	60	A	13	65	A	1	5	A	3	15	A	5	25	A	1	5
B	3	15	B	2	10	B	1	5	B	2	10	B	1	5	B	2	10	B	4	20	B	3	15
C	14	70	C	11	55	C	5	25	C	4	20	C	17	85	C	13	65	C	7	35	C	11	55
D	3	15	D	5	25	D	2	10	D	1	5	D	1	5	D	2	10	D	4	20	D	5	25
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

Table 4:9 above shows that 70% of learners in the control group got Question 1 correct in the pre-test. However, the number dropped to 55% in the post test. From analysing the experimental group, this is expected but what shocked the researcher is the amount of confusion highlighted by the results. In the pre-test none of the learners opted for option A but in the post test there is an even distribution between option A and B and 25% go on to choose option D. This is the same trend in Question 3 where 85% of learners got Question 3 correct in the pre-test but when it comes to the post test the number drops to 65%. There was a 5% increase in the number of learners who got Question 2 correct and a 20% increase in the number of learners who got Question 4 correct.

TABLE 4:10 COMPARISON OF THE PRE-AND POST-TEST RESULTS FOR THE EXPERIMENTAL AND CONTROL GROUP (QUESTIONS 1-4)

	1		**2**		**3**		**4**		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Mean
Control	70%	55%	60%	65%	85%	65%	35%	55%	
Gain	-15		5		-20		20		-10
Experimental	85%	85%	55%	65%	80%	70%	20%	60%	
Gain	0		10		-10		40		10

Considering the two group's performance in the first 4 questions as summarised in Table 4:10 above, similar patterns are immerging. Overly the experimental group has a higher average of 10% while the control group is lagging behind with a negative 10%.

Question 5-8 still provide a wealth of information about the experimental and control group's learning journey. Table 4:11 below presents a continual presentation of findings.

TABLE 4:11 PRE-AND POST-TEST RESULTS FOR EXPERIMENTAL GROUP (QUESTIONS 5-8)

Question 5 Pre-test			Question 5 Post-test			Question 6 Pre-test			Question 6 Post-test			Question 7 Pre-test			Question 7 Post-test			Question 8 Pre-test			Question 8 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	4	20	A	5	25	A	2	10	A	5	25	A	5	25	A	4	20	A	11	55	A	7	35
B	9	45	B	5	25	B	1	5	B	0	0	B	6	30	B	6	30	B	3	15	B	6	30
C	3	15	C	3	15	C	1	5	C	3	15	C	8	40	C	10	50	C	5	25	C	5	25
D	4	20	D	7	35	D	16	80	D	12	60	D	1	5	D	0	0	D	1	5	D	2	10
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

In Question 5, a sizable 45% of learners in the pre-test chose the correct option B, with 55% choosing the incorrect ones. This question's performance is really concerning because it is a general question that asks about something they use every day, and they have to relate it to the states of matter. Indeed, there is a lingering struggle with conceptualising as majority of the learners still chose the wrong answer in the post test dropping the average from 45% to 25%. The question required them to choose the correct answer that would state what a ruler is between the three states of matter and the last option gave them room to refute all the options. To the researcher's surprise there were learners (15%) who still thought a ruler was a gas (option C), others thought is it was a liquid (25%). This indicates that perhaps the intervention brought some confusion to the learners as a majority of opted for D which indicated that there is no correct answer in the options given. Similarly, Question 6 reveals the same pattern of failing to understand the question and linking individual words in the sentence to the answer. The average dropped from 80% to 60 %.

Moving on to Question 7 and Question 8 the trend shifts to consistent grasp of the material. Question 7 has a 10% increase and Question 8 has a please 15% increase. While some of the learners answered correctly in the pre-test, post-test scores revealed a commendable upward trajectory. This shows the effectiveness of the intervention in enhancing learner's understanding.

TABLE 4:12 PRE- AND POST-TEST RESULTS FOR THE CONTROL GROUP (QUESTIONS 5-8)

Question 5 Pre-test			Question 5 Post-test			Question 6 Pre-test			Question 6 Post-test			Question 7 Pre-test			Question 7 Post-test			Question 8 Pre-test			Question 8 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	1	5	A	3	15	A	4	20	A	1	5	A	0	0	A	0	0	A	9	45	A	9	45
B	8	48	B	5	25	B	0	0	B	1	5	B	6	30	B	4	20	B	1	5	B	8	40
C	3	15	C	8	40	C	2	10	C	3	15	C	12	60	C	14	70	C	8	40	C	1	5
D	8	40	D	4	20	D	14	70	D	15	75	D	2	10	D	2	10	D	2	10	D	2	10
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

The control group's performance is presented in Table 4:12. Though the learners had a concerning 23% drop from the pre-test of Question 5 to its post-test, they managed to have a steady upward growth in the subsequent questions that is Question 6 (70% to 75%), Question 7 (60% 60 70%) and Question 8 (5% to 40%).

TABLE 4:13 COMPARISON OF THE PRE-AND POST-TEST RESULTS FOR THE EXPERIMENTAL AND CONTROL GROUP (QUESTIONS 5-8)

	5		**6**		**7**		**8**		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Mean
Control	48%	25%	70%	75%	60%	70%	5%	40%	
Gain	-23		5		10		35		6.75
Experimental	45%	25%	80%	60%	40%	50%	15%	30%	
Gain	-20		-20		10		15		-3.75

Considering the two group's performance in Questions 5 to 8 as summarised in Table 4:13 above, the experimental group seemed to be struggling. Though the intervention worked for the other two questions 7 and 8, the learner's performance is not as pleasing as a majority of the learners still opt for wrong answers. Overly the Control group has a higher average of 6.75% while the experimental group is lagging behind with a negative 3.75%.

Furthermore, Questions 9-10 provide an interesting insight of the learner's performance and the impact the intervention had on their learning. Table 4:14 below presents a continual presentation of findings.

TABLE 4:14 PRE-AND POST-TEST RESULTS FOR EXPERIMENTAL GROUP (QUESTIONS 9-12)

Question 9 Pre-test			Question 9 Post-test			Question 10 Pre-test			Question 10 Post-test			Question 11 Pre-test			Question 11 Post-test			Question 12 Pre-test			Question 12 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	9	45	A	4	20	A	10	50	A	11	55	A	8	40	A	6	30	A	13	65	A	12	60
B	5	25	B	5	25	B	4	20	B	3	15	B	5	25	B	4	20	B	2	10	B	1	5
C	0	0	C	1	5	C	1	5	C	1	5	C	5	25	C	5	25	C	3	15	C	5	25
D	6	30	D	10	50	D	5	25	D	5	25	D	2	10	D	5	25	D	2	10	D	2	10
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

Question 9 and 10 reveal a commendable upward trajectory. In Question 9 learners managed to move from an average of 30% to 50%, showcasing the intervention's ability to solidify existing knowledge and propel understanding to new heights. Similarly, Question 10 saw a 5% increase showing revealing that learner's knowledge had been solidified and though there was a constant 25% in option D most learners managed to answer the question correctly.

However, confusion reared its head again in Question 11 and 12. A majority of learners in the pre-test mistook A for the correct answer B and the same happened in the post-test. The same trend is observed in Question 12. However, in Question 11, a majority of learners had chosen the correct option even though there was a 5% drop. This highlights a potential lingering struggle with understanding instruction and knowing what the statement means.

TABLE 4:15 PRE-AND POST-TEST RESULTS FOR THE CONTROL GROUP (QUESTIONS 9-12)

Question 9 Pre-test			Question 9 Post-test			Question 10 Pre-test			Question 10 Post-test			Question 11 Pre-test			Question 11 Post-test			Question 12 Pre-test			Question 12 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	6	30	A	1	5	A	7	35	A	8	40	A	5	25	A	1	5	A	13	65	A	6	30
B	5	25	B	9	45	B	3	15	B	6	30	B	6	30	B	12	60	B	0	0	B	5	25
C	3	15	C	1	5	C	3	15	C	1	5	C	2	10	C	2	10	C	4	20	C	7	35
D	6	30	D	9	45	D	7	35	D	5	25	D	7	35	D	5	25	D	3	15	D	2	10
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

While the experimental group paints a somewhat improved performance in Questions 9-12, the experimental group reveals a drop in performance. Though there is a 15% and 5% increase in Question 9 and 10 consecutively, a majority of learners still show a conceptual hurdle. The instability is further highlighted in Question 11 where the post-test paints a much brighter picture with a resounding 60% of learners nailing the question making Question 11 have 30% increase. Just after this increase there is a 35% decrease in question 12 where learners dropped from 65% to 30%. Table 4:16 below compares the performance of the two groups: the control and experimental to get a more nuanced analysis.

TABLE 4:16 COMPARISON OF THE PRE-TEST AND POST-TEST RESULTS FOR THE EXPERIMENTAL AND CONTROL GROUP (QUESTIONS 9-12)

	9		**10**		**11**		**12**		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Mean
Control	30%	45%	35%	40%	30%	60%	65%	30%	
Gain	15		5		30		-35		3.75
Experimental	30%	50%	50%	55%	25%	20%	65%	60%	
Gain	20		5		-5		-5		3.75

Considering the two group's performance in Questions 9 to 12 as summarised in Table 4:16 above, both the experimental and the control group seem to be struggling with different questions. This results in them achieving the same average but when closely analysed, there is a significant improvement in the experimental group. It is important to note that the intervention worked quite well in the experimental group. There is a steady consistent mastery by the experimental group and a closer look in Question 12 unveils a fascinating tale of overcoming misconceptions and solidifying understanding. Interestingly both the experimental and control group scored 65% in the pre-test but the control group seem to be overcome by confusion, resulting in the drop in performance from 65% to 30%. The intervention did bridge a conceptual gap enabling learners to understand the different concepts and master them well.

Questions 13-15 provide an intriguing insight of the learner's performance and the impact the intervention had on their learning. Table 4:17 below presents a continual presentation of findings for number 13 to 15.

TABLE 4:17 PRE-AND POST-TEST RESULTS FOR EXPERIMENTAL GROUP (QUESTIONS 13-15)

Question 13 Pre-test			Question 13 Post-test			Question 14 Pre-test			Question 14 Post-test			Question 15 Pre-test			Question 15 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	10	50	A	4	20	A	7	35	A	2	10	A	12	60	A	4	20
B	4	20	B	13	65	B	2	10	B	6	30	B	5	25	B	16	80
C	2	10	C	3	15	C	9	45	C	10	50	C	2	10	C	0	0
D	4	20	D	0	0	D	2	10	D	2	10	D	1	5	D	0	0
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

Delving in the last 3 questions of the test, the results seem to be embedded in a silver lining. Across all three questions there is a pleasing improvement with Question 15 having the highest increase in all 15 questions. In the pre-test of Question 13, a significant portion of learners (80%) erred, a majority opting for A. This clearly shows that they relied mostly on their prior knowledge which had nothing to do with structures but rather general. The question required them to state which of the given materials gave support and most opted for "*shell*" relating it to the animal (snail) instead of structure. This reveals the misconception that they had and the lack of understanding that emanates from conceptual confusion. With a remarkable 65% of learners selecting the correct answer B in the post test, the intervention evidently built on the learner's prior knowledge and linked it to the topic of structures. In like manner, Question 14 saw a slight improvement and though somewhat impressive, the researcher realised that some learners still chose the characteristics that were for the glass and not against.

A similar pattern of misconception-turned-mastery unfolds in Question 15. In the pre-test, 75% chose incorrect answers with a dominant 60% of learners opting for option A, seemingly convinced that rondavels were built by the Zulu people, when instead they were built by the Xhosa people. This highlights a potential confusion regarding familiarity to certain words and associating them with the answer to whatever question because learners barely understood some of the concepts. However, the post-test witnessed a remarkable shift. With 80% of learners choosing the correct answer B. The intervention effectively equipped learners with the necessary knowledge to understand different phenomena.

TABLE 4:18 PRE-AND POST-TEST RESULTS FOR CONTROL GROUP (QUESTIONS 13-15)

Question 13 Pre-test			Question 13 Post-test			Question 14 Pre-test			Question 14 Post-test			Question 15 Pre-test			Question 15 Post-test		
	Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %		Frequency	Valid %
A	4	20	A	2	10	A	5	25	A	2	10	A	10	50	A	5	25
B	13	65	B	7	35	B	3	15	B	5	25	B	5	25	B	15	75
C	1	5	C	8	40	C	8	40	C	6	30	C	2	10	C	0	0
D	2	10	D	3	15	D	4	20	D	7	35	D	3	15	D	0	0
Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100	Total	20	100

Table 4:18 presents the performance of the control group. Cognisant of the concern raised when this post-test analysis started in Table 4:8, the researcher highlighted that there had been an observed trend of confusion among learners thus they saw it fit to compare the analysis of the experimental group, parallel to that of the control. Clearly that observation has been maintained throughout this section and as if that was not enough, Questions 13-15 are wrapping it up. From the Table 4:17 Pre-and post-test results for Experimental group (questions 13-15) above, it is clear that there is conceptual misunderstanding among learners as they fail to stick to the correct option or rather to choose a correct option. In the pre-test of Question 13 a majority of learners opted for B which was the correct answer but in the post test they seem to be unsure of which answer is correct and there is a drop from 65% in the pre-test to 35% in the post test. This misconception is carried over to Question 14 where learners are failing to understand the needs of the question and they are just choosing all the answers. However, Question 15 sees a turn with a 50% increase and a skewed selection between option A and option B.

Table 4:19 below shows a summary and comparison of the two groups in the last 3 questions.

TABLE 4:19 COMPARISON OF THE PRE-AND POST-TEST RESULTS FOR CONTROL AND EXPERIMENTAL GROUP (QUESTION 13-15)

	13		**14**		**15**		
	Pre	Post	Pre	Post	Pre	Post	Mean
Control	65%	35%	40%	30%	25%	75%	
Gain	-30		-10		50		3.33
Experimental	20%	65%	45%	50%	25%	80%	
Gain	45		5		55		35

Considering the two group's performance in Questions 13 to 15 as summarised in Table 4:19, the nuanced analysis of questions 11-15 transcends mere statistics. It showcases the intervention's ability to not only impart new knowledge but also actively address and rectify pre-existing misconceptions. This targeted approach to tackling conceptual hurdles paves the way for a more robust and sustainable understanding of the subject matter. The researcher is confident that about these claims because of the comparison made with the control group as presented in the table above.

4.7 Qualitative data analysis

In the pursuit of understanding the dynamics of language instruction in Grade 4, and to get a deeper meaning of the quantitative data presented above the researcher analysed the qualitative data of the study. Qualitative data is a systematic process that examines non-numerical data to extract meaning, patterns, and insights. Unlike quantitative analysis, which focused on numbers and statistical metrics, qualitative data delved into the qualitative aspects of data, such as observation and interviews. It aimed to understand every facet of learner, parents and teacher's experiences, perceptions, and behaviours by exploring the richness of the data. The researchers used this method to explore complex and nuanced aspects of phenomena, understand contextual insights, develop theories, highlight participant perspectives, and conduct exploratory research.

4.7.1 Observations.

The researcher conducted observations in the two distinct NS classroom groups (the control group that received instruction in English only and the experimental group taught in isiZulu and isiXhosa, the learners' home language) consisting of 20 learners each. The first group was taught exclusively in English being the control group, while the second utilised a translingual approach, incorporating both home languages (isiZulu and isiXhosa) and English which was the experimental group. The objective was to discern the impact of these language modalities on the learners' comprehension and overall academic performance.

Prior the intervention, both groups had an English-only instructional environment, the teacher had little to no spontaneous integration of multiple languages into their pedagogical practices. Everyone had to abide by the school rules and African languages were not permitted in the NS lesson. This had been the norm and though some learners had a difficult time, they conformed to the rules and due to the multiple languages in the class this was understood to be the best option that accommodates everyone.

The class was less vibrant with a tense silence punctuated by hesitant whispers and the rustle of frustration as learners tried to express themselves. There was reduced participation and only a few learners would repeatedly raise their hands to answer the questions posed, evidence of the imperceptible barrier that a single language creates. This initial observation, though disheartening, offers a crucial window into the normalised effects of a monolingual classroom.

As the research unfolded, the stark contrast between the English-only classroom and the learners' pre-existing language environment became a palpable reality in the experimental group. Stepping out of the monolingual landscape, the learners found themselves somehow grappling with uncharted waters, their accustomed monolingualism compass gradually guiding them. The struggle was evident, etched in furrowed brows and hesitant responses as they were not used to the new pedagogy.

The subject concepts, though abstract became familiar friends in the tapestry of their diverse languages. Comprehension became a seamless dance and gradually the atmosphere became vibrant with the hum of multiple tongues. Participation improved, a testament to the unveiled barrier erected by a single language. This demonstrated how crucial it is to value the diversity of learners' language landscapes and not force them to navigate scientific concepts on their own. It highlights the possible advantages of scaffolding learning by using their familiar languages to create connections between new ideas and their prior knowledge. Drawing upon the linguistic repertoires of the learners, and adopting a multilingual pedagogical stance enhanced even the mood of learners.

One learner’s raw, unfiltered exclamation,

"*we are always told to use English in Natural Science lesson and the only time we use isiZulu is when we are in the Zulu lesson, this is not a Zulu lesson miss*,"

cracked open a window into the hidden language landscape of these young learners.
"*Even if we do not understand sometimes, we have to try...*" it echoed, not just a simple statement, but a powerful testament to their former experiences. This spontaneous declaration was not just a confirmation of their monolingual classrooms; it was a ripple of apprehension, a whisper of unease at the prospect of diving into a multilingual dominant classroom and expressing oneself fully.

This appeal across languages revealed two vital requirements. Firstly, it emphasised the significance of scaffolded support. The learners, accustomed to monolingual pedagogy may

require support in how to incorporate their home languages in an effective manner in order to have a smoother transition. Secondly, it also highlighted the possible importance of bridging activities. Establishing connections between their own languages and the content could facilitate the shift, offering comfort and familiarity amidst the unfamiliar. This learner's voice, amplified by the concurrence of others, became a powerful reminder that language is more than just words; it is a lifeline, a bridge, a home and a useful tool. In their apprehension, we see not just a challenge, but an opportunity to create a learning experience that honours the richness of their multilingual tapestry, one where every tongue finds its voice and every learner finds their way.

Contrastingly, in the monolingual classroom, where only English was used, a monotonous engaged learning environment was observed. The learners had their normal lessons and were seemingly comfortable. The monolingual pedagogy did not seem to faze them, and they demonstrated a somewhat understanding of the instructional content. The monolingual approach seemed to facilitate a somewhat inclusive learning experience with less learner participation. From this observation there were emerging themes and these will be delved into in the subsequent paragraphs:

Theme 1: Linguistic disorientation: The sad reality in the classroom

Confined within the walls of an English-only classroom, learners from diverse linguistic backgrounds find themselves grappling with a paradoxical reality. Learners are forced to conform to an English only pedagogy at school. This linguistic gulf and discord serve as a forging ground for their cognitive problems. The control group which was immersed in an English-only approach faced the brunt of the language dissonance. Despite having a home language different from the language of instruction (English) but choosing to be taught in English, learners in the control group faltered in the face of monolingual pedagogy. Comprehension is a hurdle and interaction a distant mirage. In the barren terrain of a monolingualism, learners fail to even express their confusion for they do not understand that which they do not know as Learner 5 expressed.

Learner 5: "…*sometimes I have questions, but I don't have the words to say it and that is just hard.*"

In the same manner Learner 39 echoed similar frustrations.

Learner 39: "*if we are doing group work for example, I sometimes want to say something but because my English is bad and other learners laugh at me it just becomes hard to say anything so I just keep quiet*."

The disheartening linguistic disorientation dominating the classroom reveals the unseen challenges of surviving in a world where the learner's linguistic repertoire is marginalised or even denied. This challenges us to reconsider the often-overlooked realities of learners' daily lives especially those who find themselves struggling within the confines of a monolingual classroom. Linking it back to the hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.* This theme heightens the fact that indeed translanguaging has an effect in Johannesburg science classrooms because learners feel the need to express their views in more meaningful ways and the use of language is echoed as a major hindrance. Thus, the hypothesis is accepted.

Theme 2: Exploring the linguistic tapestry

Unlike the control group, the experimental group was introduced to a new world. A world where there is a rich and intricate interconnectedness of languages. The group was exposed to isiZulu and isiXhosa together with English. a notable theme emerged—exploring the linguistic tapestry. Cognisant of the fact that these learners have never been in a translingual class where their home language is used alongside English since grade 1, this brought a cultural shock. The transition between languages was new to them and though they gradually began to freely engage actively in classroom activities, it was a bit of a hurdle for most of them. Below is an example of learner 17 expressing how they felt.

Learner 17: "*Since grade 1 I have used English and now that I can use isiZulu to as questions, its nice but then it feels wrong because I still think that this is Science and I must not use isiZulu. Also I get to forget other words in isiZulu so 'nje' Miss it is a bit challenging*."

As their home languages and English danced hand-in-hand, a symphony of learning unfolded. This was not just a case of juxtaposed languages; rather, it was a colourful tapestry intertwined with strands of comprehension and empathy. More than just being linguistically agile, learners' ability to switch between languages fluidly served as a ticket to deeper engagement. Their home languages alongside English turned into a bridge, and the linguistic walls seemed to disappear.

The learners' voices, which had sounded uncertain when speaking in a single language, were now filled with confidence and excitement. An example by Learner 10 clearly suggests emancipation.

Learner 10: "*I don't see the reason why we should be taught in English only because actually this is fun. Even though our teacher is not Zulu but they know a little bit and they can let us discuss with my classmates, so why not do this every time? In any case it's not like we understand her English better than isiZulu."*

Their multilingual tapestry served as the fundamental building block for their educational journey as they posed queries, brought up some familiar examples, asked for clarity, refuted theories, and participated in spirited debates. This theme explored the core of how learners can be empowered by interconnected languages, fostering their curiosity and sparking their love of learning. It celebrates the diversity and depth that multilingualism provided to the classroom while challenging the idea of a single "dominant" tongue. This theme also accepts the hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.* It acknowledges the fact that fluidly switching between languages serve as a ticket to deeper engagement. In essence, if learners are able to comprehend what is being taught, then they are able to understand what could be required of them in assessments and they can be able to do well as also revealed in their post- tests.

Theme 3: Language variation and dialectology.

Multilingual pedagogies were introduced into the classroom with the intention of fostering socio-cultural inclusivity rather than only teaching language learning. This theme explores the educational transformational potential of translanguaging techniques, emphasising how they foster beneficial social interactions among learners from various origins. The act of conversing in several languages in the classrooms served as a bridge to link learners to one another's identities and cultures. Understanding and empathy were promoted by the sharing of thoughts and experiences, which was frequently made possible by local tongues. The cultural distinctions that once separated learners were now seen as threads that weaved a richer learning environment rather than obstacles.

Inclusivity took many different forms. Collaborative, respectful, and mutually supportive interactions become the norm. Learners participated in dynamic dialogues, utilising their varied cultural upbringings to enhance their comprehension. Language proficiency-based hierarchies

became obsolete, and a collective sense of ownership and belonging to the classroom took their place. This concept of multilingual-driven inclusivity casts doubts on the idea that mastering one language in a classroom is the only way to succeed academically. It illustrates how multilingual pedagogies that embrace cultural and linguistic variety may promote good social dynamics and turn classrooms into lively learning communities where all perspectives are valued, and every experience adds to a deeper comprehension of the world. This is revealed in the following extract:

Learner 17: "*If someone speaks to me or teaches me in isiXhosa I feel honoured, special and loved. This makes me want to listen to that person attentively and continue the conversation. I also get to ask about them and we also help each other, in the process my marks get better. So yes being taught in my home language makes a huge difference in my school work."*

By unravelling the intricacies of language diversity, dialectology shed light on the rich tapestry of learners' communication and cultural significance embedded in different linguistic expressions. Within this multilingual classroom, a subtler beat was heard: the pulse of cultural relevance. The incorporation of cultural components into the classroom encouraged learners to engage more deeply and comprehend material. It explored the transformative potential of information with a cultural foundation, allowing learners to recognise themselves and their experiences as part of the learning process. Learners began to make connection of the content with their prior knowledge and the realisation of these connections brought so much joy, for example Learner 13 felt the need to even expand the lesson and talk of the different aspects because they felt connected to the topic:

Learner 13: "*Every time I go to KZN we sleep in rondavels and they are such a cool place. I have a good understanding of what they are and how they are roofed using grass. Miss a can even tell you where they get the grass…it's a long process my uncle once showed me…*"

This theme proves that multilingualism is the norm in Johannesburg. Learners in a Grade 4 classroom are likely to come from diverse linguistic backgrounds, speaking various official South African languages and potentially other languages from across the African continent and beyond. Given this context, Johannesburg's language variation and dialectology accepts the hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.* This is because the sheer diversity of languages and language variation in makes translanguaging a highly relevant and potentially beneficial pedagogical approach. If learners are already drawing on their full linguistic repertoires in their daily lives, allowing

them to do so in the classroom acknowledges and values the diverse linguistic resources that they bring to the classroom, fostering a sense of belonging and self-esteem.

Theme 4: Shifting pedagogical models

This theme explores how important it is for teachers to be flexible when negotiating the ever-changing environment of multilingual classrooms. It looks at the crucial role of the teacher and what the research observed throughout the study. Undoubtedly teachers deal with a lot of difficulties when orchestrating learning especially in a densely multilingual environment and they at times take advantage of the chances that come with serving learners from a variety of linguistic backgrounds. By examining the different methods used by the experimental and control groups, important lessons can be drawn about how to design inclusive, linguistically diverse learning environments.

The teacher in the experimental group demonstrated a good adaptation to the new pedagogical approach. In order to facilitate understanding and the creation of knowledge, this required weaving a tapestry of translanguaging strategies. They promoted links between the academic domains and the home languages of the learners by utilising culturally appropriate materials, examples and content. This adaptable curriculum design valued the cultural backgrounds of the learners while offering scaffolding for language development. In essence, it involved the coordination and management of various teaching resources and capacities to meet the linguistic learning challenges effectively. In the control group, the teacher was more comfortable. The sporadic code-switching ultimately highlighted the rigidity and exclusivity inherent in a monolingual setting, even while it demonstrated the natural flexibility of language in real-world interactions. The teacher seemed to flow regardless of the minimal participation.

Teacher: "*Remember if you are quiet, it means that you understand so we move forward*."

This comparison unveils the different dynamics between teacher-centredness and learner-centeredness. It highlights the significance of adopting a more comprehensive approach that celebrates linguistic diversity and gives learners the freedom to use their multilingualism as a strength, rather than just focusing on language acquisition. This analysis reveals several important lessons. First of all, responsiveness and flexibility are necessary for effective multilingual education. To meet the unique demands and linguistic profiles of their learners, teachers must modify their approach and be lifelong learners on the new and effective ways to

cater for the needs of learners. Secondly, translanguaging and culturally appropriate information are great resources for encouraging language learning and inclusivity. Even though the teacher does not know the language of the learners, learners can be able to converse and have an effective lesson and some will even translate what certain things say in their language. Lastly, professional development courses ought to give teachers the abilities and information required to confidently negotiate the challenges of teaching in several languages.

Learner 5: "*I agree that being taught in my home language made a huge difference on my marks. As someone who always wants to be number 1 in class, I had tried reading the topic [matter and materials] on my own but I didn't understand some of the things until it was explained to me in my own language. My parents were also happy that I had been taught in our home language. It [use of one's home language] gives you a sense of belonging and pride."*

This theme focused on how important it is for teachers to be flexible in order to create inclusive, stimulating, and language-rich learning environments for multilingual learners. The full potential of every learner in a multilingual classroom can be realised by teachers through the use of flexible and culturally responsive teaching and the embrace of multiple linguistic voices. Though this theme acknowledges the potential held by this pedagogy it neither accepts nor refutes the hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.*

Theme 5: Aligning Policy perspectives with practical implementation

This theme emphasises the need to address both adapting ongoing practices to prescribed policy demands and adapting the policy itself to the needs of practice within the educational context. It explores the intricate relationships that exist between current educational regulations, the dynamic realities of multilingual classrooms, and the effects that multilingual teaching methods have been shown to have on learners in Grade 4. It highlights the urgent need to close the gap between official policy declarations and their practical implementation, making sure that language policies recognise and value the linguistic variety that characterises South African classrooms.

The notion of policy-practice alignment is central to this issue. The observed difficulties that educators and learners encounter bring to light the differences between the aspirations that underpin language policy and the actual difficulties that arise when putting them into practice.

Some policies' rigidity and intolerance make it difficult to apply multilingual techniques effectively, which could compromise their ability to help learners.

Apart from the misalignment between policy and practice, the researcher notes an enormous advantage that come with accepting linguistic diversity. This theme also acknowledges the hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.* The data gathered may help guide recommendations for effective policy reform, which may open the door to the creation of adaptable and responsive language policies. With the use of translanguaging techniques and culturally relevant materials, these policies would enable teachers to fully utilise the diversity of their learner's languages to create inclusive and stimulating learning environments. This will in turn promote a more nuanced awareness of the potential and problems inherent in multilingual education by bridging the gap between policy and practice, guiding the creation of context-specific teaching methods that enable educators to maximise the potential of every learner in South African classrooms by utilising the strength of linguistic diversity.

4.7.2 Interviews

To complement the quantitative analysis, the researcher incorporated semi-structured, interviews with fifteen participants (10 learners in the experimental group, 4 parents and the teacher) to delve deeper into their experiences during the study. Semi-structured interviews according to McMillan and Schumacher (2010) are a flexible data collection method that combines elements of structured and unstructured interviews. In this approach, the researcher had a set questions, but the phrasing, order and where necessary the language used to ask the questions was not fixed to accommodate different interviewees (the parents, teachers, and learners). The questions were open-ended, allowing for flexibility. This approach sought to gain in-depth insights into participants' perspectives, attitudes, and experiences as well as reveal the interpretations and meanings attached to the intervention for the experimental group (McMillan & Schumacher, 2010). The researcher where necessary translated the question to cater for the needs of the interviewees. They sometimes translated the questions into isiZulu or isiXhosa as the questions were initially written in English.

The verbatim accounts of the conversations constituted the basis of the interviews, although audio recording was a useful tool for verifying accuracy and completeness. Recordings allowed the researcher to be more focused and attentive during the interview itself, and they also offered

information for reliability tests (McMillan & Schumacher, 2010). The act of taking active notes, which is still a crucial stage in the data collecting process, should not be confused with audio recording, as Cohen et al. (2017) point out. The benefits of audio recording were numerous. The researcher was able to fully capture the depth of the participants' voices and expressions while accurately transcribing the interviews. It also served as a source of validation for the research findings that were discovered during the interview (McMillan & Schumacher, 2010). As a result, the experiences of the participants are represented in the final analysis in a more accurate and nuanced way. The researcher adhered to a meticulous methodology for data analysis after every interview.

To ensure that all the data were recorded and retained, the handwritten notes were immediately finalised and typed after the interview and every detail of the conversation was painstakingly captured in the transcription of the audio recordings. In order to identify the underlying themes, patterns, and meanings concealed inside the participants' narratives, the researcher finally started an extensive analysis of the data that had been gathered. The meticulous procedure of data analysis, which included instantaneous transcription and thorough scrutinisation of the gathered materials, guaranteed the production of trustworthy and perceptive conclusions that encapsulated the essence of the participants' interaction with the intervention. Following the post-test, these interviews were carried out with the goal of triangulating results by combining the quantitative data with the diverse array of participant subjective experiences and linguistic preferences. The interviews served a multi-faceted purpose, offering participants to:

- Evaluate the intervention: Selected learners and their teacher shared their perspectives on the intervention's effectiveness, highlighting its deemed advantages, disadvantages, as well as possible areas for development. This gave important information about the intervention's effects, revealing nuances missed by purely quantitative methods above.
- Analyse and interpret their performance: The interviews allowed learners to make sense of their own performance and discover non-statistical reasons that might have influenced their outcomes, going beyond the chilly figures of test scores. This revealed the personal perceptions and internal conflicts that are frequently missed by quantitative statistics and gave more valuable insights to the researcher about the test outcomes.
- Share language proficiencies: Parents shared some insights on their language proficiency, how often they use their home language at home and how this in turn affects them and their children. The teacher on the other hand elaborated on their

experience with teaching using the translanguaging pedagogy.

The researcher sought to establish a convergence of evidence by utilising this qualitative approach. In order to create a more complete picture of the intervention's effects, the researcher combined data from quantitative and qualitative approaches, taking into account the participants' linguistic preferences and subjective experiences in addition to statistical results (Cohen et al., 2017). With each interview lasting roughly ten minutes, the one-on-one style provided a customised forum for participants to express their distinct viewpoints and perceptions. The interview questions (six questions for the learners, 3 for the teacher and 3 for the parents) were asked to each participants guaranteeing consistency and enabling cross-group comparison analysis.

Figure 4:16 below summarises the different processes the researcher used to analyse and record the data from the interviews:

FIGURE 4:16 SUMMARY OF DATA COLLECTION PROCESS (MCMILLAN & SCHUMACHER, 2010)



The process of deciphering meaning from the complex web of interview responses was initiated by the data analysis. The segments served as building blocks, dividing the data set into digestible parts centred on individual concepts, episodes, or pertinent information (McMillan & Schumacher, 2010). After segmenting the data, the researcher started a methodical process of code development. Each segment was given a code, a name that served as a condensed version of its main notion, given its potential significance. The codebook, which is an assemblage of these designated labels, converted the unprocessed data into a system of arranged and comprehensible classifications. In this study, the decision to use a manual, software-free technique made sense given the volume and type of data. The researcher conducted a personal and comprehensive analysis delving into the participants' voices and painstakingly creating codes that encapsulated the core of their experiences. The researcher

was able to customise the codebook to the unique themes and insights that emerged from the interviews.

The researcher embraced a place for in-depth interaction with the qualitative material by taking on manual coding. This in-depth method revealed the hidden meanings that the participants' experiences held, offering a glimpse into their opinions of the intervention, how they saw their own performance, and the language they preferred to use when learning NS. The segment-and-code method of manually analysing the interview data provided a unique and sophisticated methodology for this study. The opportunity for revealing the rich insights and hidden meanings in the qualitative data was present in this in-depth interaction with the participants' voices.

By utilising the advantages of both pure coding and qualitative content analysis, the researcher was able to identify important themes that eventually addressed the study question and produced insightful information on the experiences of the participants. Through the combination of content analysis precision and pure coding flexibility, this method ensured a thorough and nuanced understanding that was further enhanced by representative participant voices. This combination of methods provides a useful approach for further qualitative study.

Learner interviews

It is important to note that the main objectives for the interviews were to get a deeper understanding of the language proficiency that learners have (Charamba, 2017), to find out the causes in the difference in the participant's performance (if any) in the two tests and to evaluate the effectiveness of translanguaging and get different thoughts about it. Below are the different questions that were asked to the participants and some of their responses.

Six questions were posed on learners:

(1) What language do you usually speak at home and how do you think it affects your understanding of what you are taught at school?

In answering this question, all learners pointed out that their home language was different from the language of instruction. For some it was purely isiZulu or isiXhosa and for others they came from hybrid languages backgrounds where either of the parents belonged to one of the two languages. For instance, Learner 27 said "*My mother is Zulu and my father speaks Afrikaans so I understand both languages partly…*" and Learner 40 said "*At home we use Setswana and isiXhosa but when I am playing with my friend we use isiZulu and sometimes English because*

some of my friends don't understand any of the languages I use at home." This highlights the diverse linguistic landscape that was in the classroom.

To answer the second part of the question, most learners expressed how difficult it was for them to understand some of the concepts as they could not even articulate their thoughts and misunderstandings in order to get more clarity. Learner 20's statement, "*I think sometimes its hard because when I am at home my grandmother is always using isiZulu and also when I play with my friends, we don't use English, only if we are in class we must use English only and its hard sometimes to understand.*" This seemed to be a majority answer and it pointed to the restricts that were put in place and had to be adhered to. Most learners alluded to the fact that when they are learning sometimes they do not fully understand certain aspects of the lesson and would have loved to get a deeper understanding when explained to them in a language they are familiar with.

However, a few seemed to have a different perspective for instance, Learner 1 said: "*Even if my parents are Zulu speakers they make me read English books and make sure I am able to communicate in English, and sometimes they explain things I do not understand in isiZulu.*" The statement sheds light on the crucial role of parental agency in fostering bilingualism and combating negative stereotypes. The parents' proactive approach in providing access to diverse reading materials and promoting English proficiency empowers Learner 1 to navigate various linguistic landscapes with confidence. This proactive family support as advocated by the Social Cultural theory serve as a buffer against external pressures and promote a positive linguistic identity which is shown even in the performance of the learners.

(2) How does your performance in the three tests relate?

The 10 learners who were picked for the interviews had varying performances in their three tests (English language proficiency, pre- and post-test). Most of them hinted that they did badly in the Natural Science pre-test because they failed to understand the language and some words in the test even though they did well in the English proficiency test. They claimed that science is difficult, and that English was their second or third language. They also highlighted that though they have been using English since grade 1, it is still hard to understand some concepts because at home they do not use English and they do not get enough exposure outside from school. Below are examples of such responses:

Learner 3:

I think the English test (Proficiency test) was fair. I did well and I was happy also the last test was very easy. I finished it early and I knew I did well. The second test (the pre-test) was hard. I had a lot of words I did not understand even though I heard Miss talking about them I just could remember the spelling sometimes since I saw it on the board, but I did not know what it meant that why I did not do well.

Learner 10:

I am not good in English. I try and sometimes I think I did good but when the marks come, I am always surprised. I liked the last test. I had an idea of what most words meant, and I understood most of the questions.

This explains why most learners did well in the English Proficiency test and the Natural Science post-test but failed in the pre-test.

(3) What could have caused the difference? (If any)

Upon much analysis of the interview responses with a lot of learners echoing the benefits of the intervention and the freedom it brought, Learner 16's response is more concerning:

" *It was confusing to me what I had to read, and I was unsure which sentence to read as the question. For the second test it was just worse, I could barely understand even the isiZulu part. It was just a lot and even if I know what we learnt I cannot write it well or read it…"*

This response reveals the potential for ambiguity and cognitive overload in dual-language materials. The presence of parallel translations within the same text space might create confusion for some learners, particularly when navigating complex syntax or nuanced meaning. It is clear that though English was not Learner 16's home language, they also had less proficiency in their home language. The fact that they did not have adequate experience of not knowing which sentence constitutes the actual question suggests a distracting effect of the dual presentation, leading to decreased comprehension and ultimately, a decline in performance. This shows how crucial it is to carefully plan and execute bilingual learning resources. For certain learners, direct translations alone might not be sufficient. Such materials can be highly effective when layout, font size, colour coding, and distinct separation of original and translated content are used. According to research, in multilingual learning contexts, orderly presentation and clear visual aids can reduce confusion and improve cognitive processing (Magana, 2017).

The experience of Learner 16 also emphasises the necessity of instructional techniques and tailored support in addition to bilingual education. When reading books in two languages, learners might need specific assistance navigating and deciphering the content, especially when they come across difficult vocabulary or concepts. More experience translating meaning between languages and locating important information in dual-language formats helps reduce misunderstanding and boost confidence.

In contrast to the divisive views on direct translation that Learner 16 had voiced, Learner 2 offers an alternative viewpoint that emphasises the autonomy of learning preferences and the impact of the intervention. They said, "*I can read the content in either English or isiZulu; I have no trouble understanding either language. My parents help me with reading at home*." A flexible and practical approach to language in learning is suggested by the statement.

This experience emphasises how crucial it is to understand learner diversity when putting tactics like direct translation into practice. While some learners, like Learner 2, benefit greatly from the instant assistance of their native tongue, other learners, like Learner 16, find it challenging to understand the parallel approach. The fact that Learner 2 brought up parental support highlights how important outside influences are in determining how well language learners succeed. Regardless of the language used in the course, they are empowered to fill up any comprehension gaps since they have access to extra help and clarification at home.

This emphasises how important it is for teachers and families to work together to promote language development and establish welcoming, needs-based learning environments. Drawing from the theoretical framework of this study, Vygotsky (1978) in his Social-cultural theory values cooperative dialogues with more knowledgeable members of family. He argues that this process of social mediation is how humans develop. This insinuates that through meaningful collaboration, learners actively acquire new cognitive skills with an assisting adult in a language they can fully understand (Ameri, 2020). As a result, Learner 2's situation serves as an assurance that with the right support, learners can greatly benefit from both the home and school environments.

(4) Comment on the lessons you received during the study.

Learner 10: "*Mina Miss isingisi siyang'hlula*, (translating to Miss I find English challenging) *but this way of learning was nice. Noone was laughing at me and I was able to ask for*

clarification (clarity) *so that I understand. It was so fun and I was also participating more and asking my group members to help me in translating some of the questions because sometimes I don't even know what the question is asking and I end up just wring whatever I think is right*."

This experience reveals the level of joy that learners had and how much the intervention helped them navigate their worlds and get solutions. The fact that Learner 10 pointed out that some learners laugh shows that this affects them and results in low participation in fear of being laughed at.

García (2020) adds that when learners use their home language to learn another language, their understanding and performance are likely to improve. This is revealed in Learner 10's performance who improved from 40% in the English proficiency test and 33% in the pre-test to 87% in the post test. This shows that being able to move between two languages lessens the cognitive load, allowing learners to explain what they know and can do and in turn necessitates deeper understanding necessary for academic success.

Learner 14 adds another layer to the multifaceted theme of translation in bilingual learning environments. They said: "*It was all fun and good but when it came to the test I realised I couldn't even make sense of the words that were written in isiXhosa. I can talk in isiXhosa because its my mom's language but I can't read it so I was all confused. I did enjoy telling my friends about my culture and also contributing to the lesson but it was hard in the test."* Their independent stance emphasises the importance of understanding individual learner needs and highlights the potential of collaborative efforts between schools and families to support language development and academic success. As educators navigate the complex landscape of bilingual education, recognising and catering to learners like Learner 14 will be crucial in fostering inclusive and effective learning experiences for all.

From this question it is clear that different pedagogical approaches can influence how learners connect with and profit from them, depending on a variety of factors including individual language proficiency, learning preferences, and external support systems. In order to effectively teach language to a diverse learner body, educators must embrace a flexible and nuanced approach that incorporates a range of methodologies and values the contributions of families and communities.

(5) Which language do you think is the best for you to learn Natural Science in and why?

It is interesting how learners answered this particular question in a unison response. Majority gladly accepted the translingual approach and a few said English because they get to write tests in English and they would not want to be disadvantaged. This is further discussed in the themes below.

(6) *Do you think being taught Natural Science and or discussing it in your home language makes any academic difference? Why?*

Learners pointed out that translanguaging encouraged a fluid and creative approach to language use where they could blend their languages to enhance understanding. Half of the learners strongly agreed to the fact using their home language to discuss made it easier for them to express themselves.

Learner 10:

"*I didn't have to say all the isiZulu words nor the English. Though at home we speak strict Zulu I understand that some of my friend might not know it so I was just mixing it up as I go and my mates understood what I meant and it was soo fun because I felt like I am just outside having a normal conversation with my friends yet learning and discussing serious stuff. It made me pass. Even when I was doing the second test (post-test) I'd sometimes just think of what my group mates said and I would look at the Zulu sentence and there was the answer*"

Learner 2:

"*At home we speak like that. I do not have to strictly speak in English. Sometimes I just use isiZulu sometimes any language with English and it makes my life easy*."

Drawing for the linguistic interdependence model by Cummins (2009), mastery of one's mother tongue affects learning a second language. Learners needs to become proficient in their mother tongue, which is their first language, before they can effectively study a second language. This means that by seamlessly switching between languages, learners managed to leverage their strong base in their home languages (BICS) as a springboard to access the cognitive academic language proficiency (CALP) demands of the Natural Science test. This cross-referencing empowered most learners to grasp the nuances of the material, fostering deeper understanding and improved performance. This experience speaks to the potential of direct translation to bridge the gap between language and knowledge domains in STEM education. Immediate access to well-known language frameworks via direct translation helped reduce anxiety,

increase interest in the subject matter, and eventually boost academic performance echoing the findings of (Hattingh et al., 2021).

The affirmative response from Learner 10 illuminates the psychological advantages of directly translated content. A more pleasant learning environment can be created when individuals are able to easily seek clarification and affirmation in their native tongue. This can also increase a sense of empowerment and ownership. This emotional component makes the case for direct translation as an effective teaching strategy in schools with diverse learner populations even stronger.

In like manner Learner 2's personal transformation is further illustrated by their remarkable performance improvement between the first and second tests. Jumping from 13% to 87% which underscore the efficacy of the multilingual approach in boosting academic achievement. Their concluding remark, "*I really enjoyed learning in a way I use at home*," adds a powerful emotional dimension, revealing the intrinsic value and sense of ownership that comes with learning in one's familiar linguistic space. Learner 2's experience illuminates the connections between identity, family, and language in multilingual learning settings. The learner's admission that " *At home we speak like that. I do not have to strictly speak in English*…" illustrates the complex linguistic environments that many language learners must manage. isiXhosa and isiZulu rule supreme in the coziness and community of family and friends, whereas English rules the school environment in the classroom.

These two interviews stand as a testament to the potential of language sensitive pedagogical practices in nurturing scientific understanding and academic success. Learner 10 and 2's experiences serves as a compelling case study for further research into the diverse and effective ways of incorporating learners' home languages into the scientific curriculum.

Contrary to these learners, Learner 27 highlighted that:
"*I do not know isiZulu that deep so even though I wanted to say something, I just could not find the right word to say even in Zulu or English."*

This according to Sierens et al. (2019) mostly occurs in learners with underdeveloped first language skills. They usually encounter barriers in furthering their first-language acquisition,

and this negatively affects their ability to learn a second language. She contends that the ability of a learner to successfully acquire a second language is always influenced by their level of skill in the first language.

Parents/guardian interview

The study incorporated parents/guardians as they play a pivotal role in the development of the proficiency of the learner's home language and in language acquisition. The aim in interviewing them was to find out how often they used their home language at home and to get their perspective on language teaching especially in the NS classroom. Only 4 parents availed themselves for the interviews and those it is a small amount, the researcher believes that they provided valuable insights on some of the perceptions parents have when it comes to language and science.

Three questions were posed to the parents/guardians

(1) What language do you mostly speak at home?

Most parents/guardians pointed out that they do not use their 'original' home language when they are home. Parent 2: "*I am a Zulu woman, my parents are Zulu speaking and I know isiZulu very well. However, I am married to a Nigerian man and at home we mostly speak English. I have taught my child to speak isiZulu and he knows it 'well' but its not original isiZulu. See here (meaning in Johannesburg) the isiZulu is different from the one in KZN but my child knows enough to converse with their cousins when we go home during the holidays."*

This response stood out for the researcher because it painted a real picture of what the researcher observed in the classroom. Though learners do not have a strong proficiency in English which is the language of instruction at the school. Most of them also do not have full proficiency in their home languages. This is in line with the above observation of poor development in both the BICS and CALP of learners. From this verbatim it is clear that from the parental perspective this is cause by interracial families. The amalgamation of different languages though beneficial to a larger extent, poses so much pressure on some parents and children. Of the other three parents, they pointed out that they either used isiZulu and or isiXhosa at home. Parent 1 was a grandparent and though she was able to converse in English she stated that at home they spoke isiXhosa only.

(2) Do you believe that academic performance in Natural Science is affected by a lack of proficiency in the language of instruction (English) for your child? Explain your answer.

All parents/guardians believed that a lack of proficiency in the language of instruction, such as English, negatively impacted their children's academic performance in Natural Science.
Parent 3: "*Science is in English and if my child cannot read English then obviously, they won't be able to understand."*

Parents 2: "*Yes. I can give an example using my child. I think the reason why he performs well is because most of his times he is always using English and he likes conversing with his father who uses and English and also watches a lot of school videos in English. Probably that is why he has no problem because he understands English better."*

From these two verbatims it is clear that the belief that a lack of proficiency in the language of instruction negatively impact learners often stems from the idea that understanding complex scientific concepts requires not only knowledge of the subject matter but also a strong grasp of the language used to convey that knowledge. When learners struggle with the language, they may find it difficult to follow lessons, participate in discussions, and complete assignments, which can lead to lower performance in science subjects (Sefotho, 2022).

Additionally, parents worry that language barriers prevent their children from fully engaging with the curriculum, limiting their ability to succeed academically.
Parent 1: "*Yes. My grandchild barely knows how to read a story for me in English. I think it would be very hard for her to understand science because some of the homework we end up asking her sister to help. I am no longer that good with English so even at home it is sometimes hard for us to help her. I think that is why she is not performing well because she does not understand English*."
This verbatim echoes some important aspects raised by McKinney (2022), Mgijima and Makalela (2021) and Omidire and Ayob (2022a). The authors point that lack of proficiency in the language of instruction is very detrimental to learners and their academic growth because they often fail to make sense of what they learn at school and their lived experiences. Looking back at the theoretical framework the researcher notices a gap between home and school. At school, teachers often give learners homework with the

assumption that they will get better help at home but rather Parent 1 shows that there is a struggle in meeting some of these demands. Therefore, Vygotsky argues that both parents and teachers should work together to help learners and in so doing the load becomes bearable for the learner, the teacher and even the parents/guardians. Which leads us to the last question posed to parents/guardians.

(3) How can translanguaging (using/incorporating African languages to teach or learn NS) be effectively incorporated into the classroom and even at home to support your child?

From the interview responses, this question was a bit challenging for parents and they needed some time to think of strategies that can help effectively. Though all of them were positive towards translanguaging and concurred that it can be effectively incorporated into the classroom and at home to support their children's learning in NS, they had to also put themselves into perspective and reflect on the role they play.

Parent 2: "… *I think using the internet can help. Especially allowing children to familiarise themselves with digital resources like YouTube and even TikTok. There are channels and people who have content in a language children can understand and that present scientific concepts in both English and an African language. Some of these channels are even funnier and child friendly. This helps children understand terminology and concepts in a language they are more comfortable with. I think both parents and maybe the school if possible, can look into that."*

This response acknowledges not only the classroom interaction but what parents can harness at home and gives light to some accessible ways of learning that can help learners and parents. Multilingual digital technologies have been studied around the globe (see for example: Charamba & Nkomo, 2022; Mohmmed, Khidhir, Nazeer, & Vijayan, 2020; Nkoala, 2024) especially after the outbreak of COVID-19 pandemic where learners had to use online learning. Scholars argue that learners found some of these platforms very helpful.

Parent 1: "*I think teachers should be encouraged to make children have discussions where children can express their understanding in their home languages…*"

Parent 3: "*If the learners can be allowed to maybe ask questions in their language and translate later or ask their friends talking in their language. Also us parents we need to teach our children our languages*"

The two parents share the same sentiments. Collaborative learning that is implicitly alluded to in the two verbatims can help learners articulate their thoughts and questions more clearly, fostering a deeper understanding of the subject matter (McKinney, 2022). This is further corroborated by Motlhaka (2020) who argues that promote group work where learners can collaborate in their preferred languages allows them to share ideas and explain concepts to one another, reinforces their learning through peer teaching.

Teacher interview questions

The teacher gave insights on their experience with teaching using translanguaging pedagogies. The teacher's pseudonym is Mrs Xae.

Below are the three questions which were posed to the teacher and the parents and the responses will be included in the subthemes:

(1) *What is your experience in teaching Natural Science using more than one language?*
(2) *Do you believe that academic underperformance in Natural Science is caused by a lack of proficiency in the language of instruction? Explain your answer.*
(3) *How can translanguaging (using/incorporating African languages to teach or learn NS) be effectively incorporated into the classroom to support multilingual learners?*

From the interviews, there were emerging themes, and these will be delved into in the subsequent paragraphs:

Theme 1: Language as a resource in the classroom

This theme explores the interplay between language, academic performance as well as the overall performance in Natural Science among the experimental group learners. The findings reveal that language is not a barrier but a resource for communication and learning. They emphasise the value of multilingualism and highlights the benefits of using different languages to enhance understanding and express complex ideas. In the interview with the 10 learners from the experimental group there was a revelation of the profound positive impacts in the use of

their home language alongside English. The verbatims used in theme 1 are solely those from learners in the experimental group and their teacher.

Learner 3:
I liked how I could discuss with my friends and ask them to explain for me what I did not understand nicely. Also using isiZulu made it better for me because at least I could link it to what I do at home or see on Tv. I feel like I also could understand the teacher better.

This suggest that the translanguaging approach enabled learners to get clarification when learning and when encountering difficulties with the English section in the post-test, exemplifying its co-operative effect. This highlights the potential of leveraging multiple languages as instructional tools in the Natural Science classroom. By recognising and allowing the use of learners' existing linguistic strengths and offering additional language support, educators can facilitate deeper understanding and potentially bridge the gap between language and academic performance

Learner 1:
Using isiZulu made sense. I actually made a connection of when it is raining and all these big science words when related to isiZulu were actually not that bad, I just needed them to be translated..

Learner 1 highlights the value of dual explanations in achieving deeper understanding. This implies that by leveraging the familiar linguistic landscape of isiZulu or isiXhosa, learners were able to bridge the gap between abstract scientific concepts and their own cognitive framework. The present study adds to the extensive corpus of literature that emphasises the close relationship that exists between academic achievement and the medium of instruction, especially in the fields of science education. This emphasis on language explores how language shapes the basic cognitive processes, going beyond its use as a tool for communication but an important resource in comprehending different scientific concepts. As Rorty (2020) so eloquently put it, a large portion of human thought is expressed through language. This suggests that the capacity for critical thought and knowledge acquisition is intrinsically tied to one’s proficiency in the language of instruction. Ndhlovana and Charamba (2023) adds that it also promotes inclusivity in academic settings by recognising and valuing the linguistic resources that learners bring to the classroom.

Similarly, the teacher acknowledged the value of incorporating learners' languages in the science classroom in facilitating learning.

Mrs Xae: *"For once I do not have to be the one doing all the thinking and how I can find more examples that will help the learners but as they discuss on their own in their languages, much information is reached and even things I could not have thought on my own are raised. This makes learning much fun and productive*."

This shows that when translanguaging pedagogies were implemented in the classroom, learners were able to draw from their entire linguistic repertoire and the engaged in a more meaningful manner where their language became a very useful tool in helping each other understand certain concept. This in turn reduced the strain on the teacher who felt a lot more ease as some of the things were being explained by learners to their peers at a level and with a language they fully understand. Learners were able to ask questions and also got time to discuss in their MT and get clarity. This is in line with the findings of Charamba (2023) who argues that translanguaging pedagogies encourage critical thinking and inquiry-based learning.

Mrs Xae: "*I noticed that when I was teaching in the experimental group, I was at ease and though I am not full proficient in the languages that is isiZulu and isiXhosa but I know some words that I could use to help my learners and even give them feedback in some of the questions they had."*

From the verbatim it is clear that language was used as a tool to providing feedback. The teacher used language to guide learners' understanding and correct some misconceptions which promoted epistemic access and also enhanced learners' understanding. Using the learner's home language helps them understand new concepts more easily. They can relate the new information to what they already know, which reduces cognitive load. It was clear that when learners can express themselves in their native language, they can better articulate their thoughts and understanding. This clarity enhances comprehension. According to Cummins (2009), the foundation for a person's identity, learning, and way of thinking is their home language or primary language, which is developed through a variety of social interactions and cultural experiences. When learners are denied access to this foundational language in the classroom, it causes a serious disconnect that hinders their capacity to interact with concepts, access study materials, and grow cognitively. Thus, the present study places itself in the critical conversation concerning LoLT and its effects on science education. It opens the door for

instructional approaches that recognise learners' linguistic realities and use them as launching pads for academic success by recognising the deep connection between language and learning.

Drawing from the hypothesis of the Funds of Knowledge coiled by Gonzalez (2005), learners bring knowledge from their prior experiences, social and cultural interactions with both their immediate family and the larger community to the classroom (Charamba, 2017). Acknowledging their home language necessitates better understanding making language a very important tool for them and their overall academic success. This social approach to education according to Pun and Tai (2021) allows learners to not only participate in class but form deeper relationships among themselves and the content as a whole.

Research cited in Chapter 2 of this study highlights this phenomenon of language being a useful tool. Charamba (2022a); McKinney (2022); Mgijima and Makalela (2021); Omidire and Ayob (2022a); Sefotho (2022) draw attention to the possibility that learners may find it difficult to use language successfully in decontextualised academic settings hence incorporating a familiar language enables them to decipher concepts. They also argue that learning in one's native language fosters a positive emotional connection to education. Learners feel more comfortable and confident, which positively impacts learning outcomes. Scientific concepts, terminology, and problem-solving require a higher level of linguistic sophistication than casual conversation, therefore, the research presented in this excerpt highlights the need for pedagogical approaches that bridge the gap.

This analysis of interview data reveals that even learners appreciate the incorporation of their home language in the Natural Science classroom as learner 20 during the study exclaimed that "*I think asking my question in isiZulu made me get the exact answer I needed…*". These experiences highlight how language skills can serve as a bridge to understanding and successful performance. Further research would be valuable to explore the long-term impact of such translingual approaches on science learning outcomes in Johannesburg.

Theme2: Bridging the gap: Incorporating multilingual print for academic support

Though most participants appreciated the incorporation of their home language in the discussions and the teaching, they raised some insights into the reinforcement of this approach.

Most materials that the grade 4 learners receive for Natural Science are written in English and this was a challenge to most. Learner 40's quote below expresses this frustration.

"English is not my home language I think most of the times I listen attentively and yes, I sometimes understand when Miss is talking during the class but when I try to read alone I cannot. I think the lessons [in their home language] helped me a lot and I am sure even others but if we can have some of the things written in our home language like in the test (post-test) then I will be able to match the different words with my home language and know how to read better."

This suggest that multilingual print can allow grade 4 learners to see and interact with different languages, which can reinforce their understanding of vocabulary, grammar, and sentence structure in both their native language and the target language. Though some learners applauded the use of the textbook in the classroom, others showed concern on how it is used as they are expected to read it on their own and understand sometimes. Learner 27 said "*sometimes if I do not understand a word I am told to look at the key words or use a dictionary of which sometimes I still fail to understand the English*." This suggest that the way educators use textbooks and other printed material does not cater for the needs of most learners.

Not only does multilingual print help learners understand concepts, but it also exposes them to different cultures and languages, fostering an appreciation for diversity and promoting cultural understanding among learners. This creates an inclusive learning environment where learners from diverse linguistic backgrounds feel valued and represented. It acknowledges and celebrates the linguistic diversity within the classroom. Considering the views of the following learners:

Learner 1:

"In the first test I thought the rondavel was built by Zulu people. Little did I know that it was actually the Xhosa people, its cool learning about other cultures."

This sentiment shows appreciation of other cultures. In this study the main topic was matter and material and in one of the lessons learners were looking at the different structures and one of which was a Rondavel. It sparked so much excitement among learners, learning about the different and somewhat familiar content and the discussions that emanated from this topic were such heartwarming. This was more than just education; it was a voyage that allowed learners to learn from their own environment as well as about the outside world.

The results of this cultural inclusion were evident. Engagement, which had been a smoldering flame, suddenly erupted into passion. Once wary of novel learning environments, learners now confidently traversed them with the aid of their cultural compass. It needs more than simply word decoding to be able to apply knowledge to real-world situations and interpret the classroom's echoing echoes of their own cultures. The concept of cultural resonance goes beyond a single learner.

Diversity is not only accepted but encouraged in the classroom as a result of it. Beyond linguistic and ethnic barriers, cultural knowledge becomes a common currency that promotes empathy and understanding. As pointed by Mrs Xae: "…*the classroom transformed into a vibrant marketplace of experiences, where stories, songs, and traditions were exchanged, learners felt free and very happy*". The significance of multilingual education with cultural relevance lies not just in academic achievement, but in empowering learners to be active participants in shaping their own learning. It challenges the notion of a universal knowledge base, recognising that knowledge is woven from the diverse threads of human experience. In essence, it is a call to celebrate the symphony of cultures that learners bring to the classroom, using it as the very foundation for building a more inclusive and meaningful learning experience.

Though the print was in English, the few African languages in that section brought so much joy. What more if they can have access to an entire book that has their home language alongside English? By encountering multiple languages in print materials, grade 4 learners can develop the ability to navigate and make connections between different languages, enhancing their overall language skills and fluency. From the interviews it emerged that learners have no access to these materials, they mainly use book written in a language they have low proficiency in. Thus, incorporating multilingual print into grade 4 education, learners can develop language skills, cultural awareness, and a sense of belonging. It can also serve as a bridge for grade 4 learners who are still developing their proficiency in the target language allowing them to use their home language to support their understanding (Charamba, 2017) and expression, facilitating their learning and academic success.

Theme 3: Translanguaging as a transformative pedagogy

Recognising the value of learner's linguistic resources and promoting multilingual competence is a very crucial component of this study. From the interviews it was clear that translanguaging helped grade 4 learners develop cultural awareness and appreciation. It allowed them to share

and learn about different languages, traditions and perspectives fostering an inclusive and culturally rich learning environment. This theme delves into translanguaging as a transformative pedagogy which involves leveraging bilingual and multilingual learners' linguistic practices to promote inclusion and social justice.

Translanguaging goes beyond multilingualism by recognising that bilingual learners do not have separate languages—they have a dynamic, integrated translanguaging being. Translanguaging challenges raciolinguistic ideologies and views racial/ethnic identities and linguistic practices together. In order to fully embrace the linguistic repertoire of learners and be able to cater for their need a pedagogical mindset shift is required. This is highlighted by Mrs Xae when she said:

"*During the intervention I had to move from what I think helps the learners to understanding what they actually want and its like I had a paradigm shift that necessitated effective learning."*

To use translanguaging for inclusion and social justice, educators need a mindset shift. It is about translanguaging pedagogy, not just using translanguaging as a strategy. This shift involves seeing learners' linguistic diversity as an asset and promoting co-learning. Drawing from the research cited in chapter 2 above, Lewis et al. (2012) argue that the fundamental feature of translanguaging is that it prioritises cognitive function and language production over form, as well as communication and function. This means that translanguaging focuses learning and teaching on forming and improving experience, forming identity, and producing meaning. It necessitates a change in power dynamics and it increases the authority of the instructor and the learner.

From the interviews, the researcher observed that there was co-learning between the teacher and the learners. This means that the teacher and the learners were learning together. This form of learning recognises that teachers do not have all the answers and encourages collaborative exploration of language and culture. Though the teacher belonged to none of the languages in the study, she managed to understand what the learners were discussing and everyone had a chance to fully understand the subject matter. A remarkable statement was said by Learner 1:

"*Miss, I do not mind translating what Learner 14 says, I know you do not understand*."

This showed the collaboration that was among the class, and everyone benefitted from the exercise. Even the teacher, Mrs Xae made a confession during the interview saying:

"*I did not think this idea was going to work because I do not know their language and I did not want to look incompetent. Little did I know I have an entire library in my class.*"

This reveals the complexities that are embedded in the classroom and sometimes teachers are not aware of the potential buried in the linguistic repertoire of the learners. This insight called for transpositioning. This involves moving beyond existing language boundaries. It means allowing learners to creatively disrupt language norms and explore new language practices which in turn empowers learners, promotes social justice, and challenges the prevalent colonial pedagogies that fail to cater for the need of all learners.

Furthermore, Learner 20's experience exemplifies the transformative power of direct translation within multilingual learning environments. Their statement, " *I would read the English section first, then the isiZulu section for clarification if there was anything I did not understand.*" highlights how two languages can work together to improve confidence and make comprehension easier. The immediate availability of isiZulu translation in the post test served as a critical safety net, mitigating confusion and enabling Learner 20 to decode complex concepts.

Learner 16:
"I feel like I was participating more and I was happy to use isiZulu in a science lesson freely, even though I did not do well but I know something and I can tell you Miss some of the things we learnt."

Learner 16's experience vividly paints a picture of the transformative power of multilingual instruction in Natural science. Their narrative reflects a journey from initial struggle to increased comprehension and ultimately, though there is still need for more work to be done to improve performance. Their statement, "*I did not really understand what the teacher was saying"* suggests that the reliance solely on English, a language unfamiliar to them, created a barrier to accessing mathematical concepts. However, the introduction of isiZulu, their home language, proved to be a game-changer.

Research suggests that continuing to learn and using the home language alongside the target language (e.g., English) accelerates language acquisition. Learners build on existing linguistic skills. This facilitates transdisciplinary learning, where learners draw on multiple languages and disciplines to explore complex topics. It encourages interdisciplinary collaboration, creativity, and the integration of diverse perspectives.

Theme 4: Empowerment and agency

Chávez-Moreno (2021) argues dual-language programs often prioritise learners with linguistic privilege, leaving historically oppressed English learners at a disadvantage. From the interviews translanguaging proved to be an empowering pedagogy that gave learners and the teacher agency over their language practices. It challenged linguistic hierarchies and promoted language rights, allowing individuals to use the languages that best serve their needs and aspirations. Learner 3's experience underscores the interconnectedness of language and identity. Their statement "*I really enjoyed these lessons. See Miss I could freely talk and share my ideas without fear of contradiction because I know that the word I will be using is the correct word that I want to use*." This shows that using their home language gave them confidence to articulate themselves and felt empowered to participate more during the discussions.

It is clear that translanguaging boosted the learners' confidence and engagement providing them with a sense of ownership and agency over their language use, enabling them to actively participate in classroom discussions and express their ideas more comfortably. This is in line with the findings of Sefotho (2022) who stated that, encouraging a holistic approach where learners use their linguistic repertoire encourages them to critically reflect on language use, power dynamics and language ideologies. It prompts discussion about language variation and the impact of language on identity and social relationships.

This exact thought is echoed by Learner 18 who said "*All my life I have never thought of using isiZulu to learn science, it was very strange for me at first and even if I enjoyed the freedom, I somehow was very confused when it came to individual exercises and I had to read in English and even write in English. In the discussions I fully understood and enjoyed the lesson though."*

Additionally, Learner 14 said "*I thought NS was only learnt in English. Little did I know that I can also use isiZulu and it actually makes sense.*"

This shows the paradigm shift that learners had to undergo. Though they might have faced some hurdles at first, they felt empowered to grasp the nuances of scientific concepts in both languages. However, more work is to be done given the confusion raised by some learners and their performance for instance Learners 18 and 14 had 67% in their pre-test but dropped to 53 and 40 respectively. This is justified by their verbatims above calling for more research to be done on how to keep empowering such learners in a more effective manner.

From the interviews there was a discrepancy between official language policies and the linguistic practices of the community. This led to the issue of language maintenance, language shift and the marginalisation of certain languages. From the other end the learners expressed the status core. Some dialects were given higher status and this led to inequalities in access to resources and opportunities. Thus, translanguaging serves as an empowering pedagogy that breaks down the barriers faced by multilingual learners.

Additionally, research shows that continuing to learn home languages can make the process of learning English faster and easier. So, embracing learners' home languages can enhance their overall learning experience. Omidire and Ayob (2022) argue that English at school may be perceived as distancing learners from their family and community, potentially leading to internal conflicts and struggles with belonging. Therefore, educators must be mindful of these complexities and provide support for learners navigating these diverse linguistic and cultural spaces. However, from the interviews it was clear that not only do learners need this empowerment but both teachers and learners and even parents. The following verbatims point to the need for such support:

Mrs Xae: "*Having seen the potential of this approach, I wish we could have workshops that equip us on how to handle the multiple languages in our classrooms so that we meet the needs of all learners because it might be very challenging to handle the chaos. Sometimes the official languages is not the language that the learners speak because there is a local 'tsotsi taal' that they also use and so such dynamics needs to be considered and it just becomes a hustle really."*

The teacher's contribution adds another layer to the complex tapestry of navigating diverse linguistic spaces in multilingual learning environments. Their concern illuminates the shared challenges faced by individuals in multilingual communities and calls for the empowerment of

teachers to meet the current needs of learners. This concern is closely aligned to Charamba's (2021) finding who argued that there is a lack of qualified multilingual teachers and this hinders effective multilingual education as teachers fail to recognise that learners may have varying levels of proficiency in different languages. Promoting translingual pedagogies will then support learners' language development by allowing them to draw on their full linguistic repertoire to express their thoughts, ideas, and understanding.

By incorporating translanguaging approaches, learners can develop critical thinking, communication, and problem-solving skills, ultimately enhancing their overall academic performance. In addition, supportive and inclusive learning environment that values learner's linguistic and cultural diversity will be promoted allowing learners to fully engage in their learning and fostering a sense of belonging. Drawing from the concept of FoK leans more on the role the family plays when it comes to child development. Gonzalez and Moll (2002) states that the teacher and family of the learner should establish a connection based on "confianza" (mutual trust) in order to: a) foster cooperative learning and build bridges that can lessen stereotypes and assumptions between the two settings of the activity and b) link the lifestyle of the learner to the school curricula and educational practice (McIntyre et al., 2001). This means that there should be a relationship between not only the teacher and the learner but the family must be regarded as a pertinent stakeholder in the learning of the child.

In conclusion, embracing learners' home languages can enhance their overall learning experience, benefits both their cognitive development and sociocultural understanding, but addressing barriers is essential for equitable education. Through the use of a blended methodology, the strengths of quantitative accuracy and qualitative depth were combined in an effort to enhance the study and provide a comprehensive understanding of the potential of translanguaging pedagogies on intermediate-phase foreign language learners. The study's goal was to reveal a comprehensive knowledge that transcends numerical measurements and captures the substance of learners' experiences and the dynamics within the educational context by triangulating data from these various sources.

4.8. Summary of research findings

Presented below is the summary of the research findings from the present study:

English Language Proficiency test

Control group

The English Language Proficiency test results for the control group paint a picture of remarkable excellence. The highest mark obtained by a participant in the control group was 87% with the lowest being 20%. The group had a mean of 66.7% and a pass rate of 95%. This therefore means that about 9 in every 10 participants passed the test, considering the DoE's pass mark of 40% for additional languages. The standard deviation for this group was 14.9%.

Experimental group

The highest mark obtained in this group was 87% with the lowest being 20%. The experimental group had a mean of 58% and a pass rate of 80% for the proficiency test. This also means that 8 in every 10 participants in this group passed to score 40% or higher in the English Language Proficiency test. The standard deviation for the group was 19%.

This shows a fair distribution in terms of cognitive abilities as far as the English language proficiency test is concerned. Most learners managed to meet the minimum score of 40% and most learners in the control group had a better grasp of the language than those in the experimental group even though they both showed a pleasing performance. Moreover, the averages indicates room for improvement as there is a huge gap between the highest and the lowest achiever in both groups. It also suggests an exploration of different pedagogical strategies that cater for the individual needs of all learners.

Pre-test

Control group

The highest mark in this group was 73% and the lowest was 20%. The group's mean stood at 47.7%, with a standard deviation of 13.21%. The pass rate for this group stood at 75% indicating that the majority navigated the test successfully. The pass rate was calculated using the DoE's pass mark of 40%. Conclusively the performance was quite acceptable though the difference in performance among participant remains a close call, highlighting the persistence of a performance gap within the group.

Experimental group

The experimental group's pre-test results provide an intriguing window into how language and learning interact. The highest mark obtained in this group for the pre- test was 67% with the lowest being 20%. Their pass rate was 70%, translating to 5% lower than that of the control

group. The control group had a mean of 47.7% whereas that of the experimental group was 45.33%. The standard deviation for the experimental group's marks in the pre- test was 16.55%. Considering the means for the two groups as well as their standard deviations, the performance of the two groups was almost the same (Charamba, 2017).

Both groups did not do so well in the pre- test. During interviews most learners in the experimental group provide a more nuanced perspective of their poor performance in the pre-test. A majority of the learners argued that the language used during the lessons prior to writing the test was the reason for their performance (Charamba, 2017). Learners 2's response below serves as an example

Learner 2: "*The last exam was very easy, and the proficiency test was fair. The test that caused me trouble was the second one. The words were too complex for me to understand*."

This shows that some learners may have had language hurdles as a result of the teacher's exclusive reliance on English, which limited their capacity to fully understand and interact with the subject matter. The average pass rate for the two groups for the pre- test was 46.5%.

Post-test

Control group.

The post-test results of the control group show a general satisfactory level of understanding among learners with an average score of 51.33% from 47.7% in the pre-test. A closer look into the distribution of scores reveal that 65% of the learners passed the minimum 40% benchmark stipulated by the CAPS. The highest learner achieved a score of 80% and the lowest had 20%. Recognising the upward trend in the control group is important because it shows that learning was progressive. Nonetheless, a considerable proportion of learners exhibit a decline in comprehension as seen by a pre-test score much higher than their post-test score.

Experimental group.

The post-test results of the experimental group provide an engaging story of promise and confusion. The highest score soars to 93%, 26% higher than the pre-test's high score of 67%. The lowest score stayed at 20% which was concerning for the research but was later cleared during the interviews. The groups' average increased from 45.33% to 55% showing good progress among learners in the experimental group. The standard deviation was 22.76%.

From the above comparison, though somewhat similar, it can be deduced that most learners improved from their pre-test performance. The control group had approximately 3% increase while the experimental group had approximately 10% increase. Most of learners in this group improved their performance by above 10% after the intervention (the use of their home language during the NS lessons).

4.9 Discussion of research findings: Quantitative and Qualitative.

Over the years South Africa has faced challenges with regards to catering for the needs of its rainbow nation. Many efforts to address the needs of multilingual learners have been made but challenges persist. The status of literacy in South Africa presents a disconcerting scenario, highlighted by concerning statistics indicating that more than 80% of grade 4 learners cannot read for understanding (Howie et al., 2023). This situation is further emphasised by South Africa's unimpressive ranking at the bottom in the 2021 PIRLS, emphasising the critical need to tackle the nation's literacy emergency. A pivotal aspect that significantly influences this issue is the correlation between the language of instruction and academic achievement. Various comprehensive investigations, such as those conducted by scholars cited in Chapter 2 of this study, establish a strong connection between learner's proficiency in the language of instruction and their performance in assessments based on academic content. This prompts a fundamental inquiry: Are we effectively addressing the linguistic requirements of the learners in order to optimise their educational capabilities?

The increasing cultural and linguistic diversity in society frequently results in learners entering educational settings with a home language that is totally differing from the established Language of Learning and Teaching (LoLT), typically English. As emphasised by Dhokotera and Makalela (2022) and Sefotho (2022), this issue is particularly crucial in early childhood education, where the sudden transition from utilising one's mother tongue as the LoLT to an unfamiliar language like English can pose significant obstacles to academic progress. For learners in the fourth grade, managing this intricate linguistic shift while also dealing with challenging academic material establishes a difficult and potentially disadvantageous learning atmosphere. Thus, addressing the literacy challenge in South Africa requires a sophisticated approach that recognises language as a fundamental instrument for educational advancement.

Venturing beyond a standardised LoLT framework and investigating alternative methodologies, such as integrating aspects of learners' home languages into instruction or implementing multilingual educational models, could offer potential in enhancing reading comprehension and overall academic achievement. By critically evaluating the existing LoLT methodology in intermediate phase education through a research-oriented perspective and acknowledging the diverse linguistic environments within the classrooms, we can initiate the development of a more inclusive and efficient learning setting for all learners, irrespective of their language backgrounds. This, in turn, has the potential to narrow the literacy disparity and cultivate a generation of capable and self-assured readers in South Africa.

Driven by the aspiration to comprehend the correlation between language and academic achievement, this study investigated the subsequent fundamental questions:

- Does language have a transformative effect on the academic performance of grade 4 NS learners in Johannesburg?
- How can translanguaging be transformatively used in a multilingual NS classroom?
- To what extent can translanguaging be used in a NS classroom with multiple languages?
- Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

The research was guided by specific hypotheses that aimed to be either confirmed or rejected through the analysis of the data.

Research Hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.*

Null Hypothesis: *There is no significant difference in the academic performance of grade 4 NS learners post intervention in the experimental group.*

This research delves into the complex interplay of language and literacy, investigating their intertwined impact on learner's achievement in fourth-grade Natural Science. Through the utilisation of a multilevel hierarchical regression analysis, it elucidates the significant roles that both home language and literacy play in the language used for teaching (English), in conjunction with variables such as parental influence as well as teacher ideologies. The results align with existing literature, including the findings of Omidire and Ayob (2022) who emphasises the difficulties encountered by learners when their home language differs from the

language of instruction, particularly in STEM disciplines like mathematics and science. By showcasing the direct influence of native language and English literacy on academic success, this study enhances comprehension of this issue.

Essentially, the analysis uncovers a multifaceted scenario where each aspect of language and literacy contributes to the overall framework of learner accomplishment. This complexity calls for a nuanced educational approach that recognises the varied linguistic environments of classrooms and actively strives to bridge the gap between learners' home languages and the language of instruction. The study's results present a compelling depiction of the significant impact of language on academic performance, notably observable in the results of the English language proficiency test, the pre- and post-assessments. In the control group, relying solely on an additional language for instruction proved to be ineffective. The results of the assessments exhibited minimal improvement, with a slight increase of approximately 3%. This minimal progress highlights the drawbacks of a monolingual strategy in heterogeneous classroom settings.

In stark contrast, the experimental group fully embraced the transformative potential associated with multilingual pedagogies. Through the delivery of instruction in isiZulu, isiXhosa and English, the outcomes achieved were impressive. There was a better increase in the average score with a 10% increase, leading to a number of learners passing remarkably well. This noteworthy change serves as a clear indication of the effectiveness of translanguaging, wherein learners adeptly manoeuvre and utilise their varied linguistic skills to enrich the process of learning. It is important to note prior the improvement, learners had to face some hurdles which were further delved into during the interviews.

The pleasing improvement of the experimental group can be ascribed to numerous factors. Initially, the utilisation of the learner's home languages as an instructional medium established a feeling of familiarity and ease, enabling learners to interact with the content at a deeper level. This linguistic connection facilitated the comprehension of intricate concepts that may have otherwise seemed obscure when viewed through an unfamiliar language. Subsequently, translanguaging enabled learners to leverage the strengths and subtleties of isiZulu, isiXhosa and English, enhancing their comprehension and promoting analytical thinking abilities. The discoveries of the research carry significant implications for educational methodologies especially with regards to the Johannesburg context. It questions the conventional model of

single-language teaching and promotes a more comprehensive approach that acknowledges and appreciates the varied linguistic competencies of learners. By integrating translanguaging and multilingual teaching methods into the educational setting, teachers can unlock the complete potential of their learners, irrespective of their language backgrounds, and pave the way for a fairer and more enriching learning environment for everyone.

Cognisant of the fact that the official language policies in South African schools often prioritise English or Afrikaans as the medium of instruction, sidelining African languages spoken in the area, most learners in Johannesburg central fall victim to such practices where they do not get the chance to be taught in their home language from grade R-3. From the get-go teachers frequently engage them in a language they are not familiar with resulting in a cognitive overload as strongly emphasised by Carrim and Nkomo (2023). However, this study explored a more flexible approach that embraces translanguaging (using multiple languages) in creating a meaningful learning environment in diverse classrooms of Johannesburg, putting into consideration the vast linguistic resources at our disposal.

The remarkable improvement of the experimental group, as demonstrated by their performance in the post-test and insightful interview responses, presents a vivid portrayal of the transformative influence of translanguaging pedagogies in the field of science education. Through embedding instruction and educational resources in isiZulu and isiXhosa, the learner's mother tongue, alongside English, the learning environment underwent a significant change from a potential place of marginalisation to a domain of empowerment and enhanced learning. The outcomes of the post-test serve as a compelling validation of this transition. The rise in mean scores and the nearly universal pass rate sharply contrast with the minimal progress noted in the control group, which adhered solely to English as the medium of instruction. These disparate results underscore the inherent constraints of monolingual methods in heterogeneous classrooms, where learners encounter challenges in comprehending intricate ideas through the lens of an unfamiliar language.

Nevertheless, the advantages of utilising the home language at home go beyond mere comprehension. The results of the interviews demonstrate a more profound, social, and cognitive benefit acquired by the group subjected to the experiment. Learners articulated how the use of their home languages facilitated a feeling of confidence and involvement, enabling them to communicate genuinely and establish a deeper connection with the subject matter. This

linguistic inclusiveness nurtured a sense of community and belonging, reshaping the classroom into a cooperative environment where different perspectives and voices could flourish. Moreover, translanguaging, which involves fluidly transitioning between languages, emerged as a potent mechanism for enhancing comprehension. Learners recounted how they leveraged the distinct subtleties of their home languages and English to elucidate complex ideas, engage in analytical thinking, and ultimately build intricate and interconnected knowledge structures. This linguistic flexibility pushes the boundaries of conventional monolingual classrooms, demonstrating the significant potential of utilising learner's varied linguistic abilities to improve and augment learning.

The success of the experimental group provides compelling proof for the necessity to alter educational paradigms and adopt multilingual teaching methods. Through acknowledging and honouring the varied linguistic proficiencies of learners, educators can establish inclusive and fair learning settings in which every learner has the chance to achieve their utmost potential. This research functions as a rallying cry, encouraging educators to dismantle language barriers and unleash the concealed riches of home languages for the advantage of all learners. The enthusiastic acceptance of the multilingual classroom by the experimental group transcended mere understanding and entered the domain of emotional bonding and inclusiveness. Insights from interviews unveiled a significant transformation in their engagement with the educational process. Below is an example of an interview response of Learner 10 expressing the joy that came with being able to use their home language:

Learner 10 beaming with excitement, exclaimed: "*It was a fantastic lesson! The teacher used isiZulu and English, and it wasn't just about explaining things, she used examples we could relate to. It felt like I was included in the lesson."*

This simple assertion bears significant importance. It denotes a shift in the classroom environment from one of mere reception to a dynamic setting enriched by a variety of languages and collective encounters. Through the integration of isiZulu and isiXhosa in the teaching framework, the educator addressed a pivotal disparity, deconstructing the intangible barriers of linguistic marginalisation and nurturing feelings of inclusivity and camaraderie.
The learner's use of the term "fantastic" is notably revealing, indicating a transformation from viewing learning as challenging and isolating to perceiving it as a source of delight and involvement. The relatable instances, conveyed in the comforting embrace of their native

language, facilitated deeper comprehension and instigated a feeling of possession over the subject matter. This alteration in perspective emphasises the influential role of language in not only shaping cognitive but also emotional involvement in education. Moreover, the learner's observation underscores the transformative capacity of translanguaging, the effortless transition between languages. The instructor's adeptness in navigating both isiZulu and isiXhosa alongside English, seamlessly integrating them into the educational framework, cultivated a vibrant and enriching setting. This linguistic flexibility nurtured a sense of academic assurance in the learners, enabling them to utilise their varied linguistic skills to interact with the content on their own terms.

The notable improvement of the experimental group in the post-test vividly illustrates translanguaging as a potent catalyst for academic advancement in multilingual educational settings. When educators strategically incorporate learner's home languages alongside the instructional language, the outcomes eloquently speak for themselves: enhanced academic achievement, increased involvement, and a thriving sense of belonging. The data unequivocally supports this: translanguaging harbours significant potential for enhancing performance, especially in cases where the language of instruction differs from the learner's home languages. By integrating familiar linguistic reference points, teachers bridge the comprehension divide, enabling learners to grasp intricate concepts at a profound level. This eradicates potential comprehension obstacles and empowers learners to genuinely engage with the material.

McKinney's (2022) research resonates with this discovery, emphasising the beneficial influence of validating learner's multilingual identities on their academic accomplishments. Within multilingual classrooms, deconstructing rigid linguistic barriers and celebrating the array of linguistic resources accessible fosters an inclusive and inviting atmosphere. Consequently, this nurtures confidence, participation, and a sense of authority over the educational journey, all of which contribute to heightened academic success.

This research presents compelling proof not only of the importance of reassessing conventional monolingual methodologies and embracing the advantages of translanguaging but also of providing necessary scaffolding to learners especially those that have never been exposed to the use of their home language in the educational space. By seamlessly incorporating learner's home languages into the instructional framework, educators can establish fair learning environments where all learners, irrespective of their linguistic backgrounds, can unlock their

full capabilities. Nonetheless, it is imperative to recognise that while the post-test outcomes exhibit a positive association between translanguaging and academic performance, further investigation is required to mitigate potentially confounding variables. Exploring the influence of individual learning preferences, resource accessibility, and socioeconomic aspects will yield a more comprehensive comprehension of the intricate relationship between language and academic success in multilingual classrooms.

The control group encountered a persistent challenge as they were instructed in English, a language they found difficult based on the pre and post-test results, despite the tests being identical. This posed a notable difficulty, given the requirements of the subject matter and literacy development. As Cummins (2009) appropriately pointed out, a key differentiation exists between basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP). BICS prepares individuals for daily conversations, while CALP delves into the intricate, abstract realms of academic disciplines such as science. Charamba (2021) further accentuate this distinction, observing that academic environments involve "context-reduced" communication, necessitating not only comprehension of specific terms but also navigation of complex ideas and intricate interrelations among those ideas.

In line with Charamba (2021), Ndhlovana and Charamba (2023) further articulate this notion that academic environments especially of young learners in the intermediate phase, entail deciphering phenomena, grappling with abstract reasoning, and applying knowledge to novel situations – all within the context of a conceivably unfamiliar language. For the control group, the discrepancy between language proficiency and academic requirements hindered their learning progress, resulting in poor performance on both assessments. Just envision attempting to unravel the complexities of the topic of matter and materials while contending with a rudimentary grasp of the language itself. Consequently, it is unsurprising that their advancement remained constrained. This underscores the vital importance of considering a learner's language proficiency, particularly CALP, when laying the groundwork for academic achievement, especially for 4th-grade learners.

The sharp contrast between the control and experimental groups illuminates this disparity. By employing translanguaging techniques and harnessing learner’s home languages in the experimental group, a significant transformation not only in comprehension but engagement and expression was observed. This reinforces the argument that bridging the language barrier,

recognising the intricacies of CALP, and establishing an inclusive learning atmosphere are pivotal steps toward unlocking the complete potential of all learners, irrespective of their linguistic backgrounds.

This research underscores the critical nexus between language and science instruction, specifically comparing the post-test performance of an experimental group taught in isiZulu and isiXhosa alongside English to a control group receiving instruction exclusively in English. The marked disparity in their outcomes sheds light on the profound influence of the language of instruction on academic accomplishments, particularly in challenging subjects like science and also provides a concerning insight exclusive to the context of Johannesburg where there is the amalgamation of different cultures and languages.

This study echoes Sibanda (2019) assertion that learners who find themselves in some parts of Johannesburg develop what he called 'lok'shin lingua' which is a dialect that is used by people in a specific community. In the present study though not strongly stressed Learner 14 alluded to the fact by saying: "I can speak isiZulu and isiXhosa but I feel like what I say is not pure and I cannot even read either languages but I know them and I understand." This ties to the aforementioned BICS and CALP and it brought to the study a different viewpoint in how to fully and effectively cater for such learners. The researcher realised that when learners struggle with grasping fundamental vocabulary and sentence structures, the complexities of scientific ideas remain veiled in ambiguity. Some learners in the experimental group were confronted with this very obstacle and encountered difficulties in demonstrating notable advancements which is why their performance were not as remarkable in the quantitative data. However, by translating crucial concepts and employing familiar linguistic frameworks, a pathway to comprehension was established. Learners' proficiency in CALP was enhanced, enabling them verbally navigate a nuanced linguistic landscape of science using their BICS.

The importance of this study goes beyond the success of individual learners. According to Tytler (2020) STEM disciplines are essential for the advancement of society and culture. To ensure fair access to these areas, it is crucial to recognise the various languages spoken by learners in the classrooms and to employ teaching methods that bridge the gap between their home languages and the medium of instruction. By replicating and expanding on this study, we can pave the way for a future where language is a tool for inclusivity and empowerment rather than a barrier to education. Only then can we truly unlock the full potential of all learners,

irrespective of their language backgrounds, and guide them towards success in the STEM fields that propel the world forward. This study echoes and emphasises this worrying trend, with the experimental group that received instruction in both their home language and English outperforming the control group that was only taught in English. These results are in line with a growing body of research that highlights the influence of the relationship between native language and LoLT on STEM performance (see for example: Charamba, 2020b; Hattingh et al., 2021; Lemmi & Pérez, 2024; McKinney & Tyler, 2019; Schoeman et al., 2023)

The implication of this study goes beyond the individual academic performance of learners. In an increasingly interconnected and diverse global environment, it is crucial to recognise the significance of language proficiency and reading capabilities in academic success especially in science education. Educational strategies need to adapt to cater to the requirements of learners who are navigating unfamiliar linguistic terrains, offering them the necessary assistance and structures to bridge the gap between their native languages and the Language of Instruction and Learning (LoLT). It is only through this adaptation that we can guarantee fair access to academic achievement for all learners, irrespective of their linguistic backgrounds. By delving more profoundly into the complex interconnections of language proficiency, reading skills, and teaching methodologies, we can continuously decipher the intricate pattern of academic success and create a future where language serves as an enabler, rather than a barrier, to learning.

In sum, the quantitative and qualitative data converge showing that translanguaging pedagogies can potentially develop deeper epistemic access and the perception multilingual learners have of their multilingual repertoire. This study has some limitations because it has been carried out in a specific context and with a limited number of learners. The learners' age can also be considered a limitation because it has not allowed for deeper questions regarding the pedagogy. In spite of these limitations, the findings obtained in this study support those obtained in other research studies because they show that translanguaging can be positive for multilinguals learners. In fact, this study contributes to research on translanguaging in primary science education by revealing the possibility of using more than one language at the same time as a resource in pedagogical translanguaging.

4.10 Chapter Summary.

This investigation monitored 40 fourth-grade learners as they learned NS. The experimental group (comprising 20 learners) was taught in isiZulu and isiXhosa, the learner's home

language, alongside English, while the control group (consisting of 20 learners) was taught solely in English. Both sets of groups participated in pre- and post-tests; however, the experimental group had a distinctive experience as their post-test was conducted in both English and either isiZulu or isiXhosa, revealing the advantages of translanguaging.

The outcomes of the study were unambiguous as the experimental group improved significantly, surpassing their peers who were taught exclusively in English. This indicates that the utilisation of translingual pedagogies which involves seamless transitioning between languages, provided cognitive benefits. Interviews with learners from the experimental group unveiled a heightened comprehension of the subject matter, implying a more enriched educational experience facilitated by familiar linguistic connections, with advantages extending beyond the cognitive realm. The conversations also exhibited social and emotional benefits for the experimental group, showcasing increased confidence, engagement, and inclusivity within the classroom. The teacher also expressed ease in the teaching as the lessons became more learner centred giving the teacher a chance to fully engage with learners and facilitate learning.

These discoveries present a compelling argument for the integration of multilingual teaching approaches in fourth-grade settings. By recognising and capitalising on learner's native languages, educators can establish inclusive learning environments where every learner, irrespective of their linguistic backgrounds, can prosper. This research serves as a clarion call for educators, encouraging them to formulate and apply multilingual teaching techniques that unlock the diverse potentials of their classrooms.

4.11 Conclusion

The current chapter has presented the study's findings. The quantitative results of the 3 tests have illuminated the proficiency levels of Grade 4 learners, indicating a significant difference between the control and experimental groups. Specifically, the experimental group exhibited a more improved performance in the post-test. The quantitative findings from both groups along with the qualitative data from learners, the teacher and parents interviews, provided further insights into the utilisation of home language and LoLT (translanguaging) as pedagogical tools in science comprehension. The subsequent and ultimate chapter will conclude the dissertation, summarising key investigation issues, addressing the research questions from Chapter 1, outlining research limitations, and proposing recommendations.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

Chapter 4 presented a detailed representation of the data collected during the study, how it was analysed by the researcher as well as the results that emanated from the analysis. This chapter presents a synthesis of the research findings, offering a comprehensive interpretation of its implications and suggesting actionable recommendations based on the study's outcomes. A concise summary of the research endeavour is provided, outlining the significant discoveries resulting from the thorough examination of the gathered data. Potential recommendations are also put forth.

5.1 Introduction

The study inquired into a critical issue: Does language have a transformative effect on the academic performance of grade 4 NS learners in Johannesburg? It specifically focused on learners who had a home language different from the language of instruction (English). Fundamentally, the researcher explored whether the introduction of a home language would cause a transformation in their academic performance. Through this exploration, valuable insights were sought to enhance educational practices and ensure equal learning opportunities for all learners, irrespective of their language backgrounds.

Guiding this study were pivotal sub questions:

- How can translanguaging be transformatively used in a multilingual NS classroom?
- To what extent can translanguaging be used in a NS classroom with multiple languages?
- Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

To address the research questions and investigate the potential of translanguaging in grade 4 classroom instruction, a quasi-experimental design with two distinct groups (the control group and the experimental group) was utilised in this study. The control group, representing the traditional monolingual method, received instruction exclusively in English, the official language of instruction in South Africa. Conversely, the experimental group, adhering to the country's multilingual policy, received education in both English and isiZulu or isiXhosa, their home language. Notably, the post-test for the experimental group was in both English and isiZulu or isiXhosa, recognising the cognitive benefits that multilingualism can provide.

This study aimed to challenge this norm by allowing the experimental group the flexibility to engage in translanguaging- transitioning between languages throughout their learning process. Unlike the control group restricted to a monolingual setting, the experimental group could seamlessly switch between English, isiZulu and isiXhosa, promoting clarity for fundamental concepts, definitions, and scientific explanations. This adaptability empowered learners to utilise their language strengths, potentially fostering deeper comprehension and encouraging more nuanced interaction with the subject matter. After the intervention phase, the researcher investigated the possibility of using a bilingual approach to education in Grade 4 classrooms. The research reached the critical point: the post-test. This evaluation was the key to discovering the real answer: Does using home languages actually improve learning outcomes?

Motivated by concerns about low literacy rates as revealed in the 2021 PIRLS where 81% of grade 4 learners could not read for comprehension, alluding to the language gap between home and school, the hypothesis maintained that learner's academic success is greatly influenced by the language of instruction. Additionally, TIMSS, an international evaluation of science and mathematics conducted on 4th and 8th grade learners from a selection of counties across the globe also show that though South Africa is the least in terms of performance in science tests (Reddy et al., 2017). In 2015, South Africa was ranked 39th out of 39 participating countries in the examination of science for ninth grade and in the seventh assessment cycle, following the 2015 which was administered in 64 countries, once again, South African learners performed below average (South African Parliamentary Monitoring Report, 2017). To make matters worse, most learners in Johannesburg fail to understand the concept from the get-go in foundation phase as they are abruptly introduced to English due to multicultural and multilingual learners that are from within South Africa and abroad (Wunseh & Charamba, 2023). This claim is unequivocally supported by the post-test findings.

Proposing a bifocal language strategy that embraces the diverse languages that are woven throughout communities, the study's advocated approach to language acquisition turns out to be a powerful instrument. The researcher witnessed a striking change in participation and performance when learners in the experimental group used their home languages alongside English, the language of instruction. Data from these learners show significant improvements in their retention, understanding content knowledge and even participation. This implies that the use of home languages not only creates cognitive scaffolds but also encourages a closer bond with the content being learned, resulting in more retained and significant knowledge.

Nonetheless, the dedication to diversity went beyond the test group. Understanding that information should be shared, the researcher and the teacher ensured that following the intervention, the control group had access to the same courses and materials. This moral strategy ensured that every learner, even those who did not take part in the study, profited from the knowledge acquired.

Chapter 5 currently serves as a bridge between the findings of the research and the future of education. It provides a brief synopsis of the study, explores the deep inferences made from the information, and makes specific recommendations for researchers, educators, and legislators. The findings reveal that by recognising the value of home languages and implementing bilingual education policies, we can empower learners, close the performance gap, and open the door to a day when all learners, regardless of language background, can succeed.

5.2 Chapters overview.

Chapter 1.

The background of the research problem was covered in this chapter. It explored the intriguing relationship that exists in South Africa between language, education, and national policy. Although the idea of using multilingual classrooms—especially as a transitional approach between Foundation Phase and Intermediate Phase—has garnered momentum in several countries, its application in the majority of Africa is still restricted. Under the aegis of the eleven official languages and the Education Language policy of the country, South African schools are in a position to transform into multilingual schools where the learners' home language can find resonance within the daily lessons. Research, however, presents a different picture, one in which these policies' potential is still mostly unrealised.

Most NS classes in South Africa particularly in Johannesburg, are still oppressed under the monolingual paradigm, mostly having a medium of instruction different from the learners' home language. A plethora of studies on the relationship between language and ways of knowing and conceptual knowledge assimilation has convincingly established that using a medium of instruction which is different from the learners' home language places the learners under tremendous pressure to use a monolingual lens to make sense of the world and of who they are (see for eaxmple: Carrim & Nkomo, 2023; Charamba, 2022a; Hattingh et al., 2021;

Mgijima & Makalela, 2021; Ndhlovana & Charamba, 2023b; Schoeman et al., 2023; Sefotho, 2022; Zano, 2020).

Chapter 1 critically explored this discrepancy. This dogma of monolingualism in the school curricula was imbued by a one- ness ideology (that is one language, one nation; one classroom, one language), which was crucial to the formation of European nation countries in the 18th century (Baker, 2011; Makalela, 2018). Over the years teachers have traditionally taken a protective stance to prevent cross-contamination across languages, and since this European Enlightenment period, schools have also consistently produced scenarios where one language was pitted against another (Makalela, 2018). Thus, the researcher examined the state of existing research and analysed the prospects and problems of incorporating home languages into Grade 4 NS classes in South Africa. This analysis served as a vital starting point for the researcher's future work, which sought to shed light on the possible advantages of a bifocal language strategy in terms of improving academic achievement and closing the language gap for younger learners.

Literacy development has been pointed out as a cornerstone of academic success and it appears to cast a long shadow across the early years of schooling in South Africa, yet most learners are forced to navigate English as the sole LoLT with minimal to no support from translanguaging and multilingual pedagogies. As a result, their inability to understand English makes it difficult for them to read for meaning, endangering their progress toward literacy and having an effect on their academic journey as a whole. This sobering fact highlights the necessity of critically reassessing the 21st century language policies in school. The curriculum's heavy dependence on English at the expense of other languages, without considering the varied linguistic environments seen in South African schools, results in a system that disadvantaged many learners. This problem is made worse by the absence of multilingual pedagogies, which deprive learners of the tools necessary to bridge the gap between their home languages and the LoLT.

Rather than realising the potential for synergy across languages, schools frequently reproduce circumstances where languages are seen as competing entities. This position unintentionally inhibits the inherent flexibility and adaptability that define multilingualism. The LiEP of 1997 set forth two noble goals, but only part of these goals have been realised: ensuring that all learners have access to mother tongue instruction throughout their schooling and encouraging additive multilingualism. Through advocating for the use of mother tongue in education and

supporting the preservation of native languages alongside second language acquisition, the policy aimed to establish a fair and welcoming learning atmosphere. However, there were two significant conditions that limited these goals: firstly, the decision for mother tongue education depended on parental choice, potentially leading to inequalities in school selection; secondly, individual schools were responsible for translating the LiEP principles into action, resulting in diverse understandings and applications.

Despite its admirable goals, the LiEP has yet to fully deliver on its promises twenty years later. There remains a continuous necessity to push for a broader and more effective integration of mother tongue and multilingualism in educational settings. This task demands a comprehensive strategy to address the existing constraints within the current system. Historically, educational approaches often favoured a single LoLT different from learner's home languages, but recent studies on schools with highly diverse populations question the effectiveness of this method.

Relying exclusively on an unfamiliar LoLT does not adequately support the academic and social progress of multilingual learners, especially those facing challenges in keeping pace (Charamba, 2020b). The rise of super-diverse environments, characterised by the amalgamation of languages and cultures, necessitates a new direction in education. Traditional, monolingual methods fall short in recognising the rich linguistic diversity present in these classrooms. Instead, effective teaching practices and policies should capitalise on learner's various language skills, acknowledging the dynamic and interconnected nature of their languages.

This chapter also delved into the theoretical frameworks and practical approaches that underpin multilingual and translanguaging pedagogies in diverse educational settings. Various successful models from around the world that utilise learner's linguistic abilities and encourage learning through multiple languages were explored. By actively grappling with the complexities of language in contemporary education, research endeavours to establish inclusive and stimulating learning environments where all learners, irrespective of their language backgrounds, can excel. The chapter also details the aim of the study, research questions, hypotheses, limitations, and definition of key terms used in the study.

Chapter 2.

Drawing upon an extensive array of scholarly resources, this chapter elucidates the current understanding of the research problem, establishing a foundation for further investigation. The intricate fabric of language and literacy development within global primary schools was explored in this chapter. Emphasis was placed on the transformative potential of translanguaging in the educational setting, drawing insights from both local and international studies.

Research conducted by Set (2023) and McKinney (2022) highlights the challenges faced by learners whose home language differs from the language of instruction in terms of academic performance. Interestingly, a closer examination reveals the complex relationship between language proficiency and academic achievement. Mgijima and Makalela (2021) along with (Charamba, 2021b) present evidence of a positive link between self-reported language proficiency and reading comprehension, serving as foundational elements for higher academic success. This underscores the significant role of proficiency in the LoLT in academic accomplishment, as underscored by Hattingh et al. (2021). Nevertheless, it would be erroneous to consider it the sole determinant, especially for learners grappling with a non-native LoLT.

The researcher charted a course guided by empirical evidence that illustrates the transformative capacity of translanguaging, an instructional strategy that embraces the fluidity and interconnectedness of learner's varied language skills. The chapter presents four themes that delve deeper into relevant literature conducted globally. In the first theme, the researcher conducted a thorough analysis of the current landscape on the role MT plays in the classroom, shedding light on the obstacles linked to underdeveloped mother-tongue competencies. This analysis set the stage for the primary focus – the transformative influence of translanguaging and multilingual teaching strategies. In the second theme, complexities of monolingualism were unveiled with particular focus on the multidimensional perspective.

The third theme focused on multilingualism: embracing global linguistic diversity. Research revealed that translanguaging acknowledges and celebrates the dynamic interaction among languages in educational settings. By leveraging the complete range of linguistic resources that learners bring to the classroom, it promotes deeper understanding, increased engagement, and enables learners to grapple with challenging academic concepts more effectively. The fourth theme was on pedagogical translanguaging in multilingual classrooms. Here the researcher delved into the theoretical foundations of this approach, demonstrating its potential to narrow

the achievement gap and cultivate an authentically inclusive learning atmosphere. This exploration transcends theoretical constructs, drawing upon compelling empirical data from various regions worldwide. An evaluation of successful instances of translanguaging and multilingual teaching strategies implemented in diverse settings underscores their efficacy in enhancing reading comprehension, literacy abilities, and overall academic performance. This comparative analysis facilitates the identification of optimal practices that can be tailored to suit the specific requirements of South African classrooms.

The contemporary landscape of multilingualism has fundamentally challenged the rigid conceptualisation of languages as self-contained, static entities with well-defined boundaries. Current scholarly works, as exemplified by Dhokotera and Makalela (2022), Cenoz and Gorter (2021) and Zano (2020) adopt a more intricate perspective where languages are viewed as dynamic, interconnected systems that create complex networks of communication, overlapping and mutually influencing one another. This shift in paradigm or multilingual turn, acknowledges multilingualism as the foundational aspect for comprehending language practices and their effects on learning.

This departure from the monoglossic orthodoxy, marked by a focus on individual languages, holds particular significance in the contemporary globalised, dynamic, and mobile communicative environments (García, 2020). Makalela and Silva (2023) argues that a strict emphasis on monolingualism impedes learners' potential for success across diverse subject areas. As indicated in the literature review, language plays an undeniable and crucial role in shaping academic accomplishments in various fields.

The researcher critically evaluated the different ways of using translanguaging as a pedagogical approach of monolingual methods and investigated the potential for transformation through the acceptance of multilingualism in educational settings. By utilising theoretical frameworks and empirical data, it was illustrated how utilising learner’s varied linguistic abilities can enrich their comprehension, involvement, and overall academic performance. Through acknowledging the interrelated nature of languages and capitalising on learner’s linguistic proficiencies, we can enable them to navigate the intricacies of knowledge acquisition and excel in a context where diverse viewpoints and voices enhance the educational landscape.

Chapter 3

This chapter explains the meticulous methodological framework, data analysis procedures, ethical considerations, and research design that support this study. In this instance, the researcher shed light on the tools and techniques used to address the research questions and closely assess the study hypothesis's validity.

The researcher used a mixed-methods approach, which combines quantitative and qualitative techniques to provide a thorough grasp of the research topic. This multimodal method recognised the intrinsic complexity of the study subject, necessitating the richness of qualitative insights in addition to the accuracy of quantitative data. The researcher obtained empirical evidence that quantified and assessed important factors through methodically designed rigorous statistical analyses and systematic data gathering. By using a quantitative lens, the researcher was able to identify trends, patterns, and correlations that provided a useful summary of the field of study.

Nonetheless, the study gained depth by means of the qualitative methodologies' emotive perspective. In order to go deeper and capture the subjective experiences and viewpoints that numerical data alone could not express, instruments such as observations, interviews, and documented analysis were used. Through the weaving together of participant voices and perceptions, the researcher was able to uncover the complex and human aspects of the research questions. The study used a two-phase, sequential explanatory design in which complementing qualitative and quantitative threads were interwoven to shed light on the research questions. Every stage required gathering and analysing data independently.

Meticulous procedures for gathering data were used, and the results produced numerical threads that encapsulated the main ideas of the study phenomena. The quantitative lens allowed the researcher to statistical analysis, then carefully scrutinised these strands, exposing patterns and trends that served as the basis for additional investigation. The second set of analysis moved the emphasis to qualitative research. Through the use of interviews and observations, the researcher was able to delve further into the subjective viewpoints and lived experiences that were beyond the scope of quantitative data. Rich tales and interpretations were weaved together to create this qualitative tapestry, which deepened and nuanced the findings and improved the comprehension of the research questions.

Due to the complex relationship between language and academic performance, a thorough research methodology is required. In this quest, triangulation—the convergence of various perspectives—proved to be invaluable (Bos, 2020). Through the utilisation of many theories, research methodologies , and data gathering strategies, triangulation provided the researcher with a multifarious perspective to elucidate the intricacies of the phenomenon being studied.

Such a multimodal approach was necessary in this study to investigate the potential of isiZulu and or isiXhosa, the home language of Grade 4 learners, as a contributor to academic success. In order to fully explore this complex link, information was gathered from a wide range of sources such as pre- and post-test results from learners that provided quantitative insights into how language integration affected learning objectives. It was possible to gain a sophisticated understanding of how language was used in the learning environment and how it affected learning through classroom observations and teaching techniques. Furthermore, interviews with some experimental group learners, the teacher and parents provided different opinions, sentiments, and experiences on the usage of home languages (isiZulu and isiXhosa) in the classroom.

Through interlacing these varied elements, the study aimed to uncover the complexities of how language can either facilitate or hinder the learning journey of Grade 4 learners. This study utilised qualitative content analysis as its main methodology to uncover the intricacies and complexities present in the qualitative data. Akin to pure coding in its initial phases, this approach focused on systematically categorising and organising textual data without imposing predetermined theoretical frameworks (Gläser & Laudel, 2010). In contrast to other qualitative methodologies that include specific techniques for recognising patterns and integrating information, qualitative content analysis gives priority to the emergent nature of meaning, allowing themes and insights to naturally emerge through the iterative process of coding and analysis.

By meticulously following the detailed steps outlined in Gläser and Laudel (2010) framework, the researcher embarked on a rigorous exploration of the qualitative data. Each text fragment was carefully scrutinised and coded to capture its fundamental concepts and interpretations. Through a cyclic process of coding, memo-writing, and theoretical contemplation, the researcher continuously refined and sharpened the developing categories, ensuring their consistency and relevance to the research inquiry. This inductive approach, rooted in the data

itself, facilitated the emergence of fresh and unforeseen insights, enhancing the comprehension of the phenomenon being studied. By rejecting predetermined frameworks and embracing the emergent nature of meaning, qualitative content analysis proved to be a potent instrument for delving into the subjective experiences and viewpoints reflected in the data. This exploration of the qualitative landscape, revealed a plethora of insights that would have remained concealed within the raw text, ultimately contributing to a more profound and comprehensive understanding of the research question.

Chapter 4.

This chapter explored the intricate realm of data, where the results of the research are presented and thoroughly examined. Central to this investigation is the interaction between learners' home languages, their proficiency in the LoLT, and their academic achievements. To elucidate this correlation, learners underwent both a pre-test and a post-test, yielding a comprehensive collection of quantitative data. The data analysis utilised a bivariate method, focusing on the relationship between language and academic success. This approach produced various statistical measures, such as frequencies, percentages, learning improvements, p-values, standard deviations, effect size indicators, and averages, for each group of learners (control and experimental) involved in the research.

To further explore these measures and compare the performance of the two groups, the researchers employed the robust technique of the two-sample t-test. This statistical tool, also referred to as an independent sample t-test (Ali & Bhaskar, 2016), is fundamental in statistical analysis as it helps in determining if there are significant differences between two distinct groups on a specific variable (McMillan & Schumacher, 2010). Using R computing software, the two-sample t-test was applied to each measure derived from the tests, meticulously evaluating the control and experimental groups. This thorough comparison aimed to ascertain whether incorporating learners' home language into the learning process had a tangible impact on their academic performance in grade 4 classrooms. By rigorously analysing the quantitative data, this chapter not only presented the research findings but also provided valuable insights into the intricate relationship between language and education especially in Johannesburg where there are multiple languages. The detailed explanation of the analysis procedures, particularly the two-sample t-test, ensured transparency and enabled readers to comprehend the data transformation process into meaningful evidence (Ali & Bhaskar, 2016). Ultimately, this

chapter unveiled the quantitative narrative of the study, establishing a foundation for a deeper comprehension of its implications and contributions to the academic domain.

In the qualitative data analysis of this study, the researcher followed the methodological framework delineated by Glӑser and Laudel (2010). This entailed a systematic examination of the data, where it was meticulously categorised into words or themes, laying the groundwork for the emerging narrative elucidating the phenomenon under scrutiny. Throughout the data collection phase, it was crucial to utilise codes that protected the anonymity of the learners by substituting their actual names, a procedure primarily guided by ethical considerations. Each learner was denoted by a numerical code ranging from 1 to 40 to ensure confidentiality and uphold ethical standards in the research process. The researcher condensed and categorised the data into the following themes for analysis:

Theme 1: Linguistic disorientation: The sad reality in the classroom
Theme 2: Exploring the linguistic tapestry
Theme 3: Language variation and dialectology
Theme 4: Shifting pedagogical models
Theme 5: Aligning Policy perspectives with practical implementation

The examination of the responses from the interviews, considering the relatively limited sample size of 15 participants, was carried out manually. To establish a comprehensive information repository, the researcher utilised a combined methodology of coding and qualitative content analysis in accordance with the principles delineated by Glӑser and Laudel (2010). By integrating these two techniques, the researcher implemented a reductionist approach, systematically revisiting the data on numerous occasions to pinpoint and refine emerging themes until reaching a point of saturation. Concurrently, observations were conducted in the classroom settings to gain a deeper understanding of the learning and teaching strategies employed. This multifaceted methodology was designed to enrich the scope and depth of the research outcomes by triangulating data obtained from the interviews and classroom observations.

The majority of the participants interviewed emphasised that the integration of multiple languages during their lessons, especially when one of these languages corresponds to their home language, facilitated a more profound comprehension of conceptual content compared to

traditional monolingual interactions; conversely, some learners and even parents expressed confusion during the study and even given their community setting. These findings align with a prevalent theme in various literature on translanguaging, indicating that the use of multiple languages, particularly those spoken by the learners in the classroom, validates their social identities (Wilson, 2021). Moreover, this multilingual pedagogical approach nurtures a psychologically safe environment that enables learners to express themselves authentically and foster positive experiences within the educational milieu (Wei, 2018). This emotional disengagement is evident during the observations as most learners in the experimental group display signs of distraction and frustration.

5.3 Summary of research findings

The results of the study piqued the interest of the researcher by revealing the significant impact that language proficiency has on Grade 4 learners' academic achievement. This discovery presents intriguing directions for future research, especially in the area of alternating input and output languages. For multilingual learners, this kind of approach could not only help with greater comprehension of the topic but also with identity creation and expanding access to knowledge.

5.3.1 English Language Proficiency test

The English language proficiency data, derived from a cohort of 40 fourth-grade learners represents a good proficiency among learners giving them a mean score of 62.33%. The pass rate stood at 87.5%, meaning 87.5%, that is 35 learners out of the 40 participants managed to achieve a mark of 40% or better in the test. However, 82.5% of the participants achieved a mark of 50% and above. This is proof that most learners have an adequate or rather good proficiency in the language. Only 5 participants got a mark below 4 and it is safe to say this was really impressive.

The 40 learners were further split evenly into experimental and control groups. An analysis of the groups revealed that the highest mark was 87% with a lowest of 20%. This depicts an intriguing narrative of the English proficiency intertwined with glimpses of potential and intricacy. The control group, comprising 20 individuals, showcases a diverse array of academic performances in the test results. Noteworthy instances of excellence are visible, exemplified by the top score of 87% in the control group. Nevertheless, this commendable accomplishment is juxtaposed with a stark reality of performance inadequacy, highlighted by a score of 20%

from one learner. This glaring disparity underscores the enduring presence of an achievement gap within the cohort, despite the group's average score of 66.7% surpassing the minimum benchmark (40%) established by CAPS for fourth-grade languages. A detailed examination of the score distribution reveals a nuanced outlook. Promisingly, a pass rate of 95% (19 out of 20 learners) suggests that the majority performed satisfactorily in the test. This positive trend is reinforced by a standard deviation of 19.9%, indicating a relatively compact cluster of scores around the mean.

The English language proficiency test results from the experimental group (comprised of 20 learners) offer a perceptive insight into the proficiency of the learners. While the initial raw data may paint a seemingly positive picture, with a peak score of 87% and an average exceeding the recommended passing threshold (58%), the wide range of scores implies a varied learning environment within the group compared to the control group. Certain learners exhibit a strong grasp of concepts, whereas others seem to encounter significant challenges. This observation is further corroborated by the standard deviation of 19%, suggesting a somewhat broader dispersion of performance beyond the immediate vicinity of the mean. This was crystal clear evidence of how much the groups under study are struggling with understanding their LoLT.

5.3.2 Pre-test

The pre-test data, obtained from 40 Grade 4 learners who were divided into two equal groups (experimental and control), portrays a captivating narrative of academic proficiency, interspersed with glimpses of potential and complexity. Within the control group consisting of 20 participants, the pre-test results reveal a diverse range of academic performances. Notably, there are pockets of excellence visible, with the highest score achieving 73%. However, this notable achievement is contrasted by a stark reality of performance deficiency, exemplified by a score of 20% from one learner. This stark disparity emphasises the persistent existence of an achievement gap within the group, despite the average score of 47.7% slightly exceeding the minimum benchmark (40%) set by CAPS for Grade 4 Natural Science. Further analysis of the score distribution unveils a nuanced perspective. Encouragingly, the pass rate of 75% (15 of 20 learners) indicates that most learners navigated the test well. This positive trend is supported by a standard deviation of 13.21%, indicating a relatively tight cluster of scores around the mean.

The pre-test outcomes from the experimental group (comprised of 20 learners) provide an insightful glimpse into the intricate interplay between language and academic attainment. While the raw data initially presents a seemingly optimistic scenario, with the highest score of 67% and the average surpassing the recommended pass threshold (45.3%), the broad spectrum of scores, suggests a varied learning experience within the group as they have a lower pass rate from the control group. Some learners demonstrate a clear mastery of concepts, while others appear to face significant obstacles. This observation is further supported by the standard deviation of 16.55%, indicating a somewhat wider dispersion of performance beyond the immediate vicinity of the mean.

The pre-test data from both groups reveals a complex landscape of academic achievement. While positive patterns and pockets of excellence are observable, the presence of notable challenges and performance disparities cannot be overlooked. Additionally, the data from the experimental group underscores the critical role of language in the educational process, prompting a deeper exploration of its nuanced influence on individual learner success.

5.3.3 Post-test.

Following the implementation of the intervention, the post-test outcomes reveal an intriguing narrative surrounding advancement, inequality, and the lasting impact of language on the educational process.

The control group, adhering to a monolingual teaching method, portrays a perplexing scenario. Despite a slight increase in the mean score from 47.7% to 51.33%, the positive learning progression prompts inquiries into the effectiveness of the current approach. Nevertheless, this apparently good improvement conceals a more intricate truth. The existence of both a perfect score of 80% and a 20% accentuates notable individual performance diversification. Clearly, some learners excelled in the monolingual environment while others encountered difficulties. This is further validated by a pass rate of 65% and a standard deviation of 20.99%.

The experimental group, exposed to a multilingual intervention and bilingual post-assessment, illustrates a notably contrasting scenario. The mean score surged from 45.33% to a remarkable 55%, surpassing the control groups. This significant improvement implies that the integration of isiZulu and isiXhosa, the learner's home language, alongside English, fostered substantial and transformative educational outcomes. The data further demonstrates the breadth and depth

of this enhancement. The top achievers continued to excel, achieving a maximum score of 14/15. However, the most compelling aspect lies in the substantial improvement observed among some of the previously struggling learners. Notably the minimum score stayed at 20% highlighting some of the challenges that learners in this group faced. This is supported by a standard deviation of 22.76%, indicating a more dispersed distribution of scores around the mean. Perhaps the most indicative sign of complexity is the fact that while the highest had a 26% increase from their pre-test mark, some learners had about 10% decrease in their post- test results. This substantial decrease in failing grades strongly suggests that the multilingual approach though effectively addressed the language barriers that previously hindered certain learners' educational progress can also cause problems which calls for more research in this regard. However, post-test results present a multifaceted depiction of learning advancements and enduring obstacles.

While the control group depicts a narrative of stagnation amidst individual differences, the experimental group provides a compelling argument for the transformative potential of multilingual education. The notable progress observed in the experimental group, particularly among some previously struggling learners, emphasises the crucial role language plays in the educational process and highlights the potential of incorporating learner's home languages into academic environments. Further investigation is necessary to comprehend the long-term effects of such interventions and enhance their implementation for wider applicability.

5.3.4 Qualitative data

The research scrutinised the impact of language teaching on the academic performance of fourth-grade Natural Science learners. Two separate educational settings were examined: one where learners were taught only in English, and another where a bilingual method incorporating isiZulu and isiXhosa alongside English was utilised.

5.3.4.1 Observations

Initial observations unveiled an intriguing educational occurrence. In the control (English-only) group, the teacher naturally embraced a monolingual approach and as a norm there was no introduction of any pedagogical practice. Understanding concepts and actively engaging in class proved to be challenging for some learners, resulting in feelings of detachment and lack of involvement. As the study advanced, it became apparent that relying solely on English posed significant obstacles for numerous learners.

Contrary to the control group, the experimental group integrated other languages into their teaching. Initially the teacher found it odd though they had an open mind. They gradually adapted and embraced sensitivity to the diverse linguistic requirements of their learners. The sight of learners embracing the familiarity of their home languages underscored the importance of recognising and utilising a child's linguistic abilities in the educational process. The sharp disparity between the two educational settings emphasised the importance of building on learner's existing language skills. The bilingual classroom epitomised this notion, creating a lively and interactive learning environment where instructional support and connecting activities were pivotal. By seamlessly integrating isiZulu and or isiXhosa into the English syllabus, learner's comprehension was enhanced, and it also encouraged participation, and cultivated a deeper grasp of scientific concepts.

" I thought NS was only learnt in English. Little did I know that I can also use isiZulu and it actually makes sense." The declaration made by a learner in the experimental group, advocating for linguistic inclusivity, resonated profoundly, highlighting the emotive aspect of language. It shed light on the feelings of vulnerability and unease that learners face when their primary language is not present in the learning environment. This plea went beyond mere words, emphasising the significant role of language as a means of connection, a pathway to knowledge, and most importantly, a source of solace and stability. The observations underscored the profound influence of language instruction on the educational journey of Grade 4 learners. While relying solely on English posed challenges, the bilingual approach showcased the transformative power of recognising and embracing linguistic diversity. Scaffolding instruction, establishing links between different languages, and prioritising learner well-being emerged as essential strategies for creating a genuinely inclusive and productive learning environment where every learner can flourish.

5.3.4.2 Interviews

From the initial sample of 40 participants, the researcher selected a sample of 15 individuals (10 learners in the experimental group, 4 parents and the teacher) for in-depth interviews. The 10 learners were randomly sampled from the 20 participating learners in the experimental group to avoid biases. The parents were sampled based on their availability and willingness to participate and there was only one teacher who also volunteered to participate. From the interviews the researcher identified the following themes:

Theme 1: Language as a resource

Theme 2: Bridging the gap: Incorporating multilingual print for academic support grade 4

Theme 3: Translanguaging as a transformative pedagogy

Theme 4: Empowerment and agency

A thematic analysis of interview data unveiled a pivotal element contributing to the complex performance of the experimental group in the consistent incorporation of isiZulu and or isiXhosa, the learners' home language, alongside English during both teaching and the post-test. This discovery is in accordance with the experimental group's post-test outcomes, which consistently indicate that utilising learners' home languages along with the LoLT should be viewed as a fundamental aspect of effective classroom pedagogy. Insights from learners in the experimental group illuminated their language preferences and perceived learning encounters. The learners articulated a preference for integrating their home language into lessons, emphasising perceived advantages in understanding and a feeling of inclusion within the learning environment. Noteworthy is that they attributed their enhanced post-test performance to the improved comprehension facilitated by the integration of isiZulu and isiXhosa.

Conversely, some learners expressed frustration and challenges in grasping content presented in both their home language alongside English, potentially contributing to their decrease in post-test marks compared to the pre-test marks. These results unveiled the complexities that come with multilingual education as learners have been immersed in a single language as the primary reference point for learning (Mgijima & Makalela, 2021).

Moreover, parents also brought in their perspective and a majority were for the incorporation of the home language as they testified that their children were more enthusiastic about learning "*My child says she enjoys the class activities and she can finally ask questions in a language she is fully proficient it and get the help she needs. I think this is a good initiative.*" This sheds light on language preferences and perceived learning experiences that the parent observed form their child. Even the teacher expressed a desire for incorporating home languages into lessons, highlighting benefits in comprehension and a sense of belonging within the learning environment. These findings challenged the traditional, monolingual bias in education, which often prioritises a single language as the point of reference for learning (Charamba, 2021a).

The researcher's deduction proposed that introducing multiple languages into Grade 4 classrooms provided notable cognitive and language acquisition benefits not evident in monolingual contexts. This emphasises the potential drawbacks of enrolling learners in programs that confine their linguistic abilities and contradict the diverse sociolinguistic settings in which they naturally learn and employ numerous languages.

Learner feedback raised apprehensions regarding the potential homogenising impact of education, particularly in dominant language environments. Their observations imply that as learners progress through the educational system, the emphasis on a single language escalates, potentially resulting in an accumulated "language deficit" (García & Wei, 2014; Makalela, 2019; Wei & García, 2022). This underscored the necessity for educational strategies that welcome and harness learner's linguistic diversity, nurturing multilingual proficiency and advocating for linguistic inclusiveness.

5.4 Research conclusions.

The research sought to answer one main question and 3 sub-questions.

Research subquestion: Does language have a transformative effect on the academic performance of grade 4 Natural Science learners in Johannesburg?

The impact of language on academic performance, particularly in subjects like Natural Science, is a complex and well-researched area. In this study, it was apparent that for Grade 4 learners, this impact is especially significant due to developmental and educational transitions. Since NS involves abstract concepts and specialized vocabulary, the researcher found that learners needed strong language skills to understand and articulate these concepts. As previously stated by other scholars, the ability to read, comprehend, and interpret scientific texts is crucial for success and science has a language of its own that is distinct; abstract, objective and information oriented (Mavuru & Ramnarain, 2020). This highlights the unique linguistic demands of science and language is essential for learners to express their understanding, ask questions, and participate in classroom discussions.

From the observation and the interviews, it was clear that the lack of fluency in the language of instruction, reduces the participation of learners during the teaching and learning process. This also has a ripple effect on their cognitive abilities influencing how they process and organize information. The experimental group revealed that strong language skills support

critical thinking, problem-solving, and analytical abilities, all of which are essential for Natural Science and increased their academic performance. With the introduction of translanguaging much understanding was facilitated and this proved that language does have a transformative effect on Grade 4 learners. Through group discussions, small debates, and presentations, the teachers was able to provide opportunities for learners to use language in a meaningful way and this created a classroom environment that encouraged language use and interaction. It is however important to note that the impact of language on academic performance is influenced by various factors, including learners' prior language experiences, socioeconomic background, and access to resources.

Research subquestion 1: How can translanguaging be transformatively used in a multilingual NS classroom?

The historical and cultural backgrounds of African learners exert a profound impact on their encounters in classrooms, with significant implications for teaching and learning methodologies. Historically, the legacy of colonialism and apartheid has deeply influenced education systems across Africa, often leading to the imposition of foreign languages as instructional mediums. This historical context shapes the linguistic environment of classrooms, affecting learners' identities, communication patterns, and academic paths.

Culturally, African communities are known for their linguistic diversity, as learners frequently come to classrooms with diverse multilingual backgrounds. The clash between this cultural richness and monolingual teaching approaches can result in a disconnect between learners' real-life experiences and the educational setting. Language is intricately linked to culture, and the exclusion of learners' native languages may contribute to feelings of isolation and detachment from the learning process as evidenced from the observation in the control group when compared to the experimental group.

Undoubtedly, the strategies utilised by teachers, the language of instruction, and the degree of linguistic adaptation all hold significant roles in the classroom. When these practices align with the linguistic variety of the learner body, they contribute to a more inclusive and efficient learning environment. This inclusiveness is pivotal, as acknowledging linguistic diversity contribute to a fairer educational setting that ensures cultural pertinence. However, in the absence of such alignment, learners may encounter comprehension challenges and hindered active involvement, impacting their academic progress.

Developing linguistically inclusive educational materials is not merely an instructional pursuit; it is a transformative endeavour. It challenges existing norms, breaks down language barriers, and empowers educators to design inclusive learning environments. This process necessitates collaboration among educators, linguists, curriculum designers, and, crucially, the learners themselves. Through their diverse experiences and linguistic knowledge, they can collaboratively create materials that resonate with their specific needs and viewpoints.

The prevalence of monolingualism in these policies could unintentionally marginalise learners whose native languages differ from the designated teaching medium. Therefore, embracing translanguaging promotes an inclusive curriculum that acknowledges and appreciates the multilingual heritages of learners, nurturing a more supportive and culturally sensitive educational atmosphere. By tailoring curricula to learners' language backgrounds, it enhances their engagement and comprehension, transforming even their educational achievements.

Additionally, it empowers learners, giving them a voice and fostering a sense of belonging which in turn enhance motivation. Ultimately, the effectiveness of education in these settings depends on recognising the linguistic diversity of the learners, breaking down the artificial barriers between school and community, and embracing the varied linguistic tapestry that learners bring from their societies. Only then can we transcend the monolingual chains that constraints learners and even teachers and establish a genuinely inclusive and efficient learning environment for all.

In conclusion, recognising and building on learners' diverse linguistic skills, including their home languages, alongside the enhancement of LoLT proficiency, alters the brain of the learner as they being to critically think, linking their thoughts to their everyday life. When the cultural and linguistic backgrounds of learners are intersected with teaching practices, learner's educational experiences become more than just education but a decolonial powerful tool that open the bigger spectrum of learning.

Research subquestion 2: To what extent can translanguaging be used in a NS classroom with multiple languages?

Participants of the study primarily reside at the heart of Johannesburg, a small suburb called Yeoville. This geographical location translates to an immerse of multiple languages apart from

the two chosen for the purposes of this study. Learners are exposed to many languages that go beyond the 11 South African languages and even across borders. With such in mind, proficiency in the language of instruction emerges as a critical factor, influencing cognitive advancement and academic accomplishments. One learner vividly articulated that venturing beyond the school boundaries and conversing in English can seem like traversing a cultural barrier, sometimes even leading to being labelled "coconut" for their language preference. This feeling of discord extends to the classroom environment, where the prevailing monolingual teaching method poses a significant challenge for many learners.

Limited to English as the exclusive medium of instruction, their understanding and engagement are frequently impeded. This language gap creates a dilemma: the language they learn within the school setting seems foreign in their daily lives, while their native languages are not officially recognised in the educational sphere. This intricate interplay among language, space, and identity holds significant implications for educational outcomes. The enforced monolingual approach risks isolating learners from the educational content they are supposed to interact with. By disregarding their existing linguistic abilities, the teaching method overlooks the cognitive and cultural assets that these learners bring to the learning environment. Moreover, the negative societal consequences associated with English outside the school premises can further demotivate learners and discourage their active involvement.

Hence, addressing the linguistic challenges faced by these learners requires a sophisticated strategy that acknowledges the diverse linguistic contexts they navigate. Educational approaches that integrate translanguaging practices, allowing learners to fluidly switch between languages, can promote deeper comprehension and bridge the gap between the classroom and the society.

In monolingual educational settings, there is a need to reassess instructional methods in light of the historical and cultural backgrounds of African learners. It is crucial to emphasise the importance of recognising and appreciating the variety of languages present, in order to establish an educational setting that is inclusive and culturally sensitive. Teachers should strive to incorporate the cultural heritage of learners into their teaching strategies, recognising the valuable contributions that multilingualism can offer to the educational process. A pedagogy that mirrors the varied historical backgrounds of African communities can enhance the educational journey by providing a more significant and empowering experience. The

implications for instructional strategies revolve around acknowledging the historical and cultural aspects that influence the educational encounters of African learners. By embracing the diversity of languages, integrating culturally pertinent material, and adopting inclusive teaching methods, educators can take vital steps towards establishing an educational milieu that aligns with the authentic experiences of the learners, thereby fostering a more fair and rewarding learning environment.

Research subquestion 3: Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

An examination of the pre-intervention assessment results unveiled relatively low achievement levels in both groups, with the control group averaging 47.7% and the experimental group 45.3%. This discovery indicates that, prior to the intervention, both groups exhibited restricted understanding abilities and grappled with the foundational scientific principles essential for academic achievement while engaging in learning exclusively in an additional language (English). This assertion was further substantiated by learner interviews, which underscored prevalent comprehension obstacles and challenges with crucial scientific concepts.

The disparity between the academic performance of the two groups laid bare the significant impact of language instruction on learner education. While the control group, depending solely on English, experienced a slight increase in their post-test results, the experimental group embracing a bilingual approach incorporating both isiZulu and or isiXhosa alongside English surged from 45.3% to an impressive 54.7% having an approximately 10% increase. This differentiation implies that monolingual pedagogies might unintentionally impede academic advancement, potentially due to comprehension challenges, disengaged learning, or a mismatch between the instructed material and learner's linguistic realities. Conversely, the triumph of the experimental group can be ascribed to the manifold advantages of multilingual teaching. By integrating the learners' home languages as a pedagogical tool, the teacher likely offered familiar linguistic support that facilitated deeper comprehension of intricate scientific concepts. Thus, utilising translanguaging practices, where learners fluidly switch between languages, may have stimulated cognitive processes, enhancing critical thinking skills and cultivating a more comprehensive grasp of the subject matter.

Monolingual classroom practices, such as teaching methods and interaction dynamics, influence the delivery and absorption of content. These practices can present obstacles for

learners not proficient in the language of instruction, impacting their academic performance. The repercussions on learning outcomes are multifaceted, affecting language proficiency, cognitive growth, and the fair involvement of learners with diverse linguistic backgrounds as observed in the control group. Grasping these dynamics is essential for moulding more inclusive pedagogies that foster educational fairness and efficiency.

Acknowledging and valuing learners' home languages contributed to a more inclusive and engaging learning environment, potentially enhancing motivation and participation, which are essential for academic success. Consequently, there is a clear need to critically reassess the prevailing monolingual approach in education, as indicated by these compelling findings. The adoption of multilingual pedagogies, which acknowledge and utilise learners' varied linguistic abilities and tap into the benefits of translanguaging practices, shows great promise in improving learning outcomes and supporting academic success, particularly in diverse and multilingual settings.

In conclusion, while proficiency in the LoLT is advantageous for academic achievement, it is imperative to acknowledge that learner heterogeneity requires a multifaceted educational strategy. This comprehensive approach has the potential to enhance academic performance among all learners and recognising this intricate interplay is crucial for policymakers, educators, and researchers aiming to enhance educational equity and the overall learning quality for intermediate phase grade 4 African learners.

Research hypothesis: *Translanguaging will enhance learner academic achievement in a multilingual grade 4 NS classroom.*

This hypothesis is partially supported by the results of the post-test phase, where different teaching methods were used for the control and experimental groups. The control group received instruction solely in English and took an English-language post-test. On the contrary, the experimental group was taught using a bilingual approach, incorporating their native language, isiZulu or isiXhosa, alongside English. Consequently, the post-test for the experimental group was conducted in both languages, reflecting the bilingual nature of their teaching method. This methodology enabled a comparative evaluation of the effects of monolingual versus multilingual teaching strategies on the learners' performance in the post-test results.

The analysis of p-values, means, effect sizes, and standard deviations provided significant insights into the complex academic achievements of the learners in this study. A comparison of the pre-test and post-test scores of both groups revealed a dynamic improvement in the experimental group. In contrast, the control group showed a less significant difference, with minimal progress in academic performance after the post-test phase. These quantitative measures emphasise the potential impact of the teaching approach, suggesting a positive effect on the learning outcomes of the experimental group compared to the control group.

The experimental group, exposed to an intervention utilising translanguaging pedagogies, achieved a good average score of 54.7%, in contrast to the control group's average of 51.3%. This 3.4% difference vividly demonstrates the complexities that came with the introduction of the translanguaging pedagogy. It highlights the effectiveness of translanguaging in enhancing comprehension and understanding among learners as well as ensuring active engagement with the educational content. Notably, it points to the potential translanguaging has and more research should be done to find out its longer impacts. Conversely, in the control group, which was limited to an English-only environment, learners had a minimal gain, emphasising the potential drawbacks of strictly following CAPS guidelines without considering the varied linguistic backgrounds of the learners.

This intervention, combined with the average improvement seen in the experimental group, confirms the substantial influence of the language of instruction on the academic performance of Grade 4 learners learning in a language different from their mother tongue. The inclusion of a familiar language (isiZulu and or isiXhosa) had a positive impact on the learners' comprehension abilities, empowering them and leading to better outcomes compared to the control group, which strictly followed the CAPS-recommended English language instruction.

Furthermore, the intervention illustrated a beneficial impact on the academic performance of the experimental group as a whole, demonstrating the effectiveness of integrating multilingual and translanguaging teaching methods. The 10% variance between the pre-test and the post-test emphasises the transformative influence of embracing linguistic diversity within the educational setting. These results not only confirm the original research hypothesis concerning the impact of instructional language on academic achievement but also underscore the potential of translanguaging methods in bridging linguistic divides and improving overall learning

results among Grade 4 learners. The positive influence observed in the experimental group indicates a necessity for a more adaptable and inclusive language policy that acknowledges and utilises the inherent linguistic variety present in South African classrooms.

5.5 Recommendations

The following suggestions are made in order to improve grade 4 students' overall academic performance and obtain a more nuanced understanding of how translanguaging affects their academic achievement:

Research subquestion 1: How can translanguaging be transformatively used in a multilingual NS classroom?

Findings.

Translanguaging has a significant impact on the educational outcomes of intermediate phase grade 4 African learners. It recognises and accommodates linguistic differences, ensuring engagement and comprehension thus contributing to a fairer educational setting that is inclusive. Its implementation is fascinating as it is more learner centred, affecting not only language skills but also cognitive growth and the fair involvement of learners with diverse language backgrounds. Understanding and acknowledging these dynamics is crucial for unveiling its transformative potential that unveils richer communication and learning.

Undoubtedly translanguaging has proven to have a transformative potential on learners. The inclusion of multiple languages validates learners' cultural identities and backgrounds promoting a feeling of belonging and inclusivity, establishing a classroom atmosphere where all languages are appreciated and respected, nurturing a culture of cooperation and mutual comprehension. Recognising and leveraging learners' linguistic competencies, lock a plethora of untapped abilities that multilingual learners possess. Part of these are cognitive skills linked to managing multiple languages, which can be utilised to enhance critical thinking, issue resolution, and metacognitive abilities.

The majority of learner responders gave instances of terminology that either did not translate exactly in the other language or would require a lengthier phrase, and they contended that some concepts were better expressed in one or the other language. Other parents said that because language is strongly tied to the situation in which it was learned, translanguaging is a natural

process. specific participants, for example, stated that they found it simpler to explain specific themes in English, whereas they found it easier to articulate notions relating to their home culture in isiZulu or isiXhosa. The teacher went on to say that translanguaging was a natural and beneficial behaviour since it made conversation easier. She made the case that multilingual interlocutors could converse more quickly and fluidly because they could choose terminology in either language.

Recommendation 1:

For successful implementation of the translanguaging pedagogy, educators need to be equipped with the necessary skills and strategies to use for achieving success in multilingual education. This involves more than just adopting appropriate pedagogical frameworks, but it also relies on the level of readiness demonstrated by educators themselves. To effectively navigate the intricacies of translanguaging approaches and provide adequate support to their learners, teachers must have access to high-quality professional development opportunities. In the absence of adequate support, learners who are predominantly accustomed to oral communication may encounter challenges in comprehending, analysing, and articulating themselves effectively within the new linguistic parameters of the academic setting. Such difficulties can result in disengagement from academic pursuits, feelings of frustration, and ultimately impede their long-term academic advancement. Therefore, professional development initiatives targeted at educators should be meticulously crafted to provide them with the essential tools and strategies for delivering effective translanguaging instruction.

Additionally, fostering culturally inclusive and responsive educational settings that recognise and utilise the native languages of learners is vital. Through the comprehensive implementation of professional development programs, educators are empowered to serve as proficient mentors for their multilingual learners. Consequently, this cultivation of expertise contributes to the establishment of an inclusive and nurturing educational milieu where all learners have the opportunity to cultivate the requisite academic language proficiencies essential for succeeding not only in Grade 4 but throughout their academic trajectories.

Recommendation 2:

Collaboration among policymakers, scholars, and language specialists has traditionally been compartmentalised. Language policies, typically developed independently, often fall short due to a disconnect between theoretical ideals and classroom realities. To address this disparity, a

shift in approach is essential, one that encourages strong collaboration among policymakers, language experts, and educational researchers. This collaborative triad, supported by advanced research, practical experiences, and a profound comprehension of language acquisition, shows great potential in shaping the successful implementation of translanguaging in the classroom. It is only through such cooperative endeavours that language policies can genuinely empower learners to navigate diverse linguistic environments and succeed in an increasingly multilingual world. Theses cooperations can also birth accessible and relevant materials for learners for example, it was seen that learners had a hard time reading in their neglected home languages hence providing dictionaries can be of great benefit to the learners and even the teachers.

Recommendation 3:

By ensuring inclusivity and addressing diverse linguistic needs, translanguaging becomes a resource that empower families to actively engage in their children's language learning experiences. Community engagement initiatives have the potential to cultivate a comprehensive approach to language development. By facilitating collaboration, knowledge sharing, and celebration of linguistic variations, we can bridge the traditional gap between schools and communities, creating a supportive environment where families and educators collaborate to nurture the language competencies of young learners. This joint effort, where language learning extends beyond classroom boundaries and becomes a communal mission, can unleash the full potential of every child, irrespective of their linguistic background.

Research subquestion 2: To what extent can translanguaging be used in a NS classroom with multiple languages?

Findings.

The examination of monolingual classrooms unveiled a unique demographic backdrop, wherein learners predominantly dwell in the inner city of Yeoville, Johannesburg. This spatial configuration suggests language saturation where most learners are multilinguals but constrained to only one language (English) that they do not fully understand, presenting a significant challenge for learners. Constrained to English as the exclusive instructional medium, many learners face difficulties in understanding and actively participating. This linguistic discrepancy presents a dual dilemma: the language learned within the school context seems foreign in their everyday lives, while the languages spoken in their households and communities lack formal recognition within the academic domain.

The complex interaction among language, spatial dimensions, and identity holds significant implications for academic achievements. The utilisation of learner's existing linguistic skills by the teaching approach tapped into the cognitive and cultural assets these learners bring to school. Moreover, cultivating a more inclusive and encouraging learning atmosphere that incorporates multiple languages allows learners to have a voice and use their linguistic repertoire to help each other and even understand scientific concepts.

Recommendation 1:

Firstly, policy makers are urged to revisit Section 6 of the Constitution, which was established in 1996, as it represents a fundamental document recognising the presence of 11 official languages in South Africa. The Official Languages Act of 2012 complements this constitutional basis by outlining a thorough framework that mandates the utilisation of official languages in diverse sectors, including courts, governmental bodies, and public establishments like schools. The constitutional acknowledgment of numerous official languages highlights a dedication to linguistic diversity and inclusivity within the specific context of South Africa. Additionally, it reinforces this dedication by establishing a definitive framework that directs the application of official languages in crucial areas of public life, particularly emphasising the significance of multilingualism in the field of education, reflecting the linguistic diversity ingrained in the social structure of South Africa. Thus, if this policy is refined to suit the needs of learners then adequate materials will also be provided to both teachers and learners. This alignment has the potential to act as a catalyst for the creation and execution of all-encompassing language policies in educational institutions, advocating for fairness, accessibility, and cultural pertinence in the educational setting.

Recommendation 2:

The conventional uniform approach to educational materials often fails to acknowledge the diverse array of languages present in educational settings. To effectively meet the needs of varied learners, a bold initiative is required to develop linguistically inclusive curriculum materials. This effort aims to transform education into a flexible and responsive environment that embraces the diversity of learners' language skills. The investment in creating such materials goes beyond simple translation tasks. It necessitates a shift in mindset, acknowledging that languages are not just tools for communication but gateways to distinct cultural viewpoints, knowledge systems, and ways of perceiving the world. By integrating elements of learners' home languages alongside the primary language of instruction, we can

improve the relevance of educational content: Curriculum materials enriched with diverse linguistic perspectives become more relatable and significant for learners. Ideas presented in familiar linguistic contexts resonate more deeply, fostering a sense of ownership and involvement in the learning process.

Recommendation 3:

Navigating the academic environment in this language saturated context can be likened to traversing a linguistic mountain pass. To ensure successful progression, it is crucial to invest in targeted language transition support programs. These programs provide essential scaffolding, equipping learners with the necessary tools and strategies to overcome the linguistic barrier between their native tongues and the classroom language. It is advisable for educators to implement comprehensive strategies within educational settings. This entails developing culturally inclusive educational programs that emphasise the worldwide diversity of the English language and incorporating literature and materials that represent various cultural heritages. Additionally, engagement initiatives within communities can have a significant impact on dispelling stereotypes and appreciating linguistic variety. Furthermore, workshops that delve into language identity can foster a sense of pride in linguistic legacy, and collaboration with language specialists can guide culturally appropriate language teaching methods. Promotion of inclusive language policies and facilitating open discussions within communities further contribute to challenging negative associations with language usage, creating an environment where English proficiency is universally esteemed.

Research subquestion 3: Does translanguaging enhance the understanding of science concepts as well as overall academic performance for Johannesburg learners?

Science achievement is positively correlated with proficiency in the language of instruction, especially in reading comprehension (Aung, 2021). The more proficient students are in the language of instruction, and in particular, in reading comprehension, the more successful they will be in NS. This implies that proficiency in the language of instruction is essential for success in science.

Upon examination of the English language proficiency and pre-test results, it was evident that both groups demonstrated relatively good levels of English proficiency but when it came to comprehending the scientific concepts they exhibited low performance, with the control group averaging 47.67% and the experimental group slightly lower at 45.33%. This preliminary

evaluation suggests that, though learners seemed to have an adequate understanding of the English language before the intervention took place, learners in both groups encountered difficulties in comprehending and engaging with fundamental scientific concepts crucial for academic competence. The presence of these difficulties, despite English being an additional language of instruction, underscores the necessity for a more thorough investigation into the influence of language on academic understanding. This observation is in line with findings from interviews with learners, which further emphasised the widespread obstacles and comprehension difficulties regarding essential scientific concepts due to the sole use of an additional language.

Insights gleaned from interviews with learners and the teacher revealed a struggle in understanding the vocabulary presented in the pre-test with the teacher further highlighting the struggles they face when teaching. However, the academic performance trajectories diverged in the post-test. When compared to the control group, the experimental group's performance was noticeably better. The intervention given to the experimental group may be the cause of this variation. Introducing a transformative element of a familiar language (isiZulu and or isiXhosa) that positively impacted their comprehension and application of the taught material, distinguishing them from their peers in the control group who had not received such targeted support.

Recommendation 1:

Educational institutions in Johannesburg are urged to embrace the BICS that is very necessary for CALP. Most schools do not consider learners' home languages even in foundation phase (Grade R-3) and this shows that the LiEP has not been well implemented. This abrupt introduction to a second and even a third language (English) is causing more harm than good. Learners seemingly know the English language, but they lack comprehension. Thus, incorporating learner's home language alongside English acts as a scaffolding tool crucial for a harmonious and efficient learning. This approach recognises the importance of linguistic diversity and aims to utilise it as a valuable asset in the educational process.

Recommendation 2:

Educational policymakers and practitioners should be encouraged to formulate and implement translanguaging activities that are customised to meet the specific needs of learners at the intermediate level. These activities should encompass a deliberate amalgamation of indigenous

languages and English, fostering an atmosphere where learners can gradually refine their academic language proficiency without experiencing linguistic overwhelm. The utilisation of learners' mother tongue alongside English serves not only to preserve a link to their cultural and linguistic heritage but also functions as a support mechanism for attaining more sophisticated academic language skills. This approach aligns with studies that underscore the beneficial impacts of bilingual and multilingual educational methodologies on cognitive development and academic achievement.

Furthermore, there has been a significant development in South Africa regarding "Mother Tongue-based Bilingual Education" (MTBBE) which is a crucial area of focus within the South African education system. This MTBBE emphasises using a learners' MT as the foundation for learning, while also developing proficiency in other languages, particularly English. Having deeply delved in South African historical inequities where English and Afrikaans speakers have had an advantage due to instruction in their home languages and how this has been detrimental for a majority of learners in the country, it is only ethical to adopt MTBBE with open arms so as to enrich and emancipate learners. MTBBE will not only acknowledge the existence of multiple languages but will also address the educational gap between learners who are taught in their home languages and those who are not. This will further better the economic participation of learners, as it prepares them for a multilingual South African society. In essence, MTBBE is a move towards a more equitable and effective education system in South Africa, recognizing the importance of home languages in learning.

Recommendation 3:

Effective language education goes beyond the confines of educational institutions and relies on active involvement of the surrounding communities. It is imperative to establish robust community engagement programs to fully support learners' language development, especially in multilingual settings. These programs aim to create a collaborative environment where parents, family members, and community stakeholders participate actively in the educational process. One method of engagement is through workshops and educational sessions that equip parents and caregivers with the necessary knowledge and skills to facilitate language development at home. These sessions cover areas such as early literacy techniques, effective communication strategies, and utilising home languages to reinforce academic progress.

By providing parents with practical resources, they can effectively assume their role of being children's primary language instructors, thereby laying a strong foundation for future academic achievements. Additionally, organising community events that celebrate linguistic diversity can play a crucial role in promoting connections and nurturing a collective commitment to language development. Cultural festivities, multilingual storytelling sessions, and community book gatherings create dynamic settings for families and educators to exchange languages, cultures, and stories. These events not only foster appreciation and acceptance of diverse linguistic heritages but also offer informal opportunities for language acquisition.

Additionally, encouraging peer support networks and mentorship initiatives can facilitate integration into the new linguistic community, offering vital social and emotional support essential for a successful transition. The advantages of robust language transition support programs are manifold. By arming learners with the requisite linguistic skills and fostering a nurturing learning atmosphere, we enhance their academic achievements, bolster their self-assurance, and nurture a sense of belonging. Consequently, this fosters active engagement in learning, diminishes the likelihood of marginalisation and disengagement, and ultimately lays the foundation for their long-term academic and personal development. Investing in tailored language transition support programs is not only an educational necessity but also a moral responsibility. Recognising the diverse linguistic landscapes present in the classrooms and providing the needed assistance for successful transitions are imperative for ensuring equal access to quality education for all learners. By promoting a linguistically inclusive setting and empowering learners with the necessary tools to navigate the academic landscape, we empower them to be confident and successful participants in their educational journey, irrespective of their linguistic backgrounds.

Recommendation 4:

It is also important that these pedagogies be instilled from teacher training institutions so that when the student teachers get to classrooms, they are able to cope with the different dynamics. The researcher therefore suggests that student teachers must develop a deep understanding of the linguistic principles underpinning bilingual education and this includes training in the structure and characteristics of the relevant African languages, the principles of language acquisition and development, strategies for translanguaging in the classroom and developing their own proficiency in the languages they will be teaching in. Though some institutions are slowly applying some of these strategies, the researchers urges a more practical approach that

fully engages students and enables them to be confident in their pedagogies. A more explicit framework for this implementation could involve developing bilingual lesson plans and materials, using visual aids and realia to support language learning, creating a language-rich classroom environment and being taught how to create and implement effective assessment strategies for bilingual learners. This development of culturally relevant and linguistically appropriate teaching resources will enrich our classrooms and promote a sense of respect and valuing each other's home languages and cultures.

However, this goes beyond teacher training institutions and taps into real classrooms as in-service teachers also need continual support with the ever changing classroom environments. On a broader scale, the DBE should provide ongoing professional development opportunities for practicing teachers this could include workshops, seminars, and online courses. On a micro level, the researcher recommends that principals or School Governing bodies should be flexible in their choice of LoTL and should create active, professional learning communities to support in-service teachers in implementing multilingual education especially in STEM subjects. Collaboration with universities, research institutions, and language experts is essential becomes of paramount importance as it connects the real world with the different suggestion that are being discovered by researchers. This can help to ensure that teacher training programs are based on the latest research and best practices.

Lastly, the researcher acknowledges that the shift towards translanguagin requires significant adjustments in teacher practices. Therefore, teachers need to be intentionally in their pedagogical practices. This entails learning and being willing to adjust into translanguaging pedagogies to facilitate understanding, knowing when and how to switch languages to clarify concepts, reinforce learning, and encourage participation. Cognisant of the fact that some teachers are already informally practicing this, teachers need to create lesson plans that intentionally integrate both the learners' mother tongue and the additional language (often English). This includes planning for vocabulary development in both languages, and designing activities that allow learners to use both languages to express their understanding. Another recommendation is that teachers should fill their classrooms with bilingual resources, such as posters, charts, and books and this will bridge the gap between language differences. By embracing these changes, teachers can play a crucial role in ensuring the successful implementation of translanguaging and improving educational outcomes for all learners.

5.6 Avenues for further research

A prospective longitudinal study would offer insightful information into the intricate dynamics of the connection between academic success and language, surpassing the boundaries of the current introductory pedagogy. Through monitoring learners over an extended duration, such a study could identify patterns and trends in academic performance, offering a nuanced comprehension of the influence of instructional language on learner's academic performance. This methodology would allow researchers to investigate whether learners display different performance trajectories when using their native language as the LoLT in comparison to scenarios where other languages are utilised. The longitudinal viewpoint could reveal whether academic performance remains stable, undergoes fluctuations, or shows a noticeable pattern over time, presenting a comprehensive overview of the lasting consequences of language decisions in the educational setting.

5.7 Concluding remarks.

In conclusion, this research provides valuable contributions to the existing limited body of literature investigating language's effect on fourth-grade students' academic achievement in South Africa, especially those with a different mother tongue from the language used for instruction (English). The study emphasises the crucial role of language, particularly in cases where learners use a different language at home as to the one used for teaching. The recognised importance of the home language in the academic success of fourth-grade learners is in line with theoretical beliefs suggesting that learners who receive instruction in a language other than their mother tongue face challenges in achieving similar academic levels. The study revealed a significant level of emotional investment enabled by the utilisation of learner's mother tongue in the experimental group. The observed difference in average improvement in the post-assessment between the control and experimental groups provides concrete proof of the academic challenges faced by learners who are exclusively taught in an additional language. These results shed light on the complex connection between language and academic performance, stressing the necessity for nuanced approaches in teaching methods to ensure equal educational opportunities and achievements for all learners.

The revelation of the complex dynamics of language proficiency and its effects on academic success in this study underscores the requirement for specific interventions and policy deliberations. The difficulties observed among learners transitioning from monolingual to

multilingual instructional settings underline the significance of structured assistance and gradual adjustments. Recommendations derived from this study advocate for a review of constitutional clauses acknowledging linguistic variations and advocating for multiple languages to be used in educational contexts. The examination of the socio-cultural environment in the study, where English might be viewed as a cultural barrier, calls for more comprehensive language policies that recognise and appreciate linguistic variety. Suggestions also extend to educators, encouraging the development of educational programs that nurture a positive attitude towards English, thus reducing any negativity associated with the language.

When envisioning future research endeavours, a longitudinal framework is suggested to gain a deeper comprehension of the evolving relationship between language and academic success. This could offer invaluable insights into the enduring impact of language dynamics on learners' performance over an extended period. Fundamentally, this research acts as a strong appeal to educational stakeholders to acknowledge and tackle the diverse challenges posed by the language of instruction in the academic performance of fourth-grade learners. The implications surpass individual classrooms, resonating with the broader objective of establishing an inclusive and fair educational environment that respects linguistic diversity and fosters optimal learning results.

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APPENDIXES

Appendix A: Letter to Principal



University of the Witwatersrand,
WITS School of EducationFaculty of Humanities,
Address: 27 St Andrews Rd Parktown, Gauteng, 2193
Johannesburg
Phone number: 011 717 3007

Dear Principal,

Re: Permission to conduct research at Holiness Combined Primary School.

My name is Shalom Nokuthula Ndhlovana. I am studying for a Master's degree in Education at the University of the Witwatersrand. I am seeking permission to do my research at Holiness Combined Primary School.

I am conducting research on exploring the incorporation of African languages in the teaching and learning of Grade 4 Natural Science. My study is entitled: ***Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.*** The thrust for this study will be to explore the effect of translanguaging pedagogies in enhancing the acquisition and comprehension of scientific concepts in grade 4 classrooms. The study will also seek to establish if there is a correlation between proficiency in the language of instruction and academic performance in the intermediate phase grade 4 classrooms.

The research will entail collecting data through observing, testing and interviewing the learner, teacher (no testing for the teacher) and willing parents. I will also observe lessons as learners are being taught then give them a test as part of the intervention. I will also spend 3 to 4 days each week for four weeks in the grade 4 classroom, resulting in approximately 40 hours (depending on the Natural Science lesson duration at your school) on observational data. Each observation will be approximately an hour long. The study will require two grade 4 classrooms,

whereby there will be an experimental group and a control group. At the end of the intervention both groups will be helped to get on the same level.

With your permission I will be:

- Observe during lessons
- Document learner's participation in the lesson
- Conduct 3 tests to the learners (English proficiency test, pre-test and post-test)
- Interview learners, the teacher involved and willing parents

All participants will be asked to give their written or verbal consent before the research begins. Their responses will be treated confidentially and their identities (their names and the name of the school) will be anonymous. Individual privacy will be maintained in all published and written data resulting from the study. The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their consent at any time during this research study without any penalty. There are no foreseeable risks in participating in this study, and there is also no form of renumeration offered to the participants (participants will not be paid for this study). All research data will be kept securely in a locked cabinet and password protected computer with restricted access to the researcher and will be destroyed within 5 years after completion of the study. If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below.

I therefore request permission in writing to conduct my research at your organization. The permission letter should be on your School's headed paper, signed and dated, and specifically referring to myself by name and the title of my study. Please let me know if you require any further information. I look forward to your response as soon as is convenient. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email: hrecnon-medical@wits.ac.za.

Yours sincerely,

Shalom N. Ndhlovana

Researcher: Shalom N Ndhlovana, 2093652@students.wits.ac.za , 084 240 4546

Supervisor: Dr Erasmos Charamba, erasmos.charamba@wits.ac.za , 0117173183

Appendix B: Teacher's information letter



Participant Information Sheet for the teacher

Dear Sir / Madam

My name is Shalom N. Ndhlovana. I am a Masters student in Education at the University of the Witwatersrand, Johannesburg. My supervisor is Dr E. Charamba. I am conducting a research study about the effect of using African languages in the teaching and learning of Natural Science in a grade 4 classroom. The study title is: **Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.**

I am inviting you to take part in this study. The study will consist of lessons, observations, interviews and have learners write 3 tests (these tests are not for marks and will not contribute to their academic marks). If you decide to take part, your participation in this research study will last about 4 weeks. You will be kindly requested to teach Natural Science under the topic of Matter and materials for 3 or 4 days in a week and I will be observing. I will also have an interview with you at the end of the study.

During the first week, learners will write an English Proficiency test which will be aimed at understanding their basic English Language skills. During this week you will teach all learners in English. At the end of the first week learners will write their Natural Science pre-test which will assess their understanding of the Natural Science concepts on the topic of Matter and Materials. Thereafter they will be divided into two groups. There will be the control group that is learners who will be solely taught in English and the experimental group that will be taught in either IsiZulu and or IsiXhosa alongside English. There will be a total number of about 12 lessons, 6 lessons of approximately an hour each in each of the 2 classes for the 4 weeks, on the topic of Matter and materials which is a topic in term two according to the CAPS document.

The third test will be taken after the 6th lessons in each class that is probably in the third or fourth week of the study. It will be divided into 2 in accordance to the two groups or classes since they will have been taught differently. The first group will be the control group that will be taught in English only and they will take the Natural Science post- test in English only. The second group will be the experimental group that will be taught in IsiZulu and or IsiXhosa. Their test will incorporate their preferred African language between the two alongside English and it will be the same as the one taken by the control group just with an additional language. All the tests will have a duration of 20 minutes and I will mark them. The lessons will take place at the school during or after school.

If you agree to participate in the interview, it will last about 5 -10 minutes and I will want to understand your perspective on the use of African languages, how they affect your teaching if they do, how you think they affect the learners if they do and what you generally think about incorporating them in the Natural Science teaching and learning. With your permission, I would like to audio record the interviews and the lesson. This data will be stored in a password protected computer for five years and thereafter will be deleted. Only my supervisor and I will have access to the data. The interview will be confidential and anonymous. When I share the results of the research study, I will not include your name or anything else that could identify you. With your permission, other researchers may use the data collected from this research study, but your name and any personal information will not be used or passed on.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study. The risks for this research study are no more than what happens in everyday life however, perhaps some of the questions asked may make you feel sad or upset. If this happens, I will stop the interview and continue another time. This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,

Shalom N Ndhlovana

Researcher:

Shalom N Ndhlovana, 2093652@students.wits.ac.za , 084 240 4546

Supervisor:

Dr Erasmos Charamba, erasmos.charamba@wits.ac.za , 0117173183

Appendix C: Learner information letter



Participant Information Sheet (PIS)

Dear learner

My name is Shalom N. Ndhlovana. I am a Masters student in Education at the University of the Witwatersrand, Johannesburg. My supervisor is Dr E. Charamba.

As part of my study, I will be with you learners for some time, doing research on how you learn in English and your home language. The title of my research study is: **Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.**

I will be in your class watching your teacher teach you and how you learn with your teacher. I will be with your class 3 or 4 times a week for 4 weeks, learning and having a good time with everyone. Sometimes you will get to use your home language as well as English in our Natural Science class.

After the person who looks after you signs and allows me to work with you I will:

- Watch you during lessons.
- Give you a number to use as your name in the tests.
- Ask you to write 3 tests (the tests are not for marks)
- Have a chat with me outside so we can talk about your experience.

Teacher Shalom will not give you any extra marks or money for helping her with the research but she will highly appreciate your help. After the research no one will know who you are or what school you go to so you can feel safe and trust teacher Shalom. If you feel uncomfortable, please tell your teacher or teacher Shalom and you shall be allowed to not continue. If teacher Shalom makes you feel uncomfortable or bad please let your teacher know as well, she will contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

With your permission, I would like to audio record the chats we will have both in class and outside. This recording will be stored in a computer that is protected by a password and after five years will be deleted. Only teacher Shalom and her supervisor will have access to it.

Appendix D: Parent/Guardian information letter



Participant Information Sheet (PIS)

Dear Sir / Madam

My name is Shalom N. Ndhlovana. I am a Masters student in Education at the University of the Witwatersrand, Johannesburg. My supervisor is Dr E. Charamba. I am conducting a research study about the effect of using African languages in the teaching and learning of Natural Science in a grade 4 classroom. The study title is: **Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.**

I am inviting you to take part in an interview. If you decide to take part, your participation in this research study will last about a few minutes to 10 minutes. The interview will take place at Holiness Combined primary school at your convenient time. If you choose to participate in the interview it will be an one-on-one with the researcher (me) and I would like to understand your perspective on the use of African languages in the teaching and learning of Natural Science.

With your permission, I would like to audio record the interview. This data will be stored in a password protected computer for five years and thereafter will be deleted. My supervisor and I are the only people who will have access to the data.

The interview will be confidential (I will not tell anyone what you tell me) and anonymous (your identity will not be disclosed). When I share the results of the research study, I will not include your name or anything else that could identify you. With your permission, other researchers may use the data collected from this research study, but your name and any personal information will not be used or passed on.

If you decide to take part in the research study, it should be because you want to volunteer. You do not have to take part. You can stop being in the study at any time. You do not have to answer any questions if you do not want to. You will not get any direct benefits if you choose to join the research study. You will not lose any services, benefits or rights you would normally have if you decide not to join. Taking part in the research study will not cost you anything. You will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life, if some of the questions asked make you feel sad or upset, I will stop the interview and continue another time. This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Shalom N Ndhlovana

Researcher:
Shalom N Ndhlovana, 2093652@students.wits.ac.za , 084 240 4546

Supervisor:
Dr Erasmos Charamba, erasmos.charamba@wits.ac.za , 0117173183

Appendix E: Parent/Guardian information letter for children



Participant Information Sheet (PIS)

Dear Sir / Madam

My name is Shalom N. Ndhlovana. I am a Masters student in Education at the University of the Witwatersrand, Johannesburg. My supervisor is Dr E. Charamba. I am conducting a research study about the effect of using African languages in the teaching and learning of Natural Science in a grade 4 classroom. The study title is: **Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.**

I am requesting permission for your child to take part in this study by doing the following activities: partake in about 12 Natural Science lessons, an interview of about 5 to 10 minutes and also write 3 tests (these tests are not for marks and will not contribute to their academic marks).

If you decide to allow your child to take part, their participation in this research study will be one lesson a day (1 hour long) taught by their teacher, for 3 or 4 days a week. The study will last for about 4 weeks. The first test will assess their English proficiency- their basic understanding of English language and it will be written in the first week of the study. The second will assess their understanding of the Natural Science concepts in the topic of Matter and Materials and it will be written in English. The third test will incorporate a preferred African language while assessing their understanding of the Natural Science concepts in the same topic and or will be in English only depending on the learner's group.

In the interviews I will want to understand their perspective of using their African languages alongside English while learning Natural Science and if it affected them in any way. The lesson will take place at the school, that is Holiness Combined primary during or after school. With your permission, I would like to audio record the interview and the lesson. This data will be

stored in a in a password protected computer for five years and thereafter will be deleted. My supervisor and I are the only people who will have access to it.

During the research activity, I will need to ask for some personal information about your child, including their age and language they speak at home. The interview will be confidential (I will not tell anyone what your child will tell me) and anonymous (their identity will not be disclosed). When I share the results of the research study, I will not include their name or anything else that could identify them. With your permission, other researchers may use the data collected from this research study, but their name and any personal information will not be used or passed on.

If you decide to let your child take part in the research study, it should be because you want them to volunteer. They do not have to take part if you do not want them to. They can stop being in the study at any time. They do not have to answer any questions if they do not want to. They will not get any direct benefits if you choose to join the research study. They will not lose any services, benefits or rights they would normally have if they decide not to join. Taking part in the research study will not cost them anything. They will not be paid for being in this research study.

The risks for this research study are no more than what happens in everyday life, if some of the questions asked make them feel sad or upset, I will stop the interview and continue another time. This research study will be written up as a research report. The report will be available on the university library website. If you would like to receive a summary of this report, I will be happy to send it to you.

If you have any questions during or afterwards about this research study, feel free to contact me or my supervisor on the details listed below. If you have any concerns or complaints about the ethical procedures of this research study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Yours sincerely,
Shalom N Ndhlovana

Researcher:

Shalom N Ndhlovana, 2093652@students.wits.ac.za , 084 240 4546

Supervisor:

Dr Erasmos Charamba, erasmos.charamba@wits.ac.za , 0117173183

Appendix F: Consent form for teachers



Consent Form for the teacher

Title of project: *Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.*

Name of researcher: Shalom N Ndhlovana

I, …….., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the study.	YES	NO
I agree that the researcher can observe me.	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that I will teach the learners in a multilingual manner	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report)	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used.	YES	NO

…… (signature)

…… (name of participant)

…… (date)

Shalom N Ndhlovana 

Appendix G: Consent form for parents/guardians



Consent Form for the parent/guardian

Title of project: *Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.*

Name of researcher: Shalom N Ndhlovana

I, …….., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the study.	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that direct quotations from my interview may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name or other identifying data will not be used by the researcher in their research report)	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used.	YES	NO

…… (signature)

…… (name of participant)

…… (date)



Shalom N Ndhlovana

Appendix H: Consent Form for a child's parent/legal guardian



Consent Form for a child's parent/legal guardian.

Title of project: *Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.*

Name of researcher: Shalom Nokuthula Ndhlovana

I, ……., agree that my child ……..… can participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that my child can volunteer to take part in the study	YES	NO
I agree that my child can write the tests	YES	NO
I agree that my child be interviewed	YES	NO
I agree that the interview with my child may be audio recorded.	YES	NO
I agree that the lesson may be audio recorded	YES	NO
I agree that direct quotations from the interview with my child may be used by the researcher in their research report	YES	NO
I agree that direct quotations from the lesson with my child may be used by the researcher in their research report	YES	NO
I agree that my child's participation will remain anonymous (their name or any identifying data will not be used in their report)	YES	NO

…… (signature)

…… (name of parent/guardian)

…… (date)



(signature)

Shalom N Ndhlovana (name of researcher)

Appendix I: Assent form for learners

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Assent Form for the learner.

Title of project: *Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg.*

Name of researcher: Shalom Nokuthula Ndhlovana

I, …….., agree to participate in this research project.

I agree to the following:

(Please respond to the statements below)

Miss Shalom explained the project to me. I understand what it is about.	👍	👎
I understand that no one will force me to be part of the project.	👍	👎
I agree that I will write the tests and they are not for marks	👍	👎
I agree that I will have a small chat with Miss Shalom after the lessons	👍	👎
I agree that the chat I will have with her may be audio recorded.	👍	👎
I agree that the lesson we have may be audio recorded	👍	👎
I agree that what I say in the chat may be used by Miss Shalom in their project report	👍	👎
I agree that what I say in the lessons may be used by Miss Shalom in their project report	👍	👎
I agree that no one will know my name or who I am when Miss Shalom writes her report.	👍	👎

…… (signature)

…… (name of participant)

…… (date)



Shalom N Ndhlovana

…… (date)

Appendix J: English Proficiency test

English FAL Proficiency Test

Marks: 15 marks

Time: 20 minutes

Participant number: _____

Class (e.g. 4A): _____

Instructions to the participant

1. Read all instructions carefully.
2. Answer all questions in the space provided.
3. The test duration is 20 minutes.
4. The teacher will lead you through the practice exercise before you start.
5. Write neatly and legibly.

Practice exercises

Example 1

Circle the letter of the correct answer.

A tomato is a …

A fruit

B vegetable

C root

D berry

You have answered correctly if you have circled (B)

Read the passage and answer questions 1-6

A black cat lives on my street. He walks up and down the street every day. The cat has no family and likes to eat from the trash. One day, he chased a large dog all the way home.



The black cat is not scared of other dogs or cats or chickens. He looks old and his fur is always dirty. I want to bring him home, but dad says he belongs in the street.

1. **Circle the letter of the correct answer.**

   What does the black cat do every day?

   A bath

   B walks up and down the street

   C play with his family

   D sleeps

2. What does the cat like to do?

   A eat from the trash

   B fight with people

   C sit under a tree

   D cry all night

3. The cat is very _____.

   A old

   B friendly

   C tiny

   D clean

4. Where does the story take place?

   A in the park

   B in the zoo

   C in the street

   D inside the house

5. Which animal is not in the story?

   A cat

   B dog

   C lion

   D chicken

6. Find the same word in the passage that has the same meaning as “afraid”

   A happy

   B brave

   C sad

   D scared

7. “You _____ too small to help.” said the old man to the small boy.

   A is

   B am

   C be

   D are



8. The cat woke up and caught the mouse.

   "The cat" in the sentence is the _____

   A object.

   B subject.

   C adverb.

   D verb.

9. Use the correct preposition.

   Press the dressing _____ the wound.

   A from

   B to

   C onto

   D by

10. The girl is sitting _____ the chair.

   A on

   B with

   C to

   D in



11. Circle the letter of the correct adjective to complete the sentence.

   The boys also used _____ gloves to protect themselves.

   A clean

   B poor

   C exciting

   D honest

12. Choose a word opposite in the meaning to the underlined word.

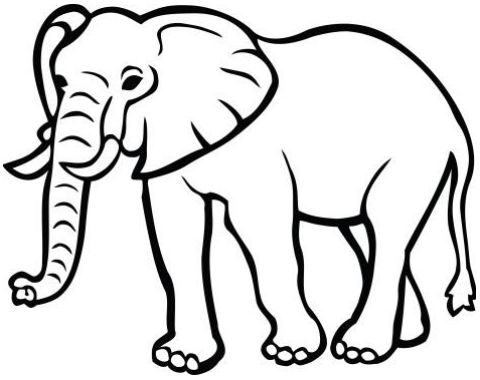
The elephant <u>happily</u> pulled down the branches, while the bird watched.

A sad

B angry

C sadly

D angrily



13. The elephant had a very <u>short</u> trunk.

A big

B tall

C fat

D long

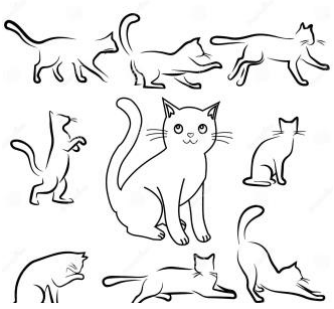
14. One cat but many _____.

A cats

B cates

C catts

D cattes



15. One dish but many _____.

A dishes

B dishs

C dishis

D disheese



Memorandum

Question	Expected answer		Marks
1	**B**	walks up and down the street	1
2	**A**	eat from the trash	1
3	**A**	old	1
4	**C**	in the street	1
5	**C**	lion	1
6	**D**	scared	1
7	**D**	are	1
8	**B**	subject	1
9	**C**	onto	1
10	**A**	on	1
11	**A**	clean	1
12	**C**	sadly	1
13	**B**	tall	1
14	**A**	cats	1
15	**A**	dishes	1

Appendix K: Natural Science Pre-test

Natural Science Pre-Test

Marks: 15 marks

Time: 20 minutes

Participant number: _____

Class (e.g. 4A): _____

Instructions to the participant

6. Read all instructions carefully.
7. Answer all questions in the space provided.
8. The test duration is 20 minutes.
9. The teacher will lead you through the practice exercise before you start.
10. Write neatly and legibly.

Practice exercises

Example 1

Circle the letter of the correct answer.

The _____ of substances are solid, liquid and gas.

A states

B water

C space

D ice

You have answered correctly if you have circled (A)

1. Liquids take the _____ of a container they are in.
   A material
   B type
   C shape
   D states

2. Gases have no shape, but they take up _____.
   A space
   B condense
   C solids
   D bottle

3. When a solid is heated, it _____ and becomes a liquid.
   A freezes
   B evaporates
   C melts
   D condenses

4. Water boils at which temperature?
   A 70 degrees Celsius
   B 85 degrees Celsius
   C 100 degrees Celsius
   D 65 degrees Celsius

5. A ruler is a _____
   A liquid
   B solid
   C gas
   D None of the above

6. Which one of the following is not part of a water cycle.
   A evaporation
   B condensation
   C freezing
   D weaving
7. _____is used to make ceramics.
   A leather
   B coal
   C clay
   D animal wool

8. Manufactured materials are _____
   A raw materials.
   B changed raw materials.
   C natural materials from nature.
   D sand

9. When heated _____ cools down, it becomes glass.
   A coal
   B water
   C sheep
   D sand

10. Coal and oil are found _____
   A underground.
   B in the clouds.
   C in animals.
   D through burning wood.

11. Which one of the following properties is not related to animal wool and hides.

A spun into yarn

B dug from underground

C woven into fabrics

D can be changed into leather

12. A frame structure must be _____

A very strong

B very flexible

C weak

D a liquid

13. _____ gives support.

A Shell

B Frame

C Wall

D Basket

14. Which one of the following is not a property of glass?

A waterproof

B heat resistant

C flexible

D transparent

15. Rondavels were built by the _____

A Zulu people

B Xhosa people

C Nama people

D Ndebele people

Memorandum

Question	Expected answer		Marks
1	**C**	shape	1
2	**A**	space	1
3	**C**	melts	1
4	**C**	100 degrees Celsius	1
5	**B**	solid	1
6	**D**	weaving	1
7	**C**	clay	1
8	**B**	changed raw materials.	1
9	**D**	sand	1
10	**A**	underground	1
11	**B**	dug from underground	1
12	**A**	very strong	1
13	**B**	frame`	1
14	**C**	flexible	1
15	**B**	Xhosa people	1

Appendix L: Natural Science Post-test for control group

Natural Science Post-Test (English)

Marks: 15 marks

Time: 20 minutes

Participant number: _____

Class (e.g. 4A): _____

Instructions to the participant

11. Read all instructions carefully.
12. Answer all questions in the space provided.
13. The test duration is 20 minutes.
14. The teacher will lead you through the practice exercise before you start.
15. Write neatly and legibly.

Practice exercises

Example 1

Circle the letter of the correct answer.

The _____ of substances are solid, liquid and gas.

A states

B water

C space

D ice

You have answered correctly if you have circled (A)

1. Liquids take the _____ of a container they are in.
   A material
   B type
   C shape
   D states

2. Gases have no shape, but they take up _____.
   A space
   B condense
   C solids
   D bottle

3. When a solid is heated, it _____ and becomes a liquid.
   A freezes
   B evaporates
   C melts
   D condenses

4. Water boils at which temperature?
   A 70 degrees Celsius
   B 85 degrees Celsius
   C 100 degrees Celsius
   D 65 degrees Celsius

5. A ruler is a _____
   A liquid
   B solid
   C gas
   D None of the above

6. Which one of the following is not part of a water cycle.
   A evaporation
   B condensation
   C freezing
   D weaving
7. _____is used to make ceramics.
   A leather
   B coal
   C clay
   D animal wool

8. Manufactured materials are _____
   A raw materials.
   B changed raw materials.
   C natural materials from nature.
   D sand

9. When heated _____ cools down, it becomes glass.
   A coal
   B water
   C sheep
   D sand

10. Coal and oil are found _____
   A underground.
   B in the clouds.
   C in animals.
   D through burning wood.

11. Which one of the following properties is not related to animal wool and hides.

A spun into yarn

B dug from underground

C woven into fabrics

D can be changed into leather

12. A frame structure must be _____

A very strong

B very flexible

C weak

D a liquid

13. _____ gives support.

A Shell

B Frame

C Wall

D Basket

14. Which one of the following is not a property of glass?

A waterproof

B heat resistant

C flexible

D transparent

15. Rondavels were built by the _____

A Zulu people

B Xhosa people

C Nama people

D Ndebele people



Memorandum

Question	Expected answer		Marks
1	**C**	shape	1
2	**A**	space	1
3	**C**	melts	1
4	**C**	100 degrees Celsius	1
5	**B**	solid	1
6	**D**	weaving	1
7	**C**	clay	1
8	**B**	changed raw materials.	1
9	**D**	sand	1
10	**A**	underground	1
11	**B**	dug from underground	1
12	**A**	very strong	1
13	**B**	frame`	1
14	**C**	flexible	1
15	**B**	Xhosa people	1

Appendix M: Natural Science Post-test for experimental group

Natural Science Post-Test (isiZulu)

Marks: 15 marks

Time: 20 minutes

Participant number: _____

Class (e.g. 4A): _____

Instructions to the participant

16. Read all instructions carefully.
17. Answer all questions in the space provided.
18. The test duration is 20 minutes.
19. The teacher will lead you through the practice exercise before you start.
20. Write neatly and legibly.

Practice exercises

Example 1

Circle the letter of the correct answer.

The _____ of substances are solid, liquid and gas.

A states

B water

C space

D ice

_____ zezinto uketshezi, oluqinile kanye negesi.

A Izimo

B Amanzi

C isikhala

D Iqhwa

You have answered correctly if you have circled A

Uphendule kahle uma ujikeleze u-

1. Liquids take the _____ of a container they are in.

   A material

   B type

   C shape

   D states

   Uketshezi uthatha _____ sesitsha esikuso.

   A impahla

   B uhlobo

   C isimo

   D uthi

2. Gases have no shape, but they take up _____.

   A space.

   B condenses.

   C solids.

   D bottle.

   Amagesi awanakho ukuma, kodwa athatha _____.

   A isikhala.

   B ukufiphala.

   C okuqinile.

   D ibhodlela.

3. When a solid is heated, it _____ and becomes a liquid.

   A freezes

   B evaporates

   C melts

D condenses

Lapho okuqinile kushisa, kuya_____ futhi kube uketshezi.

A qina

B ukuhwamuka

C ncibilika

D ukufiphala

4. Water boils at which temperature?

A 70 degrees Celsius

B 85 degrees Celsius

C 100 degrees Celsius

D 65 degrees Celsius

Amanzi abila kuliphi izinga lokushisa?

A 70 degrees Celsius

B 85 degrees Celsius

C 100 degrees Celsius

D 65 degrees Celsius

5. A ruler is a _____

A liquid

B solid

C gas

D None of the above

Irula li_____

A wuketshezi.

B qinile.

C wugesi.

D Akukho kulokhu ukungenhla.

6. Which one of the following is not part of a water cycle.

A evaporation

B condensation

C precipitation

D weaving

Yikuphi okunye okulandelayo okungeyona ingxenye yomjikelezo wamanzi?

A ukuhwamuka

B ukufiphala

C ukuna

D ukwaluka

7. _____is used to make ceramics.

A leather

B coal

C clay

D animal wool

_____ lusetshenziselwa ukwenza i-ceramics.

A I-lather

B Amalahle

C Ubumba

D Uboya bezilwane

8. Manufactured materials are _____

A raw materials.

B processed raw materials.

C natural materials from nature.

D sand

Izinto ezikhiqizwayo ziyizinto ezi_____

A zinto zokusetshenziswa azicutshungulwanga.

B ezingavuthiwe ezicitshungulwayo.

C izinto zemvelo ezivela emvelweni.

D isihlabathi.

9. When heated _____ cools down, it becomes glass.

A coal

B water

C sheep

D sand

Lapho _____ esishisayo siphola, siba ingilazi

A amalahle

B amanzi

C izimvu

D isihlabathi

10. Coal and oil are found _____

A underground.

B in the clouds.

C in animals.

D through burning wood.

Amalahle namafutha kutholakala _____

A ngaphansi komhlaba.

B emafini.

C ezilwaneni.

D ngokusebenzisa izinkuni ezivuthayo.

11. Which one of the following properties is not related to animal wool and hides.

A spun into yarn

B dug from underground

C woven into fabrics

D can be changed into leather

Yisiphi esinye sezici ezilandelayo ezingahlobene noboya bezilwane nezikhumba?

A ukusonta intambo

B ambiwe ngaphansi komhlaba

C kwelukwa zibe izindwangu

D ingashintshwa ibe yilather

12. A frame structure must be _____

A very strong

B very flexible

C weak

D a liquid

Uhlaka kumele lube _____.

A namandla kakhulu.

B luvumelana nezimo.

C buthaka.

D uketshezi.

13. A _____ gives support.

A Shell

B Frame

C Wall

D Basket

_____ lunikeza ukusekela.

A Igobolondo

B Uhlaka

C Udonga

D Ubhasikidi

14. Which one of the following is not a property of glass?

A waterproof

B heat resistant

C flexible

D transparent

Yikuphi kokulandelayo okungeyona impahla yengilazi?

A engangeni manzi

B imelana nokushisa

C ivumelana nezimo

D esobala

15. Rondavels were built by the _____

A Zulu people

B Xhosa people

C Nama people

D Ndebele people



Amarondaveli akhiwa _____.

A ngamaZulu.

B ngamaXhosa.

C ngamaNama.

D ngamaNdebele.



Memorandum

Question	Expected answer		Marks
1	**C**	shape	1
2	**A**	space	1
3	**C**	melts	1
4	**C**	100 degrees Celsius	1
5	**B**	solid	1
6	**D**	weaving	1
7	**C**	clay	1
8	**B**	changed raw materials.	1
9	**D**	sand	1
10	**A**	underground	1
11	**B**	dug from underground	1
12	**A**	very strong	1
13	**B**	frame`	1
14	**C**	flexible	1
15	**B**	Xhosa people	1
Total			**15 marks**

Appendix N: Natural Science Post-test for experimental group

Natural Science Post-Test (isiXhosa)

Marks: 15 marks

Time: 20 minutes

Participant number: _____

Class (e.g. 4A): _____

Instructions to the participant

21. Read all instructions carefully.
22. Answer all questions in the space provided.
23. The test duration is 20 minutes.
24. The teacher will lead you through the practice exercise before you start.
25. Write neatly and legibly.

Practice exercise

Example 1

Circle the letter of the correct answer.

The _____ of substances are solid, liquid and gas.

A states

B water

C space

D ice

_____ zezinto ziqinile, ulwelo kunye negesi.

A Iimeko

B Amanzi

C Isithuba

D Umkhenkce

You have answered correctly if you have circled A

A

Uphendule ngokuchanekileyo ukuba ujikeleze u-

1. Liquids take the _____ of a container they are in.

   A material

   B type

   C shape

   D states

   Ulwelo luthatha _____ yesikhongozeli esikuso.

   A impahla

   B uhlobo

   C imilo

   D isimo

2. Gases have no shape, but they take up _____.

   A space.

   B condenses.

   C solids.

   D bottle.

   Iigesi azinayo imilo, kodwa zithatha _____.

   A isithuba.

   B axineneyo.

   C izinto eziqinileyo.

   D ibhotile.

3. When a solid is heated, it _____ and becomes a liquid.

   A freezes

   B evaporates

   C melts

D condenses

Xa i-solid ishushu, _____ kwaye ibe ngamanzi.

A ikhephu

B umphunga

C iyanyibilika

D axineneyo

4. Water boils at which temperature?

A 70 degrees Celsius

B 85 degrees Celsius

C 100 degrees Celsius

D 65 degrees Celsius

Amanzi abila ngaliphi iqondo lobushushu?

A 70 degrees Celsius

B 85 degrees Celsius

C 100 degrees Celsius

D 65 degrees Celsius

5. A ruler is a _____

A liquid

B solid

C gas

D None of the above

Umlawuli u_____

A ulwelo.

B qinile.

C igesi.

D Akukho nanye kwezi zinto zingentla.

6. Which one of the following is not part of a water cycle.

A evaporation

B condensation

C precipitation

D weaving

Yiyiphi enye yezi zilandelayo ayiyonxalenye yomjikelo wamanzi.

A ayaphuma umphunga

B amanzi axineneyo

C imvula

D ukwaluka

7. _____is used to make ceramics.

A leather

B coal

C clay

D animal wool

_____ lusetyenziselwa ukwenza i-ceramics.

A isikhumba

B Amalahle

C Udongwe

D Uboya bezilwanyana

8. Manufactured materials are _____

A raw materials.

B processed raw materials.

C natural materials from nature.

D sand

Izinto ezenziwe zizinto _____.

A ezibonakalayo.

B ekrwada ezilungisiweyo.

C zendalo ezivela kwindalo.

D isanti.

9. When heated _____ cools down, it becomes glass.

A coal

B water

C sheep

D sand

Xa i_____ eshushu ipholile, iba yiglasi.

A amalahle

B amanzi

C igusha

D santi

10. Coal and oil are found _____

A underground.

B in the clouds.

C in animals.

D through burning wood.

Amalahle kunye neoli zifumaneka _____.

A phantsi komhlaba.

B emafini.

C kwizilwanyana.

D ngokusebenzisa iinkuni ezivuthayo.

11. Which one of the following properties is not related to animal wool and hides.

A spun into yarn

B dug from underground

C woven into fabrics

D can be changed into leather

Yiyiphi enye yezi mpawu zilandelayo ayinxulumananga noboya bezilwanyana kunye nezifihli.

A ijikeleziswe ibe yiwuwula

B igrunjwe phantsi komhlaba

C ephothiweyo ibe ngamalaphu

D inokutshintshwa ibe sisikhumba

12. A frame structure must be _____

A very strong

B very flexible

C weak

D a liquid

Isakhiwo sesakhelo kufuneka sibe _____.

A namandla kakhulu.

B bhetyebhetye kakhulu.

C buthathaka.

D ulwelo.

13. A _____ gives support.

A Shell

B Frame

C Wall

D Basket

_____ sinika inkxaso.

A Iqokobhe

B Isakhelo

C Udonga

D Ibhaskithi

14. Which one of the following is not a property of glass?

A waterproof

B heat resistant

C flexible

D transparent

Yiyiphi kwezi zinto zilandelayo ingeyopropati yeglasi?

A engenamanzi

B ubushushu ukumelana

C bhetyebhetye

D elubala

15. Rondavels were built by the _____.

A Zulu people

B Xhosa people

C Nama people

D Ndebele people



I-Rondavels yakhiwa ngabantu _____.

A bamaZulu.

B bamaXhosa.

C bamaNama.

D bamaNdebele.



Memorandum

Question	Expected answer		Marks
1	**C**	shape	1
2	**A**	space	1
3	**C**	melts	1
4	**C**	100 degrees Celsius	1
5	**B**	solid	1
6	**D**	weaving	1
7	**C**	clay	1
8	**B**	changed raw materials.	1
9	**D**	sand	1
10	**A**	underground	1
11	**B**	dug from underground	1
12	**A**	very strong	1
13	**B**	frame`	1
14	**C**	flexible	1
15	**B**	Xhosa people	1
Total			**15 marks**

Appendix O: Learner Interview questions

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Interview questions

Objectives:

The objectives of this interview are:

- To get a deeper understanding of the language proficiency that learners have
- To find out the causes in the difference in the participant's performance, if any, in the two tests.
- To evaluate the effectiveness of using home languages and get their thoughts about it.

Interview questions for learners:

1. What language do you speak more at home and how do you think it affects your understanding of some of the things you are taught at school in your Natural Science class?

2. What are some of the things you realised during the lessons you received during the study?

3. Which language do you think is the best for you to learn Natural Science in and why?

4. Do you think being taught Natural Science and or discussing it in class in your home language makes any difference in how you understand what you are learning? Why?

Appendix P: Teacher Interview questions



Interview questions

Objectives:

The objectives of this interview are:

- To find out the causes in the difference in the participant's performance, if any, in the two classes and tests.
- To evaluate the effectiveness of using home languages in teaching and learning and get their thoughts about it.

Interview questions for the teacher:

1. What is your experience in teaching Natural Science using more than one language?

2. Do you believe that academic underperformance in Natural Science is caused by a lack of proficiency in the language of instruction? Explain your answer.

3. How can using/incorporating African languages to teach or learn NS be effectively incorporated into the classroom to support multilingual learners?

Appendix Q: Parent/guardian Interview questions



Interview questions

Objectives:

The objectives of this interview are:

- To find out if parents use or develop their children's first language.
- To get the parents' perspective in the incorporation of the African language in Science education.

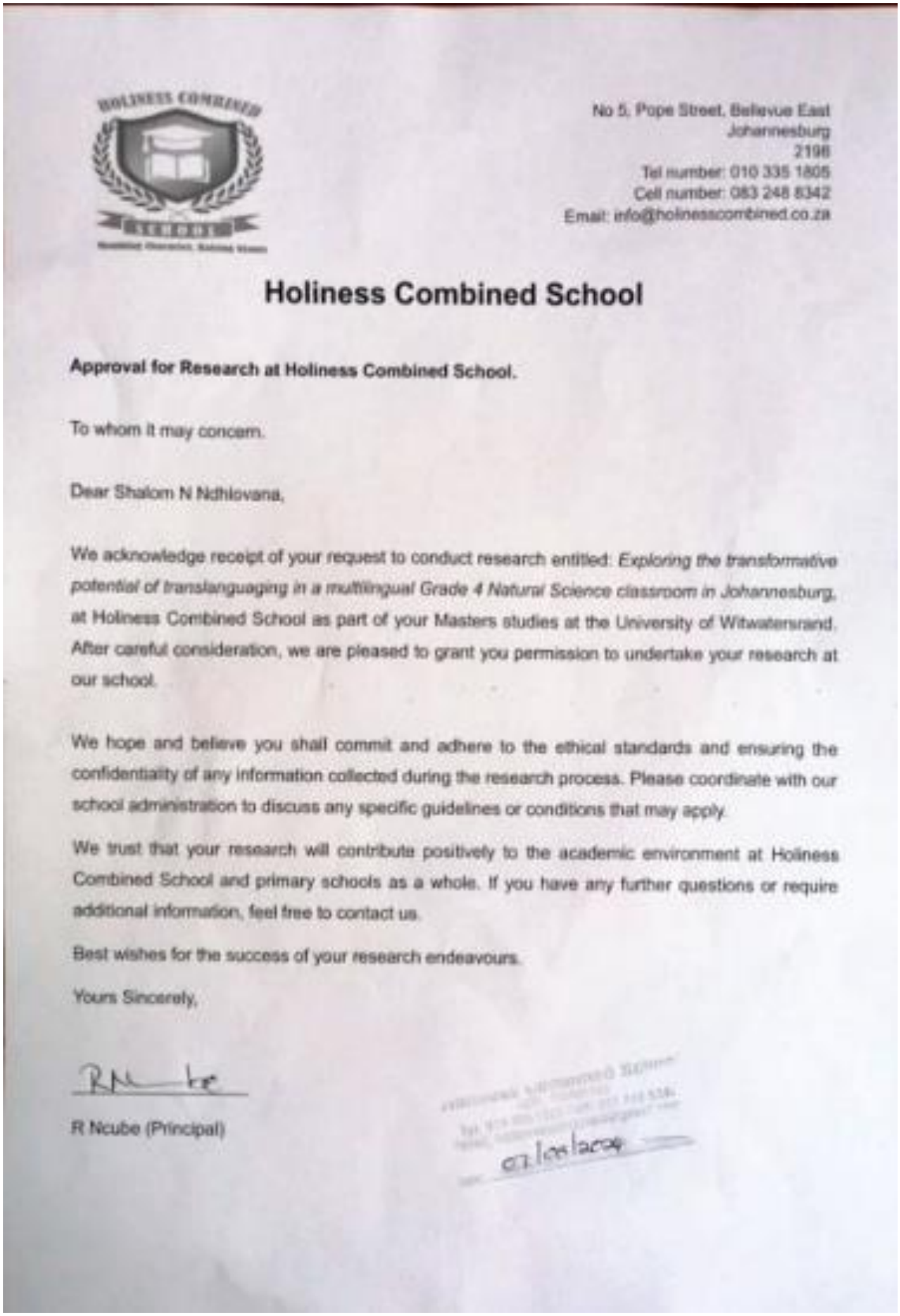
Interview questions for parents:

1. What language do you mostly speak at home?

2. Do you believe that academic performance in Natural Science is affected by a lack of proficiency or understanding in the language of instruction (English) for your child? Explain your answer.

3. How can using/incorporating African languages to teach or learn Natural Science be effectively incorporated or used into the classroom and even at home to support your child?

Appendix R: Permission letter from the school



No 5, Pope Street, Bellevue East
Johannesburg
2198
Tel number: 010 335 1805
Cell number: 083 248 8342
Email: info@holinesscombined.co.za

Holiness Combined School

Approval for Research at Holiness Combined School.

To whom it may concern.

Dear Shalom N Ndhlovana,

We acknowledge receipt of your request to conduct research entitled: *Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg*, at Holiness Combined School as part of your Masters studies at the University of Witwatersrand. After careful consideration, we are pleased to grant you permission to undertake your research at our school.

We hope and believe you shall commit and adhere to the ethical standards and ensuring the confidentiality of any information collected during the research process. Please coordinate with our school administration to discuss any specific guidelines or conditions that may apply.

We trust that your research will contribute positively to the academic environment at Holiness Combined School and primary schools as a whole. If you have any further questions or require additional information, feel free to contact us.

Best wishes for the success of your research endeavours.

Yours Sincerely,

R Ncube (Principal)

07/08/2024

Appendix S: Ethics clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Ndhlovana

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H24/09/36**
PROJECT TITLE	Exploring the transformative potential of translanguaging in a multilingual Grade 4 Natural Science classroom in Johannesburg
INVESTIGATOR(S)	Ms S Ndhlovana
SCHOOL/DEPARTMENT	Wits School of Education/
DATE CONSIDERED	27 September 2024
DECISION OF THE COMMITTEE	Approved Risk Level: Low
EXPIRY DATE	18 November 2027

DATE 19 November 2024 **CHAIRPERSON** _____
(Professor J Watermeyer)

cc: Supervisor : Dr E Charamba

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **A SIGNED COPY** returned to the Secretary electronically. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I/we agree to completion of a regular progress report. For Minimal and Low Risk studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

_____ 19 / 11 / 2024
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix T: Turnitin report

shalom masters dissertation turnitin-1.docx

ORIGINALITY REPORT

10%	9%	5%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	4%
2	www.tandfonline.com Internet Source	1%
3	e-journal.undikma.ac.id Internet Source	1%
4	www.researchgate.net Internet Source	<1%
5	Sonia Wilson. "To mix or not to mix: Parental attitudes towards translanguaging and language management choices", International Journal of Bilingualism, 2020 Publication	<1%
6	onlinelibrary.wiley.com Internet Source	<1%
7	www.coursehero.com Internet Source	<1%
8	www.scielo.org.za Internet Source	<1%