

**THE EFFECTS OF EMBRACING MULTILINGUALISM ON THE ACADEMIC  
PERFORMANCE OF LEARNERS IN PRIMARY SCIENCE EDUCATION IN BOTSWANA**

By

DUMELANG LORATO THOMAS-KEREEDITSE

Supervisor: Professor Judith Inggs

December 2023

A thesis submitted in fulfilment of the requirements for the degree of

**PhD in TRANSLATION AND INTERPRETING**

**UNIVERSITY OF THE WITWATERSRAND**

## **Abstract**

In Botswana, primary school learners perform better in Setswana as a subject than in the science subjects. This trend can be observed in the annual Primary School Leaving Examinations results despite the country's high literacy rate. Since these learners are emergent multilinguals, this study sought to determine the effects of embracing multilingualism on Botswana learners' academic performance in science as a subject at primary level. Considering that using translation as a pedagogical strategy has never been fully recognised as a useful way of scaffolding in lower levels of education, the translanguaging perspective was employed to determine the effects of translation in multilingual contexts. This was done to enhance comprehension of fourth year primary science texts using bilingual texts because, in the Botswana education system, codeswitching is usually practised as a communication strategy, but textbooks and assessments are printed monolingually in English from Standard 2. The study acknowledged the benefits of both English and Setswana in the education system and on learners' cognitive development. Therefore, it employed a cognitive theory of communication in translation coupled with the translanguaging theory to develop bilingual science texts that could enhance pedagogic strategies for emergent multilinguals. A quasi-experimental design was used to assess the effects of using bilingual texts on learners' academic performance. Three participating schools from different language communities in Botswana were selected via non-proportional stratified sampling. The control group received a monolingual science topic with content as usual, whereas the experimental group received the same text translated and presented bilingually in English and Setswana. Both groups attempted a written comprehension exercise after reading the same topic. Data were analysed statistically using SPSS Statistics and qualitatively using moment analysis to determine the significance of differences between the control and the experimental groups. Learners in the

minority language speaking school showed a considerable improvement as well as a significant difference in the performance of learners who used monolingual texts compared to those who used bilingual texts. Other schools showed an insignificant difference between the performance of the experimental group and the control group. These results show the potential of bilingual texts in the creation of translanguaging space in the classroom. They support the ostensive multilingualism pedagogy which brings together translanguaging pedagogy and relevance theory in translation to open translanguaging spaces in science education.

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## List of Abbreviations

BIA	Bilingual Interactive Activation
BICS	Basic Interpersonal Communication Skills
CALP	Cognitive Academic Language Proficiency
CLIL	Content Language Integrated Learning
HOTS	High-Order Thinking Skills
LOTS	Low-Order Thinking Skills
LSBT	Language Supportive Biology Textbook
LSTT	Language Supportive Teaching and Textbook
LTSM	Learning and Teaching Support Materials
PIRLS	Progress in International Reading Literacy Study
PSLE	Primary School Leaving Examination
RHM	Revised Hierarchical Model
TIMMS	Trends in Mathematics and Science Study

## DECLARATION

University of the Witwatersrand, Johannesburg

School of Literature, Language and Media

### SENATE PLAGIARISM POLICY

Declaration by Students

I Dumelang Lorato Thomas-Kereeditse (2244358) am a student registered for PhD in Translation and Interpretation in the year 2023. I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and /or without acknowledging the original source) is wrong.
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- I have followed the required conventions in referencing the thoughts and ideas of others.
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## **CHAPTER 1**

### **Introduction**

The first chapter of this thesis introduces the study by presenting the overall field of this research. It begins with the background to the study, which gives a broad overview of the research topic to lay a foundation for the research topic. After providing the background, it specifies the research problem to be addressed. The aim, research questions, objectives and the methods to be followed are given next together with the rationale that makes an argument for the significance of the study. The key terms are defined, and the scope of the study is discussed before stating the potential limitations of this study.

#### **1.1 Background to the study**

In the 21<sup>st</sup> century, the world is beginning to appreciate the unitary nature of the languages that a multilingual learner speaks, and numerous studies show how multilingual learners can be accommodated in pedagogy. The earliest bilingual models separated languages and compartmentalised them to avoid language interference, but translanguaging, which is the latest model of bilingualism, embraces multilingualism. It does this by supporting the development of equitable pedagogical strategies that view multilingualism as a resource from which a multilingual learner can draw in the learning process. The earlier models of bilingualism did not provide any room for translation in the classroom, but recently, the translanguaging model has recognised translation as one of the effective pedagogical strategies that can be employed in the classroom (see Choi & Liu, 2021 and García et al., 2019). However, in Botswana, there is a preference for the earliest model of bilingualism that separates the only two languages recognised by policy, which are English and Setswana, out of about 28 languages. Setswana as a national language seems to be preferred because, according to the country's history of language

in education after independence in 1966, Setswana was used from the first year to the third year of primary education. Later, in 1977, the use of Setswana as a language of learning and teaching was extended to the fourth year. This was close to the interdependence hypothesis model, which recognises the learner's first language to some extent (see Cummins, 2000). However, a significant regression was realised in 1994 when Setswana was allocated only the first year of primary education so that English was the language of learning and teaching from the second year.

Generally, translation has not been exploited to any great extent in Botswana. However, as shown by Phetlhe (2018) it has contributed to the development of Setswana literature even though literary works that have been translated have not received much attention. In his translation of Setswana idioms into English Seboni (2011) shows that translation can be used to preserve documented elements of culture in the target language. Earlier translations in Botswana were used to convert Batswana into Christianity and for educational purposes. It must be noted that translation for educational purposes mainly focused on literary works such as the novel, drama, poetry and children's literature. In this regard the earliest translations were from oral to written Setswana and then into English. The translation of folklores was also rendered in pictures and this was crucial in internationalising the content of Setswana literature (Phetlhe, 2018). However, Shole (1990) criticises early translators for ignoring the cultural elements of the source text which resulted in compromising concepts of culture that are dominant in Setswana culture. Moreover, Phetlhe (2018) reiterates that Setswana translations cannot develop fully if decontextualisation is not addressed.

A translation of the Bible from English into Setswana was published early in 1909 by Paris Evangelical Society and the second translation was rendered in 1989 by the Bible Society of

South Africa (Makutoane & Naude, 2009). Translation of the Bible, which is one of the earliest texts to be translated, was influenced by the arrival of missionaries such as David Livingstone (1813-1873) and Robert Moffat (1795-1883) who played a significant role in the earliest translation projects that were done in Botswana. They considered translation crucial in their mission to convert Batswana to Christianity. Just like literary translators, translators of the Bible applied different strategies and techniques to overcome the challenges that they encountered in the translation process. However, translation of learning material from English into Setswana has received insignificant attention.

Despite the poor proficiency of Batswana learners in English, as shown by Arthur (2001), Makwinja (2017), Mokgwathi and Webb (2013), language practices in the classroom are predominantly in English and learners' performance in content subjects and international assessments such as Progress in International Reading Literacy Study (PIRLS) and Trends in Mathematics and Science Study (TIMMS) continue to decline. Bagwasi (2017) critiques the Language-in-education Policy of Botswana from a translanguaging perspective, but local research has not explored how using translation through bilingual texts can enhance learning.

Botswana has been described as an African success story based on its growing economy despite the prevailing high rate of inequality (Bolt & Hillbom, 2016). The country gained independence in 1966 after being colonised by the British, who brought literacy to Botswana through missionaries. According to the National Literacy Survey 2014, the rate of literacy for the population aged 15 to 65 is 90% (Statistics Botswana, 2016) because, as stated by Matambo (2019), the government of Botswana recognises investing in education as a component of human capital development as it trains individuals to utilise opportunities in the economy. Matambo (2019) explains that even though more than a quarter of the annual budget has been allocated to

education in the past, the education sector is still affected by the poor quality and non-relevance of its products. In this regard, the Ministry of Education, Skills and Development has been divided into two ministries for enhanced productivity. The Ministry of Basic Education (MoBE) oversees primary and secondary education, and the Ministry of Tertiary Education, Research, Science and Technology coordinates research while striving to make Botswana a knowledge-based economy.

The Ministry of Basic Education oversees different departments that ensure the running of 13 years of basic education: one year of pre-primary, seven years of primary education and five years of secondary education. The Ministry is about to complete rolling out pre-primary education in all public primary schools and it is therefore the first level of primary education. In Standard 4, the fourth year of primary education after preschool, learners sit for attainment tests that do not determine progression to upper levels of primary education. Learners can progress to Standard 5 even if they fail the attainment tests. In Standard 7, the final year of primary education, learners sit for the Primary School Leaving Examination (PSLE) in agriculture, English, mathematics, religious and moral education, Setswana, social studies and science. Like the attainment tests, the PSLE is set by the Botswana Examinations Council. All subjects are based on objective multiple-choice questions except for agriculture, which is examined in structured questions. Objective questions do not require high-order thinking skills as subjective questions do, as the latter ask learners to define, explain or differentiate concepts. It must be noted that annually, either agriculture or science occupies the lowest category of the most failed subjects in primary education in Botswana (Botswana Examinations Council, 2012-2021).

Mosothwane (1995) claims that the evolution of the science curriculum in Botswana was mainly dependent on the change in the science curriculum in Britain, and by 1995, the

curriculum that was in use was adapted from the Scottish Integrated Science Scheme. During this time, science textbooks from Standard 1 to 4 were translated into Setswana, and content was delivered monolingually in Setswana. Currently, the curriculum is localised, and the use of Setswana in science is limited to one year, Standard 1, as recommended by the Revised National Policy on Education (1994). According to Mosothwane (2014), the science curriculum was innovated to enhance its relevance. Currently, science is studied as environmental science from Standards 1 to 4, and from Standards 5 to Standard 7, it is pure science taught as a PSLE subject. Since independence, education policies have aimed to enhance learning, teaching and the academic performance of learners. However, Batswana learners continue to perform poorly academically, which is one of the reasons the government intends to reduce the number of examinable primary leaving examinations from seven to four in the future. Instead of reducing the number of examinations Commeyras and Ketsitlile (2013) argue that it makes more sense to introduce innovations in reading pedagogy to accommodate the literacy needs of learners from different backgrounds.

The issue of which language to use for learning and teaching has always been controversial in multilingual settings such as Botswana. Botswana is a multilingual country with approximately 28 languages from three language groups: Indo-European, Bantu and Khoisan (Batibo, 2005). Setswana is a Southern Bantu language spoken in Botswana by about 90% of the population (Bromber and Smieja 2011, p. 53), and therefore, it is a majority language, while the other 26 indigenous languages are minority languages spoken by only 10% of the population. Despite this diversity of languages, Botswana does not have a comprehensive language policy; rather, its language policy is inferred from the Language-in-education Policy. The development of Setswana began early in 1820 through the translation of the Bible; therefore, Setswana was

readily available for use in the education system as its grammar was already codified (Batibo, 2005). However, it is not widely used in the education system despite its level of development. According to Mooko (2006), those in power during independence used Setswana to unite the nation, marking the beginning of its assimilation into Botswana. This assimilation is mainly practised through the education system using the Language-in-education Policy that does not embrace multilingualism.

Before independence Setswana and a few minority languages of Botswana were used for teaching and learning but after independence, the main language for education became English, as Setswana was only used for learning and teaching from Standards 1 to 3. In 1977, the first education policy was formulated, increasing the use of Setswana from Standards 1 to 4. The second commission was directed in 1992 to review the first policy as there had been major economic, cultural and political change. The Revised National Policy in Education was published in 1994, but some of its recommendations are still to be implemented almost thirty years later. In formulating this policy, the second commission sought public opinion, and it was found that the majority of Batswana preferred using English in the whole education system as it was believed that the language is a prerequisite for educational achievement in an era of globalisation. This opinion was accepted as the academic performance of Batswana learners was poor, and there was hope that using English would enhance their performance. However, this recommendation was amended to allocate at least one year for Setswana to be used as it is a national language. In this regard, both Setswana and English are studied as compulsory subjects throughout basic education, but Botswana's minority languages do not feature at all as the Language-in-education Policy does not recognise them since Setswana as a national language is symbolically used to unite Batswana. In formulating this policy, public opinion was given

priority over research and was mainly influenced by the prestige around the use of English in Botswana, reflected by the use of monolingual English textbooks in primary education.

To ensure compliance with the recommendation that promotes using Setswana only in Standard 1 for teaching and learning, the government, through the Department of Curriculum Development and Evaluation, prescribes textbooks written in the recommended language of learning and teaching. The lack of any material in the learners' mother tongues leads inevitably to a multilingual environment in the classroom (Mokibelo, 2014b). Even though there is no mother-tongue education in Botswana, in practice, teachers resort to Setswana to facilitate learning and understanding. In 1997, Nyati-Ramahobo recommended a mother-tongue education model with four programmes catering to minority and majority language speakers. Her model promotes strictly using the learners' mother tongue for four years, and from Standard 5, introducing two subjects taught with English as the language of learning and teaching. This would have allowed parents to participate in their children's education, enhance national unity and link home and school for enhanced academic achievement. However, this model was never seriously considered for implementation in the education system and therefore it has never been tested. In more recent studies, Arthur (2001) and Mokibelo (2014b) argue that the realities on the ground must be considered in language planning for education purposes, as codeswitching occurs naturally in classrooms. Mokibelo subsequently (2016b) discovered that schools often resort to using cooks, other learners and teachers' aides to address learners' communicative needs through translation, even though none of these has received proper training in academic translation and interpretation. This is because in rural areas, as shown by Mokgwathi and Webb (2013), English is foreign, and learners predominantly use Setswana; therefore, using English for learning and teaching is ineffective in acquiring knowledge.

Although the monolingual Language-in-education Policy was intended to improve academic performance by promoting the use of English, Batswana learners continue to perform unsatisfactorily, especially in science. There are low levels of achievement in science and agriculture, while the best grades are obtained in Setswana (Table 1.1). In order to deal with this, as mentioned above, the government plans to reduce the number of PSLE subjects from seven to four: English, Setswana, Mathematics and Science. However, the hegemony of English in the education system continues to disadvantage the acquisition of knowledge.

## **1.2 Statement of the problem**

Currently, Botswana's education system separates the languages that Batswana learners as emergent multilinguals bring to school. This can be observed from how the system treats English, which the learners learn at school. This has been critiqued by numerous studies, calling for a multilingual approach that will equitably include learners in education. However, these studies rarely provide evidence of how embracing multilingualism might influence learning in real classroom settings. The current study, therefore, presents the problem of the lack of locally available evidence to influence pedagogical strategies in a multilingual Botswana. It adopts a quasi-experimental approach to evaluate the effects of embracing multilingualism through using bilingual texts in fourth-year primary science.

## **1.3 Aim**

In the hope of influencing policy by providing theoretically-based evidence, the researcher sought to investigate the effects of adopting multilingual practices in the classroom on the cognitive development of Batswana learners at the primary school level. This was expected to provide evidence of the effects of practising multilingualism in the classroom to enhance learning. Therefore, bilingual texts were used because Arthur (2001) and Mokibelo (2014b) state

that learners and teachers already use codeswitching orally in learning and teaching even though they do not apply it in content learning. These realities of language contact may be resolved by developing inclusive pedagogical strategies, as suggested by Commeyras and Ketsitlile (2013). Also, as a control, the study investigated the implications of using English only for teaching and learning primary education science. In doing this, a topic for Standard 4, the middle level of primary education, was purposively selected, considering the study's financial and time constraints. Then, the topic, objectives and a corresponding lesson in the recommended textbook were translated to be used alongside the corresponding English text.

To realise the aim of the study, Standard 4 pupils were selected from three language groups: those in an area where Setswana is predominantly spoken, those in a city where the hegemony of English is prevalent and those in an area where a minority language is predominantly used. This was necessitated by the territorial multilingualism predominant in Botswana. Standard 4 was used to represent primary school learners as this is the middle level where we find the use of some abstract terms, as well as context-embedded content. Two groups, one experimental group and one control group, were selected from one primary school in each of the abovementioned areas. These sub-groups received the same treatment of using bilingual texts for reading comprehension on the chosen science topic. Then, they received a test to measure their achievement through matched pair test sampling. The control groups received no intervention but were given the same text, monolingually in English.

### ***1.3.1 Research questions***

The study sought to answer the following research questions:

- 1) How do bilingual science texts affect the comprehension of scientific content?

This question was answered using the first dataset of learners' scores from the assessment after reading the texts. Their scores were used as indicators of their level of comprehension of the text. The assessment included subjective, objective and collaborative questions. Learners were expected to comprehend the text better when it was bilingual than when it was monolingual; therefore, bilingual texts were expected to affect learner performance positively.

#### Null hypothesis

$H^0$ : Bilingual texts will not enhance comprehension of scientific content tested at  $\alpha = 0.05$ .

#### Alternative hypothesis

$H^1$ : Bilingual texts will enhance comprehension of scientific content.

2) What are the effects of bilingual science texts on collaborative work?

Data were collected by observing language practices in the classroom to determine crucial moments in learners' communication. The last two questions of the assessment task were collaborative, encouraging learners to interact with fellow learners as they engaged with the text. For this reason, the first dataset came from observing the language practices of Batswana learners as emergent multilinguals. Here, the bilingual text was an independent variable, and collaborative work was the trigger of language practices. It must be noted that collaborative work is part of the assessment, and therefore it also falls under the dependent variable of learner performance.

#### Null hypothesis

$H^0$ : Bilingual science texts do not have an impact on collaborative work tested at  $\alpha = 0.05$ .

## Alternative hypothesis

H<sup>1</sup>: Bilingual science texts have an impact on collaborative work.

3) How can bilingual texts be applied in pedagogy to enhance learners' performance in science?

Datasets from observation and learners' scores were used to answer this question. This objective is summative as it presents a formal conclusion of lessons learnt from the experiment and how they can be applied to enhance learning and teaching using translation in a multilingual setting. It involved analysis of both datasets to see how best the bilingual texts can be applied in multilingual contexts as a pedagogical strategy. This means the observed consequences, whether negative or positive, are presented and critically analysed to establish how multilingualism could be embraced to enhance learner performance.

### ***1.3.2 Procedures***

As pointed out by Gutt (2010a), the relationships between the message, context and stimuli are empirical, thereby making testable predictions about the success or failure of human communication. In this regard, this study used a quasi-experimental design to investigate the relevance of bilingual science texts as a communication stimulus in the classroom. The quasi-experimental design was used as it was not possible to assign subjects to treatment groups randomly, and the independent variable could be manipulated. Using pre-existing classes differentiates quasi-experiments from true experiments as it is not easy to assign the already intact classes to experimental and control groups (Schreiber & Asner-Self, 2011). This generated two data sets from the experiment: one from the observation of learners' language practices analysed through moment analysis, and the second from learners' scores, analysed by SPSS

Statistics. The cross-sectional study was preferred over a longitudinal study because of the limited duration of the researcher's study programme.

#### **1.4 Rationale**

The Botswana science curriculum has been localised (Mosothwane, 2014). However, it still seems irrelevant to learners, and perhaps it needs to be modified to be optimally relevant to Batswana learners. In this regard, Ketsitlile and Commeyras (2014) show that developing pedagogical strategies that accommodate the needs of diverse learners would enhance learners' academic performance.

Cummins (2000) claims that using a second language for teaching and learning early in education can adversely affect learners' academic achievement as they move to higher levels of learning where content becomes abstract. Hence, it is recommended that education in the first language should last for at least five years for the learners' cognitive development (see Baker, 1996 and Cummins, 1984). According to Baker (1996), it is best to use one's first language in education as the learner can use it to contextualise acquired knowledge. Cummins (1995) shows that this promotes learning as learners can identify with texts or instruction in their first language. Cummins (2000) cautions that introducing a second language very early as a language of learning can lead to low Cognitive Academic Language Proficiency (CALP). CALP is a level of proficiency that takes approximately five years to acquire and involves academic language in abstract terms. Low CALP negatively affects learners' performance in cognitively demanding tasks, such as abstract thinking, problem-solving and learning in content subjects. Cummins (2000) also claims that Basic Interpersonal Communication Skills (BICS) acquired before CALP are context-embedded and can be acquired within two years. However, Batswana learners only use their first language in the first year of education, which is when communication in the

classroom demands BICS. From Standard 2 and throughout the education system, they use English even though their academic language proficiency is shown to be low by poor performance in multiple-choice questions for all subjects and in structured questions for agriculture. This highlights a language problem that could hinder the cognitive development of Batswana learners in content subjects like science.

The conceptual distinction between BICS and CALP applies to the education system of Botswana, where learner performance is unsatisfactory, while the Language-in-education Policy supports the use of English for learning and teaching. To ensure the success of the policy that recommends using Setswana for learning and teaching only in Standard 1, the government prescribes textbooks to be used. Currently, the prescribed environmental science textbooks for Standard 1 are in Setswana, and from Standard 2, the textbooks are written in English. This reveals a gap in Botswana's education system, as one year of education in the learners' first language is not enough to develop CALP. It also suggests regression in the development of Setswana, once used for four years for learning and teaching in the education system. Therefore, explanatory research into this problem is indispensable as it will lead to discovering how embracing multilingualism could affect learners' academic achievement in primary science.

The effects of low CALP may be observed in PSLE results as published by the Botswana Examinations Council. The results in Table 1.1 show that learners continue to perform unsatisfactorily in science but perform very well in Setswana, which is spoken by about 80% of the population as their first language.

**Table 1.1: Primary School Leaving Examination performance from 2017 to 2021**

Year	2021	2020	2019	2018	2017
Subject with the highest A to C grades	Setswana 79.98%	Setswana 81.91%	Setswana 83.64%	Setswana 82.67%	Setswana 82.07%
Subject with the lowest A to C grades	Science 55.66%	Science 57.29%	Science 58.49%	Science 55.49%	Science 54.12%

*Source: Botswana Examinations Council (2022) [www.bec.co.bw](http://www.bec.co.bw)*

The trend of academic performance in Table 1.1 shows a margin between the subject with the highest A to C grades (Setswana) and the subject with the lowest percentage of learners with A to C grades (science). This persistent problem in the PSLE performance calls for linguistic intervention in science education since the Setswana language is the most passed subject. Therefore, since science is taught in English, it may be necessary to consider the intellectualisation of Setswana for basic science education so that it can be used to teach the subject alongside English and enhance learners' academic performance in scientific fields.

The academic performance of learners in Botswana is generally unsatisfactory, and Botswana's government, through the Revised National Policy in Education, has recommended several measures to improve it, but to no avail. As mentioned earlier, it was envisaged that learners' performance would improve if English was used for longer. It must be noted that the language policy has not changed, and therefore, this study is deemed crucial to see how language can be used to improve the academic performance of learners in science. This could be addressed

by translating the adopted curriculum and reviewing the Language-in-education Policy. Therefore, this study sought to investigate the effects of adopting multilingual practices on the cognitive development of Batswana learners at the primary school level.

However, the mechanisms underlying this problem must be identified by providing evidence from local contexts using multilingual texts to show their effect on learning in a science classroom at the primary education level.

### **1.5 Definition of terms**

- |                             |  |
|-----------------------------|--|
| 1) Relevance -              | When an input connects with the audience's background information so that the input ends up yielding conclusions that mean something to the same audience (Sperber & Wilson, 2002).  |
| 2) Context -                | Assumptions that the hearer holds about the world. It is a psychological construct (Gutt, 2010b).  |
| 3) Emergent multilinguals - | Children who speak a different language at home and learn English at school (García & Kleifgen, 2018).   |
| 4) Translanguaging -        | Communicating by using different linguistic structures, systems and modalities (García & Kleifgen, 2018).  |
| 5) Translanguaging Space -  | Translanguaging space is a context in which different identities, values and practices combine to generate new identities, values and practices. It embraces creativity and criticality, which are fundamental dimensions of multilingual practices (Wei, 2011). |

6) Linguistic An individual's set of various language features (Creese & Repertoire - Blackledge, 2015).

7) Minority Languages - Languages spoken by fewer speakers than those of other language groups in a defined area (Owens, 2000).

## **1.6 Scope**

This study focuses on the effects of using bilingual science texts in the fourth year of primary education in Botswana on learners' performance. To cover the territorial multilingualism existing in Botswana, three primary schools were selected: 1) one in the capital city where young learners predominantly use English for communication, 2) one in a Setswana-predominant village and 3) one in another village where a minority language is predominantly spoken. All participants were in the fourth year of primary education, and the data were collected in the second term between April and August. The study is based on a theoretical framework of relevance in translation and translanguaging.

## **1.7 Limitations of the study**

Potential limitations of this study fall under methodology, resources and generalisability.

Effects of language practices were observed in a cross-sectional study because of time constraints. A longitudinal study could have been conducted over a longer period to allow more observations.

Regarding resources, eye-tracking devices could have been used to determine the utility of bilingual texts, but because of financial constraints, the experimental group's learners were given

bilingual texts with an instruction telling them to read either of the texts or both if that allowed them to understand the content better.

Finally, this quasi-experimental study does not support the generalisation of results because it could not randomly select learners already allocated to classes. This would have disrupted classes and could have significantly increased the number of participants so that there would be a much larger amount of data to analyse.

## **1.7 Structural outline**

Chapter 1 of this thesis introduced the research by stating the problem it was trying to solve. It also gave the background to the study, as well as the justification, the scope and the limitations of the study.

Chapter 2 is the literature review, which presents scholarly sources relevant to the topic of the study. It gives an overview of existing current research that allows the researcher to identify the research gaps.

Chapter 3 focuses on the study's methodology by discussing the research design and data collection procedures. Then, it discusses validity and reliability, data analysis methods as well as more information of potential limitations of the study.

Chapter 4 of this study presents the results of this research alongside results of similar studies. It does not discuss the results but simply presents them as they were after analysis.

Chapter 5 discusses the results that are presented in Chapter 4. It does this through interpretation, evaluation and explanations of the significance of the results of this study.

Finally, the concluding chapter summarises the key research results and how they address the research questions. It also reviews the potential limitations of the research and suggests recommendations for future research.

## **1.8 Conclusion**

This chapter introduced the thesis by giving the background and context to the study conducted in Botswana primary schools. It defined the research problem, highlighting minimal local research on the benefits of embracing multilingualism in pedagogy in Botswana schools. Most of the research on language-in-education in Botswana highlights the negative impacts, such as poor academic performance and exclusion of minorities, but lacks evidence regarding the results of implementing multilingual programmes in the education system. If this is not addressed, the language practices in teaching and learning may continue to regress because of a lack of evidence concerning the benefits of multilingual approaches to learning science. Therefore, this highlights a gap that could be addressed by translating learning material since translation values both or all the languages involved. Hence, this chapter indicated that this study intended to determine the effects of using bilingual texts on the academic performance of learners in Botswana so that the results may serve as evidence in influencing pedagogical approaches that embrace multilingualism as a resource. The following chapter reviews the existing literature and provides a theoretical framework for the study.

## **CHAPTER 2**

### **Literature Review and Theoretical Framework**

#### **2.1 Introduction**

This chapter is divided into two sections: the literature review and the theoretical framework. The first section reviews literature on language in education and the effects of various language practices on the academic performance of learners. It starts by discussing bilingual education programmes and elaborating on the learning strategies in second language acquisition. It goes on to focus on reading comprehension as one of the crucial factors in education and then narrows these down to orthography and reading science that is predominantly printed in English. As discussed in this chapter, this has reduced voluntary reading of science by learners at the primary level of education. The focus then moves to intellectualisation, translation in education and embracing multilingualism in education. The first section ends by reviewing literature on language in the education system of Botswana, showing that Botswana's Language-in-education Policy continues to separate and compartmentalise languages in the education system. Only two languages in Botswana (English and Setswana) are included in the Language-in-education Policy, which recommends the use of Setswana only in the first year of primary education and English from the second year. However, scholars show that this does not address the language issues that arise in Botswana's education system because the reality of multilingualism on the ground necessitates the use of more languages in the classroom to increase learners' communicative potential and comprehension of content.

The second section of this chapter presents a theoretical framework to situate the study. Since the reviewed literature shows that the language practices in Botswana's education system do not consider the linguistic repertoires of learners, even though territorial multilingualism has

been highlighted, this study employs translanguaging theory to broaden the understanding of this language practice, which has the potential to support communication in the classroom.

Thereafter, the linguistic interdependence hypothesis is considered as it acknowledges the multiplicity of languages as a resource. Bilingual learners are fitted into the framework to try and understand the process of bilingual reading, and finally, a relevance theory of translation is considered to create a translanguaging space in which multilingual learners base their own translanguaging spaces to show criticality and creativity in the learning of science in the fourth year of primary education.

## **2.2 Language in education**

In different education systems worldwide, language issues usually involve questions of power and identity. Today, some people view multilingualism as a resource, while others place no value on multilingualism. According to García et al. (2015), those who place a market value on bilingualism usually prefer to treat the languages separately. However, García (2017) emphasises that acknowledging that multilinguals' language practices exist in a unitary system liberates multilingual learners and allows them to generate knowledge for enhanced academic performance. Apart from the language of learning and teaching Hungi and Thuku (2010) show that repetition, socio-economic background, pupil age and speaking the language of instruction at home can affect learner performance. In multilingual countries, the language of teaching and learning is always highly contentious, but research has shown that the learners' first language is the best for their cognitive development (see Cummins, 2000). Draper and Spaal (2015) highlight the importance of using the learner's first language as they show that poor literacy positively correlates with poor academic performance, mainly due to poor oral reading fluency. Because different governments address the issue of multilingualism differently, they embrace

multilingualism differently in education. Other countries choose to use submersion as a bilingual education programme that promotes subtractive bilingualism by taking away the learners' first language and substituting it with a second language for their education. According to Gorp and Verheyen (2018), the L2 submersion model negatively assumes that the learners' two languages are competing. It assumes that there is interference between L1 and L2 because of negative transfer and the time learners spend on their first language comes at the cost of second-language learning or vice versa. Others use incremental<sup>1</sup> and additive<sup>2</sup> bilingualism models that promote multilingualism.

In this regard, bilingual education is described as a programme that uses two or more languages of instruction in an organised and planned way. This does not only involve learning these two languages; it means being taught in these languages and this can be applied at any level of education. The following are typologies of language practices in the education system as stated by Long and Doughty (2011): the use of majority or minority languages where the chosen language is for a numerically predominant or non-predominant group; dominant or subordinated students' language where power and status of groups in the society despite their number, are used to remediate linguistic deficits as observed from bilingual learners; and the maintenance or transitional programmes that intend to assist minority language learners to develop proficiency in their first language. There are also transitional programmes which temporarily bridge learning and teaching through a predominant language of the school. However, Cummins (2018), lists the following three disadvantages that characterise the education of minority language learners: they

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<sup>1</sup> The incremental bilingual model is a model that supports slight changes in language practices enacted over time to end up with significant changes.

<sup>2</sup> The additive bilingual model maintains and develops the learner's first language/s while they are learning another language.

are required to abandon their first language when they get to school; they are usually from a community with a low socio-economic status; and they are usually marginalised and discriminated against. These are considered as the risk factors for learners' academic performance as stated by Cummins (2018), who goes on to show, based on 15 years' collaborative research with teachers, that learners from multilingual communities engage actively with texts that allow identity affirmation.

According to García and Baker (1995), submersion was predominant in countries such as Sweden and the United States of America, where minority languages were marginalised, and this had a negative impact on the learners' academic performance. Additionally, García et al. (2015) show that in the early 1960s in the United States of America, according to the Civil Rights Act, Mexican students were integrated through the submersion model of using English only in education; hence the direct and audio-lingual methods were used in education, and the learners' home language was not allowed in the classroom. Since translation was also not allowed, the learners' home language had no space in the classroom. García et al. (2015) show that subsequently, around 1974, the student's right to education through the language they understood was upheld, and bilingual education programmes were introduced in schools. Therefore, fluidity of communication using the students' repertoire as a resource was supported. In one instance, translanguaging was used in mathematics classes that were said to be bilingual classes, as the teacher of these classes was raised in the Dominican Republic and used translanguaging to facilitate learning. As shown by García et al. (2015), the teacher could switch to Spanish if the class could not understand the content in English; for example, she could use Spanish to help learners understand mathematical concepts by focusing on the development of language practices and how they could serve academic functions. It must be noted that the authors show

that this teacher did not leave out translation, as she used it to help learners understand mathematics concepts.

Some countries choose to support immersion as an additional bilingual education programme. This entails the addition of a second language alongside the first language. It is very common in Canada, where English and French are both official languages. As shown by Dicks and Genesee (2017), in 1963, parents could register their children where they felt an appropriate language was used, but parents of learners who learnt French as a second language realised that their children did not receive adequate education in the language. They requested a study to determine the best ways of teaching their children French as a second language. An enhanced immersion project was implemented after review, and during the first few years of primary education, 50% of the curricula were delivered in French for most learners who spoke English as their first language (see Dicks & Genesee, 2017). They learnt their second language in formal art classes, and content teachers were allowed to switch to the learners' first language when they realised they were struggling. It must be noted that there is early total French immersion, early partial immersion, middle, delayed immersion and late French immersion. In late French immersion, learners only use their second language for learning in Grade 6 while receiving traditional French second-language pedagogy in the preceding years. In this regard, Johnson et al. (1997) claim that French immersion programmes are vital in acquiring a second language while the child acquires academic language proficiency in their first language. In addition, Swain and Lapkin (2013) postulated that using the learners' first language to explain difficult concepts can enhance their proficiency in the second language. This highlights the need to harness multilingualism in classrooms to see how it can benefit the learners' cognitive development.

Mukhopadhyay (2016) shows that in contexts where learners only have minimal exposure to their second language at home, it seems disadvantageous to exclude their L1 at school by using the monolingual instructional model. Mukhopadhyay (2016) also points out that the ‘two-solitude assumption’ which separates languages suppresses the learners’ knowledge of their first language. Therefore, to engage the learners’ repertoire, a dynamic or fluid approach is recommended in writing the second language in a natural and accessible way by using knowledge of the first language, even though languages are usually kept separate in language classrooms, and languages are always treated monolingually. Contrary to this assumption that languages are separate entities, Herdina and Jessner (2002) show that as languages come into contact, they contribute to dynamic bilingualism. Mukhopadhyay (2016) goes on to show that in India, the monolingual pedagogical practice is common in the education system as this can be observed in the learning material that is used and even in the instructional methods and assessment activities as prescribed by the curricula, but sometimes teachers find themselves using two languages in the classroom. As shown by Chalmers (2017), this may be because research on multilingual schools does not address the linguistic challenges that teachers are facing. Regarding research on multilingualism in education, Chalmers (2017) presents an article summarising research on applying bilingual learners’ first language in learning. The article also summarises research focusing on the effects of using bilingual learners’ L1 in pedagogy, for example, in translating vocabulary. Some studies like Krashen and McField (2005) found that learners who attend bilingual schools performed as well as those who attended English-only schools, and some actually performed better.

The immersion programme in Canada is an example of embracing bilingualism where two major languages are official, just as in Botswana, where English and Setswana have official

status. It shows how education in the first language benefitted learners in their cognitive development. One striking point is that there were no strict monolingual class policies as the teachers could switch to the learners' first language while delivering content, legitimising using more than one language in the classroom to facilitate learning and teaching. However, Howatt (1984) uses the 'monolingual principle' to show that using the target language for instruction may exclude the learners' first language so that it does not interfere with their acquisition or their use of the target language. This method works like the direct method that emphasises avoiding the use of translation. Therefore, there is the separation of languages, which does not allow learners to make cross-linguistic connections as they acquire a second language. In this regard, Mitits et al. (2018) undertook a study to examine the effects of home language on learners' development of the first language or second language. They used Ongun and Daller's (2015) claims that using L1 at home can support the development of a second language by immersion in L2 at school through Cummins' Underlying Proficiency Theory. The participants of Mitits et al.'s (2018) study spoke Turkish as their home language and were learning Greek as their second language. They realised differences among participants who predominantly spoke Turkish and were still acquiring Greek as a foreign language. Their vocabulary size scores showed that they used Turkish frequently. Overall, they found that the development of learners' proficiency in L2 is influenced by the support they get in the development of their L1.

In another case related to language use in the education system, in 2004, Anghel et al. undertook a study that focused on a programme that established bilingual education in some primary schools in Madrid. Just like other studies (see Buttler & Hakata, 2004 and Hamers & Blanc, 2000), Anghel et al. (2004) support the bilingual model in education. Cummins (2008) suggests some strategies that can be used to promote learning in both the learners' first and

second languages: concentrating on cognates if languages have common roots, using dual language books and projects, and using the internet to connect with other bilingual learners. In this programme, the languages of learning and teaching were English and Spanish, and learners did not only learn English as a subject but also learnt it in content subject lessons. Anghel et al. (2016) state that a standardised test was administered to Grade 6 learners to assess the programme. The test results of learners whose parents had not completed senior secondary school were not good. This highlights a problem that policymakers usually overlook as they formulate a one-size-fits-all Language-in-education Policy that fails to address territorial multilingualism in different countries. Therefore, the sample population must be sub-categorised into characteristics of the main population to avoid generalisations that ignore outliers.

Territorial multilingualism is observed in Switzerland, where there are four national languages and four linguistic territories. German is predominant, spoken by about 63.5% of the population, while Romansh is spoken by only 0.5% of the population but is considered a national language (FSO Structural Survey, 2015). The structural survey shows that French is spoken by 22.2% and Italian by 8.1%. Switzerland presents a different way of viewing equality of languages despite a wide range between the predominantly spoken language and the one spoken by only 0.5% of the population. According to Kużelewska (2016), Switzerland's positive attitude towards multilingualism is demonstrated in its official Latin name, *Confoederatio Helvetica* (Swiss Confederation). Kużelewska (2016) further states that language equality, language freedom and territoriality promote the coexistence of languages in Switzerland. However, this blurs national identity; for example, residents have no right to use the German language in French-speaking Switzerland (Füglister & Wasserfallen, 2014). The education system is also facing the challenge of language planning. Kużelewska (2016) shows that the language of

learning and teaching is determined by the canton under the principle of linguistic territoriality that supports multilingualism as courses are offered in other official languages. Since the cantons were responsible for language planning in 1998, the canton of Zurich, supported by the public, decided to increase English in the curriculum while reducing French, and English was taught alongside a second official language (Kużelewska, 2016). In Switzerland, English is treated as a foreign language introduced by the third grade and another foreign language is introduced by the fifth grade.

Björklund et al. (2013) highlight that Scandinavian unifies Nordic countries, but their languages are distinct. Swedish is predominant in some parts of Finland, and there is linguistic diversity in Denmark, Norway and Sweden, but one language is predominant in each country (Björklund et al., 2013). According to Norrby (2015), there has been an increase in using Content Language Integrated Learning (CLIL). This approach involves teaching a subject through a language that is not normally used for teaching. It also entails the incorporation of content in different languages. CLIL was introduced to Swedish schools in the 1970s (Igawa & Yagi, 2011). It is considered in multilingual education as it allows learners to study content using different languages, increasing their motivation and confidence in both the content and language. According to Björklund et al. (2013), English is taught as a first foreign language from Grade 1 in Sweden, while in Denmark, it is introduced in Grade 3, and in Finland, it is introduced no later than Grade 3. In Swedish medium schools, it is introduced before Grade 5. Norrby (2015) points out that codeswitching is common in Scandinavian schools as English is used as a lingua franca; therefore, there is always codeswitching between the national language and English. English is mainly used in higher education, but learners can collaborate in Swedish; therefore, they can use both languages in class (Norrby, 2015).

In a different study Little and Keirwan (2018) state that, in 2006, about 10% of the Irish population came from other countries (p.314). Schools that admitted immigrant children had to give them full access to education and look for ways to embrace multilingualism to benefit all learners. Therefore, each school had to develop its own policy of accommodating such learners. Little and Keirwan (2018) state that primary and post-primary immigrant learners first had to become proficient in English, and hence in 2000 English was taught as an additional language in Irish schools. At first, some parents are reported to have thought using the learners' first languages might impede their acquisition of English, but their apprehensions were overcome by the learners' enhanced performance in education.

Alby and Léglise (2018) undertook a study in French Guiana, a French territory where about two-thirds of the children are not proficient in French, the official language of teaching and learning. Therefore, most children only learn French when they get to school, and their first language is always perceived as an impediment to their academic achievement. This territory has a high dropout and underachiever rate (see Alby and Léglise, 2018) but the education system has partly adopted mother-tongue models, and some of these education issues have been addressed by various programmes such as teacher training and language-in-education policies. However, most education systems continue to treat languages separately, disregarding multilingual pedagogy. The researchers state that even though the schools support the monolingual norm, the reality on the ground in everyday classrooms and language learning is characterised by multilingualism. They continue to highlight the fact that teachers and students play a significant role in resisting monolingual ideology often imposed by top-down policies. Hence Alby and Léglise (2018) concluded that translanguaging and codeswitching in multilingual classrooms are crucial pedagogical resources that can be used in learning and teaching. Learners who speak

minority languages are expected to be assimilated, and the development of two languages separately is supported (French and French Guianese Creole), but on the ground, things are different because many languages meet in the classroom.

In Africa, Tanzania has been praised for elevating Swahili as an official and national language despite over 120 languages in the country (Swilla, 2009). According to Blommaert (2005), developing Swahili through modernisation and standardisation has elevated its status and made it readily available to be used as a language of learning and teaching. In this regard, Swilla (2009) shows that since 1961, Swahili has been used as a language of learning and teaching at the primary level, and English is used as a medium of instruction at the secondary level. However, Tibategeza and du Plessis (2012) elucidate that there are two categories of stakeholders: those who support using English at the secondary level and those who support using Swahili. According to Swilla (2009), others felt that switching to English as a language of learning at the secondary level delayed learners' acquisition of English. However, The Six-Year Primary Project in Nigeria revealed that mother-tongue education can enhance learners' academic performance and does not affect second-language acquisition (Abidogun & Adebule, 2013). Obanya (2004) points out that in Nigeria the experimental groups were taught all subjects in Yoruba except for English using trained teachers. The control groups were taught using orthodox methods that use English for teaching and learning while learning Yoruba as a subject. Consequently, this project showed the benefits of mother tongue education and it also contributed to the development of Yoruba as terminology was developed (Abidogun & Adebule, 2013). However, multilingual countries like Ghana have experienced the challenge of developing learning material and the curriculum in different languages. This was realised in a study that

sought to analyse the efforts of pre- and post-colonial governments in promoting mother-tongue-based education (Opoku-Amankwa et al., 2015).

According to the new education Sustainable Development Goal, relevant learning outcomes are privileged for global monitoring. Barrett and Bainton (2016) illustrate how local projects in Tanzania interpret relevant learning using their evaluative frameworks based on socio-cultural theories. They undertook a study to demonstrate the effects of the intervention on learning rather than focusing only on enrolment. Therefore, their research presents a framework of a project which ran from 2013 to 2015 to evaluate the effects of the Language Supportive Teaching and Textbook in Tanzania (LSTT) on learning. This project developed pedagogical materials for Form 1 students who rarely use the language of learning and teaching at home. Therefore, LSTT focused on terminology and acquisition of scientific knowledge; hence it dealt with English, biology and mathematics. Drawing from the socio-cultural theories of learning, the learning materials that support languages were developed with the knowledge of the language as the outcome and also as the main tool for learning. That is why, as shown by Barrett and Bainton (2016), the framework must clearly differentiate between the language of learning and the language as a subject because secondary education involves using a formal register in different genres. In biology, the direct translation of specialised vocabulary was used to translate terms from English into Kiswahili, but the challenge usually arose when there was no readily available equivalent term in Kiswahili. The baseline study found that most textbooks did not support moving from talking to formal writing (see William and Ndabakarane, 2017). Another challenge was that most of the textbooks were not localised. The researchers, therefore, intended to develop textbooks ideal for independent study while supporting creativity and criticality in

English by including glossaries on the introduction page of a chapter and the sequencing of learning activities, starting with informal talk, followed by reading, exploratory talk and writing.

In this regard, William and Ndabakarane (2017) show that when learners reach secondary school, the communicative approach is adopted to help them learn English; therefore, only English is used, and no other language is allowed. The learners find content in textbooks difficult to comprehend because it is presented monolingually in English. To address the issue of monolingual education in Tanzania, Barret et al. (2014) conducted a baseline study in 21 schools in Dodoma, Morogoro and Lindi in 2013. They introduced LSTT materials to be used in participating schools for two months. Learners were given a pre- and post-test as a written and verbal assessment, focus group discussions were conducted, and biology, mathematics and English textbooks were reviewed for accessibility. Barret et al. (2014) found that Form 1 students were not ready to use English only as the language of teaching and learning as they struggled to comprehend mathematical terminology. Only the keywords were translated to help learners link them to prior content in the primary curricula, and there was a shortage of textbooks. The study used the same chapters from a multilingual mathematics textbook for Form 1 students in Tanzania. A mixed method approach was used to conduct the study in the disadvantaged and low-performing schools in Morogoro, Lindi and Dodoma in 2015, where the LSTT project was piloted. Most learners in these schools faced a challenge when they had to transition to using English as a language of learning and teaching because they spoke other languages at home; hence Kiswahili was their second language and English their third. Teachers implemented the designed material, and the researchers had to ensure that the material was implemented effectively. Intervention took place over four weeks in which Form 1 students learnt mathematics using adapted material. The pre- and post-tests were vocabulary and reading

comprehension, verbal tests and written tests and student and teachers' questionnaires were administered. Observation was also used to collect data. The researchers found that learners' performance was higher in the post-test than in the pre-test. They concluded that the LSTT intervention brought about a significant positive effect on performance in vocabulary and reading. In the verbal assessment pre-test sessions, most students were not confident as they were hesitant to make mistakes. The teacher then resorted to translating mathematical concepts, but the students resorted to Kiswahili because they found it challenging to learn mathematics in English. However, in the post-test assessment sessions, there was a significant improvement as more students could use English to describe mathematical operations. It must be noted that they did not use English in textbooks, and the majority chose to use Kiswahili as they deemed it powerful in the discussion of mathematics. The learners' ability to write or express mathematical ideas was enhanced using the LSTT material. William and Ndabakarane (2017) also show that the LSTT materials made learning mathematics easy as the lessons with this material were more enjoyable as learners showed that the content was well translated during data collection.

Similarly, Gabrieli et al. (2018) show that quality education mainly depends on how teachers, students and learning materials interact. They state that this interaction usually uses communication as the basic tool that enriches this engagement. Gabrieli et al. (2018) continue to show that in Tanzania, students' abrupt switch to English at the secondary level of education, leads them to resort to codeswitching and codemixing in class, which some authors such as Gabrieli and Elisa (2017) claim is not useful as it does not help them to understand the content fully. Textbooks may be irrelevant as they ignore the English proficiency level that learners bring to secondary education. Therefore, Gabrieli et al. (2018) undertook a study to develop a Language Supportive Biology Textbook (LSBT) that supports Form 1 students in Tanzanian

secondary schools. The project was piloted in Dodoma, Morogoro and Lindi, the lowest performing regions. They used participatory action research design to plan, implement and revise learning materials with teachers, students, researchers and curriculum developers. The initial LSBT development started with the findings reflected in the baseline study. Experts reviewed the first version, and it was improved into the second version, which was also reviewed and tested to produce the third version. At first, it was realised that conventional biology textbooks were not accessible to Form 1 students as they contained complex sentences with difficult terminology for learners who were just beginning to use English as a language of learning and teaching. The textbooks did not support the learning process as they were not comprehensible to learners. They did not have glossaries or translations of key terms. This shows that Gabrieli et al. (2018) acknowledged bilingualism in the development of textbooks. In the case of Tanzania, even though the content of textbooks builds on the learners' prior learning, using a completely new language for teaching and learning impedes the learning process of biology (Gabrieli et al., 2018). In the second version of the biology textbooks, Gabrieli and colleagues included objectives, key ideas and glossaries, and content localisation was emphasised. One of the reviewers suggested that biology textbooks should develop the learners' reading, collaborative and writing skills so that they can actively participate in learning because these skills are also crucial in language development and fluency. With this in mind, the third version included colourful diagrams and illustrations after suggestions from biology teachers. Translations of keywords were added on the same page as difficult words, and teachers suggested adding more terms to the glossary. Gabrieli et al. (2018) show that, at first, learners were quiet when using the newly-developed book. Later, the students felt free to participate in class using English and Kiswahili. This shows that translation can be used to embrace multilingualism and to support

translanguaging for enhanced participation. ‘The findings indicated active engagement of students in reading, talking and writing during lessons’ (Gabrieli et al., 2018, p. 11).

Milligan et al. (2018) discuss the complexity of the functions of learning and teaching support materials (LTSM) by showing case studies from Rwanda and South Africa as they claim that textbooks can be used to support the engagement and participation of learners, even though Glewwe et al. (2009) claim that using textbooks has only shown a positive impact on learners with high socio-economic status. Koornhof et al. (2018) undertook a study that sought to benefit disadvantaged learners who did not speak the language of teaching and learning at home. The authors viewed LTSM as artificial cultural objects rich with cultural meaning and used to reach some goals. They can enable or constrain human activity depending on the teacher’s ability as a mediator, as shown by Remillard (2005). Furthermore, Barrett and Bainton (2016) claim that using multiple languages for teaching and learning mathematics and science in multilingual contexts can be beneficial to learners. They show that in South Africa, extensive use of workbooks was observed. It was realised that in poor-performing schools, there was no reading or writing, and learners did not participate in lessons as teachers mainly used visual aids instead of textbooks. Teachers in low proficiency schools showed that the learners wrote very slowly. In most cases, the learners did not understand the content of their reading. Still in South Africa, Koornhof et al. (2018) point out that teachers of Grades 4 to 12 received a tracker allowing them to access all the prescribed textbooks, and this has had a positive impact on the coverage of the curriculum. Grades 1 to 3 mathematics teachers are said to have used “*Jika iMfundu*”, the tracker for lesson plans, with some printable materials and learner workbooks with class activities. It must be noted that at this stage, the use of LTSM involved translanguaging to facilitate learning. The activities were presented using parallel English/Isizulu text, and a bilingual dictionary was

provided to aid translation. This influenced confidence in teaching and enhanced coverage of the curriculum.

In the 2013-2018 Education Sector Strategies plan, Rwanda recognised textbooks and other LTSM as crucial aspects for improving literacy and numeracy skills that learners acquire at school. Koornhof et al. (2018) point out that even though enrolment of young learners is satisfactory in South Africa, learners' performance in international tests is poor. In South Africa, workbooks were preferred over textbooks, but textbooks were commonly used in Rwandan classes. However, in most cases, only the teacher had access to the textbook. Using glossaries that contain the translation of terms from English into Kinyarwanda was observed to promote independent learning. The researchers found that language-supportive textbooks had a significant effect on pedagogy and learning outcomes. Even schools with low proficiency in English showed improvement in post-test scores because learners were motivated to read language-supportive textbooks. As shown by Koornhof et al. (2018), learners showed that these materials support collaborative learning by participating actively in class. Therefore, from these two cases of South Africa and Rwanda, it was realised that some contextual barriers could limit the effective use of textbooks.

In neighbouring South Africa Oyoo and Semeon (2015) posit that South African learners struggle in science as a subject because of low proficiency in the language of learning and teaching. Additionally, Setati and Adler (2000) claim that most South African schools are multilingual as neither teachers nor learners use their first language as the language of teaching. Despite the new language policy embracing multilingualism, Setati and Adler (2000) show that learners practise codeswitching as they face learning content and language challenges in mathematics lessons. This is mainly because mathematics has a special register, and it is difficult

to move learners from using their day-to-day vocabulary to using mathematics terminology in class. It must be noted that even in mathematics education, translation is a crucial element of codeswitching because learners can apply knowledge of their L1 when they do mathematics in L2, using it to reflect on what they are writing. This is known as selective translation, which Cohen and Allison (2007) claim can benefit language learners' comprehension and writing skills.

Fleisch (2016) points out that the Minister of Education in Gauteng crucially transformed primary education by implementing the Gauteng Primary Language and Mathematics Strategy from 2012 to 2014. This programme focused on quality learning materials as an intervention strategy such as multilingual mathematics textbooks and vocabulary posters, which are deemed crucial in early grade learning. In light of this programme, Fleisch et al. (2016) undertook a study that discovered that the Gauteng Primary Language and Mathematics Strategy intervention positively influenced elementary mathematics performance. Generally, this showed that a combination of lesson plans, quality teachers and learner resources could contribute to enhanced teaching and learning in the classroom. In another South African study, Fleisch et al. (2017a) realised a bimodal distribution of achievement between learners of middle-class schools and rural working-class schools. Using data drawn from literacy tests, Fleisch et al. (2017a) found that learners misspelt monosyllabic words, and there were L1 language interference and pre-grapho-phonemic errors, resulting in poor reading skills. The literary tests used pre and post-test instruments with four components: language, vocabulary, spelling and comprehension. Fleisch et al. (2017b) also found that in the middle years, learners perform poorly in English as a first additional language because Grade 4 learners were not proficient in English. The Gauteng provincial government realised this achievement gap and launched a remedial programme to reteach reading and writing in their English as a second language programme in Grades 4 to 6.

However, Fleisch et al. (2017b) realised that this programme was effective in improving the learners' proficiency in English even though the post-test results showed a slight change that was statistically insignificant between the control and the treatment groups. This highlights the need for a qualitative approach to support the quantitative approach to language-in-education issues.

Different literature shows that language-in-education issues shape the language policies and models that we find in different countries as shown in this section. The adopted models are selected depending on whether multilingualism is viewed as a resource or not. As shown by Mukhopadhyay (2016) the dynamic approach to multilingualism in education is ideal because it is natural and accessible as it supports engagement with the text. However, in Botswana we find a traditional approach to language planning which separates languages and marginalises others as they are spoken by the minority. This may have an impact on the performance of learners academically. The Botswana Examinations Council (2014) states that, in 2011, Batswana learners performed poorly in the piloting of PIRLS in the fourth year of primary education, which is equivalent to four years of formal education. Botswana then decided to assess learners in the sixth year of primary education using 140 schools, sampling one class from each school.

### ***2.2.1 Learning strategies in second language acquisition***

Learners who view the use of a foreign language as a challenge often use learning strategies in the acquisition of their second language in the classroom. Lin, who has been engaged in classroom codeswitching research for more than three decades, suggests that research in multilingual education needs an approach that would 'try-and-see and then document and re-try another pattern and see what happens and re-design future action plans' (Lin, 2013, p. 20). This would shed light on what to aim for to achieve when using different multilingual strategies. Lin (2013) highlights that early studies of L1 and L2 relied mainly on the statistical analysis of

the prevalence of the two languages in a class by the teacher or the students. This was studied by data through field notes or audio and video analysis. Cummins (2008) suggests some strategies that can be used to promote learning in both the learners' first and second languages: concentrating on cognates if languages have common roots of origins, using dual language books and projects and using the internet to connect with other bilingual or multilingual learners.

The programmes of Mandarin Chinese as a foreign language have shown a high number of international students learning Chinese, and in most cases, they learn this language after they have acquired a high level of proficiency in English. According to Wang (2016), this has resulted in linguistically diverse classrooms that employ some strategies that go beyond a monolingual teaching approach, which has always been the norm in language teaching. Wang (2016) continues to show that most Chinese teachers educated in the Chinese Education system rarely encourage learners to express their ideas. The researcher focused on beginner classes to understand the students' attitudes, teachers' attitudes and language practices. Mandarin Chinese foreign language students used a bilingual questionnaire in English and Chinese, and the teachers chose to be interviewed in Mandarin Chinese. Beginner classes of the interviewed teachers were observed and audio-recorded to determine language practices in the actual classroom setting. Wang (2016) used translanguaging in Mandarin Chinese foreign language classes to explain and elaborate new vocabulary or cultural meaning, to manage the class and for interpersonal strategies. The researcher found that the teachers' and students' attitudes towards translanguaging showed some techniques of practical scaffolding to enhance collaboration in the classroom. Therefore, Wang (2016) reached the conclusion that translanguaging as a language practice can be strategically used by second language learners to give international students a chance to voice their ideas in the languages in which they are proficient.

Pslaton-Joycey and Sougari (2010) show that young children use simple language acquisition strategies, while older learners use more effective strategies. The authors found that younger learners preferred compensation strategies in learning a new language. In a similar study Wharton (2000) observed a mutual relationship between proficiency in a language and the frequency of strategies. Furthermore, Bremner (1999) posits that learners with low proficiency use more strategies and therefore concluded that successful learners did not necessarily have to use more effective strategies. Relating to this, motivation to learn a language also contributed to strategies for learning a new language because high motivation plays a significant role in learning a language. Motivation also affects the application of learning strategies in that highly motivated learners tend to use more strategies than those who are less motivated. According to Schmidt and Watanabe (2001), motivation also affects cognitive and metacognitive strategies but does not affect social strategies to any great extent. Liking a language would also serve as a motivation influencing language learning strategies (Oxford, 2003). Dörnyei (2003) points out that learners choose to use the strategies they consider the best according to what they think will help them become proficient in a language. In this case, learners may choose to use cognitive or communicative strategies, the strategies chosen tend to depend on the characteristics of the learner and the individual learning style.

However, it must be noted that in Botswana the formality of second language learning in the school environment does not support the bilingual strategy that the language learner may choose to use. For instance, the use of strategies that go beyond a monolingual approach may be disapproved of, and this may limit the application of techniques of practical scaffolding through the practice of translanguaging. Consequently, limiting the use of second language learning

strategies will result in poor comprehension, quiet classes and a negative attitude towards the acquisition of the second language.

### ***2.2.2 Comprehension***

In education, reading comprehension is crucial for making meaning. This includes decoding words and sentences and integrating them into a meaningful whole. According to Rupp et al. (2006), comprehension draws on perception processes, but is more complex than perception because comprehension of a text that does not have any underlying meaning nor assessment is different from comprehension of a text with an assessment exercise. According to Singhal (2020), reading comprehension assessments can be beneficial to learners as they may prompt the learner to use language actively, they emphasise writing skills, and they expose learners to different types of reading strategies and test both low-order thinking skills (LOTS) and high-order thinking skills (HOTS). Therefore, the questions should be designed to help the reader understand the meaning of a text. In constructing the questions, Bloom's taxonomy of cognitive domains can be considered: the cognitive, affective and psychomotor domains. According to Bloom (1956), the cognitive domain has the following hierarchy of levels: 1) knowledge that assesses knowledge acquisition; 2) comprehension that focuses on the learners' ability to recall but also to paraphrase, define and discuss; 3) application that deals with using abstract information in real life situations; 4) analysis that shows whether the learner can determine the relationships between ideas from communication; 5) synthesis that tests whether the reader can create a whole from disorganised parts; and finally 6) evaluation that tests if the learner can judge how valuable methods or materials are.

As shown by Paris and Hamilton (2014) it has been realised that life experiences and comprehension influence each other. Chall et al. (1996) state that readers gain skills starting with

pre-reading skills, then decoding skills and finally comprehension skills. In the first stage, the early reader learns the letters and phones and how to handle the book while reading. Later on, they begin to develop decoding skills as they realise the differences in letters and words and letters and sounds. Then they go to a higher stage of decoding as they add some sight words into their vocabularies, and their fluency increases so that by the fourth grade, they are not only learning to read, but they are reading to acquire information and enhance their knowledge. Here the concentration is no longer solely on narrative stories, but they can also read content.

According to Pearson (2014a), until the 1980s reading comprehension was only realised as part of classroom instruction, after which it was designed to enhance the curriculum. However, it is not easy to observe understanding directly and therefore in the 20<sup>th</sup> century it was only used in education as an index of reading competence because prior to that, oral capacity was considered to be mastery of reading a text and because value was placed on memorising texts. Pearson (2014a) goes on to show that in the early 20<sup>th</sup> century, only multiple-choice questions and stopwatches were used to assess reading comprehension. In relation to cognition, Oakhill et al. (2014) describe reading comprehension as a task that is not straightforward as it involves different cognitive skills because for readers to understand a text, they need to be able to decode the words that make up that text. Hence proficiency in reading is influenced by high proficiency in a language. This includes decoding words and sentences and integrating them into a meaningful whole. To do this, an appropriate mental model, defined as ‘a mental representation that is created from information in the, or imagined world’ must be constructed (Oakhill et al., 2014:2).

According to Perfetti (1997), the verbal efficiency theory can describe the model that leads to a coherent understanding of texts. The processing levels necessary to successfully comprehend

a text include the lexical level, propositional encoding and text modelling. This means the reader starts by recognising words and matching them to the concepts and phonological representations. The reader then recognises different meanings of words linked to the memory of other words to create units of meaning. Finally, the propositions are integrated into a coherent mental representation of the text. Therefore, lexical access must be automatic to enable encoding and integrating propositions to result in text modelling that is elaborative and efficient. In this regard Kintsch (1998) suggested the construction integration model, which focuses on adult reading comprehension. This model proposes simultaneous construction of the literal text model and the model of the situation implied by the text. This includes constructing the relations between the text's microstructures and macrostructures. This model focuses on the reconciliation of successive inferences and relations in a text to consolidate them into integrated representations. Thus, this is a top-down model because it depends on the reader's prior knowledge and vocabulary, as well as on the activation of relevant schemata. Here, readers' engagement with the text starts by constructing meaning from what they are reading to arrive at activated mental concepts that are compatible and integrated with the implied situation. According to Paris and Hamilton (2014), the incompatible is de-activated; therefore, if readers do not have sufficient background knowledge, they will have to try to connect the disconnected details, which may distort the intended meaning of the text. However, when the two models are compatible, the reader may simultaneously use them to influence the other, resulting in a cohesive interpretation of the text. This comprehension process consists of the word-level component, where vocabulary is viewed as a crucial part of comprehension, the sentence-level component in which readers have to process, store and integrate different information at the syntactic level and the semantic-level component to comprehend a sentence. At the text level, inference and monitoring

comprehension are crucial in establishing coherence in what is being read. This shows that for minimal comprehension to be enabled, the thresholds for the component skills must be met for that particular text because there is an interaction between the reader, the context and the text. Therefore, early readers need to understand situations, facts and words in their languages to understand the text.

Oakhill et al. (2014) show that the title of a passage can aid in creating a suitable mental model which makes it easy to understand a text by drawing on different aspects such as pictures, titles and general knowledge; therefore, integrating information into a mental model triggers comprehension. In the simple view of reading, word decoding and language comprehension, there are two crucial components of reading ability and a child who lacks one of the components would not be able to read (Oakhill 2014). According to Paris and Hamilton (2014), decoding words is a bottom-up process, while language comprehension is a top-down process, and this is where the readers' language becomes the equation ( $R + D \times LC$ ), which shows this relationship. According to this view of reading, when the reader struggles to decode the words, their reading comprehension will be limited because only a few cognitive resources are applied to language comprehension. However, the reader is not expected to know the meaning of every word but to infer meaning from the context. At the same time, the reader must know both the deep and surface meaning because deep vocabulary is also crucial in building mental models. Comprehension will be easier when decoding skills come automatically, but this will depend on various language factors. In this simple view of reading the efficiency of decoding is recognised as an important aspect of comprehension.

Hung-Chang Liao and Wang (2018) state that anxiety means that learners find it difficult to read English because of the need to use comprehension strategies. Therefore, Taiwanese

teachers tend to focus more on teaching learners to read English rather than speaking the language so that learners can meet the examination requirements. Against this backdrop, Liao and Wang (2018) undertook research to evaluate how comprehension strategies can enhance self-efficacy in reading and reading comprehension. Their 62 Taiwanese university participants were from different faculties, where 43% were men and 57% were women (Liao & Wang, 2018). The participants completed an English reading Self-Efficacy Scale before the experiment, and they completed the English Reading Anxiety Scale and the English Reading Proficiency test after the experiment. In their quasi-experimental study, the control group received instruction using traditional methods for 15 weeks, whereas the experimental group were taught using English reading comprehension strategies. The comprehension strategies included identifying main ideas, inference, critical reading and context clues. These strategies reduced anxiety and contributed to greater English reading self-efficacy and self-affirmation in the experimental group than in the control group.

Fletcher (2006) suggests that reading comprehension assessments should use different indicators to ensure the underlying latent variables and avoid the mono-operation bias (see Cook and Campbell, 1979). One of the common errors in reading comprehension is spelling, mainly because readers fail to remember a word, as shown by Alcock and Ngorosho (2003). This may be due to deep or opaque orthography. Some errors can be observed when assessing reading comprehension with multiple-choice questions. According to Madiba (2013), for learners to be able to succeed in understanding a text, they need to be able to infer its meaning from the text, but this is not easy for emergent bilinguals as monolingual pedagogy makes it harder to infer meaning. According to Kispal (2008) inferencing means combining and applying information from a text with the reader's background knowledge so that they may arrive at a conclusion. This

allows the readers to understand the whole text as presented by the writer, aiding reading comprehension. They mention that lexical training and question generation are crucial in making inferences; therefore, texts for inferencing skills at primary school should be interesting and prompt the learner to make predictions. However, as shown by the Department of Basic Education (2014) in Botswana, most elementary learners lack inferencing skills, which, according to Mgijima and Makalela (2016), contributes to the learners' limited comprehension.

In a study by Moll et al. (2001), English language learners' ability to comprehend the text in the textbook is affected by limited experience with cultural and linguistic resources when that text assumes common cultural experiences. Sometimes learners with limited skills in English struggle to make meaning as they pay more attention to being fluent in English pronunciation rather than reading to make meaning. This limits the acquisition of English language learners' disciplinary literacies for better academic performance. It must be noted that different texts can position learners socially because English language learners are forced to negotiate between cultures even if the teaching and learning process rarely allows them to negotiate with the text they are reading. These learners usually resort to certain language learning strategies, which may be influenced by internal or external factors in the learners' environment. According to Mitits (2015), these factors include age, gender, learners' language proficiency, motivation to learn a language, learners' attitudes toward learning a language and cultural background.

Raney et al. in Heredia and Altarriba (2001) use Kintsch and Van Dijk's (1978) model of bilingual language in memory to explore the relationship between text comprehension and the models of multilingual language representation. They address the issue of whether processes used in reading one language are identical to those used in the second language and found that similar processes are employed when reading in each of the languages, but the reader uses

different reading strategies according to their reading fluency and the characteristics of the text. Raney et al. in Heredia and Altarriba (2001) also found that there is a separate representation of words and their meanings in memory and that therefore interpretation is based on the reader's background knowledge. A related study by Zhang and Webb (2019) investigated the effects of using bilingual texts on vocabulary learning. In this study, Chinese learners of English read English-only texts and English texts with translations. After a pre-test and a post-test, learners who used bilingual texts obtained higher scores on the post-tests than those who read monolingual English texts. Therefore, Zhang and Webb (2019) concluded that bilingual texts are crucial in vocabulary learning. They also realised that the order of languages in a bilingual text does not affect the acquisition of second-language vocabulary and that bilingual texts could help learners understand content as they are able to identify the correct meaning of words from the beginning.

PIRLS sets the standard of reading comprehension for the fourth year of formal education in Botswana by focusing on literary experience and the acquisition of information by assessing the learners' ability to retrieve explicitly stated information. PIRLS literacy is measured on the PIRLS achievement scale. According to Csapó et al. (2012) by eight years of age, transparent orthography learners should be able to read accurately, to acquire and use information in the text that they are reading. They therefore need to demonstrate their understanding by making straightforward inferences and interpreting and integrating ideas and information. In Grade 4, the focus is on decoding skills, reading basic sentences and text comprehension. Csapó emphasises this by showing that the higher level of reading competency reached by Grades 3 to 4 allows an increasing number of students to allocate a greater share of the finite amount of cognitive

resources available for reading processes to conscious strategic decisions and enjoyable, meaningful reading (Csapó et al., 2012).

Around 1970, across the world in general there was a constructivist turn in psychology and pedagogy in which sense was emphasised over accurate rendition. Earlier educational psychologists viewed reading as reading comprehension because it involves the organisation of sentences and accepting some connotations and rejecting others. Thorndike (1971) likens understanding a text to solving an equation in mathematics. He assumed there is a correct way of reading to maximise comprehension. However, Paris and Hamilton (2014) show that in the process of reading, visual memory, phonological memory, semantic memory and situated meaning work together to process texts. This means the reader must pay attention to what they are reading so that cognitive resources can be allocated to the task of reading. First, the reader decodes the text, but if it is difficult, more attention will be diverted to this process of decoding. If decoding is automated, additional cognitive resources will be available to aid understanding of the text. It must be noted that even though decoding abilities and reading comprehension seem to be closely related, there is in fact a weak correlation, especially in children who have high decoding skills and low comprehension abilities (Paris & Hamilton, 2014). Therefore, even though decoding is crucial in comprehension, it is insufficient. Another model views reading as the interaction of two processes, the bottom-up and top-down. According to Rumelhart et al. (1994), readers use different tools to construct the meaning of a text, so the bottom-up process starts with decoding words and the top-down deals with applying background knowledge to the text. Here, readers compensate for weak skills using strong skills.

In the 1950s skills development increased its scope to include comprehension and vocabulary alongside phonics. Pearson (2014a) notes that in the late 1950s, transformational

generative grammar as developed by Chomsky was regarded as the basis of human language processing. Therefore, from the late 1960s to the mid-1970s, a good deal of empirical and theoretical work was done in psycholinguistics. Some scholars view reading as a natural process involving general linguistic and cognitive skills. After the cognitive revolution, psychologists focused on the text, its characteristics and the knowledge students bring to the reading exercise. Some authors, like Anderson (1977), focused on the reader as someone who actually constructs meaning. Therefore, the reader was viewed as important and possibly even more important than the text. Schema theory contributed to the study of reading comprehension in that it accounts for everything learnt and understood. Johnston and Pearson (1982) state that prior knowledge contributes significantly to the comprehension of a text. Then the metaphor of the fixer emerged after the builder as the strategic reader was viewed as flexible in enabling and repairing comprehension. The metacognitive theory showed that in reading, declarative knowledge, procedural knowledge and conditional knowledge should be included in comprehension or comprehension instruction.

Gough and Tunmer (1986), found that by the ages of eight to nine, decoding is not only learnt but is automated. This is where we find that decoding skills influence comprehension, but skills influencing language comprehension are always present; therefore, Gough and Tunmer (1986) fail to account for the development of decoding skills as well as language comprehension skills. Riley (2020) notes that teachers do not use evidence-informed approaches to help students learn the skill of reading even though spoken language is learnt naturally. Reading is not natural, however, as it involves human innovation. Cummins (2014) states that printed material in a learners' first language can prompt their engagement with the text. In this regard, Riley (2020) shows that experts believe that children can decode text through phonic instructions because

fluency in reading can be gained through extensive reading practice with different texts, though strategies employed to improve comprehension are not sufficient to compensate for lack of content knowledge or vocabulary. Hence, using the children's first language in early stages of reading can support extensive reading while supporting comprehension of content as well as vocabulary.

Regarding the biological sex of a learner in relation to comprehension (Egolund, 2012) found that learners in the Nordic countries only enjoy reading online and that girls outperformed boys in all four countries when using a literacy scale that ranges from 1a to 6, level 6 being the highest. Similarly, Kennedy (2008) shows that girls are better readers because culture significantly shapes children's reading abilities. Girls' literacy is supported at an early age and therefore they have stronger reading skills and a positive attitude towards reading in later life. Oxford (2003) also examined how males and females apply strategies in language learning, finding that females make use more strategies. In contrast, Tercanlioglu (2004) and Wharton (2000) found that males apply strategies more than females, while Griffiths (2008) confirmed this observation that males apply strategies more often although there were similarities in the way males and females made use of the strategies applied.

Experienced language learners can be easily prompted by reading comprehension to actively use L2 as they attempt questions involving both low-order and high-order thinking skills. These learners are always ready to use comprehension strategies to overcome anxiety and to avoid common errors such as poor inferences and poor spelling by copying directly from the given text. In Botswana, after four years of primary education, learners are expected to be able to read with increasing fluency, confidence and understanding. They are also expected to develop a personal reading culture for specific information and general knowledge. According to the

Lower Primary English Syllabus (Botswana Government Printer, 2010), learners should be able to infer meaning from different contextual clues but international assessments such as PIRLS have shown that this is an ideal that has not been achieved.

#### ***2.2.2.1 Reading Science***

Texts in different genres have different functions but the necessity of reading comprehension applies across all texts. The texts in different genres also differ in language use, and this influences the readers to use different strategies when they are responding to questions depending on the type of text and the type of questions. According to Rupp et al. (2006), reading comprehension exercises are problem-solving processes that require verbal reasoning unlike reading for non-assessment, which is fluid in the integration of propositions so that we end up with connected mental representations of a text. Osborne et al. (2016) show that reading, writing, talking, representing and doing are vital in the scientific enterprise where knowledge is also presented through diagrams and simulators. Therefore, reading and writing can be seen as literacy activities, which are important not only for practising scientists but also for comprehending the content and the nature of science as a field of study. As shown by Schroeder (2013), the goal of reading is to access meaning. Moreover, Tegegne (2017) points out that reading should be a habit as it determines the learners' success in modern society. Tegegne's (2017) study was conducted to assess the reading habits of students at the University of Gondar (Ethiopia) using a descriptive survey design. Data were gathered using questionnaires and interviews, and it was realised that the student's reading skills were poor as a result of the absence of reading habits, the lack of access to books and limited early reading experience.

Cartwright (2009) argues that for readers to comprehend a text, they must coordinate different text features fluidly to perform optimally. She suggests that cognitive flexibility has

crucial implications for understanding reading because there is a positive correlation between reading skills and cognitive flexibility. This is based on Piaget's ideas as Cartwright considered the complexity of representation and the specificity of domains in cognitive development, showing that cognitive development continues until someone becomes an adult. In this regard, experience has been highlighted in the production of cognitive change and people show cognitive development in those domains where they have more experience or knowledge.

In Africa where different education systems favour using colonial languages from lower levels of education, science is usually taught in English using learning materials developed in English. Therefore, English proficiency contributes to enhanced achievement in science in these contexts. One approach used in learning to read English refers to the grain size, which uses a string of phonemes or letters that a learner must process to be able to read (Schroeder, 2013). The grain size differs according to the transparency of the orthography. Therefore, children learning to read in a transparent orthography often develop reading skills faster than children learning to read in a language with an opaque orthography. Schroeder (2013) concludes by challenging the use of English-based research to guide reading pedagogies in African languages as English is structurally different from African languages.

Chi (2009) points out that collaboration in science lessons can contribute to enhanced academic performance because most learners can read a science text without understanding its content. According to Lin (2015), collaborative learning was first recognised in North America around 1970. Gokhale (1995) views it as 'an instructional method in which students at various performance levels work together in small groups toward a common goal'. This means collaborative learning promotes student-centred learning and can help learners become independent learners. Zhan et al. (2010) conclude that collaborative learning can improve

language comprehension as well as language production. This is one of the motivations for the objective of this research, which sought to determine how bilingual passages could enhance comprehension. Ammar and Hassan (2018) corroborated Zhan et al.'s findings and found that learners with both high and low proficiency levels learners benefited from collaborative learning. One of the challenges that these learners face is scientific vocabulary and academic language (Cummins, 2000). Words like "interaction" and "whereas", which cannot be categorised as science vocabulary, and which may be rarely used by students in everyday life, form part of academic language (Norris & Philips, 2003). Norris and Philips (2003) also highlight polysemous words, the meaning of which is context-specific. For example, the meaning of "energy" must be determined by learners from the context as the meaning in a scientific text differs from the meaning in everyday vocabulary. An additional problem is the fact, as Alexander and Jarman (2018) realised, that most children find science books boring which adversely affects readers' understanding. Therefore, the authors developed a science reading programme to encourage children to enjoy reading science texts. They gathered data at various times during the three years of their project and found that only a few students said they read science books in their spare time. Probably this was due to the unavailability of science texts at home, but 22% of the children claimed to read science texts at school (Alexander & Jarman, 2018, p. 81). After the reading challenge, more children found science texts interesting as they derived more pleasure from reading them.

Jiménez et al. (2015) show that using translation in science lessons allows learners to use their unitary linguistic system to make meaning of the texts they read, and this increased level of understanding means that they derive more enjoyment from their reading. In a study in Indonesia, Sinaga et al. (2017) assessed ways in which science texts could be made accessible to

secondary school learners to increase scientific literacy. The researchers wanted to find out how the readability of science textbooks could be improved by developing two prototypes of science textbooks to test if the draft textbooks increased the scientific literacy of the audience. The textbooks were developed using a model for writing teaching materials in which the secondary science curriculum was analysed, writing goals were formulated and elaborated using indicators, and material was selected and sorted according to the demands of the curriculum. The sequence of discussions in science textbooks was also outlined, concept maps created, outlines revised and concepts represented. In doing this, translation was used for cohesion, and the quality of the science textbooks was tested using teachers and experts because the books were to be used for comprehensibility and readability tests for secondary school learners. Subsequently, the drafts were revised, and instructional material was implemented in field testing to establish if there was a significant difference between the performance of learners using the new science textbooks and those using the standard textbooks. Sinaga et al. (2017) concluded that appropriately developed science textbooks could increase secondary school learners' scientific literacy. Therefore, the model of using instructional material in developing scientific literacy has a medium to high category of readability of the main ideas. However, this particular study overlooked the translation of textbooks in enhancing scientific literacy.

Csapó et al. (2012), elucidating on the diagnostic assessment frameworks for reading, explain that scientific research must be adapted to benefit students in the education system as individuals and in the system as a whole. They highlight the fact that the diagnostic assessment developed covers reading, mathematics and science because, on the one hand, a certain level of comprehension is needed in learning mathematics and science, but on the other hand, mathematics and science can enhance comprehension skills as they use text that does not follow

the literary style of assessing comprehension. It is necessary to consider these networks of relationships while learners are in the early grades or while they are responsive to stimulating factors. Therefore, it is best to treat these three domains: reading, mathematics and science in parallel as they enrich one another. The Programme for International Student Assessment (OECD, 2009) asserts that sentence comprehension is a precondition of reading for meaning because reading literacy involves understanding the text, reflecting on it and engaging with it to develop knowledge and participation in society. Hence readers should be able to retrieve information to understand it and integrate it, as well as reflect on it and evaluate it, just as in the PIRLS, which supports lifelong reading.

After conducting a study on reading fluency measurements in All Fast Track Initiative countries (EFA FTI) in 2010 Abadzi (2010) showed that the learners' oral and reading fluency can differ from their level of text comprehension. Piper et al. (2016) studied the relationships between learners' oral reading fluency and comprehension in four languages in Kenya: English, Dholou, Kiswahili and Gikuyu. The study involved analysing data that were collected before the study using the three-stage stratified random sampling which involves stratification, sample allocation and sampling in different districts in Kenya Central province. The main objective was to investigate if the ability to decode words in a certain language influenced the ability to decode words in another language. The researchers also studied the implications of the Kenyan language policy. They did this by assessing Standard 3 learners in English and Kiswahili, assuming that for a learner to be fluent in reading, they need to master both polyphonemic syllables and polymorphemic words. They found that some learners find it easier to read English sight words than words in Bantu languages because linguistic features such as phonology and morphology have an effect on reading fluency. Piper et al. (2016) found that in reading comprehension,

learners combine the information in the text with what they already know to construct meaning as they used bilingual texts to observe a statistically significant difference in the mean scores between the two languages. The results showed that children read more fluently in English than in Kiswahili or their mother tongue, but the learners' reading comprehension was higher in Kiswahili than in English. They concluded that the 'increased instructional time helps the children unlock the orthography challenges of English and gain some basic fluency. However, they are neither gaining proficiency in spoken English nor mastering English academic vocabulary.' (Piper et al., 2016, p. 146). It must be noted that all questions were answered orally in this study. In order, to expand this knowledge, the questions could be answered in writing to take into account other features such as spelling. Rupp et al. (2006) state that assessing reading comprehension with multiple-choice questions changes the comprehension process and therefore probed supplementary processes specifically for the testing context. They reached this conclusion after conducting cognitive interviews with ten adult participants who use English as their second language. They were interviewed about how they answer multiple-choice questions on a standardised language test. The interviews were analysed using quantitative and qualitative methods.

In this section reading is shown as a literacy activity necessary for comprehension of content. To read and understand a text the reader has to have cognitive flexibility. Other factors such as the orthography of a language has been pointed out as one of the properties that can affect the rate of development of reading skills. This aspect of reading is discussed in the next section. Furthermore, collaborative learning has also been identified as one of the strategies that can benefit second language learners even though they will still be faced with the challenge of understanding and acquiring scientific vocabulary. Jimenez et al. (2015) highlight the value of

translation in science lessons to embrace multilingualism by allowing learners to employ their unitary linguistic system to make meaning of the text as they read science in different languages and different orthographies.

### ***2.2.3 Orthography***

Another important factor to take into account when developing science textbooks is orthography, because children who are used to reading transparent orthography find it difficult to read opaque orthography (Rosebery, 2008). This negatively impacts learners' reading proficiency, their understanding of meaning and style and their academic achievement because 'the conceptual basis of the sciences is firmly rooted in language' (Rosebery, 2008, p. 109).

Ellis and Hooper (2001) elucidate that the orthographic transparency of a language can affect the acquisition and reading skills of learners after testing a hypothesis predicting that children who learn to read in a language with a transparent orthography should learn to read faster than those learning to read in a language with opaque orthography. Their study compared the rate of acquisition of opaque English and orthographically transparent Welsh using frequency-matched tests of written Welsh and written English to study whether Welsh children progressed further in reading English than Welsh. Ellis and Hooper's (2001) study also investigated whether the learners showed differences in reading comprehension abilities. They also studied the learners' reading latencies to determine whether they indicated different reading strategies. This was a longitudinal study of six primary schools in northeast Wales. Half of them were English-speaking and the other half were Welsh-speaking children in their second year of formal education. The questionnaire included a question about the learners' home language, and in one of the tests, learners read the workbook and individually answered questions. In other tests, words were sampled according to their frequency. Despite Welsh-speaking children's skills

in reading, the English learners showed exceptional comprehension ability. The errors were quantified, and it was concluded that there were no reading differences associated with transparency or opacity of the orthography and the differences in comprehension were likely a result of the bilingualism of Welsh children as they already speak both languages before starting school (Ellis & Hooper, 2001).

In their study Hanley et al. (2004) ensured that participating children lived in the same area and started reading at the same age using similar methods. The researchers purposively selected a sample of 46 Welsh and 52 English learners aged 11 from five classes. Testing material included 110 regular and irregular words, of which one-third were of high frequency, one-third of medium frequency and the remaining were words of low frequency. They also used non-word reading, word reading, rhyme judgement, phoneme matching tasks and reading comprehension to assess the reading speed of texts adapted from different tests translated into Welsh for the Welsh children. Hanley et al. (2004) concluded that in European countries, the reading skills of Welsh speaking children may be due to their age rather than transparent orthography. In a similar study, Spencer and Hanley (2003) realised a significant difference between English-speaking and Welsh-speaking children at the bottom end of the lowest performing 25% of learners, i.e., the fourth quartile. Analysis of variance showed a significant effect of language as Welsh children performed significantly better than English-speaking children. Spencer and Hanley (2003) also investigated the impacts of learning transparent orthography on the ability to learn an opaque orthography by comparing the reading skills of Welsh-speaking children with English-speaking children. The mean number of words read correctly was 90.1/100 ( $SD = 10.6$ ) by Welsh children and 87.7/110 ( $SD = 14.2$ ) by English children (Spencer & Hanley, 2003, p. 1402). This showed that learning to read a transparent orthography does not result in any challenge in subsequently

learning to read opaque orthography. However, it must be noted that Welsh children reading in Welsh answered 17.2/24 questions correctly ( $SD = 4.3$ ,  $F(1,96) = 4.19$ ;  $p < .05$ ), which was lower than English-speaking children reading in English as they obtained a higher comprehension score from the Neale (1989) test (19.1/24;  $SD = 4.7$ ). The English learners read aloud and more quickly than Welsh children even though it was realised that the opaque nature of English orthography negatively impacts the decoding skills. Therefore, learners learning to read in English need to be exposed to irregular written words for them to read fluently. This study revealed the two findings that necessitate studying the cognition of bilingual learners (exposed to both opaque and transparent language systems) in the conceptualisation of bilingual texts because, according to Spencer and Hanley (2003), a transparent orthography does not actually enhance comprehension of a text probably because opaque orthography emphasises semantic reading strategies compared to transparent orthography which fosters phonologically-based reading strategies.

In South Africa, De Sousa (2011) undertook a study to investigate how the acquisition of isiZulu as a first language could influence English reading acquisition as a second language. The study describes phonological awareness as the ability to realise and manipulate phonemes and views it as crucial in acquiring reading skills. This requires a linguistic analysis of the difference between languages such as English and isiZulu, as their orthography could affect the way learners organise the phonological representations. De Sousa (2011) used a non-experimental, ex-post facto group design to study 100 emergent bilingual Grade 3 learners to assess their phonological awareness skills, which are crucial in reading English as a second language. The researcher used the English phoneme test, a categorisation test, an auditory analysis skills test, the Weschler Individual Assessment test and reading comprehension tests to realise that English

reading outcomes as a first or a second language are related for phonological processing skills.

The research instruments showed that different reading strategies were determined by phonological processing skills when reading English as a first or a second language. De Sousa (2011) found that the learners' language background and orthographic transparency count in the reading acquisition of learners who speak English as their second language. Because the syllabic structure of isiZulu is highly salient and the orthography has a high degree of transparency, 'the emergent bilingual's English-only educational environment may be incapable of bridging the gap between EL1[monolingual English speakers] and EL2[English language learners] PA [phonological awareness] and reading skills' (De Sousa, 2011, p. 11). This necessitates providing reading instruction in isiZulu to allow phonological awareness development in isiZulu and to enhance it in both languages through the interdependence of the first and second languages. Similarly, Greenop (2004) shows that transparent orthography enhances the acquisition of reading skills while opaque orthography does not. However, it must be noted that De Sousa's study states that bilingualism can facilitate children's literacy acquisition because developing the learners' first and second languages simultaneously can facilitate second language learning. Hence, De Sousa (2011) concludes that using isiZulu as a medium of instruction alongside English is crucial.

Most African languages use transparent orthographies, whereas some languages like Chinese have opaque orthographies in which the graphemes do not directly correspond to phonemes. However, as shown by Piper et al. (2016), some learners may struggle to read African languages because even though they may use transparent orthography, there may also be opaque orthography. Schroeder (2013) examined the orthography of African languages and their context to determine pedagogical strategies that would be effective for future readers, considering that

proficiency in the target language is required in the reading process. This is because accessing the meaning of a text requires the ability to decode new words and blend sounds and syllables. According to Schroeder (2013), Kenyan educators have shown that Kenyan learners are expected to have four years of formal education before they can read to understand their second language. In Botswana, this is the level of learning at which learners in the fourth year of primary education sit for their attainment tests, which may determine the learner's progression to higher levels of learning or repetition of the fourth-year curricula after seeking the parents' consent. By highlighting linguistic factors in applying Anglophone strategies to African languages, Schroeder (2013) states that how people respond to pedagogy is affected by their languages and cultural differences. She points out the significance of socio-economic factors on the effectiveness of pedagogical approaches but focuses only on the orthography, phonological and morphological properties of languages used for learning and teaching.

Schroeder (2020) posits that the language gap is what contributes to the increasing gap in economic and educational aspects between Africa and the world. She undertook research to find out why the teaching of first language reading does not contribute to the successful completion of primary education. She also wanted to find out why learners cannot use their second language proficiently for learning at secondary school and how a reading transfer curriculum can help learners use textbooks written in their second language meaningfully. Schroeder (2020) goes on to show that most secondary students rarely understand what is written in their textbooks and struggle to write comprehensible essays in their second language. She continues to show that if the learner's L1 and L2 skills are developed in primary education, they could use second-language textbooks when they are in the secondary level of education. Therefore, the regional averages will improve, and learners will be able to sit for internationally accepted examinations.

The purpose of this would be to ensure that African learners use their languages at school. It can be implemented by ensuring that from Grades 1 to 7, learners use their first language to learn all the subjects while studying L2 orally, resulting in learning that shows significant progress through primary education and learners that display exceptional knowledge and attributes in all subjects (Schroeder, 2020).

Similarly, Jiménez et al. (2015) state that emergent bilingual learners bring different ideas related to their languages into school. These are usually spontaneous and text-dependent, but in most cases, they are usually unarticulated. This can be viewed as tacit knowledge that learners use in problem-solving. Researchers can observe and examine learners in these problem-solving activities to identify those spontaneous concepts. Singhal (2020) shows that second-language learners are usually challenged by decoding the basic meanings of words and sentences and this can limit comprehension of a text, which can be assessed through short answer questions that can come immediately after a reading passage. This applies to English and Setswana in the education system of Botswana, where Batswana learners are introduced to an intensive programme of “Breakthrough to Setswana”, which ensures achievement of basic literacy skills in Setswana by the end of the first year of primary education. However, as shown in Chapter 1, Batswana learners’ language of teaching and learning is abruptly switched from their native language, which has a transparent orthography, to English, which can be relatively perceived as having an opaque orthography.

In this section researchers hold different views towards orthography and its effect on reading fluency. Ellis & Hooper (2001) have shown that the orthographic transparency of a language can affect the learners ‘acquisition of reading skills because low proficiency learners benefited from reading transparent orthography. In contrast, Spencer and Hanley (2003) showed

that transparent orthography does not really enhance comprehension of a text. De Sousa (2011) found that in South Africa learners' language background and orthographic transparency can affect the reading acquisition of learners who speak English as their second language. Furthermore Greenop (2004) echoes De Sousa's (2011) postulations and Piper (2016) showed that even if the orthography is transparent, it may still be opaque and difficult for some learners. Therefore, it would be beneficial to promote the intellectualisation of African languages in order to allow access and enhance reading skills.

#### ***2.2.4 Intellectualisation***

To show that the language of teaching and learning can affect learners' academic performance, Perez and Alieto (2018) undertook research in the Philippines, where the language policy had recently shifted from English to Filipino – the learners' mother tongue. They studied how proficiency in the learners' mother tongue related to achievement in mathematics; to do this, they used a cross-sectional design for a descriptive correlational, non-experimental study of 71 learners aged six to eight from a public primary school. Data were retrieved from the learners' academic report cards, and they measured learners' proficiency in their mother tongue through the learners' grades in their first language which they studied as a subject. Learners' scores and grades were computed to determine the mean grade, and Pearson r correlation was used to determine the correlation between the learners' mathematics performance and mother-tongue proficiency. According to Willoughby et al. (2018), there was a significant correlation between mother tongue proficiency and performance in mathematics, and they therefore concluded that learners could better understand concepts in the classroom when they were taught in their mother tongue.

Obanya (2004) refutes an assumption claiming that African languages do not have scientific terminology for understanding the world today because concepts cannot be too abstract to be expressed in indigenous languages. Kishindo and Kazima (2004) are some of the researchers who claim that Chichewa cannot express scientific concepts as it lacks sufficient terminology. However, Obanya states that human languages are capable of coping with their immediate realities and can easily expand their repertoire to absorb new experiences. African languages have proved over the years that they can do this and have done so by digging deep into their linguistic resources and borrowing and adapting from other languages, as well as coining new words (Obanya, 2004). This necessitates the intellectualisation of African language so that they may become useful across all levels of education, in fact this is the definition of an intellectualised language (Sibayan, 1999).

Liddicoat and Bryant (2002) have also shown that intellectualisation can also be defined as the development of ‘new linguistic resources for discussing and disseminating conceptual material at high levels of abstraction’. This definition implies active language planning to develop the corpus for a language to be intellectualised. Developing bilingual texts contributes to the intellectualisation of a language, allowing it to be used in a wide range of educational subjects. Translation can be used in this process as a secondary term creation strategy. Even though Alexander (2007) states that mother-tongue education can be useful in the intellectualisation of African languages, there is no overt support for mother-tongue education in Botswana, as shown in the rationale section of this study (p.9). Therefore, since Botswana does not have a comprehensive national language policy, it is important to consider the level of intellectualisation of Setswana.

Finlayson and Madiba (2002) state that a committed national language policy is vital in intellectualising African languages. Authors such as Gonzalez (2002), Alexander (2007) and Madiba (2010) consider translation as an important tool in this process. Translation for intellectualisation is also needed in developing curricula that match the ever-changing perspectives of learners and their environment to enable the latter to communicate with confidence, as elaborated by Coyle (1999). This would also help avoid situations where content subject teachers teach language in class, reducing the coverage of content (Dalton-Puffer, 2007).

In addition to translation for intellectualisation Prah (2009) suggests that harmonisation of mutually intelligible languages would reduce the economic burden of promoting multilingualism through translanguaging in education. The main reason behind this is that planning for the inclusion of every language in a diverse setting can result in poor planning or no planning at all. This will likely result in the exclusion of the learners' first language in the classroom, which may cause emotional distress for learners as they can experience emotional difficulties when they are only allowed to communicate in a second language in which they are not sufficiently proficient. In this regard the reviewed literature shows that all languages can be intellectualised through translation so that the learning material can benefit everyone. This can start with the harmonisation of mutually intelligible languages as suggested by Prah (2009).

### ***2.2.5 Translation in education***

García et al. (2019) show that translation can be used as a strategy to empower bilingual learners to use their unitary semiotic repertoire for making meaning and to develop their agency as multilinguals. According to Pym et al. (2013), from the survey that they undertook across several countries, they realised that in addition to a positive contribution of translation in pedagogy, 'mental translation also takes place even if an activity does not involve explicit

translation', although it was realised that the contribution of translation is reduced when there is more than one first language in the classroom. It was also realised that while translation is commonly thought of as word-for-word or sentence for sentence, it can be pragmatic. It can entail conversational implicatures where the speaker makes implicatures from which the listener can make an inference. Finally, they found that there was less translation in primary education. Their research did not prove any contribution of translation fluency; it only showed that translation could positively influence comprehension and writing skills.

Leonardi (2010) posits that translation may be applied in different classroom activities: pre-translation activities that include brainstorming and vocabulary, translation activities that include writing, parallel texts, speaking and listening, and post-translation activities that include written or oral summary. This shows that almost every learning activity can involve translation. However, research on multilingualism rarely relates translation to the teaching and learning of language. In most courses, translation is dealt with separately from language teaching. According to Malmkjaer et al. (2013), this follows the model that considers translation and language learning as opposites. A second model treats translation and language learning as complementary because language learning is necessary to produce translators. The last model, and the one relevant here, posits that translation is recognised in the classroom as a skill that can be taught and learnt. In this regard, it is a fundamental skill for bilinguals' acquisition of a new language. Pym et al. (2013) also highlight the fact that translation in the classroom is usually avoided in teaching English as a second language. This may be exacerbated by the fact that grammar-translation methods of learning a second language have been highly criticised in literature even though language learning should naturally show connectivity between the first and the second languages, but competent readers vary their ways of reading a text depending on their

knowledge, the type of text and the purpose of reading. According to Shanahan (2014), students struggle to learn by reading content area texts like science and mathematics because their comprehension is limited by vocabulary and text structure. Successful course design involves surveying target competencies to be covered by investigating relevant texts to determine the perspectives of scholars. It also involves determining suitable instructional methods based on learning theories or findings in translation and interpreting studies.

Li (2019) points out that surveying learners' competencies and evaluating relevant texts are crucial in developing teaching materials. Some instructors choose to develop their own teaching materials, whereas others use textbooks since 'textbooks are published teaching materials by established presses and are produced by experienced instructors after trial implementation and revision in classrooms' (Li, 2019, p. 393). Macrosocial factors like language policy can influence teachers, learners and microsocial interactions such as communication between learners and teachers in schools. These social factors can influence how learners who are also learning English learn to make meaning from what they read. Therefore, Gavelek and Bresnahan (2014, p. 161) caution that 'nowhere are these microsocial practices more harmful to students than in content area classrooms where students are expected to read the textbook and develop disciplinary understandings'.

Scholars have differentiated between specialised and literary translation. Osborne et al. (2016) point out that science texts are multimodal and in English are usually written in the passive voice which may confuse learners who are not used to this kind of language. Since science textbooks are informative texts, it is important to support learners to access content fully without simplifying it. According to Osborne et al. (2016), this can be done using the three parts model before, during and after reading. For pre-reading, anticipation guides allow learners to

think and talk about their prior knowledge relevant to the context. During reading, activities could encourage reflection and students and teachers to monitor comprehension of the texts they are reading. The third aspect of this model involves post-reading strategies, allowing students to organise and summarise new information. Even though this model can improve the comprehension of science texts, it is important to include discussion as a social process crucial in meaning-making and making inferences from a science text. However, this may be hindered if the language of learning and teaching is a barrier as vocabulary plays a significant role in reading comprehension. This was realised in the 20<sup>th</sup> century through descriptive analyses, correlational studies, readability assessments and achievement test data. Freebody and Anderson (1983) proposed the following for the relationship between vocabulary and reading comprehension; 1) that the knowledge of word meanings causes reading comprehension, therefore, teaching vocabulary promotes reading comprehension; 2) that vocabulary shows general aptitude; and 3) vocabulary and comprehension show general knowledge or schema and hence the readers' knowledge influences reading comprehension. According to Graves (2007) for comprehensive vocabulary instruction, different language experiences must be provided, individual words and word-learning strategies must be taught and word consciousness must be fostered.

Recently Zasempsa (2019) studied multimodality to show that the multimodal approach can be used to interpret both literary and non-literary texts because multimodality as an interdisciplinary concept brings together interpretation, representation and even the way we perceive content. It could therefore also be used in translation studies. Furthermore, Zasempsa (2019) highlights that literary and non-literary translations overlap and should not be treated as opposites; multimodality can be used to study translatability and accomplish equivalence.

According to Krieger and Gallois (2017), the translator should understand their audience's needs and it is important to establish who will benefit from understanding science. Raney et al. in Heredia and Altarriba (2001) use Kintsch and Van Dijk's (1978) model of bilingual language in memory to explore the relationship between text comprehension and the models of multilingual language representation. They address the issue of whether processes used in reading one language are identical to those used in the second language and found that similar processes are employed when reading in each of the languages, but the reader uses different reading strategies according to their fluency in reading and the characteristics of the text. Raney et al. in Heredia and Altarriba (2001) also found that there is a separate representation of words and their meanings in memory and that interpretation is therefore based on the reader's background knowledge. Zhang and Webb (2019) undertook a study to investigate the effects of using bilingual texts on vocabulary learning. In this study, Chinese English learners read English-only texts and English with translated Chinese texts. After a pre-test and post-test, learners who used bilingual texts obtained higher scores on post-tests than those who read monolingual English texts. Therefore, Zhang and Webb (2019) concluded that bilingual texts are crucial in vocabulary learning. They also realised that the order of languages in a bilingual text does not affect the acquisition of second-language vocabulary and that bilingual texts could help learners understand content as the correct meaning of words is available from the beginning.

In one translation in pedagogy experiment set in a primary school, Ulanoff and Pucci (1993) used concurrent oral translation and a preview-review method in a language class of third grade learners who had mixed Spanish and English reading skills. They found that learners ignored the language they were less proficient in and concentrated on their stronger or strongest language, meaning that concurrent oral translation did not stimulate their skills in either of the

two languages. Students concentrate on their strong language because they feel they are wasting their time attempting to understand content in the weaker language or languages. This indicates a negative impact of translation on L2 pedagogies. In contrast, however, Prince (1996) posits that translation in language learning can improve learners' vocabulary although weaker learners may suffer due to their inability to transfer L1 skills to L2 contexts. Hence, the impact of translation in pedagogy depends on variables such as the type of translation employed, the measurement of success and different assumptions about learners' performance at different levels of education. In this regard, Kallkusf's (2013) research shows that using both learners' L1 and L2 for translation in the classroom does not deter any second-language learning acquisition. It promotes what Cook (2007) calls 'multicompetence', whereby the learner can draw from a knowledge base larger than the L2, although this does require more time.

Danan (2010, p. 454) states that 'translation is undoubtedly a significant communicative activity that can enhance second language acquisition. It is against this background that this study sought to identify how bilingual texts developed through translation could be used to enhance learning in both L1 and L2, bearing in mind that learners' attitudes contribute significantly to how they acquire the L2. It must be noted that most parents in Africa seem not to understand that learners' first languages are resources that they can use to acquire knowledge at school, whereas most learners believe that translation can help them in acquiring a second language (Liao, 2006). Translation can also be useful as a scaffold in lower levels of education. This was highlighted by Bird and Williams (2002), who show that learners who used subtitled material were better at word recognition and pronunciation. Other authors, like Borrás and Lafayette (1994), showed that subtitling enhanced learners' speech. Since translation involves two or more languages, various findings about the contribution of translation in pedagogy result

in different education systems handling these languages differently depending on whether they presume their separation or their unity in social or cognitive functions of language.

Different scholars support the use of translation as a pedagogical strategy to empower bilingual learners to use their unitary semiotic repertoire for meaning-making and to develop their agency as multilinguals. Pym et al. (2014) has shown that translation can play a positive role in pedagogy as it can be applied as an activity that involve the use of parallel texts (Leonardi 2010). The latest pedagogical model in multilingual settings recognises translation as a skill for bilinguals' acquisition of a new language and it is recognised as part of pedagogy (Zhang & Webb 2019).

### ***2.2.6 Embracing Multilingualism in the education system***

In the past, some scholars viewed bilingualism as a negative phenomenon, while others viewed it positively. Those who viewed it negatively believed that languages were compartmentalised, whereas those who held a positive view believed that bilingualism could have a cognitive advantage over monolingualism, as shown by Cummins and Swain (2014). In this regard, Grosjean (1989) warns against viewing bilinguals as two monolinguals because they simultaneously use their languages meaningfully. Van Avermaet et al. (2018), support the use of multilingualism in multilingual contexts to strategically support instruction and learning in education as it transforms hegemony into equitable and organised spaces that support different languages for knowledge acquisition. However, Van Avermaet et al. (2018) continue to show that most education systems currently practise assimilation as an ideal activity, and they support higher proficiency in the second language as an indication of positive language learning but less prestigious languages are rarely present in the education system.

Van Avermaet et al. (2018) discuss a longitudinal intervention of pedagogy that was conducted in four primary schools in Ghent, Belgium, from 2009 to 2012. This was called the Home Language in Education project. A mixed method pre-post intervention design was used, and the concept of Functional Multilingual Learning was introduced as a learning practice that transforms multilingualism into a didactic learning tool as it views learners' different languages as didactic capital to be invested in the learning process to enhance learners' development. Therefore, in Functional Multilingual Learning, the learners' repertoires are used as scaffolding to support learning. However, this does not require a parallel curriculum in the learners' first language. In addition, the teacher does not have to master the other language as learners can be allowed to do L2 paraphrasing. According to Van Avermaet et al. (2018), parallel tools can be digital to allow learners to access academic registers simultaneously in both languages. Half of the participating schools used limited L1 for reading and writing in Turkish. No fast effects were noticed in the two schools that adopted L1 intervention and Functional Multilingual Learning nor in the two schools that adopted Functional Multilingual Learning. At the end of the four years of intervention, kindergarten teachers showed that there was a limited impact, but the impact at primary school was non-existent. This was validated by semi-structured interviews. Nevertheless, enriched vocabulary and improved use of standard L2 were observed and the questionnaire showed that learners were more confident to share their views in class.

Macaro (2009) also studied how codeswitching affects vocabulary acquisition using an experimental approach where 159 Chinese students of English at secondary school were randomly assigned to two conditions. In the first condition, there were L1 words that the teacher knew the students did not know from the first pre-test of vocabulary knowledge, and in the second one, the teacher gave definitions of the words they did not know. The control group was

provided with codeswitching and paraphrasing. Macaro (2009) realised that it was important to give L1 equivalents of words while teaching for long-term vocabulary knowledge. He concluded that providing learners with L1 word equivalents sets free the processing capacity as it reduces the cognitive load so that learners can focus on the general meaning of a text. Lin (2013) suggests that an interventionist approach rather than a descriptive one results in studies that can highlight ways of improving codeswitching processes for better pedagogical purposes. Lin, therefore, urges researchers to be experimental in looking for ways of enhancing codeswitching and to critique hierarchies that we find in society because in traditional pedagogy, we find the teacher managing the whole class, and in progressive pedagogy, we find the use of different languages in student inquiry groups. Likewise, Marawu (2018) found out that by using codeswitching in the classroom, the teachers' language practices challenge the hegemony of English in the classroom. They concluded that codeswitching is a flexible strategy that can meet the demands of a multilingual classroom.

According to Simon (2001), codeswitching seems to have a momentary boundary-levelling effect in class as teachers mainly use it to signal different frames, identities and role relationships. In a much earlier study, Halliday (1994) states that codeswitching in class may help L2 learners access the L2 curriculum by switching to their L1 for translating, explaining, elaborating or exemplifying L2 content. It can also serve a textual function to highlight shifts in topics or to show a change in activities and interpersonal functions by signalling and negotiating change in frames and identities that symbolise in-group solidarity. However, Heller and Martin-Jones (2001) present a critical research paradigm that views these switches in the classroom as showing linguistic ideologies and hierarchies in the wider society. Goffman observed this as early as in 1974 when he showed that codeswitching in the classroom involves negotiation of

what should belong to front-stage and back-stage because it deals with the legitimisation of what belongs to which stage; front-stage is usually L2, valued, legitimised, and standard, while back-stage is usually for L1, which is marginalised and viewed as inferior. In this regard, Arthur (1996:18) states that Batswana learners use Setswana as a backstage language in the learning process since the system at that time supported using only English for learning and teaching.

Mukhopadhyay (2016) states that currently, in the field of bilingual cognition, it is believed that bilinguals have fluid languages in their repertoires; therefore, they often use their languages in codeswitching and translation, allowing them to access their linguistic resources in producing language. She suggests that L2 classes in India could adopt a bilingual instructional mode to avoid the two-solitude one where the learners' first and second languages are separated strictly to avoid any interaction between the two languages. Hence, she argues that 'L2 writing can be made meaningful, natural and accessible if L1 knowledge is exploited as a cognitive aid' (Mukhopadhyay, 2016, p. 236). Additionally, Zhang and Fang (2019) elucidate the exchange of talents and increasing economic globalisation and suggest that bilingual teaching should be implemented in Chinese colleges and universities. According to Piccardo et al. (2019), a plurilingual approach harnesses the advantages of using language awareness to consider interconnections and rather than pursuing the purist approach that only focuses on the target language, enabling learners to compete internationally. Zhang and Fang (2019) arrived at this conclusion after their study on teaching using an immersion bilingual mode and analysing its impact on college learners' knowledge and application. This showed that effective bilingual teaching in tertiary education could positively influence learners' English proficiency and their ability to apply what they have learnt. They also observed enhanced academic performance.

Haneda (2014) points out that an advantage of bilingual literacies is that they can affirm the learners' identity even though monolingual models are commonly adopted in sub-Saharan Africa. According to Makalela (2018), schools do this to guard against contamination between languages under the influence of orthodox language teaching policies. Makalela (2018) continues to show that these practices have influenced people to believe that multilingualism can cause mental confusion and that monolingualism is best for nation-building (see Baker, 2011). These beliefs have been proven wrong by the mobility of different language speakers leading researchers to question the significance of language boundaries (see García and Wei, 2014). According to García (2011), translanguaging in this context can enhance reading development by enhancing pupils' higher cognitive skills. This calls for background knowledge so that they may understand the text better. García et al. (2018) echo the same postulation as they argue for education practices that recognise and empower bilingual learners to practise bilingualism in the classroom from the bottom up, allowing the learner to use their full repertoire. They go on to show that translanguaging as a pedagogical tool can open multidialectal spaces to leverage the voices of multilingual children to learn in classrooms and multilingual spaces.

García (2020, p. 558) lists the following perspectives of literacy: i) the monolingual or monoglossic perspective, which focuses on a monolingual text and believes literacy is developed as a skill of cognition that builds on one language and, to show literacy performance, the teacher must read in one language or in two different languages ii) the translanguaging perspective which focuses on multilingual students to develop literacy by considering different contexts such as the social, economic and cultural. The only valuable resource in the monoglossic perspective is the verbal and written language as elucidated by García (2020). However, the translanguaging perspective of literacy focus is on the bilingual student and literacy is developed as complex

actions that are determined by different social, cultural, political and economic situations (Street, 2003). Biliteracy, therefore, can be seen when bilingual readers present themselves and their language repertoires to reading without concentrating on the language of the text. García (2020) argues that reading involves assembling all the reader's meaning-making resources and acting on them to enable themselves to read. The same postulation is reiterated by García and Kleifgen (2019) as they show that considering translanguaging in literacy puts the performance of multilinguals on centre stage. Therefore, bilingual readers ensure they use the potential of their meaning-making resources while reading. Meaning-making resources here can be verbal or visual. However, García (2020) goes on to show that teachers view literacy in a monoglossic way, even though the language of academic texts is not static.

Translanguaging does not focus on the language used in the text, but on the reader's languages and how readers engage with the text even though books are usually monolingual and categorised according to the language of the text. To show that translanguaging involves the full semiotic repertoire of bilinguals, García (2020) presents a study on translanguaging and reading among Latin American bilinguals who usually perform less well than their white peers in reading assessments, which only accommodate less than half of their linguistic repertoire. According to García (2020), this is caused by comparing these learners to their white monolingual counterparts. From a translanguaging perspective, these learners can become competent readers without paying attention to English or Spanish. This is because bilingual readers read in a translanguaging space without any boundaries.

In a recent study, Zhang and Jocuns (2022) used ethnographic research methods for six months to examine how translanguaging is practised in Chinese private universities. The participants were 28 second-year students whose home language was Mandarin Chinese. These

students were studying English as a foreign language for a career in English teaching. The study was conducted because, in China, most private university students have performed poorly as they lack foundation skills, knowledge and self-motivation. The researchers show that this is because their reading skills are not well developed as most English majors are emergent bilinguals with low proficiency in English even though English-medium instruction is preferred. According to Zhang and Jocuns (2022), this limits learners ‘comprehension in both L1 and L2; therefore, their participation and interaction in class activities remain minimal. Nexus analysis and protocol for field notes were used to examine recorded videos. As guided by the nexus analysis, Zhang and Jocuns’ (2022) research followed three phases. The first phase ran for one month, focusing on observing the classroom without any translation intervention. The second phase ran for four months and introduced observation of classes when planned translanguaging was used in reading. The final phase lasted one month and only dealt with analysing data and compiling research reports. During classroom observation, the actions of participants were analysed to identify the actions of the participating students. The researchers show that learners under observation used translation, smartphone apps, glossaries and bilingual books as tools in translanguaging to support autonomous learning. Smartphones were not used in a distractive way but were used as literacy tools. Also, translanguaging was used to elicit comprehensive answers, allowing learners to share their views about the content to comprehend the texts better, as the texts also helped the teacher measure his or her efficiency. Participants also used translanguaging to improve their L2 reading skills after the L1 reading skills. Zhang and Jocuns (2022) reveal that learners showed active engagement in discussions as learners’ L1 was used to manage learning behaviour, and they concluded that if translanguaging is used before a reading task, it means it can be used as a scaffolding for learners to succeed academically. Hence, a systematic

approach through translanguaging can be very useful in developing all the aspects of the skill of reading, which can be reading for assessment or reading for a justified purpose.

Yafele (2021) undertook a study to evaluate the effectiveness of using translanguaging to support reading comprehension and also to determine the impact of translanguaging strategies on reading comprehension at university. They used a qualitative approach involving interviews and observations to collect data from 25 first-year students. Their study ran for ten weeks as intervention was done to develop learners' comprehension of a text, and learners showed the cognitive benefits of translanguaging, including critical thinking. They also found that translanguaging positively impacted collaborative learning, enhancing comprehension of texts.

Yafele (2021) also observed the socio-cognitive effects on how students generated and developed their ideas. In another study, Velasco and García (2014) analysed fourth-grade classes of Spanish-English and Korean-English to examine translanguaging as self-direction in writing. They found that while writing, rules and mechanics are negotiated while focusing on organisation, features, goals and form. They also found that while writing, the audience's needs and perspectives are considered. Therefore, self-regulation needs a goal-oriented writer who is resourceful as well as reflective. This shows that bilingual learners can produce texts that show that translanguaging can produce bilingual fluidity in the writing process which can be seen by:

- i) Translanguaging in planning, using multimodalities in multilingual repertoire
- ii) Translanguaging in planning, vocabulary acquisition and glosses
- iii) Translanguaging in drafting, using multilingual repertoire
- iv) Translanguaging in drafting for word retrieval and transformation

v) Translanguaging in the final product, for rhetorical engagement and transduction

(Velasco & García, 2014, p. 20)

Wong-Fillmore's (1980) study shows that for engagement in the classroom learners preferred to use L1 in casual and intimate conversations in a bilingual class. Arthur (1996) also reached this conclusion by showing that Batswana learners preferred to use L1 backstage because language practices in the classroom were mainly influenced by the teacher and his or her control over the classroom's activities. Because learners mainly use L1 during seatwork Froehlich et al. (1985) suggest that language practices must be studied during collaborative work. This study, therefore, did not intend to analyse the occurrence of English or Setswana in the classroom by comparing frequency tables but rather to study their impact on learners' collaborative work and comprehension achievement. Unlike some researchers who focus on functional categories of L1 and L2 in a bilingual class, this research does not view the functional categories as stable, and therefore adopts Li Wei's moment analysis to study the moments when learners' language practices change, enabling them to achieve what they wanted to achieve. Johnson (1989) shows that the teacher or learners may use their first language for informal conversations, 'informal aside', to emphasise a command or to enforce it by breaking away from English pedagogy. This is usually done to relay urgent communication.

The programmes of Mandarin Chinese as a foreign language have shown a high number of international students learning Chinese, and in most cases, they learn this language after they have a high level of proficiency in English. According to Wang (2016), this has resulted in linguistically diverse classrooms that employ some strategies that go beyond a monolingual teaching approach. Wang (2016) continues to show that most Chinese teachers educated in the Chinese Education system rarely encourage learners to express their ideas and therefore Chinese

is usually avoided as it is deemed detrimental to L2 learning. The researcher focused on beginner classes to understand the students' attitudes, teachers' attitudes and language practices. Mandarin Chinese foreign language students used a bilingual questionnaire in English and Chinese, and the teachers chose to be interviewed in Mandarin Chinese. Beginner classes of the interviewed teachers were observed and audio-recorded to determine language practices in the actual classroom setting. Wang (2016) used translanguaging in Mandarin Chinese foreign language classes to explain and elaborate new vocabulary or cultural meaning, to manage the class and for interpersonal strategies. The researcher found that the teachers' and students' attitudes towards translanguaging showed some techniques of practical scaffolding to enhance collaboration in the classroom. Therefore, translanguaging gives international students a chance to voice their ideas in the languages they are proficient in (Wang, 2016). To respond to the plurilingual view of language teaching and learning, the researcher states that there must be knowledge renewal on language teaching facilitation of structured translanguaging strategies and the development of a transformative teacher-student role.

Gort and Pontier (2012) present the language practices of four Spanish/English dual language teachers at preschool by analysing the teachers' mediation of bilingual interactions with learners. Early childhood education supports interaction between learners and teachers. As a result, to support bilingual proficiencies, teachers should create an environment that engages learners in real life conversational situations. This, according to Doherty et al. (2003), enhances the learners' higher-level cognitive skills, which could enhance their achievement. In doing this, teachers use sheltering strategies to enhance learners' comprehension and to ensure the interaction of children from different language backgrounds as well as the interaction between students and teachers. Gort and Pontier (2012, p. 3) state that 'this is an approach in which

teachers modify and mediate instruction to make language and content comprehensible to students learning in a second language'. This approach supports monolingual instruction by employing different strategies to aid comprehension without translation. It may involve simplifying the teachers' utterances to the level that learners could understand. This research shows that teachers strategically used languages to manage the classroom. Teachers scaffolded communication through bilingual interactions, provided support by using bilingual interactions, and managed students and activities through bilingual interactions. Finally, Gort and Pontier found that regardless of whether teachers chose a monolingual or bilingual mode, they frequently used bilingual interactions in English and Spanish language learning activities, accepted any language used by the children and rarely corrected their language. These findings show that integrating two languages can be used as a pedagogic practice to promote dual language development of bilingual learners as they support linguistic, socio-cultural and educational functions.

Owen-Smith (2010) shows that most learners with African languages as their first languages do not usually proceed to tertiary institutions; this is often caused by poor academic language proficiency leading to academic failure. Owen-Smith (2010) observed that using the learners' first language alongside English can positively impact their academic performance. Rajendram (2019) undertook a study in Malaysia to determine the affordances of employing the learners' whole repertoire in collaborative learning among Grade 5 multilinguals in an English language classroom. The researcher also sought to determine the learners' reasons for translanguaging in collaborative work. In this context, monolingualism is supported in language classrooms, but teachers are always translanguaging to manage their classes, to qualify some concepts or to help learners understand the content. Rajendram (2019) views translanguaging as

a social practice with the potential to be used as a collaborative pedagogy for English language learners. She found that cognitive-conceptual affordances deal with understanding content and planning organisational affordances, which were used to plan and organise roles. Rajendram also realised that cognitive-social affordances build rapport by engaging peers and supporting them emotionally while linguistic discursive affordances deal with employing linguistic strategies to attempt a task and to support the learners' linguistic and discursive knowledge.

To study the cognitive-conceptual affordances Turnball (2019) undertook a study with two classes of first-year Japanese students, 30 students in each class, who learnt English as a compulsory subject. The students were between 18 and 20 years old, had an intermediate English proficiency level and had learnt English for at least seven years. Each class of participating students was split in half and allocated to the academic writing or creative writing group using simple random sampling. Some had to work in monolingual English, others worked on a weak form of translanguaging using English and Japanese, and the rest employed a strong translanguaging process using the same languages. They were only supposed to discuss using the three specific language practices of monolinguals, weak translanguaging and strong translanguaging, and they were supposed to write their work in English only. Qualitative conversation analysis was used to analyse learners' group discussions, and their composition scores were analysed quantitatively to realise there was a significant difference between the monolingual, weak translanguaging and strong translanguaging groups. Turnball (2019) concluded that foreign language learners score better when they engage in strong translanguaging when planning their English compositions than those who use monolingualism. The strong translanguaging groups scored the highest composition marks. Their discussions were fluid, and they did not struggle with vocabulary or lexical differences. They were able to pull on

resources from both English and Japanese to use bilingual problem-solving skills but those in monolingual groups had incoherent discussions that were broken and indefinite.

Makalela and McCabe (2013) similarly view multilingualism as a resource that can effectively be used to enhance students' performance. In this regard Makalela (2018) designed a Sepedi course after being influenced by *Ubuntu* to highlight pedagogical principles of translanguaging. In doing this Makalela (2018) shows that translanguaging has been used to teach Sepedi to South African university students, formulating the concept of *Ubuntu* translanguaging pedagogy to show that the translanguaging phenomenon is applicable to interdependence of languages. The scholar realised that before the Bantu separated at the Limpopo valley, they were connected by the value of *Ubuntu*, which uses a philosophy originating from the belief that all people have a common origin. *Ubuntu* was practised in the Limpopo valley and as part of the culture the languages functioned interdependently. It should be noted that the multilingual practices of *Ubuntu* were interrupted by colonisation, which brought colonial languages to Southern African spaces. but using the cultural competence of *Ubuntu* translanguaging can improve learning experiences as it reaffirms the students' identities (Makalela 2018).

Using a mixed methods design, Mgijima and Makalela (2016) conducted a quasi-experimental study to examine the efficacy of using the learners' L1 and L2 in bilingual Xhosa/English classes. Their study shows the effects of using translanguaging to enhance inference skills during reading in Grade 4. Therefore, they have to be taught inferencing skills in lower grades to enable them to make correct inferences in the reading texts. They have shown that many teachers deem teaching inferencing skills to be a difficult task, but according to Mgijima and Makalela (2016), a translanguaging model can be used to facilitate strategies of

inference-making by using the learners' L1 and L2 in the same lesson for Grade 4 learners. In undertaking the quasi-experimental study, Mgijima and Makalela (2016) state that simultaneously using two languages in the learning process could reflect the learners' identities positively, encouraging them to consciously engage and take ownership, resulting in deeper understanding and desirable outcomes of the process (Mgijima & Makalela, 2016).

For data collection Mgijima and Makalela's (2016) observation and field notes to collect qualitative data and pre-tests and post-tests were used to collect quantitative data. They used a quasi-experimental design to determine if participants' behaviour changed after being exposed to some kind of intervention. Therefore, the pre-test and post-tests were used to determine the difference between comprehension and the ability to draw inferences from texts which were presented separately in isiXhosa and English. Intervention here involved co-teaching the class with subject teachers during class time in English and isiXhosa lessons for two weeks for five hours in total. The participants were observed to note their behaviour during the exercise. They selected one rural school in quartile two in the Matatiele district because schools in rural areas usually perform poorly in national assessments. Purposive sampling was used to select these schools by looking at their linguistic characteristics. The scholars state that they chose Grade 4 because learners in this grade were transitioning from isiXhosa to English as the language of learning and teaching. The reading passages were presented with open-ended questions to assess comprehension and learners' higher cognitive skills. They used functional reading passages about animals adopted from the learners' textbooks. First, the teacher read the passage aloud as the learners read silently so they could answer questions using the same language in which the questions were asked, following South Africa's assessment policy. Learners in the experimental group were taught to draw inferences using a passage from the learners' textbooks and an online

source. IsiXhosa and English were used in different sentences within the same paragraph of the same text. They used short passages read in one language and answered in a different language. Learners were asked to make predictions about the text to be read, and while they were reading, the teacher checked the learners' predictions to redirect or verify them. This was done by providing guidance on using prior knowledge and information from the text to arrive at the correct inferences. When the teacher finished reading, learners read the passage, collaborated about the passage they had read and summarised the passage in a few sentences. This study used translanguaging to guide learners to apply prior knowledge to draw inferences from the text. They were given a chance to use one of their languages to give the answers, and SPSS Statistics was used to compare pre- and post-tests to determine the effects of translanguaging on the learners' ability to use prior knowledge. An alpha value of .05 was used to measure the significance of the differences. Learners' performance was better in the post-tests than in the pre-tests. The results showed remarkable gains in both the isiXhosa ( $t = -9.831$ , df 60;  $p < 0.005$ ) and in English ( $t = -8.047$ , df 60;  $p < 0.05$ ) (Mgijima & Makalela (2016, p. 93). This showed a positive contribution of translanguaging intervention to learners' performance in both languages. It was concluded that translanguaging enhances learners' comprehension as it enhances their inferential skills by supporting their application of background knowledge when reading. The learners could draw relevant inferences when reading in both L1 and L2. They did not observe any mental confusion in the participants using the translanguaging model. The limitations encountered were that the teachers read out the passages, but in actual examinations, learners read for themselves, only the ability to draw inferences was covered, and other language skills were not assessed as in the examinations. Also, data from the control group were discarded since one of the teachers interfered with the results by giving the correct answers to the learners. The

results could not be generalised since participants did not represent all Grade 4 learners in South Africa, but it must be noted that the results are valid as a significant number of students were used to collect data. The researchers show that few groups in English exercises could have been influenced by low proficiency in L2 since drawing inference is regarded as a higher cognitive skill. They also concluded that reading trajectories in multilingual classrooms can be enhanced by engaging multilingual approaches like translanguaging. Mgijima and Makalela (2016) end their article by calling for more studies to strengthen the use of translanguaging in developing learners' higher-order thinking skills.

This article has been presented extensively since it sought to study the efficacy of translanguaging in a Standard 4 class by using a quasi-experimental design. As shown in Chapter 3 of this study, the study employed the same quasi-experimental design using a mixed method approach and counteracting Mgijima and Makalela's (2016) limitations by using both the low-order and high-order thinking skills questions in both the pre-test and the post-test comprehension and by including learners from different linguistic backgrounds, which are a Setswana predominant village, an English predominant city and a minority language predominant village.

In a similar study conducted in South Africa, Sefotho and Makalela (2017) sought to investigate the extent to which multilingual learners read texts in cognate languages. Sotho cluster language learners' ability to read texts in another language different from their home language, but in the same language family, was assessed. The Sotho cluster comprises Sepedi, Setswana and Sesotho languages, which are mutually intelligible. In their study, Sefotho and Makalela (2017) considered how heterography could be normalised to embrace multilingualism by using 60 participants from middle grades in one multilingual elementary school in Gauteng.

The mean age of these learners was 11 years, and they spoke at least one Sotho language as their home language. Sefotho and Makalela (2017) used stratified random sampling to ensure equal representation of the three Sotho languages in the sample. They used bilingual reading comprehension tests. Oral spelling-picture mapping was assessed through dictation. They read out words like *folaga* (flag), *pula* (rain) and *bolwetši* (illness), which appear in the three languages but with different spellings. The researchers wanted to assess Sepedi speakers' performance compared to the performance of the other two languages as the participants were to write the spelling of words and match the words with the pictures that were provided. The other tests involved written word-picture matching and reading rate. Finally, learners were asked to attempt five comprehension questions after reading the passage to the end. The comprehension assessment was presented as multiple-choice questions. Descriptive statistical procedures were used to determine variability, dispersion and central tendencies. The T-test was also conducted to measure differences in the means of Sepedi learners and other language speakers using alpha .05. In the listening comprehension, Sepedi learners had a mean score lower than that of Setswana and Sotho language speakers ( $t = 3.406$ ,  $df = 29$ ;  $p < .05$ ) (Sefotho & Makalela 1017, p. 47). The null hypothesis, which stated that there was no variation according to differences in languages was rejected. Therefore, they concluded that the three languages were unrelated to learners' performance in reading because there were no significant differences between learners' scores across the languages. For example, in the oral word-picture mapping, there was no significant difference between the groups, even though the Setswana/Sotho group outperformed Sepedi speakers at an alpha value of .05 ( $t = 1.793$ ,  $df = 29$ ;  $p > 0.05$ ). In the picture-word matching test, there was no significant difference between Sepedi and Setswana/Sotho groups ( $t = 0.069$ ;  $df = 29$ ;  $p > 0.05$ ); therefore, the null hypothesis was accepted, which stated that there would be no

variation between the two groups. The reading rate test also showed an insignificant difference between the Sepedi and Setswana/Sotho groups even though the Sepedi group outperformed the Sesotho/Setswana group; therefore, the null hypothesis was supported. In the literal comprehension task, Sepedi learners outperformed the Setswana/Sotho group, but there was no significant difference between the groups ( $t = -1.095$ ;  $df = 29$ ;  $p > 0.05$ ). In this test, the null hypothesis was accepted to conclude that there was no differential performance in reading or comprehension between the two groups. Since the researchers found comparable performance in all the texts, they concluded that Sotho, Setswana and Sepedi speakers can fluidly use these languages as there was no linguistic difference between them. This case challenges the validity of language boundaries as it supports harmonisation of languages' orthography for translanguaging to promote emergent bilinguals' access to education.

According to Olsen (2000), emergent bilinguals may have difficulties in English-only classes, negatively affecting their learning process. Similarly, MacIntyre and Gregersen (2012) have shown that foreign language learners' emotions can be triggered, resulting in negative emotions of anxiety, apprehension or fear when learning a new language. In this regard Back et al. (2020) conducted a multiple case study to show how translanguaging can be used as a scaffolding for emergent multilinguals' emotional well-being. The research was conducted in two rural schools to answer the research question that sought to understand how translanguaging can mediate emergent multilinguals' emotions by alleviating anxiety in language learning and reducing negative behaviours. They found that in second-language learning, the teacher may use verbal or non-verbal emotional scaffolding strategies, which include translanguaging. However, Vaish (2019) comments on the challenges that the teacher faces in constructing translanguaging space for learners who are struggling to read English by showing that sometimes the teachers'

improvisation does not bring the expected results because improvisation in translanguaging is rarely analysed in teacher talk. Another challenge of improvisation in a translanguaging classroom are diversity in the classroom as some learners have negative attitudes towards their first language and the culture of pedagogy (Vaish 2019). This can limit their creativity and criticality in a translanguaging even when the teacher tries to use a translanguaging perspective in the class.

In analysing translanguaging Li Wei (2011) uses moment analysis to critically analyse the creativity and criticality of translanguaging learners' language practices as he views multilinguals as active agents who can merge different structures that have been artificially constructed in the society. According to Li Wei (2011) moment analysis focuses on multilingual individuals and their creativity and criticality as they interact in the translanguaging space within which they create their own translanguaging space. Escobar (2019) shows that planned translanguaging can work well for emergent bilinguals. The researcher conducted a translanguaging study by designing activity with senior students who were studying English as a foreign language at a Costa Rican university. This activity supported the learners' linguistic resources since it involved projected pictures of street graffiti, and students were asked to discuss what they could see using their whole linguistic repertoire. The students tended to speak English only when they were around their lecturers. Data were transcribed, and learners were interviewed. Data were analysed through discourse analysis. The results showed that the students were conscious of mixing languages at first, but they gradually fluidly communicated using both languages without hesitations or unnatural pauses.

Prada (2019) found that translanguaging could transform learners' attitudes towards their first language. This was reiterated by Johnson (2019), who presents research which was

conducted to generate knowledge on the application of translanguaging as a pedagogical resource in learning and teaching. The data were collected in a fifth-grade class using ethnographic fieldwork, consisting of recorded observations, field notes and photos. They realised that the teacher often used translation in one class to explain and clarify content by reproducing it in another language. In this research, they found that translation was used to ensure that everyone understood the lesson. Repetition was deemed important in learning, and here it was done through translation. The participating schools used ‘double monolingualism’ whereby languages were used together but separately in a parallel form (see Jørgensen, 2008). Johnson et al. (2019) concluded that translation could enhance the learning of L2 because it is a communicative activity. In achieving this, it must be combined with other teaching approaches. Even though it may be practised in second-language classrooms, it is rarely appreciated in the curricula. It can be applied as scaffolding in the early years of L2 acquisition if it is viewed as a form of communication or the fifth skill of language as it has a measurable impact. This means it can be tested empirically in CLIL or intercomprehension, for example. It should be viewed as mediation; therefore, teachers and students are encouraged to experiment with translation (Johnson, 2019). Creese et al. (2017) state that translation loosens the boundaries between languages as learners use it to ensure clarity in comprehension, enhancing inclusion, comprehension and participation in learning.

Similarly, Vasilokonstantaki (2019) emphasises that translanguaging binds the two languages together and allows the learners to put their full repertoire into use; therefore, it should not be viewed as a threat to other languages. This means that translanguaging is effective in bridging the language gap as it ensures educational equality. This is shown by Mbirimi-Hungwe and Hungwe (2018), who report on translanguaging as a language practice in a computer science

class in South Africa. They undertook this study after realising that most lecturers complain about poor reading skills and poor reading comprehension amongst students in tertiary institutions. Mbirimi-Hungwe and Hungwe (2018) posit that in most cases, this challenge is caused by using English, which is some learners' second or third language, as a language of learning and teaching. Therefore, in this case, where universities still prefer policies that promote monolingualism, the authors consider translanguaging as a possible model to be used by multilingual students as a strategy to ensure enhanced academic performance. In this study, a computer science lecturer and English subject lecturer aimed to determine if translanguaging could assist learners in understanding science concepts because learners in the BSc computer science course found it difficult to grasp technical and abstract concepts. The presented study was actually conducted to find out if using glossaries and translanguaging had any positive impact on comprehension of difficult concepts. Descriptive statistical analysis was done to analyse close-ended data on the questionnaire and qualitative analysis was used for open-ended responses. Most learners spoke Setswana, and only a few spoke Afrikaans as their home language. The majority of learners showed that they benefitted from translanguaging as a pedagogical practice. Learners felt more confident when they were given a chance to use translanguaging. Therefore, the authors recommended translanguaging to all lecturers across faculties. Even though some students acknowledged the benefits of translanguaging, the same learners felt that English should be monolingually used in reading and writing course content.

In another study, Ngcobo et al. (2016) found that translanguaging can develop learners' literacies in African languages and English. The researchers viewed translanguaging as a language practice promoting multilingualism and justice since their study sought to understand the participants' views on translanguaging in writing summaries in academic literacy lessons. To

support learners' literacy development, the researchers point out that learners can be encouraged to do collaborative activities using their home languages when a text is presented in a predominant second language. They say that this does not require the teacher to be proficient in the learner's home languages as they can back translate, but the challenge is that when learners cannot speak African languages in the African context, they will feel excluded. Ngcobo et al. (2016) reiterate the value of bilingual texts as they state that the texts can be used to close this gap so that at least most learners can participate. Participants showed that they used translanguaging to complete the task of summarising, which they did in isiZulu and found that it was easier than in English. Their responses showed that translanguaging enriches vocabulary, as well as the criticality and creativity of multilingual learners.

To demonstrate support for translanguaging in multilingual classes Rowe (2018) shows how multilingual e-books have supported emergent bilingual students' translanguaging practices by valuing students' languages and cultures, modelling translanguaging, providing authentic opportunities for multilingual communication, using two-way translation, composing dual language texts and linking learners with multilingual audiences. In doing this, Rowe (2018) further shows that teachers can support multilingual learners in different ways by drawing on the learners' abilities and creating classroom spaces that support the learners' biliteracy development to leverage and enhance their literacy skills. España (2016) concurs as she emphasises that if bilingual students' translanguaging practices are acknowledged, they can benefit from technologies that use their language practices by involving their full repertoire through translation applications. Meanwhile, Kibler (2010) shows that bilinguals can apply their knowledge of both languages to enhance their literacy skills. This necessitates using bilingual texts in content subjects and therefore calls for a translanguaging perspective on literacy. As

shown by Li (2011), this will mean going through the borders of structures because translanguaging is a transdisciplinary approach which transforms its users' attitudes and beliefs.

Reviewed literature shows that even though some education systems have begun embracing multilingualism through translanguaging, the majority of them still practise assimilation as they support a high level of proficiency in the second language. These systems only embrace multilingualism to a limited extent as they do not consider the learners' repertoires useful in the learning process. In these educational settings codeswitching is viewed in a negative way as learning and teaching is conducted in a prescribed language which is usually the learners' second or third language. This can be observed in traditional pedagogy which separates languages. However, some researchers like Lin (2013) endorse codeswitching and suggests ways of improving it for pedagogic practices. Most recently García and other scholars who support translanguaging as a way of embracing multilingualism have shown that even though codeswitching supports multilingualism to some extent, it actually applies a monoglossic perspective toward multilingualism as it separates the languages that are used. They support a translanguaging perspective which recognises the learners' repertoires for inclusive education which promotes equity and participation of learners which results in enhanced academic performance. It is therefore crucial to study literature on language in the education system of Botswana to see how the education system of Botswana embraces multilingualism.

### ***2.2.7 Language in the education system of Botswana***

In Botswana, scholars like Nyati-Ramahobo (1999), Maruatona (2002) and Batibo (2006) have written extensively on the language-in-education policies that favour English. The current Language-in-education Policy included in the Revised National Policy in Education 1994 requires learners to switch abruptly from Setswana to English as a language of teaching and

learning in the second year of primary education. This may result in poor CALP, disruption in language acquisition or loss of interest in schoolwork (Ball, 2010). A language policy that separates languages reveals a gap in language planning at the macro level. According to Nyati-Ramahobo (2000), formal language planning in Botswana ended in 1997 when a report by the Botswana Languages Council was not approved just after the then National Setswana Language Council was asked to change its name to the Botswana Languages Council. This shows that Botswana, as a national state, denies the highly prevalent multilingualism in Botswana proven by research. Perhaps it is necessary to undertake a research study that will provide empirical evidence on the benefits of embracing multilingualism through translation in education.

The case of language-in-education in South Africa is similar to Botswana, where Kasule and Mapolelo (2005) state that a monolingual policy in a multilingual context may compel the teacher to employ strategies to enhance learning English in a mathematics class. The authors also point out that learners use their first languages to have a view of the world as they use it to simplify the ‘abstract nature of classroom learning events’ (Kasule & Mapolelo, 2005, p. 602). These results are not only prevalent at primary education levels, but learners carry them to higher levels of education where concepts are more abstract. At the University of Botswana, Chimbganda (2000) found that most learners show low-level English proficiency, which means they employ strategies such as avoidance, semantic simplification and risk-taking in biology assessment. Most of them do not perform well because ‘...one of the major skills required for success in scientific discourse is the ability to write scientific ideas with reasonable accuracy and precision’ (Chimbganda, 2000, p. 327). This may also signal low CALP at the tertiary education level. It calls for exploring secondary term creation in science to determine developments or regression so that relevant intervention strategies may be implemented.

In 1996, Jo Arthur undertook an ethnographic study to understand the interactions between teachers and learners in the sixth year of primary education in Botswana's North-East District, where minority languages are predominant. According to Arthur (1996), English is treated as a prestigious language, and Setswana and minority languages are marginalised in Botswana's education system. This is still prevalent, as shown by Batibo (2006). Arthur (1996) observed participant-related codeswitching, which teachers used to control their class, for example, to encourage student participation. She realised that only the teacher had the liberty to switch from English to Setswana, but the students were not free to do the same. Even though Arthur (1996) views this as staging, it may be viewed as the effect of negative emotions such as anxiety, which can be triggered by using a language in which learners are not proficient for learning and teaching. As shown by Back et al. (2020), involving the learners' whole language repertoire has been shown to alleviate negative emotions associated with English-only classrooms. Pekrun et al. (2006) state that students' emotions in different academic contexts can affect the way they think and their motivation, as well as their actions. Pekrun et al. (2011) show that positive emotions always enhance academic performance, but negative emotions almost always lead to failure as they impede learning. Silwal (2021) echoes this by stating that using L1 in teaching and learning can help reduce fear and anxiety since using the learners' first language could develop their writing skills. In the observed lesson, Silwal (2021) realised that the teachers used the translation method and had no other pedagogical ways of using the learners' first language to encourage participation.

Arthur (1996) views codeswitching in Botswana as staging because the teacher seemed to access Setswana as the back-stage language since they are the directors of their classes. She collected data using audio recordings of primary school year six lessons in two schools. In one

school, there was no perfect match between the learners' and teachers' language repertoires. The teachers were under pressure to follow the English-only policy in the classroom, and they only used codeswitching to fill the communication gaps with their learners. This means that even though the teachers have the liberty to control the language practices in the classroom, they do so under the influence of policy. For learners, recitation routines were prevalent in lessons. Arthur (2001) views these as the results of conventions during colonial rule; most teachers could not acknowledge the functions of codeswitching in the classroom because they viewed it as a deviation from the prescribed policy. The teachers would use it to praise or reprove their learners or to get the attention of the class. Therefore, in the context of Botswana and according to Arthur (1996), teachers depend on codeswitching to provide contextualisation cues indicating discourse-related switching. They use participant-related switching to encourage pupils to participate in class and as intercomprehension strategies. Since textbooks are monolingually printed in English from the second year of primary education, it is important to identify how language practices could enhance intercomprehension between the learner and the text they must engage with. In her study, Arthur (1996) found that teachers used codeswitching as a hetero-facilitative strategy as it added no new information to content but was just used for repetition to facilitate learning. However, in return, learners did not codeswitch, which could be viewed as a self-facilitative strategy. In one instance, a learner apologised for failing to respond to the teacher's question as it was asked in English. According to Arthur (1996), Batswana learners have internalised rules that prevent them from codeswitching, which could enhance their class participation. Another observation was a recitation of answers in classes where the teacher asked questions and learners would answer as a group or individually. The author draws some similarities between this and stage performance, when the teacher acts as the director or the stage manager as he or she calls

the learners to answer questions. English was mainly used on stage, and Setswana was used as a back-stage language. There was also ‘chorus completion of teacher’s statements’ (Arthur, 1996, p. 26), which learners used to fill the gaps because when they are called to answer individually, they are usually unsure because of poor content or grammatical errors. Arthur (1996, p. 29), therefore, borrowed McDermott and Tylbor’s (1983) term ‘safe-talk’ to describe the language practice of chorusing, used as a style of teacher-learner interaction. According to Arthur (1996), this indicates collusion of teachers and learners as they try to deny the realities of low proficiency or lack of content understanding. It was observed that learners normally used Setswana or Ikalanga outside the classroom as a back-stage language.

In another study published in 2001, Arthur shows that using English for learning and teaching is challenged by Setswana and Kiswahili in Botswana and Tanzania, respectively, as they are lingua francas in these two post-colonial African countries. Even though English is an official language in Botswana, it is only spoken by a minority of the population as their first language. In Tanzania, English functions alongside Kiswahili as an official language. Arthur (2001) observes the roles played by these languages through the lenses of diglossia and states that English occupies the higher position as the more prestigious language in both countries. This puts Setswana in the middle position above all other indigenous languages often referred to as minority languages. Arthur (2001) observed that even though English is given a high status in Botswana and Tanzania, proficiency is very low in these countries. Tanzania used English only as a language of teaching and learning at the secondary level of education, but in Botswana, English was used as a language of learning and teaching from the lower levels of primary school. Despite this, Botswana classrooms were characterised by codeswitching and teacher-centred routines. In Tanzania, secondary school learners were free to switch from English to Kiswahili,

but in Botswana, only teachers were free to switch from English to Setswana. Arthur (2001) emphasises that classroom interaction in Botswana and Tanzania are teacher-centred so that the teacher can control the classroom's language use to make the classes closely resemble English-only classrooms. However, during collaborative work, learners use their home languages, which they bring into the class through the 'back door' (Arthur, 2001, p. 355). This highlights the need for embracing multilingualism in all aspects of learning so that learners can fully participate in learning using their entire repertoire. In Tanzania, there is already an ongoing project that seeks to close the gap between Kiswahili and English in secondary school as it recognises the value of language in developing learning materials (see Barrett & Bainton, 2016, William & Ndabakarane, 2017 and Gabrieli et al., 2018). It must be noted that applying the diglossic model to language use in Botswana is challenging because language use in Botswana is rapidly changing, and there are some overlaps of different languages into different domains.

Mokibelo and Pansiri (2021) state that Batswana preschool learners are taught in English and Setswana or their home language, but in the first year of primary education, according to policy, they use Setswana only. The researchers show that there is a challenge when learners use English and their home language at preschool and abruptly switch to Setswana in the first year of primary education. This is one of the communication problems that limit learning in these contexts. Mokibelo and Pansiri (2021) noted that teachers in urban areas prefer to use English from the first year to avoid transition challenges as they admit children from English-medium preschools. Language choice was crucial because language skills determine the transition from pre-primary to primary education. Some teachers showed that even when they try to teach learners Setswana in the first year of primary education, the learners would respond in English, negatively affecting their acquisition of Setswana. The teachers' responses frustrate learners and

negatively affect their self-esteem with the result that they perform poorly across all subjects. Therefore, this gap necessitates interpretation and translation of content in learners' home languages in regions that speak minority languages.

In 2010, Molosiwa and Mokibelo conducted a qualitative study to examine the views of ethnic minorities on the introduction of mother-tongue education in Botswana. They discovered that Batswana parents were not yet convinced about the role of languages in the acquisition of knowledge by learners. The parents did not see the benefits of mother-tongue education in the early years of education in Botswana. The communities interviewed preferred Setswana or English as they claimed the use of other indigenous languages would bring disunity amongst Batswana. This shows that to some, Batswana Setswana has rightfully served its symbolic purpose as a national language for national unity. Other parents stated that other indigenous languages are not well developed and there are no trained personnel to assist in teaching minority languages. Teachers who were interviewed said using minority languages would have a negative impact on learners' acquisition of English and Setswana. Therefore, teachers also preferred to maintain English and Setswana in Botswana's education system (Molosiwa & Mokibelo, 2010). However, Mokibelo (2010) determined that most Khoe learners found it difficult to read English because the vocabulary was perceived to be difficult. In another study, Mokibelo (2014a) shows that San learners had a high number of school dropouts at all levels of education because the learners' language makes it difficult for them to access and participate education. This is because most of the San children in the Central District were not proficient in either their L1 or L2. Hence Mokibelo (2014a) used a qualitative approach to find out why San learners drop out of school at a high rate. Most interviewed participants were cattle herders around Serowe. The author found that 20% of the participants dropped out in the fourth year of primary education,

and 5% dropped out in the first year. Most learners stated that using English was the main challenge in education. Others stated that they dropped out of school because of poor academic performance. Mokibelo (2014a) shows that the learners who speak minority languages start by struggling with Setswana, and when they are just about to grasp it, they are abruptly switched to using English as a language of learning. This could result in corporal punishment if they failed to construct grammatical sentences, especially in content lessons like science with technical terminology. Introducing mother-tongue education could close this gap, but it becomes problematic if we consider parents' attitudes toward mother-tongue education in minority languages. Therefore, bilingual pedagogy becomes necessary.

As mentioned earlier, in Botswana, Setswana is the only African language used in Botswana's education system for national unity and identity. This is only possible in policy and is impractical in reality because of the language diversity in Botswana. It must be noted that other learners from minority language-speaking regions do not speak Setswana as their first language. As shown by Mokibelo (2014b), using Setswana for education in the minority language-speaking regions acts against attempts to improve relevance, quality and access to education. Mokibelo (2014b) conducted a qualitative study using interviews, classroom observations and field notes in six districts to investigate if, indeed, Setswana was used as a language of learning and teaching in the first year of primary education as stipulated in the policy. She found that in rural areas, learners brought their home languages to school but in urban areas, classes were multilingual, as schools could admit foreign learners. Mokibelo (2014b) also found that using Setswana as a language of teaching and learning acted as a language barrier to learners who brought different languages to school. As a result, some teachers did not use Setswana, they used the learners' home languages instead. This allowed

enhanced comprehension of content. However, in urban areas, Mokibelo (2014b) has shown that learners did not comprehend content in Setswana either because they were foreigners or because they went to English-medium preschools. In the observed classrooms, learners found it difficult to follow and were silent when teachers used Setswana. The elite in urban areas sent their schools to acquire early childhood education, while other parents could not afford this; This meant that teachers in urban areas switched between English and Setswana because some learners had not attended preschool. Some teachers stated that Setswana is not well developed for teaching and learning science, mathematics and creative and performing arts.

In 2015, Mokibelo undertook another study to see how Botswana was embracing multilingualism in the education system. She used observations, questionnaires and interviews, which helped her realise that specific cultural and language days, as well as President's Day, are celebrated to recognise Botswana's cultural and linguistic diversity outside the classroom. In contrast, multilingualism is not celebrated or acknowledged in the classroom (Mokibelo, 2015). According to Mokibelo (2015), this is mainly because the government is using Setswana to assimilate Batswana who speak other indigenous languages, by using Setswana only as a language of learning and teaching. In reality, this is not practicable; hence Mokibelo (2016a) examined rural schools' strategies to facilitate learning using questionnaires, classroom observations and interviews. The results showed that all the schools studied used communication strategies to solve the communication problems that arose between the learners' home languages and the language of teaching. Some schools were found to use school cooks as interpreters to help learners understand instructions or content; others used teacher aides to help reduce communication gaps. But these were not permanent solutions to the language practices that did not allow minority learners to access education fully due to language barriers. In a later study,

Mokibelo (2016b) used a qualitative approach to observe participating learners in their natural environment because Mother Tongue Conference papers reported that learners who speak minority languages usually drop out of school in the first or second year because of language barriers. The participating districts were Southern, Kweneng, Kgalagadi and Ngamiland, where learners speak minority languages as their L1. It was found that no programme has been designed to initiate the Bazezuru children into formal education. They usually drop out of school because the languages used in school are totally different from their home languages, and parents cannot help them with schoolwork at home. Statistically, Botswana achieved the goal of 100% enrolment, but it failed to ensure real access to education by ensuring that the language of learning and teaching does not become a barrier to learning (Mokibelo, 2016b). Mokibelo (2016b) realised that teachers in the Southern district understood that some learners bring their home languages to school in the first year of primary education, so they tried to use strategies such as codemixing and codeswitching. However, this worsened the problem of poor comprehension because teachers used their languages instead of the learners' home languages. San children also experienced language shock when they first attended school. Learners only felt comfortable at home where they can communicate freely using their first language with their parents.

Bagwasi (2017) used translanguaging theory to critique Botswana's language policy and practices claiming that Botswana's approach is weak as it does not support multilingualism. She claims that Botswana separates languages that exist in speech communities through the language policies that have been implemented since independence. Currently, the Language-in-education Policy separates English and Setswana and does not allow any other language in the education system. Bagwasi (2017) observed that Botswana follows a diglossic model, which separates

languages according to their status and function, assuming there could be cross-contamination or mental confusion if the languages were used concurrently. However, some authors such as Mokibelo (2016a) and Mafela (2009) have shown that both teachers and learners bring their languages to school in reality. This means that authorities try to compartmentalise languages, but, in reality, teachers and learners close the language gap by embracing multilingualism.

Commeyras and Ketsitile (2013) show that since independence, Botswana has positively developed literacy, but the needs of learners from different backgrounds should be considered when teaching reading. They reached this conclusion after undertaking a study motivated by different literacy attainments across districts. According to Fuller and Snyder (1991), Batswana learners spend more time listening to the teacher and only 11% of the time using textbooks. Molosiwa (2007) explains that learners have a reading challenge in examinations as they fail comprehension questions. Furthermore, Mmui (2002) points out that teachers of subjects other than English do not teach learners how to acquire knowledge through reading textbooks as they fail to appreciate the connection between reading and content subjects. In this context, Mathangwane and Arua (2006) explain that in Botswana, parents are aware of the importance of reading. However, Tella and Akande (2007) argue that learners read mainly to pass their examinations; teachers therefore need to change their methodologies to promote a culture of reading among Batswana learners. In 2000, SAQMEQ realised that most learners in the sixth year of primary education did not attain the standards of reading and mathematics set by the Southern and Eastern Africa Consortium for Monitoring Educational Quality.

Batswana learners also perform poorly in the TIMSS assessment, which has been conducted every four years since 1995 to monitor trends in educational achievement. It is unclear if reading skills, prior knowledge or language causes poor performance in TIMSS. According to

August et al. (2006), successful reading comprehension relies on decoding skills, knowledge in different domains such as vocabulary, and cognitive capabilities. Failure in any of these domains can disrupt the successful comprehension of a text, just as when there is a lack of word reading automaticity. Children may also fail at comprehension because of poor reading skills (August et al., 2006). The TIMSS assessments used in 2015 were based on assessment frameworks developed in collaboration with 45 countries which wanted to determine their learners' mastery of Mathematics and science or to see how they compare with other countries. Botswana assessed ninth grade. The Botswana Examinations Council (2019) shows that Botswana participated in TIMSS for the fourth time in the 2015 cycle since 2003. It did not participate in 2015 in PIRLS, which are conducted concurrently with TIMSS to assess the learners' aptitude in mathematics and science so that conclusions reached from analysing information can inform policymaking. On a scale of 0 to 1000, Botswana learners scored 390 in mathematics and 391 in science (Botswana Examinations Council, 2019). These scores are below the centre point of 500, ranking Botswana third from the bottom in mathematics and fifth from the bottom in science out of 39 countries. Of the ten educational regions in Botswana, the Kgalagadi region performed the least well, and South-East performed the best with a mean performance of 400. About 15% of Batswana learners omitted multiple-choice items, and 24% omitted structured questions in mathematics. In science, 35% of multiple-choice questions were omitted and 25% of the structured questions were omitted.

Despite implementing intervention programmes such as Strengthening of Mathematics and Science Education in Africa and curriculum review, Batswana learners' performance continues to drop. Girls perform better than boys, and older learners perform worse than younger learners because usually older learners have learning difficulties which result in repetition of grades.

Other factors such as safety at school, availability of resources and involvement of parents in pupils' work were outlined as contributing factors to poor performance in mathematics and science.

The literature shows a linguistic gap in basic education that could be addressed by translating the adopted curriculum and reviewing the Language-in-education Policy. However, this may not be straightforward unless the mechanisms underlying this problem are identified first. The mechanisms may be at the macro level involving the socio-political context or at the micro level involving the teachers, learners and the small quantity of translated terminology in the classroom. The problem of poor performance in scientific subjects may also be due to the translation process that was only half done to produce a partly relevant curriculum. This study uses the theoretical framework described in the next section to understand the theoretical aspect of cognition and multilingualism in basic science education.

## **2.3 Theoretical framework**

### ***2.3.1 Translanguaging theory***

Teaching and learning in Botswana schools employ multilingual language practices even though textbooks are monolingual (Arthur, 2001), Kasule & Mapolelo, 2005 and Mokibelo, 2014). These practices are best described using translanguaging theory, which claims that bilinguals use features in their linguistic repertoire to make sense of the world around them. According to Goldenberg (2008), translanguaging can enhance learner performance. To emphasise this, García (2011) defines translanguaging as a language practice based on multilingual language practices as emergent bilinguals integrate learnt language practices into their repertoire. However, this theory has given rise to much criticism and has been divided into two versions: a stronger and a weaker version (García & Lin, 2017). García and Lin (2017) further show that the stronger version of translanguaging does not endorse named languages as they are politically and socially constructed but the weaker version endorses named languages. The stronger version of translanguaging views named languages as social objects rather than linguistic objects and therefore differentiates between ‘languages as the names of enumerable things that are socially constructed’ and ‘languages as entities without names, as sets of lexical and structural features’ (Otheguy et al., 2015, p. 286). The weaker version of translanguaging views named languages like English and Setswana as countable entities that are linked to established nations whereas the stronger version views languages from a mental sense without aligning them to social or political labels.

García (2011) points out that the traditional models of multilingualism tend to view translanguaging from a monolingual perspective even though all the languages spoken by a multilingual person work in unison in their repertoire. They reiterate this by showing that

emergent bilinguals have a dynamic linguistic repertoire that is constantly changing because they keep adding additional linguistic repertoires as they encounter different languages. According to Lewis et al. (2012a), translanguaging began as early as the 1980s when C. Williams used it as a pedagogical strategy in Wales. It is a developing theory linked to Jacobson's (1983, 1990) concept of using different languages at the same time. In this era, translanguaging is viewed as an advantage to education as it challenges diglossia, which separates languages into those used in the classroom and those used at home. Since Arthur (1996, 2001) uses diglossia to describe language in Botswana classrooms, it will be discussed in comparison with translanguaging. It must be noted that diglossia admits the roles are not clearly defined across domains because sometimes there can be overlaps. These overlaps are addressed by translanguaging to ensure no one is left out. Diglossia was introduced by Charles Ferguson (1959) into American linguistics in the 1950s. Ferguson (1959) models diglossia on the French *diglossie* in his endeavour to examine standardised languages when two languages coexist in society. He sought to identify four speech communities and the languages they use so that he could fully describe diglossia. Then he described the features shared by communities relevant to the classification. The languages were Arabic, Modern Greek, Swiss German and Haitian Creole. He used the H for 'high' for the superposed variety and L 'low' for regional dialects. They had the challenge of citing words of the defining languages as they were unsure whether to enter the words in the H form, the L form or both forms. The issue of spelling was also a challenge if the language was not standardised. They therefore decided to adopt phonemic or quasi-phonemic transcription, which was also challenging in languages like Greek because its spelling was highly etymologising. Transliteration of the spelling of Arabic was also used in the representation of H. These challenges show that just as it can be challenging to classify words and allocate them to

different languages, it should not be easy to allocate a single language for teaching and learning, and this gap necessitates inclusive pedagogy.

Diglossia focuses on the functions of H and L as it identifies situations where only H is appropriate, or L is appropriate with only a slight overlap. Possible language use situations included a sermon in church or mosque, instruction to servants, a personal letter, university lecture, conversation with family, news broadcasts or folk literature. The following elements were used to classify languages; A high-value language is considered superior to L, therefore, prestigious as it is viewed as a beautiful, logical language that can express important thoughts better than L. The native speakers of L may prefer to listen to H even if it is less intelligible to them. Literary heritage was another factor considered in the classification of languages because if a sizeable body of literature was written in H, which is regarded as important in the community, the language would be of high status. Acquisition was another factor considered as H was mainly learnt at school, and L was learnt or acquired naturally from home as a mother tongue. In addition, standardisation and stability of a language gave it H-status.

Hudson (2002) conducted a study to differentiate strict diglossia and broad diglossia. He argues that diglossia should be restricted to Ferguson (1959), who claims that the conceptual unity of codes lies in the relationship between functional compartmentalisation of codes and an inability to acquire H as a native language, and he claims this gives L a chance to stabilise as a vernacular language. The author argues for a uniform use of diglossia as a term in research and theory, but Eckert (1980) posits that diglossia can also influence language shift, as observed in south-west France, where French replaced a local language. In this regard, Fishman (1967) recognises the relationship between bilingualism and diglossia, and this blurs the categorisations to some extent as he sought to relate psychological literature on bilingualism to its sociological

counterpart by viewing bilingualism as part of psychology and diglossia as part of sociolinguistics. According to the author, a social context can influence bilingualism and he therefore presents the relationship between bilingualism and diglossia in the following quadrants: both diglossia and bilingualism, bilingualism without diglossia, diglossia without bilingualism and neither diglossia nor bilingualism.

Abdulaziz (1978) views the language situation in most African countries as being trifocal since there are three languages in a triglossic structure. Each of the languages in this structure is assigned a complementary role where the ex-colonial language is given the highest status, and the major indigenous language is given the middle status as a widely used lingua franca for inter-ethnic communication, and the minority language is given the lowest status. Batibo (2005) points out that language use in Africa is more complicated than this triglossic arrangement of languages because applying the triglossia concept in African contexts is unrealistic. Because linguistic entities are not homogenous, complementary roles cannot be assigned. Another challenge is that small languages are usually marginalised as their roles are usually allocated to bigger languages. Batibo (2005) mentions recurring overlapping roles of languages impacting a country's socio-linguistic situation resulting in massive borrowing, language conflict, codeswitching and codemixing. He views African countries as plurilingual, which he says can significantly affect the language of choice in education in socio-economic contexts. This situation is influenced by language contact in Africa, which has led to dominancy, hegemony, and marginalisation of some languages. Batibo (2005) adds a poststructuralist view as he supports adopting a plurilingual model for equity and for democratically handling language use. The poststructuralist view supports translanguaging to a large extent. Hence to address the challenge of compartmentalisation and separation of languages in Botswana's education system, this research

adapts the translanguaging model to develop bilingual texts and identify their influence on science learning at primary level in Botswana.

It must be noted that translanguaging represents multiple voices in a similar way to heteroglossia, which is defined as ‘the simultaneous use of different kinds of forms or signs, and the tensions and conflicts among these signs, based on the socio-historical associations they carry with them’ (Bailey, 2012, p. 504). Blackledge and Creese (2013) show that both translanguaging and heteroglossia are language practices that support transformation as they view language as dynamic. García and Kleyn (2016) point out that translanguaging does not endorse the monoglossic ideology of bilingualism as does codeswitching or Cummins’ Interdependence Theory of Languages, which supports the use of the learners’ first language for about six years before using a second language for learning. Translanguaging as a pedagogic practice involves the learner’s whole repertoire and it therefore has cognitive and communicative advantages. García and Kleyn (2016) emphasise that translanguaging has been shown to be a language practice that equalises the learning conditions for minoritised learners, allowing them to be emotionally engaged. Scholars have shown that learners become more active when they use translanguaging. Therefore, translanguaging promotes independent learning as it focuses on including individual learners and not the entire group, which may be viewed homogeneously, to cater for individuals within groups. This calls for learning differentiation that helps to reclaim minoritised languages and normalise translanguaging.

Building students’ comprehension, engagement, criticality, emotional attachments, feelings and self-confidence, as well as identities, is necessary to acquire and create knowledge. This language practice has been described as a disruptor of traditional learning and teaching methods as it supports social justice as well as opportunities in education. It seeks to engage learners

deeply in meaning-making so that they can critically analyse situations because it can be used to build comprehension. Considering this, this study recognises the value of translanguaging in collaborative work to develop the literacy skills of emergent multilingual learners. It goes beyond the languages of texts, as students use their linguistic repertoires to deepen conversations, reflect and make corrections. Furthermore, translanguaging disrupts the distance between home and school language practices created by monolingual teaching practices. This is emphasised by Baker (2011), who shows that translanguaging enhances understanding and contributes to the development of minority languages. According to García et al. (2017), the core characteristics of translanguaging pedagogy are:

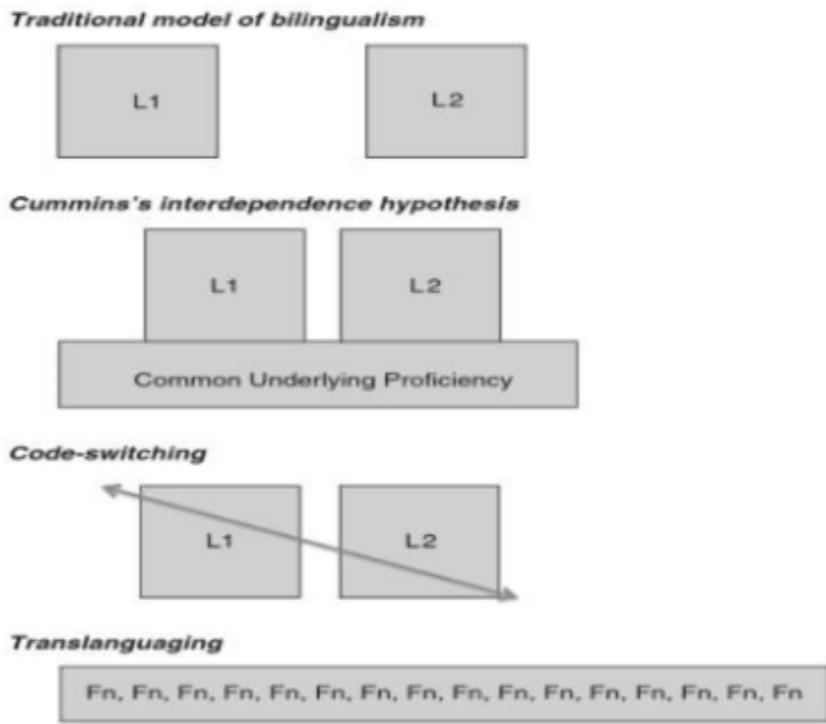
1. Stance – the teacher should draw from the learners' language practices as these practices are believed to be viable.
2. Design – creating plans and strategies that are compatible with the learners' language practices so that opportunities for language learning may be created for different tasks like assessments.
3. Shifts – the teacher can use feedback from learners to make necessary changes from moment-by-moment observations.

As shown by Velasco and García (2014), the value of translanguaging is evident even in the development of bilinguals' writing skills. They claim that translanguaging views the languages of multilinguals as a unitary system allowing multilinguals to use selected features in their linguistic repertoire for meaningful communication. Therefore, language practices of emergent multilinguals function with other languages in the multilinguals' system. This is emphasised by García (2013), who states that translanguaging also comes as a theory of learning

for minoritised populations; hence in these contexts, translanguaging supports social justice.

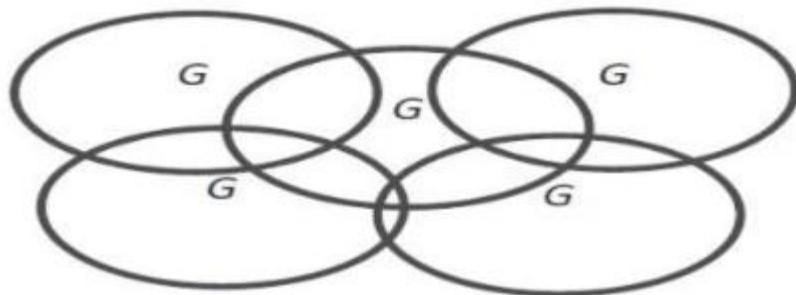
Regarding literacy skills, Velasco and García (2014) observe that using knowledge gained from both languages is necessary to enhance the learners' literacy skills as they apply different problem-solving strategies that reveal ways of meaning-making that cannot be observed in monolingual writing. They go on to show that because writing involves planning, drafting and coming up with the final piece of writing, multilingual learners often use strategies like back translation, rehearsal and postponing, whereby they write a word in a different language and will consider coming back to it later on. Velasco and García (2014) conclude that as bilingual learners translate, they use what they know so they may work out what they do not know since it is easy to retrieve information in memory if it was saved in the language of the topic. This raises the issue of self-regulation in writing, which involves mechanisms that affect thought, motivation and action because writers usually set a goal of what they want to achieve in writing and generally follow it. Therefore, translanguaging can be viewed as a self-regulatory mechanism that enhances language learning.

García and other proponents of translanguaging theory claim that bilinguals and multilinguals do not have different autonomous language systems, but a unitary system with features they use to communicate fluidly. They posit that translanguaging is transdisciplinary as it also encompasses socio-cultural and socio-cognitive lenses (García & Wei, 2014). Figure 2.1 illustrates the difference between translanguaging and other models of bilingualism. Botswana's Language-in-education Policy would be placed in the earliest traditional model that separated languages.



**Figure 2.1: Different models of bilingualism (García & Kleyn, 2016, p. 13)**

However, MacSwan (2017) holds a different view of translanguaging theory as he introduces an integrated multilingual perspective. This perspective makes language planning for translanguaging possible as it views translanguaging from the perspective of bilinguals' grammar, showing that grammars of different languages are internally different. Therefore, MacSwan's perception allows scholars and policymakers to develop bilingual learners to use their languages following rules of grammar that have been constructed for a specific named language. MacSwan's (2017) model in figure 2.2 differs from García and Kleyn (2016) as it presents a multilingual perspective on translanguaging. It serves as the middle ground between the weak and strong versions of translanguaging.



**Figure 2.2: MacSwan's view of multilingualism (MacSwan, 2017p. 180)**

Using this model of multilingualism in translanguaging, where G represents the grammar of different languages, MacSwan (2017) states that translanguaging becomes an ideology if it does not recognise codeswitching, which Wei and Lin (2019) claim has always been deemed inappropriate in the classroom. According to Li (2018), issues of ideology and power play an important role in language use. In this regard, Probyn (2019) shows that breaking the post-colonial monolingual ideologies in the classroom could allow learners to use their linguistic resources to access science and English because language, like low socio-economic status, can contribute to low achievement. According to Probyn (2019), the language practices in multilingual classrooms and the translanguaging of one teacher seemed to enhance the learning of science. Mobility and increased migration increase multilingualism in schools; hence Ferguson (2009) found that codeswitching in the classroom supports epistemic access. This study, therefore, recognises the integrated perspective on multilingualism as it opens doors for linguistic processes like translation to enhance translanguaging as a language practice that uses all the repertoire's features in the acquisition of learning. This will soften the borders between the named languages so that there is no suppression of the learners' linguistic repertoire because, according to Heugh:

Flexibility is the key feature of the multilingual school. Teachers need to be flexible about when and how they alternate between two languages of learning. In some instances, it may even be necessary to alternate amongst three languages. Students should also be able to choose their preferred language/s for the purpose of writing assignments and examinations in content subjects (1995, p. 85).

Makalela (2015) supports this as he claims that allowing multilingualism in the curriculum promotes fluid heteroglossia in Africa. Thus, translation in education can be viewed as a language practice that disrupts the set boundaries in concepts such as diglossia, which ignores the porosity of language boundaries to classify the languages into high and low values.

Makalela's (2015) article analyses how one science teacher engaged the learners' full linguistic resources to construct science knowledge in a Grade 8 classroom. The research was conducted using a small-scale multiple study in rural schools where English was the language of learning and teaching for learners whose first language was isiXhosa. As in Botswana, the researchers realised that the learners performed poorly in TIMSS and wanted to assess the extent to which classroom language practices contribute to the construction of science education. Primary data was collected through videotapes and analysed through socio-cultural discourse analysis. Lessons were transcribed, and teachers were interviewed to reflect on the videotaped lessons. It was realised that the teacher who used more isiXhosa than others created more opportunities to learn science, and the opportunities were significant in that class because the teacher was 'teaching for transfer' (Cummins, 2008, p. 232). This shows that multilingualism in education is not only necessary on its own, but learners should show understanding, which depends on the

coherence of content lessons in constructing meaning. This research, therefore, recognises heteroglossia in classroom language practices to enhance access and engage learners' resources while seeking to enhance epistemic access by affirming the learners' cultures and identities and engaging them for social justice.

Furthermore, Makalela (2019) points out that orthodox education programmes put some students at a disadvantage as they limit the learners' access. He expounds that translanguaging can be used as a pedagogical strategy to enhance understanding and assist multilingual learners in affirming their identities, as shown by Otheguy et al. (2015) and Wei (2018). This is emphasised by García et al. (2007), who state that translanguaging enhances learners' cognitive and metacognitive skills in a multilingual classroom as it allows confidence in one's first language and identity. It must be noted that Makalela (2019) views MacSwan's (2017) integrated view of multilingualism as a perspective that is hearer-based as it focuses on the ontology of languages, but he considers Otheguy et al.'s (2018) view as speaker-centred perspective interpreted from epistemology in meaning-making. On the one hand, Makalela (2015) uses the term 'discontinuation continuation' to refer to a situation in which fluidity of language use results in recreating discourse language boundaries. On the other hand, Wei (2011) calls the social space the 'translanguaging space' in which multilingual language users strategically use their full repertoire to reach their communicative goals. According to Wei (2011), the translanguaging space is a context in which different identities, values and practices combine to generate new identities, values and practices. It embraces creativity and criticality, which are fundamental dimensions of multilingual practices. It is, therefore, crucial to support translanguaging by creating a social space in the classroom that will allow emergent multilinguals to create their own translanguaging spaces that would interact with the already

created translanguaging space to allow them to create their own rules of interaction and interpretation for creativity and criticality.

Since translanguaging is considered natural to multilinguals, translation was viewed as the best programme to enhance learners' cognitive ability and improve their results. Their study showed that translanguaging could improve comprehension of a lesson. Here, Makalela (2015) views translanguaging from a cultural perspective. His research found that translanguaging can support learning in multilingual classrooms. García and Wei (2014) reiterate this by showing that translanguaging in the classroom allows the teacher to set the background knowledge, enhancing learners' understanding of the lesson. It could also help the teacher to meet the learning needs of different learners using translation while it helps engage critical thinking skills. This will allow the students and the teacher to employ different strategies that can be analysed by using moment analysis (Wei, 2011).

### ***2.3.2 Linguistic interdependence hypothesis***

Cummins (2000) claims that using a second language for teaching and learning early in education could adversely affect learners' academic achievement as they move to higher levels of learning where content becomes more abstract. Hence, it is recommended that education in the first language should last for at least five years for the learners' cognitive development (see Cummins, 1984 and Baker, 1996). According to Baker (1996), it is best to use one's first language in education as the learner can use it to contextualise acquired knowledge. Cummins (2015) highlights the following forms of transfer in the linguistic interdependence hypothesis, which rely on sociolinguistics and the education system: transfer of phonological understanding, transfer of morphological awareness, transfer of conceptual elements, transfer of pragmatic awareness and transfer of metalinguistic learning strategies. Cummins (2000) cautions that

introducing a second language as a language of learning very early could lead to low CALP. CALP is a level of proficiency that takes about five years to acquire and involves academic language in abstract terms. Low CALP negatively affects learners' performance in cognitively demanding tasks such as abstract thinking, problem-solving and learning in content subjects. Cummins (2000) also claims that BICS are acquired before CALP, are context-embedded and can be acquired within two years.

However, in Botswana, according to the Language-in-education Policy, the assumption is that learners only use their first language in the first year of education when communication in the classroom demands the use of BICS. However, the reality on the ground is silent classrooms, anxiety and fear at the transition stage (Mokibelo, 2016a). From the second year of primary and throughout the education system, learners use English even though their academic language proficiency is proven low by poor performance in multiple-choice questions and in structured questions for the agriculture examination, for example. This highlights a language problem that could hinder the cognitive development of Batswana learners in content subjects like science. Therefore, the conceptual distinction between BICS and CALP applies to Botswana's education system where learner performance is unsatisfactory, while the Language-in-education Policy supports the use of English for learning and teaching. Even though science and all other examinations are multiple-choice based, Batswana learners' performance in science is always the lowest. To ensure the success of the policy that recommends the use of Setswana for learning and teaching only in the first year of primary, the government prescribes textbooks to be used. Currently, the prescribed environmental science textbooks for the first year of primary education are in Setswana, and from the second year, the textbooks are written in English. This reveals a gap in Botswana's education system, as one year of education in the learners' first language is

not enough to develop CALP. It also suggests regression in the development of Setswana, once used for four years of learning and teaching in Botswana. Therefore, explanatory research into this problem may discover how embracing multilingualism could actually affect learners' academic achievement in primary-level science.

### ***2.3.3 Bilingual readers***

According to Kintsch and Van Dijk's (1978) model of bilingual language in memory, texts are represented at three levels: surface form, text base and the situation level. This model not only describes the representation of texts in memory but also defines the order of text processing, which begins at the surface form, where words are used in the text. This is followed by the construction of the text base, where we find meaning presented as a network of propositions in which the semantic content of words is not completely dependent on the words used but on paraphrasing the original text. Finally, the situation level involves the text base as prior knowledge and is where comprehension is reflected through making inferences. According to Fairbanks et al. (2014), culturally responsive pedagogy should draw from and build on the learners' backgrounds so they connect their lived experiences while the learners' historical, social and linguistic situations are considered. Responsive pedagogy is inclusive as it believes that children from different backgrounds should be able to participate in learning so that their higher-level thinking is promoted as they respond to the text. Wiley (2005) shows that this can be done through adaptation, accommodation and incorporation of learners' cultural practices, although adaptation is not really supported as it promotes abandonment of one's culture. It must be noted that culture and language knowledge are used in accommodation in explicit instruction. Incorporating responsive instruction with the various cultural identities of students could also be practised. This can be done by considering the local community to modify the curriculum to

address specific needs. According to Gay (2002), culturally responsive pedagogy uses cultural elements and experiences of learners' different ethnic cultures so that they can be taught effectively. This is referred to as social constructivism, which highlights the need to consider learners' backgrounds. Similarly, the socio-cultural perspectives on reading comprehension draw from the socio-cultural theory of meaning-making in reading comprehension. Here, comprehension is viewed as a dynamic and multidimensional social construct.

However, Kroll and Stewart (1994) support a hierarchical model in which lexical items from each language are saved in different lexical memories linked to independent conceptual memory that contains word meanings. According to this model, a bilingual has one conceptual store and two lexical stores, but after being revised by Kroll and Stewart (1994), it was discovered that words from two languages are linked at the lexical level, but the link from the second language to the first language is stronger than that from the first language to the second language; this shows that as a second-language learner, translation is made from the second language to the first language to decode meaning. Taking this further, Raney et al. in Heredia and Altariba (2001) add the conceptual aspect to show that there are also lexical and conceptual links of words from each language. The lexical and conceptual links are associated with the meaning of words, but this strength of lexical-to-conceptualisation varies across languages since the link between the first language words and their meanings is strong. However, the link between second language words and their meanings begins weakly, but the strength increases as fluency increases (Raney et al. in Heredia & Altariba, 2001).

The Revised Hierarchical Model (RHM) postulates that in bilingual memory, the lexical and conceptual links are active, but the fluency of a bilingual is determined by the strength of the links between the two languages. Kroll and Stewart (1994) postulate that this results in stronger

links between words and concepts for the bilingual's first language than for their second language. Even though both the lexical and conceptual links are bidirectional, they differ in strength; the lexical link from L1 to L2 is weaker than the lexical link from L2 to L1 because L2 words were initially linked to L1 in successive bilingualism. Furthermore, the RHM applies the same analysis to the link from the first language to conceptual memory, which they assume is stronger than the L2 conceptual memory. Using this model, it may be predicted that it is faster to translate from L2 to L1 than to translate from L1 to L2. Therefore, translation from the second language to the first is the conceptually mediated route to translation. This contributes to the asymmetry between the directions of translation for unbalanced individuals as Kroll and Stewart (1994) claim that translation from L1 to L2 is conceptually mediated, whereas translation from L2 to L1 is lexically mediated. This may be influenced by the level of proficiency in the two languages because in successive bilingualism, the bilingual learner has had more experience with their first language of acquisition, and they can readily make associations between words and concepts.

Various scholars have reacted differently to the RHM. Raney et al. (2001) assert that the strength of the links depends on the level of fluency, word frequency and the status of the cognates. Hence the storage of meaning can be further divided into semantic and conceptual components to differentiate meaning tied to words or multimodal representations. However, Brysbaert and Duyck (2010) argue that the RHM does not provide enough evidence to support the notion of separate lexicons and selective access, notwithstanding its dominance for 15 years. They also argue that there is a stronger connection between L2 words; therefore, they support using existing computational models of language processing in monolinguals to determine their applicability for bilinguals' input and output. Responding to Brysbaert and Duyck's (2010)

argument, Kroll et al. (2010) reiterate the point that RHM was never meant for visual word recognition; therefore, Brysbaert and Duyck's (2010) argument is baseless since it relies on different researchers' findings, which are beneficial in developing the RHM model.

The Bilingual Interactive Activation (BIA) model deals with recognising written representations; it is computational and simulates experimental studies (Dijkstra et al., 1998a). It was developed by Dijkstra and Van Heuven (2002), who proposed the BIA+ model, which accounts for different experimental data that shows interference effects and inter-lingual priming. One similarity between the BIA and BIA+ models is that, unlike the RHM, they proposed that the bilingual lexicon extends over both languages and is retrieved in a language non-selective way. In addition, the BIA+ model covers semantic representations, as well as phonological and semantic representations. Recently this model was enhanced by Dijkstra et al. (2018b), who developed a localist-connectionist model called Multilink, which uses RHM as a reference framework for bilingual translation. This new model also uses the BIA+ model as a reference framework. Therefore, it integrates BIA+ and RHM to stimulate the recognition and production of cognates, enabling it to account for various factors that take place during word recognition and production. Dijkstra et al. (2018) view the BIA+ model as effective as it can also handle words of any length, frequency, and different languages in different comprehension and production tasks for both bilinguals and monolinguals. The development of this model gives a view of how bilinguals' comprehension has been approached in multilingual instances like reading to develop a model that focuses not only on orthography but also on semantic and phonological representations. This necessitates in-depth studies of how the translation of written material can contribute to enhanced access and participation in multilingual contexts such as the education sector.

Raney et al. in Heredia and Altariba (2001, p. 170) also show that ‘many bilinguals are less proficient readers in their L2 than in their L1’. Therefore, reading ability in L2 is related to an individual’s L2 language skills, but these skills are not related to their reading ability in L1. If a learner cannot efficiently process words and sentences in L2, it will not be easy to comprehend texts in L2. Regarding comprehension, Bernhard and Kamil (1995) state that there should be a minimum level of L2 proficiency for comprehension processes to be activated effectively because the content of bilinguals’ representations is different according to the fluency in each language, as explained by the interdependence hypothesis. Consequently, bilinguals who are not fluent focus more on the surface form and text base levels, and then the situation models they create become incomplete (Kintsch & Van Dijk, 1978). Furthermore, Rosebery (2008) highlights orthography as one of the factors that can impact bilingual learners’ reading acquisition. They do this by differentiating between opaque orthography, which they say does not have a corresponding regular relationship between the phonemes and spelling, whereas transparent orthography has a regular one. Joshi and Aaron (2005) call this relationship grapheme-phoneme correspondences in transparent orthography, this relationship is sufficient for decoding words, while in opaque orthographies, this correspondence is complex. The RAND Reading Study Group (2002) states that the three outcomes of comprehension are knowledge, application and engagement. Knowledge refers to comprehending a text and integrating its information with the knowledge the reader already has, critically evaluating its content. Application is about using what was learnt in the text for new tasks, and engagement shows how the reader is involved with the text. This falls under informal measures of reading comprehension, used by teachers and assessors to inform instruction according to student achievement; therefore, they are used in

curricula content and instructional methods. Thus, undertaking a study investigating the effects of these complex correspondences in learning science is crucial.

Revised literature exposes a problem in learners' academic performance in both local and international science assessments. This places Botswana among the lowest performing countries in science despite implementing programmes that seek to enhance the curriculum, as well as learning and teaching. Even though language has been stated as one of the contributing factors to the poor academic performance of Batswana learners, no study has been conducted to determine the effects of active multilingual language practices on the performance of learners in science. Socio-cultural theories of reading comprehension, which deal with the mind and its relationship with the world, may be used in relation to approaches that originate from Vygotsky, but they can also draw from different socio-cultural approaches like sociolinguistics and second-generation cognitive science. Vygotsky's cultural-historical theory focuses on the origins of mind and knowledge, mediation of the mind and the genetic analyses of the mind. In the social origins of mind, Vygotsky (1978) states that first, the child's cultural development is on the social level (interpsychological) and then it is on the individual level (intrapsychological).

According to Vygotsky (1978), logical memory and forming concepts are examples of concepts for higher functions, which he says originate as relationships between individuals. Words will not make sense when meanings in the text do not allow the child to participate in the modes of actions that evolved socially. The more knowledgeable adult can give rise to the zone of proximal development associated with this theory, stating that good instruction does not follow development but leads it. As shown by Vygotsky (1978), tools are crucial as they play a part in controlling the environment. Therefore, signs viewed as psychological tools can help individuals to monitor their behaviour and use it purposively. According to Vygotsky, as cited by

Wertsch (1985), language is an example of a psychological tool. He also refers to schemes, writing and mnemonic techniques, showing that Vygotsky considered other semiotic processes besides language. According to Vygotsky (1978), first-order symbols deal with an individual and how they can speak and understand oral language. Vygotsky also shows that genetic analyses to fully understand comprehension of a text must understand how comprehension developed since reading is not a natural act. Since differences between cultures and the way social practices are changing can transform comprehension, it is necessary to study how language, one of the main elements of culture, may be manipulated to enhance comprehension, therefore improving the teaching and learning process.

From Vygotsky (1978), we see the Kharkov school that came up with the cultural-historical activity theory, which was the first-generation activity theory that, in 1930, began to understand how thought and activity can influence one another. The second-generation theory ties mediated action to human activity, which is practical. The levels of analysis in human activity are activity, action and operation. Here, reading is the action taking place in a larger activity in specific conditions, influencing the reader's ability to make meaning from a text. According to Gavelek and Bresnahan (2014), third-generation activity responds to criticism of second-generation activity theory, which was not culturally sensitive. It considers multi-voicedness as it creates a third space as new forms of knowledge are co-constructed by the written text and the learners' text.

August et al. (2006) studied the challenges that arise from assessing second-language readers' comprehension. They also reported on three studies conducted to develop a new measurement for comprehension called the Diagnostic Assessment of Reading Comprehension. This was meant to assess how readers remember the text they have just read, how they make

inferences according to the text's context, how they access background knowledge and finally, how they make inferences that require integration of background knowledge with the text. The Diagnostic Assessment of Reading Comprehension, therefore, reduces the need for high proficiency in English by reflecting the comprehension skills of English L2 readers. In a similar study, Probert (2019) found that in South Africa, inequalities had been realised in learners' literacy results. However, research does not provide details on how learners read African languages. It was reported that the reading performance of learners in Grade 4 in African languages was low in Setswana and isiXhosa, affecting the learners' performance in higher levels of education. Probert (2019) shows that reading a disjunctive orthography differs from reading a conjunctive orthography. Therefore, reading pedagogy in African languages must consider differences between African languages like isiXhosa and Setswana, which use conjunctive and disjunctive orthography, respectively. Hence the researcher investigated morphological and phonological awareness skills as metalinguistic skills. Phonological awareness was identified as an important aspect of reading and listening acquisition so the reader can decode words. Probert (2019:9) shows that Setswana learners performed better in phonological awareness activity which involved both the syllable and the phoneme whereas isiXhosa learners performed better than Setswana learners in morphological awareness. Casalis and Louis-Alexandre (2000) found that morphological awareness also plays a role in literacy acquisition. This has been shown to correlate with spelling, comprehension and vocabulary load because morphological awareness seems to play a more significant role for those learning conjunctive orthography than for those learning disjunctive orthography.

Some scholars have observed codeswitching and codemixing in Botswana classrooms, but they have not undertaken any study to determine the effects of using bilingual learning material

in the classroom. The national TIMSS report presents a statistical analysis of Batswana learners' performance internationally as well as regionally, showing that Botswana's South-East District, which hosts the capital city where English is used predominantly, is the best performing region, whereas the Kgalagadi region, where a minority is predominantly spoken, is the worst performing. Against this backdrop, this research employs quantitative and qualitative approaches in purposively selected schools to conduct a quasi-experimental study to determine how using bilingual texts could affect the academic performance of learners in science.

#### ***2.3.4 Translation***

Since translanguaging and interdependence of languages deal with more than one language, it is crucial to consider the interpretation of academic content in the mind of a multilingual learner. In this regard, a cognitive theory of translation is crucial in studying how bilingual texts could influence the performance of learners in science. According to Neisser (1967), cognitive approaches view the human brain as a processor that plays a significant role in interpreting discrete symbols on algorithms. Here, the connectionist paradigm assumes that the human brain functions like interconnected processors. Neisser (1967) also points out that cognitive approaches usually observe behaviour because underlying mental processes cannot be observed directly. Similarly, Risku and Windhager (2013) view cognition as the social or physical interaction between people and their environment. This involves interplay between different actors and artefacts. Therefore, Risku and Windhager (2013) use the actor-network theory and activity theory to develop the situative approach. They reiterate the value of context as a crucial aspect of cognition, which is why the situative and distributed approaches focus mainly on the situative dimension of cognition. The researchers show that environmental factors can also serve as crucial elements of the translation process as they do in cognition. From the

actor-network theory's perspective, translating a text involves mediating actor networks; therefore, the actor-network is viewed as the main agency. That is why ethnographic networks are used in the natural setting of the actors. This involves analysing artefacts and objects. However, the activity theory focuses mainly on human intention as it posits that culture and technology can shape humans' development, which is why the methodology employs ethnographic approaches. Therefore, this study is based on relevance theory first proposed by Dan Sperber and Deirdre Wilson (1986) in their study of the interface of communication and cognition.

According to Sperber & Wilson (2002), relevance theory can be closely related to Grice's claim that expression and recognition of intentions are crucial in human communication. It can be viewed as Gricean as it assumes that interpretations guide pragmatic principles using rational principles (Clark, 2013). Grice's work on meaning, logic and conversation has influenced work on pragmatics. This includes Grice's (1975) cooperative principle that consists of the maxima of quality, quantity, relation and manner. Relevance theory can thus be viewed as a cognitive theory recognising context in the interpretation of language, as well as the search for relevance, as shown by Gutt (2000). Relevance theory itself, as expounded by Sperber & Wilson (2002), is based on an inferential model of communication, which is an alternative to the classical code model where there is a communicator who encodes the intended message into a signal. This message is decoded by the audience using an identical copy of the code. Here, meaning can be constrained by the code or the similarity between the sender and the receiver's codes or the quality of the medium.

However, in the 1960s, authors like Austin (1962) and Searle (1967) realised that what is said is not always what the speaker wishes to communicate. Pragmatics focuses on how the

speaker's utterances and intended communication may be related. Grice (1975) shows that utterances only indicate what the communicator wanted to say, which must be recovered by inference. This can involve literal meaning or figurative language, but it cannot explain why the listener could differentiate between literal and literary meaning. This was because inference is applied after the derivation and rejection of the literal meaning. In the inferential model, the communicator shows that they want to convey meaning, and then the audience infers the meaning based on the evidence provided. According to relevance theory, meaning not only depends on semantic content, but also depends crucially on the content of interpretation and on the contextual information with which it is inferentially combined (Gutt, 1998). In this regard, Gibbs (2002) shows that natural language can have infinite inferences, and people can derive literary meaning quickly, just as they can literal meaning. This is based on Sperber and Wilson's (1995) claim that communication between humans is influenced by searching for relevance, where ostension is used to show the speaker's communicative intent by presuming relevance, which necessitates the hearer's efforts to make a difference in their cognitive environment. Meaning can therefore be implicit or explicit. A translation that does not sound natural requires undue processing effort on the part of the audience and may limit their comprehension of the text.

In relevance theory, context is a crucial elements that can determine the interpretation of communication. For Sperber and Wilson (1986), context is the set of premises used to interpret an utterance in relevance theory. It is, therefore, a psychological construct as it is part of what the hearer or reader assumes about the world. In this case, it does not refer to the physical environment, but it focuses on the information provided by the physical environment and how this information is available in the cognitive environment for interpretation. This includes

information stored in the memory from utterances or cultural knowledge. This means that any information from preceding utterances or memory can be the potential source of a context. For example, as shown by Sperber and Wilson (1994) when the hearer interprets an utterance, they should be able to select the actual assumptions intended by the speaker from all the assumptions in their cognitive environment. When the hearer makes incorrect assumptions, there will be a higher chance of misunderstanding the utterances. Contextual assumptions, therefore, can be accessed in different quantities and at different speeds; therefore, we need to make an effort to retrieve these in information. This effort should not be more than is necessary because inferential communication is sensitive to the processing effort, and that is why hearers start with contextual assumptions that are easily accessible. Therefore, memory will not select any or all contexts but the one that requires the least processing effort. Here, optimisation also works to obtain the benefits of understanding the modification of contextual assumptions involved in the communication act (Sperber and Wilson 1994). This means that acquired information on its own may not be appropriate, but there could be an expectation of optimal relevance where relevant assumptions will result in larger contextual effects and a smaller processing effort. Therefore, we can say that relevance depends on the contextual effects and processing efforts, which are context-dependent, making “relevance” also context-dependent.

Gutt (1991, p. 72) calls shifts in context ‘secondary communication situations’. He emphasises that context can influence interpretation of the text as the speaker’s intended interpretation of a text is context-dependent because human communication naturally relies on inference. Fotheringham (2017) highlights this shift in descriptive analyses as he proposes a taxonomy that relies on cognitive-pragmatic models. He does this by using Descriptive Translation Studies as an important area of translation, which can be viewed as a descriptive

approach in translation as it deals with the empirical aspect of describing translation systematically and in a controlled way. From Fotheringham's (2017) observation, shifts in translation are influenced by cognitive processes and not by the norms that govern the process of translation because sometimes, while trying to close the contextual and cultural gap in the source text through translation, the translator may incorrectly process the sense of the original. He suggests that relevance theory can be used to analyse the shifts in translation.

Interpretation of a stimulus is considered as an inferential cognitive process in relevance theory. Sperber & Wilson (2012) view interpretation as an output of the intended meaning from the communicator's perspective. This can be analysed by studying the comprehension of utterance in context as this deals with investigating an inferential process. Here, input is the utterance produced by the speaker coupled with contextual information. Usually, intended assumptions can be accessed easily and can be used by the hearer so that they result in an interpretation that matches relevance theory's communicative principle. This means that interpretation, which will be less accessible, may not be possible because, as shown by Sperber & Wilson (2012), this will depend on available contextual schemes. Gutt (2010b) highlights the fact that to derive the speaker's intended interpretation, the correct contextual information as intended by the speaker should be used knowing that different interpretations can arise from different contextual information used to interpret meaning. This means that context consideration is crucial in translation because it can determine whether a propositional form is intended to be an implicature or an explicature. In this regard using an inappropriate context could result in misunderstandings. Gutt (2010b) shows that stronger implicatures call for consistency with relevance. To allow access through comprehension, successful communication of the intended interpretation should result in adequate contextual effects and be easily recoverable.

Sperber & Wilson (2002) further expound on contextual implication as the most important type of cognitive effect, which is a conclusion deducible from the input and the context simultaneously. Other types of cognitive effects are strengthening, revision and abandonment of available assumptions (Sperber & Wilson 2002). These are observable and allow us to see the success or failure of translation. According to Sperber and Wilson (1995), the cognitive effects result from modification of the listener's beliefs, perceptions or knowledge and the effects can be informative or entertaining. They continue to state that in relevance theory, the conceptual elements encode context in discourse as they activate a mental representation; therefore, the procedural features, for example, discourse markers, guide the hearer's inferences in the interpretation of a stimulus.

The communicator produces a stimulus that the audience will use to infer his or her informative intention. As defined by Sperber and Wilson (1986), a stimulus is designed by the communicator to achieve certain cognitive effects. This phenomenon can be different objects or events that result in the intended cognitive effects through the properties of the stimulus. It is important to pay attention to the crafting of the stimulus, which can be observed from the cognitive effects that it has; for example, the implicatures or explicatures that are conveyed by the stimulus. Gutt (2014) also shows that the stimulus may have intrinsic properties that show whether it is reported or direct speech, which may be categorised as metarepresentation or representation. In this regard, the meaning derived from a text is attributed to both the stimulus and the cognitive environment. Even the structural complexity of the stimulus and the frequency of use of a certain structure in a stimulus, can affect the processing cost. Therefore, the interpretation of bilingual texts should result in adequate contextual effects. Bilingual texts in this context are expected to assist in achieving the communication objectives of a particular

topic. The passage on the topic serves as a stimulus and reflects the communicator's desire to communicate. As shown by Gutt (2014), the communicator must anticipate the available context so that they may design the appropriate stimulus.

It may be necessary to differentiate between an interpretive and a descriptive use of language. As highlighted by Gutt (2014), a descriptive use of language is communication in which an utterance is to be taken as true, but in the interpretive use of language, which represents someone's utterances or thoughts, there should be an interpretive resemblance between the original and its representation. This can be determined from their shared explicatures and implicatures and therefore the resemblance of texts can vary. This means that utterances that interpretively resemble each other share more explicatures and implicatures. In this case, using quotation marks shows high resemblance only if it is interpreted in a context that is the same as the original. This requires the translation to have contextual effects with minimal processing effort. It must be noted that optimal relevance does not exclude faithfulness, as shown by Sperber and Wilson (1986, p. 137) that in interpretation, '... the speaker guarantees that her utterance is a faithful enough representation of the original; that is, it resembles it closely enough in relevant respects'. Therefore, in relevance theory, faithfulness is close to resemblance as relevance determines the way of expression and how it is conveyed so that resemblance of the original to the translation should make it sufficiently relevant to the target audience by adequate contextual effects. According to Gutt (2014), these constraints are determined by the context, just like relevance, which serves as a guide for translators. In this theory, clarity and natural expression make a translation easy to understand without unnecessary effort, and hence a mismatch in associated information and unnecessary processing effort results in infelicity of the translation. In relevance the context of an utterance is a psychological construct that holds

expectations about religious beliefs, assumptions, the future, scientific hypotheses and anecdotal memories used in interpretation. This is crucial in curriculum content as it also deals with accessibility through the prescribed language of learning. Therefore, relevance theory shows that optimal relevance condition is made up of cause-effect interdependence relations that are empirical and exist between message, context and stimulus, as stated by Gutt (2000, p. 163):

1. If the message is given, then the stimulus and the context must be such that the condition of optimal relevance is fulfilled.<sup>2</sup>
2. If the context is given, then the message and the stimulus must be such that the condition of optimal relevance is fulfilled.
3. If the stimulus is given, then the message and the context must be such that the condition of optimal relevance is fulfilled.

This means that cross-language communication can be complete in that if the text is presented bilingually, the translated text could fill the gaps without re-expressing the information in the source text. The relevance theory approach in the translation of science textbooks fits well in this framework if combined with a functional theory of translation.

### ***2.3.5 Functional approaches to translation***

*Skopos* theory is a functional theory of translation that was developed in Germany between 1970 and 1980 by Vermeer and Reiss and further refined by Nord in the 1990s. In this regard Nord (1997) views translation as an activity with a purpose. She therefore claims that translation as an activity should ensure that the target text is determined by the purpose of the target text in its context. This means the target text must follow the *skopos* rule. *Skopos* is derived from Greek and means ‘aim’ or ‘purpose’ so in this approach the text type and the function of the text

determines the methods and strategies used (Munday, 2012; Du. 2012). *Skopos* theory also highlights the relationship between the source and target texts, although it is not limited by conventional views that focus predominantly on the source text.

One advantage of this theory is that a text can be translated differently according to the target text's purpose (or *skopos*) (Munday, 2012, p. 123). Reiss (1976) categorises texts according to their function and genres and states that the function of the source text should determine the translation methods employed. She lists informative texts that can use plain prose to transmit factual content and expressive texts that transmit aesthetic form while ensuring accuracy.

The following are the rules of *skopos* theory:

A *translatum* (TT [target text]) is determined by its *skopos*.

A TT is an offer of information (*Informationsangebot*) in a target culture and TL [target language] concerning an offer of information in a clearly reversible way.

A TT does not initiate an offer of information in a clearly reversible way.

A TT must be internally coherent.

A TT must be coherent with the ST [source text].

The five rules above stand in hierarchical order, with the *skopos* rule predominating.

(Reiss & Vermeer, 1984, p. 119)

Since these rules are listed hierarchically, this theory does not place as much value on the coherence rules 4 and 5 although if the text is not coherent, it will fail in its aim to communicate.

Therefore Nord (2005) adds loyalty to functionality so that the purpose of the target text can be matched with the source text. This highlights that there must be a relationship between both texts, even though the theory focuses on equivalence at the text level and not at the lexical or syntactic level. Focusing only on these two levels of analysis leaves the theory inadequate at the semantic level. Nord (2005), therefore, uses translation-oriented text analysis to tackle this inadequacy. This model analyses texts at text, sentence, and word level as it is based on functionalism that enables the translator to understand the purpose of the source text, its features and the selection of appropriate translation strategies. In the analysis of translation product and process, Nord (2005) differentiates between documentary translations, which are source-culture oriented and instrumental translations that are target-culture oriented. In undertaking the analysis, the three functionalist approaches to be used in translator training are:

The importance of the translation brief.

The role of ST [source text] analysis.

The functional hierarchy of translation problems.

(Nord, 1997, p. 59)

These three aspects strengthen *skopos* theory as they allow the two texts to be compared. It must be noted that the purpose of the source text is considered under the importance of the translation brief. *Skopos* theory as a functional theory of translation is relevant to this study as the study developed a bilingual stimulus to investigate the effects of embracing multilingualism in the classroom. It is used to translate a topic in a science textbook as an objective text. Also, this theory is valuable in analysing both the source and the target text to see how each text communicates factual scientific information to primary school learners.

However, it must be noted that relevance theory in translation partly supports the functional categorisation of translation as it claims that the presentation of a text, for instance, a textbook, plays a significant role in coordinating the communication process between the communicator and reader (Gutt, 2014). Therefore, textbook readers seek objectivity of presentation because they are pragmatically guided by the stimulus they are using. This calls for the consideration of the source's quantity and the quality for the target audience because the label of a text as a textbook performs a pragmatic function as it increases the relevance of the text by guiding the reader to the interpretation of the text. In translating different texts of different genres, interpretive resemblance is used to link the translation and the original although there may be no shared explicatures nor implicatures, as shown by Gutt (1991). It must be noted that even the specific explicatures or implicatures can be shared by the original and the translation; that is why one source text can be translated differently.

Despite the clarity and simplicity of relevance theory in translation, some scholars like Wendland (1996) claim that relevance theory marks the return to formal equivalence even though it relies mainly on interpretive resemblance, which can be presented in various ways using different implicatures and explicatures. Moreover, Luchjenbroers (1991) criticises relevance theory by showing that it only accounts for verbal understanding and leaves out non-linguistic information. Luchjenbroers (1991) starts by critiquing the definition of relevance, which she claims is biased towards the hearer as the derivation of contextual effects and processing effort both concern the hearer. Later, Luchjenbroers (1991) shows that the relevance account seems not to be predictive as she views it as vague as it proposes the three types of relevance: 1) that which identifies optimal stimuli in the environment; 2) that which allows the communicator to find the most optimal cognitive context so that the hypotheses can be

formulated in the central systems; and 3) that which selects pre-existing assumption in the Hypothesis Testing Device (HTD) so that relevant inferences or assumptions may be confined or derived in the memory.

This criticism is unfounded because this theoretical framework that presents and evaluates available literature on language, learning and relevance theory in translation offers a unified and simple account for interpreting utterances. It shows that utterances, which are optimally relevant to the communicators, can be interpreted without undue effort and therefore information is best transferred to project the participants' context. In relevance theory, this means that the translation should include the information required for optimal relevance in a particular context. Although extensive literature on language and learning exists, there is still a gap in the studies of the use of more than one language simultaneously in education. It has been shown that learners can be fluent in reading a second language but their comprehension of the language may be low (see Piper et al. 2016). Hence the missing knowledge here is how using more than one language concurrently would affect the relevance of the scientific text in multilingual contexts.

García et al. (2019) differentiate between translation and translanguaging in education, showing that if translation is analysed through a translanguaging lens, it empowers minoritised learners as it makes them visible and audible. García et al. (2019) also show that translation has generally been ignored in multilingual education systems in favour of communicative strategies of second-language learning. However, recently it has been recognised in multilingual programmes for meaning-making. The exclusion of translation in colonial Africa allowed homogeneity of one named language to erase the multilingual nature of indigenous people. Therefore, as García et al. (2019) show, this led to codeswitching as teachers tried to avoid translation, which could have been used as a pedagogical strategy. However, in Malaysia, as

shown by Martin (2005), bilingual communities started to view themselves as bilingual agentive subjects and they developed full possession of their dynamic bilingualism. Therefore, a monoglossic perspective on bilingualism was deemed appropriate in this regard. This means translanguaging was viewed as a crucial tool in second-language learning. García et al. (2019) show that translation separates learners' languages, but translanguaging does not; it treats languages within a repertoire as a single entity. Furthermore, they state that 'translation bridges cultures and languages, whereas translanguaging dwells in the entanglements of cultures and languages' (García et al., 2019, p. 84). By acting as a bridge in the connection of languages, García et al (2019) show that translation leaves one language on one side to connect it with another language on the other side. Even if they claim that translation keeps languages separate, it must be noted that García et al. (2019) emphasise that translation is an effective pedagogical strategy as it is used by primary school teachers to empower multilingual learners to use their unitary semiotic repertoire so that they can make meaning and develop their agency as bilinguals. In this regard, translation allows translanguaging pedagogy to support learners' meaning-making as bilinguals because, as shown by García et al. (2017), in translanguaging pedagogy, the teacher should develop a translanguaging stance, and design translanguaging pedagogy that insists that translanguaging rightfully has a space to occupy in the classroom so that learners may control instruction through the teachers' guidance. Therefore, the analysis of translation through a translanguaging lens can empower minoritised learners to be visible and audible.

However, Malmkjaer (1998) states that translation has its own shortcomings as it is time consuming and can interfere with acquisition of a new language. Moreover, translation is expensive as it requires preparation of learning material in more than one language. Tan and Lan

(2011) also showed that the use of translation in Mathematics and Science leads to simplification of language by focusing only on key terms which may decrease students' engagement with relevant text. Nevertheless, Ennebati (2017) shows that translation can present new opportunities in learning and teaching.

### **2.3.5 Multilingualism in Botswana's education system**



**Figure 2.3: Language in Botswana's education system**

Figure 2.3 shows that Botswana's education system currently practises the traditional model of bilingualism, which compartmentalises and separates languages. From García and Kleyn's (2016) different models of bilingualism (Figure 2.1), we can conclude that education in Botswana follows the structuralist model, which tries to separate the learners' languages. It must be noted that before 1994, Botswana adapted Cummins' Interdependence Theory of Languages to some extent, as Setswana was used for learning and teaching in the first four years of primary education, and English took over from the fifth year (see Arthur, 1996). During this time, science textbooks written in Setswana were used, but since regression to the structuralist model, science textbooks have been monolingually written in English, which has widened the gap between languages in the education system. Bagwasi (2017) critiques the separation and compartmentalisation of languages in the current Language-in-education Policy from a

translanguaging perspective. Therefore, she suggests integration and complementarity of languages in education for inclusion, to enhance confidence and to support the participation of Basotho learners in learning. We can conclude that the traditional bilingualism model shows regression, calling for intervention that embraces multilingualism in pedagogy.

In Botswana language issues are contentious because of the language diversity that we find in the country. Currently, the education system is the domain in which different languages present their value according to the proportion that they are allocated in the curriculum. That is, the extent to which a language is used for learning and teaching, at what level of education and whether a language is only studied as a subject. The roles allocated to different languages reveal that there is a market value that is placed on some languages and that is why they are allocated functions separately. As shown by Bagwasi (2021) in Botswana failing English language as a subject can hinder one from being admitted into university even if learners have done exceptionally well in other subjects.

After 56 years of independence the government has just proposed a mother tongue language policy in education which was to be implemented at the beginning of the year 2023. This policy recognises a dominant language in the child's environment even if it is a minority language. In practice, the education system of Botswana supports subtractive multilingualism by submersion models which substitute the learners' first language with a new language. The submersion model as elaborated by Gorp and Verheyen (2008) assumes that there is competition between the learner's languages. According to Long and Doughty (2011) this is a typology of language where a transitional program is used to temporarily assist in a school situation where there is a predominant language in the school. However, this has come with the disadvantages of discriminating against the majority of learners, if not all, as the transitional program

disadvantages learners from minority language speech communities in the first year of basic education and subsequently disadvantages citizens through the use of English which is rarely spoken as a first language in Botswana. This limits active engagement with the learning material which results in the declining academic performance of Batswana learners.

It must be noted that Botswana has never appreciated heteroglossic ways of viewing language in the education system. Just like in other multilingual countries, the multiplicity of languages presents a challenge in language planning in Botswana. In Nordic countries multilingualism has always been supported in the education system as learners could use their first language for collaboration in the classroom (Norby 2015). The Botswana Language-in-education Policy seems to be slowly moving from a “one size fits all” approach (in writing) as it now intends to consider a predominant language in a child’s environment. However, this policy seems to ignore the learners’ repertoires as it only focuses on the predominant language. Since life experiences and comprehension can influence each other as pointed out by Paris and Hamilton (2014), the newly proposed Language-in-education Policy might be beneficial from pre-reading stage through decoding and finally comprehension where learners’ proficiency in their first language is expected to influence their proficiency in reading as they construct mental representations (Oakhill et al 2014). The challenge is that some of the languages to be used for mother-tongue education at lower levels are not developed to a higher standard but that does not mean that they have no value as they can be developed while they are in use. In this regard the proposed Language-in-education Policy will have the advantage of contributing to the development and intellectualisation of minority languages even though, as is the case for Setswana, these languages will only be studied as subjects and English will continue its hegemony throughout the education system of Botswana.

According to the Daily News (2021), the ministry of education drafted a Language-in-education Policy that embraces the learner's first language as the language of learning and teaching. Other local languages are to be used as languages of learning and teaching and others are to be taught as subjects. According to the minister of education the proposed policy intends to use the mother tongue from reception class to standard 2 for smooth transition. However, according to Cummins (2000) at this stage the learners are still using language at the level of BICS therefore switching to using a second language for learning and teaching at this stage will be considered too early compared to five or six years of using the mother-tongue in the early stages of elementary education. In designing the proposed policy, the government initially identified 11 local languages to be used as languages of teaching and learning in geographical areas where they are predominant: Thimbukusu, Naro, Shona, Chikuhane, Sheyeyi, Ikalanga, isiNdebele, Shekgalagari, Afrikaans, Sign Language and Otjiherero. Later in 2022 Nama and Kwedam were added and the languages increased to 13. These languages, including Setswana, are to be used from the first year of basic education to the third year following which English will take over but Setswana will be taught as a compulsory subject throughout the education system for nationalism. The minister explained that this was based on research that supports the use of mother tongue in the early stages of learning. However, the policy seems to be based on earlier research which neither considers Cummins' (2000) interdependence theory nor the translanguaging theory which both support embracing multilingualism by considering the learners' repertoires as a resource even in higher levels of learning. To implement this policy the minister stated that there will be stakeholder consultation that would run for 2 months from August 2021.

Chebanne (2022) responded to the government's proposed policy in a critical reflection by stating that in addition to a lack of financial resources some speech communities have more than one indigenous languages and others, such as those in Ngamiland, have complex language situations in which children do not acquire their parents' languages but rather the languages that are dominant in their areas. This means that the proposed policy may perpetuate the exclusion of minority language speaking learners. Similarly, Bagwasi (2021) states that to embrace multilingualism policies must ensure equitable distribution of languages in all domains. This reveals a monoglossic approach that the proposed policy is adopting in addressing issues raised by language diversity in the education system of Botswana which relies mainly on traditional bilingual models.

As shown by Garcia and Klyen (2016) traditional bilingual programmes in schools hold a monoglossic view towards bilingualism and therefore they separate languages through a structuralist perspective. However, according to Dosse (1997) structuralism at first was promising as it seemed to consider criticality and to be moving towards science. As a mode of knowledge, structuralism is now a thing of the past as explained by Sturrock (2003) who defines structuralism as the study of systems which are known to be mobile but which he views as "frozen in time" (p. 20).

Before 1994 language policy and practice in Botswana schools was close to Cummins Interdependence theory of languages as they supported the use of Setswana for the first four years of primary education. Even though minority languages were not used in pedagogy, prolonged use of Setswana as a national language was supported and English was used at higher levels of learning from the fifth year of elementary education. According to Cummins (2000) it is best to use the learners' first language for at least six years in the early stages of education before

using their second language for teaching and learning because using a second language too early in the education system can lead to low CALP (see p.87).

Grosby (2005) states that nationalism is not synonymous with nation but it means beliefs that people hold about a nation. Language is usually associated with nationalism as it is part of the inheritance that parents pass on to their offspring who are also part of the nation. On the contrary Ramsay (1995) states that nationalism in Botswana is different from other African countries as Botswana did not show a specific rejection of Britain, its coloniser. Therefore modern Botswana complained mainly against the inclusion of the Bechuanaland Protectorate in the Union of South Africa. This probably led to the adoption of English as an official language and as the main language of teaching and learning. However, Campbell and Crush (2015) show that in Botswana there is postcolonial nationalism which deals mainly with who belongs or who does not belong and it is usually demarcated by linguistic boundaries. This may be another factor that contributes to a structural view of languages of Botswana where languages are strictly categorised and only a few are allocated functions in the public domain. The strict compartmentalisation of Botswana languages which does not recognise fluidity of languages has contributed to the assimilation of some languages of Botswana as shown by Malumbi and Dryden-Peterson (2018) who claim that the assimilationist and multicultural approaches in defining Botswana's national identity are conflicting and this is clearly visible in the education system of Botswana. Malumbi and Dryden-Peterson (2018) also point out that the written curriculum in Botswana is assimilationist as the recommendation that sought to include minority languages in the Language-in-education Policy in 1994 was rejected and this marks the assimilationist construction of Botswana's national identity. The assimilationist model in Botswana can be linked to the British transfer of power which Lotshwao (2021) views as passive

revolution. According to Lotshwao (2021) the ruling party is pro-British and this aided the construction of hegemony. This might have contributed to the high status of English language in Botswana because in 1962 the ruling Botswana Democratic Party (BDP), which included some Batswana and some British who continued to promote British economic interests was formed to neutralise Botswana People's Party (BPP). This resulted in the promotion of English and marginalisation of local languages.

Chebanne (2008) states that there is a significant number of Khoisan languages in Botswana. These are some of the languages that are marginalised as they are not included in the curriculum. According to Chebanne (2016) majority tribes' languages are standardised and used for learning and teaching at lower levels of primary education and studied as Setswana which is a compulsory subject throughout basic education. In this regard major ethnic groups in Botswana assimilated minority tribes in a process that they claimed was promoting unity and that is why Botswana is presented as monolithic in most literature as it is believed to be linguistically homogenous (Nyathi-Ramahobo 2002). Chebanne (2016) highlights the fact that languages that are marginalised always face the risk of extinction since the speakers tend to abandon these languages. He emphasises that even Setswana is facing regression as the vitality of the English language is strengthened by the lack of language planning in the country. Similarly Mooko (2006) points out that the high status of English and Setswana have changed the attitudes of speakers of other languages toward their languages as some parents are only focusing on their children's' acquisition of Setswana and English. Mooko (2006) also calls for a multilingual approach in dealing with languages of Botswana. He does this by highlighting the necessity of including the language speakers in language revitalisation endeavours even though some cultural groups have to work hard to change the attitudes of minority language speakers.

Some scholars like Chebanne and Moumakwa (2017) view the issue of language-in-education in Botswana as a human rights issue as they state that in Botswana multilingualism is viewed as a problem and not as a resource, and this therefore limits the access of some language users to domains such as education. This results in poor academic performance by learners who speak minority languages in rural areas as shown by Odotei (1991). Minority languages are only used within the family and the inequality and inequity of languages is the result of the education policy of Botswana (Chebanne and Moumakwa, 2017). In this regard Chebanne and Kewagamang (2020) propose a plan to include marginalised languages of Botswana in the education system. They state that even though intensive research has been conducted on the languages of Botswana, the government has not made any plans to embrace multilingualism in education. However, the government has only considered the inclusion of French in the curriculum and ignored indigenous languages because it is mainly interested on minimalistic models to include fewer languages diversity is probably viewed as a problem. Viewing language as a resource supports mother-tongue language policy in education and when planning for the use of Setswana it is best to plan for its intellectualisation so that it can be used at all levels of education. In their proposed plan Chebanne and Kewagamang (2020) place Setswana high in the hierarchy when compared to other languages of Botswana and propose that it may be used for national inter-ethnic communication and also for education. The authors also propose that English can be used as a foreign language for international ties and minority languages which are known as areal or regional languages they suggest can be used in early levels of education and for inter-ethnic communication. The proposed model shows that different languages have different status in education and it considers the fact that languages of Botswana are found in different geographic areas and therefore it proposes these languages be learnt as subjects. This

model may correct what Bagwasi (2021) views as asymmetrical bilingualism which she claims is fostered by the education system of Botswana instead of multilingualism through language policies that perpetuate exclusion.

Adeyemi (2008) states that the education system of Botswana is guided by a transitional bilingual model as it uses the child's L1 as the language of learning and teaching in early stages of primary education. However, as shown by Bagwasi (2021) Setswana is not every Motswana's first language. Bagwasi (2021) shows that English can deny good performing students admission to some tertiary institutions in Botswana. From her observation the education system of Botswana supports a monoglossic view towards language which Abdulaal (2020) suggests that these approaches have to be replaced with the indirect use of mother-tongue to enhance acquisition of the target language. The author did this by undertaking a study to determine the difference between the scores of the control and the experimental groups of International English Language Testing System (IELTS) students. The students were given 40 questions to answer in 60minutes after reading three texts. They were also given two descriptive writing tasks which involved retesting to determine the reliability of the pretest which had the coefficient correlation of  $r= 0.734$ . The readings were based on texts that used translanguaging but learners had to first read monolingual texts in Arabic. This shows one of the benefits of embracing multilingualism in education which is to enhance academic performance which Batswana learners fail to achieve partly due to policies that exclude some learners.

Adeyemi (2008) supports Nyathi- Ramahobo's (1997) decentralisation model so that the learners' first languages are considered in all geographical areas across the country. She supports the implementation of bilingual education which recognises the use of one language for teaching and learning at a certain level of education. However, from a translanguaging lens, even though

this model recognises co-existence of languages of Botswana this model of bilingual education is the one that perpetuates a monoglossic approach to language in multilingual settings as it still compartmentalises the languages and reserves them for use at the assigned levels of education.

According to Goodman and Tastanbek (2020) who support moving from a monoglossic approach to support a heteroglossic view of language practices in the classroom, the researchers realised that teachers spontaneously use translanguaging rather than using it strategically as a pedagogical tool. Therefore the researchers suggest that teachers need to be taught ways of using heteroglossic approaches and translanguaging strategies in pedagogy. This emphasises the necessity of translanguaging in meaning making as they show that pedagogical processes rarely employ translanguaging for identity, communication and meaning making. Therefore more research is needed in this field to see how translanguaging can be used to benefit learners in the classroom. Some scholars like Oliva & Donato (2020) and Choi & Liu (2021) have shown that translation can play a major role in promoting translanguaging pedagogies in schools. However, this was never considered nor recognised in the education system of Botswana.

Language in the education system of Botswana is treated in a monoglossic approach that compartmentalises language. Even though the government currently proposes what it calls “mother-tongue policy” some scholars have shown that the policy is likely to fail looking at the complex nature of some predominant minority languages that are to be used only at the first three years of primary education including reception classes. In proposing the mother-tongue policy the government is guided by research which promotes traditional models that separate languages which practically reveals a structuralist approach that has always been practiced in the education system. The traditional model reveals a gap that could be closed by using translation to bring languages together and soften their boundaries so that learners may maximise their

communicative potential and comprehension of science content. Therefore, this study used a quasi-experimental design to study the effects of bilingual science texts in Botswana primary schools focusing on the fourth year, which is the middle level of primary education in Botswana. In this regard it might be beneficial to consider translation in pedagogy to consequently embrace multilingualism for enhanced academic achievement of Batswana learners.

## **2.4 Conclusion**

Chapter 2 shows that multilingualism is embraced differently by various education systems worldwide. Most countries have realised that learners go to school with their home languages, which must be accommodated to support their participation in the learning process. However, embracing multilingualism exists in a continuum as some limit translanguaging by separating languages to end up practising the traditional model of bilingualism, and others welcome all the languages that the learners speak to and adopt a translanguaging model. Most African countries have adopted the colonial languages, and their hegemony has negatively impacted on learners' academic performance, participation and confidence in the classroom. Therefore, most African countries are looking for alternatives to accommodate their indigenous languages by reviewing their policies. Mother-tongue education follows the traditional model that compartmentalises languages to support them individually. Cummins' Interdependence Theory of Languages also embraces multilingualism but to a limited extent as its criticism from the translanguaging perspective shows that it separates the two languages even though the hypothesis claims the languages are interdependent. Tanzania, for instance, shows the disadvantages of this model as learners start with mother-tongue education at primary school but struggle to transition to English at the secondary level. The LSTT project was implemented to enhance language-supportive teaching among groups with low proficiency in foreign languages. This project

resulted in codeswitching, which is prevalent in African schools, even though it is extremely limited by policy in most contexts. It must be noted that traditional practices of language-in-education do not allow codeswitching, as we observe in Botswana, where English is the only language of learning and teaching from the second year of primary education despite learners' low proficiency in the language. This shows that Botswana's education system does not embrace multilingualism while learners continue to show excellent performance in English and Setswana as subjects but poor performance in science in the Primary School Leaving Examinations. In trying to relax the boundaries between languages and disciplines, this study used a quasi-experimental design to determine the effects of embracing multilingualism on learners' academic performance in science in the fourth year of primary education by allowing fourth-year primary school learners to use bilingual science texts. Translation was used to make information in the monolingual texts more relevant by creating a translanguaging space in which learners create their own translanguaging spaces to enhance comprehension and maximise communication. The following chapter elaborates on the methodology that was undertaken to realise the results of this study.

## **CHAPTER 3**

### **Methodology**

#### **3.1 Introduction**

This chapter describes the research process undertaken to determine the effects of embracing multilingualism on the academic performance of learners in primary science education in Botswana. It starts by explaining the methodological approach, which was quasi-experimental, since it intended to manipulate an independent variable, the use of bilingual texts, and to evaluate their effect on the performance of fourth-year primary school learners. Since the methodology was influenced by relevance theory, it was empirical as it evaluated the interpretation of texts with and without translation to derive empirical evidence of academic performance. The chapter goes on to explain how direct and indirect observation was used to gain knowledge since the study used mixed methods by assigning learners scores, observing their language practices and discussing their experience with them after using monolingual texts as well as bilingual texts. This is fully described within the chapter as it goes on to describe methods of data collection that were employed. These consisted of a testing instrument that was marked and learners were allocated scores, class observation, interviews and focus group discussions. These helped collect rich data that was analysed using SPSS Statistics to compare the overall mean scores of the control and experimental groups as well as the control and the experimental means in each of the three schools. The P-value was also determined to measure the strength of evidence for or against using bilingual texts across the three schools and between the control and the experimental groups. Observations of critical moments and interviews were analysed using moment analysis to determine critical moments, what triggered them and the consequences of those moments in classroom language practices. The fourth-year of primary

education, also known as Standard 4, was the only level participating in this study in a village where Setswana as the national language is predominantly spoken – Mmathethe village, in a village where a minority language of Botswana is predominantly spoken – Kang Primary School, and in a city where English is predominantly used in schools as well as at home. Finally, the chapter ends by listing the limitations of this methodological approach and gives suggestions for future research such as quota sampling, longitudinal research and coverage of all levels at primary school.

### **3.2 Research design**

As Gutt (2010a) pointed out, the relationships between the message, context and stimuli are empirical; therefore, they can make testable predictions about the success or failure of human communication. In this regard, this study used a quasi-experimental design adapted from the TIMSS and PIRLS to investigate the relevance of bilingual science texts as a communication stimulus in the classroom. The TIMSS assessment is mainly mathematics and science content, but in PIRLS, there is also an assessment of the cognitive aspect of reading. The quasi-experimental design was used as it would not have been possible to assign participating schools to treatment groups randomly. It was also deemed an appropriate design as this study involved manipulating an independent variable. Using pre-existing classes differentiates quasi-experiments from true experiments as it is not easy to reassign the already intact classes into the experimental and the control group (Schreiber & Asner- Self, 2011). This study generated two data sets: one from each of the observations of learners' language practices and focus group discussion, which resulted in qualitative data, and the second one from learners' scores, which is quantitative. Therefore, the study employed a mixed method approach as influenced by Fleisch et al. (2017b). According to Ary et al. (2010), mixing the qualitative and quantitative approaches

creatively can help the researcher to utilise the strengths of both approaches. These approaches were employed concurrently to triangulate different methods to study the same phenomenon. Like Rupp et al.'s (2006) study, this study resulted in a fully mixed method design mixing both approaches through data analysis and interpretation of the results. The study used teacher-directed translanguaging, which is also known as pedagogical translanguaging. According to Cenoz (2017), this deals with teaching strategies that are structured and planned using flexible strategies for new language practices. The approach was adopted to move from traditional pedagogy to progressive pedagogy that is learner-centred (see Lin, 2013). This method of translanguaging was used to motivate pupil-directed translanguaging, which Lewis et al. (2012b) describe as spontaneous translanguaging. It must be noted that García (2008) says this method of translanguaging is agentive in meaning-making.

Ndhlovu (2021) suggests that we must avoid following the imperial ways of undertaking research, which are usually based on the Euro-modernist framework because our methodology shapes our research questions. Ndhlovu (2021) goes on to show that mainstream researchers are usually biased towards the protection of hegemonic practices. Therefore, it is important to study how inequality and exclusion are determined using language in society and the role language plays in the facilitation or hindrance of acquiring education. To determine these, it is best to employ collective imagination and identify how different factors are interconnected by:

...adopting a methodological orientation in which interconnections, interrelationships, interdependencies, collaboration and coproduction, as well as recognition of diversity, tolerance, trust, equality – among other forms of socially take centre stage in our research agendas. (Ndhlovu, 2021, p. 199)

Therefore, this study adopted mixed methods to allow it to determine how the use of bilingual texts would influence learning in different linguistic regions in Botswana. The cross-sectional study was preferred over a longitudinal study because of the limited duration of the researcher's study programme.

### **3.2.1 Instruments**

- 1) A video recorder was used to record language practices. The language practices of two pairs of learners randomly selected from each of the experimental and the control groups were observed while the learners were attempting the last question that probed collaboration.
- 2) To validate these observations a 30-minute focus group discussion using an open-ended questions interview guide (see *appendix*) was conducted with each group (control/experimental) which resulted in transcribed data for moment analysis.
- 3) Reading comprehension exercises were used to determine the relevance of information in monolingual and bilingual science texts. They also served as triggers for translanguaging to open the translanguaging space in classes that are supposed to be monolingual. The written exercises were adapted from two topics in the prescribed science textbooks that follow the curriculum. Mukhopadhyay (2016) shows that writing is a productive skill that depends mainly on a certain proficiency in grammar, comprehension and vocabulary skills. It has the sub-skills of content knowledge, spelling and punctuation, discourse structure knowledge and cohesion knowledge. The last questions were collaborative questions that supported practical scaffolding through translation to enhance collaboration in the classroom (Wang, 2016). The collaborative questions were included to facilitate structured translanguaging strategies and develop a transformative teacher-student role that moves away from traditional pedagogy to transformative

pedagogy partly because Chi (2009) and Zhan et al. (2010) show that collaboration in science lessons can lead to enhanced academic performance.

4) Questionnaires to look for variability were attached to the consent form for demographic and behavioural content: age, gender and home language(s).

### **3.2.2 Variables**

#### **3.2.2.1. Dependent variables: Learner performance and language practices**

Learner performance was measured by assigning learners scores on the written assessment after a reading exercise. The scores indicated the relevance of the information given and the extent to which learners could understand the text when using monolingual or bilingual science texts.

The last two questions were collaborative, marking language behaviour as another dependent variable observed while learners engaged with the text. Their linguistic behaviour was affected by manipulating the independent variable, which entailed using bilingual parallel texts. Data were recorded with a video camera and the audio was also transcribed. Then the video-recorded learners were interviewed in pairs. Later, a focus group interview was conducted with the whole group to discuss creativity and critical moments in the learners' language practices as influenced by the language of the text that they were reading for comprehension of a science topic.

#### **3.2.2.2 Independent variable**

Science texts were independent variables as they were manipulated to determine how they affected the dependent variable and learner performance. This variable was manipulated through translation of a monolingual (English) text into Setswana and presenting the original text and the

translation as parallel texts to the experimental group. There was no manipulation of the original English text for the control group as they used the texts as they normally do monolingually in English. Therefore, manipulating the independent variable as an intervention was expected to affect the dependent variables, the performance score and language practices. Since there was no treatment of the independent variable for the control group, the monolingual texts were not expected to affect learner performance, but bilingual texts were expected to affect learners' performance depending on factors such as linguistic context and adherence to existing policy; hence two-tailed tests were conducted to determine the difference between the control and experimental groups.

Other variables such as age, gender and home language(s) were considered in relation to the cognitive effects of using bilingual texts in science education.

### ***3.2.3 Stimulus***

The experimental test stimulus, the text of a science topic (Food and Nutrition), was manipulated to observe how it affected the message derived. Only the presentation language was manipulated; the content was retained. This was appropriate for face validity as it was adapted from a recommended science textbook assessed by the Botswana government. Therefore, questions on the instrument were related to the phenomena of interest. The effects were observed through learners' language practices and comprehension scores. The meaning derived from texts was tested using objective and subjective questions measured and analysed using an assessment test, and marks were allocated to learners. The text prompted reading for information acquisition; therefore, as in the PIRLS, the learners were expected to retrieve information and make straightforward inferences while interpreting, integrating and evaluating the text. A topic the learners had not covered was chosen and translated into Setswana using a relevance theoretical

approach, and the two texts were printed alongside each other. However, the comprehension questions were monolingually presented in Setswana to avoid bias in learners' choices because of negative attitudes towards Setswana, which could have otherwise resulted in false results that measured preference and not comprehension. According to Rivera and Mazak (2017), it is important to study learners' attitudes towards translanguaging because this can influence the success or failure of this pedagogical strategy. The attitude of Batswana learners towards Setswana is shown by Laba (2016), who claims that secondary school learners in Botswana have negative attitudes towards Setswana and prefer to use English as a language of learning. Arthur (1996) also shows that English is a prestigious language that most Batswana learners want to be associated with despite their low proficiency in the language.

A relevance theory approach and a functional approach to translation were integrated into the translation process to expand the translanguaging space using bilingual texts. From the postulations of relevance theory, the researcher expected this study to show that untranslated science texts only favour a fraction of learners and therefore they only partly meet the communicability condition of optimal relevance to Batswana learners. From the perspective of translanguaging theory, this study was expected to provide evidence that using bilingual texts to study science can positively affect the academic performance of some Batswana learners as it enhances accessibility.

For the control group, the stimulus was the same text as the experimental group's text but untranslated as it is always used. Likewise, the pre-test was an untranslated text of a science topic (Procedures to follow in case of a blood spill) in English adapted from the learners' textbook which was used to ensure equivalence of content. The same pre-text was used to determine the academic performance of different participants before the experiment.

The curriculum is already localised, and there are prescribed texts to be used in science education. The task was therefore to translate a topic that the learners had not covered – a topic with content and assessment questions. These assessment questions were used as an instrument for consistency. Two collaborative questions were added to influence interaction. Gutt's (2000) guide on designing the translation was followed. This guideline includes:

- Determining the translator's informative intention.
- Designing a stimulus.
- Monitoring resemblance relationships between interpretations.

The above-mentioned steps were combined with the three functionalist approaches to design a translation that ensured successful communication of the objectives as stated in the curriculum: 1) the importance of the translation brief, 2) the role of source text analysis, and 3) the functional hierarchy of translation problems. Communication problems that occurred in translating the text and the causes of the problems were investigated and addressed.

To avoid the testing effect, which could affect internal validity, the control and the experimental texts were made equivalent in form. The assessment tests provided scores that could be used to make inferences about a construct since Schreiber and Asner-Self (2011) explain that constructs are latent as they cannot be observed directly. Here, comprehension of the texts was taken as a construct.

### **3.2.4 Research setting**

This study was conducted at three primary schools in Botswana taking into consideration the territorial nature of multilingualism in Botswana. For proper representation, the selection of the schools employed disproportionate balanced stratified sampling (see Daniel, 2011). This

allowed good comparison of strata as it allowed inferences to be made within strata. It employed simple random sampling after categorisation. According to Cohen et al. (2007), stratified sampling is where the population is divided into homogenous groups that contain subjects with similar characteristics. Furthermore, using convenience sampling, the first primary school was selected from a Setswana predominant region: Mmathe Primary School, the second one from a minority language speaking region: Kang Primary School and the last one was selected from a city where different languages of Botswana are spoken: Mophane Primary School.

### ***3.2.5 Sampling frame***

As mentioned previously, this study employed multi-mixed sampling. According to Schreiber and Asner-Self (2011), multi-mixed sampling involves using different sampling processes.

#### **3.2.5.1 Non-proportional stratified sampling**

This sampling process was used to select participating schools so that there was one school from the three regions mentioned above.

#### **3.2.5.2 Purposive sampling**

Classes in the fourth year of primary education were selected purposively for the study as it is a middle grade, and their curriculum combines linguistic characteristics of the lower and upper primary curriculum. They have abstract terms as they are moving toward using CALP and context-embedded terms as they are moving away from BICS. Therefore, this education level in Botswana is a true representative of primary education language. The reading comprehension assessments have high content validity as they reflect the scientific content of primary science in Botswana. According to Dougherty Stahl (2014), young children can be viewed as emergent readers who are still learning the correspondence between phonemes and graphemes. Their

attention span is short, they lack different world experiences and they have a low vocabulary range. Most of the comprehension challenges that learners reveal in Grade 4 are rooted in difficulties encountered earlier. The fourth grade is critical as some learners may find it hard to transition from simple decoding to comprehension and gathering information from a text when they reach Grade 4 (Chall & Jacobs, 2003). By this grade, they are supposed to be reading to learn. Since textbooks of different genres are available for learners in middle grades at primary school, these learners should be able to read and understand these. According to Wharton-McDonald and Swiger (2014), students who are not fluent and lack automaticity read less and avoid passages containing difficult words, but in the fourth year of primary education, learners can read complex texts that require different strategies for comprehension. Therefore, they should be able to monitor the processes and strategies that will help them succeed.

### **3.2.5.3 Matched pairs**

There was no random assignment of learners to the control and experimental groups and therefore matched pair design was employed to maintain a similar comparison group. To allocate participants to the control and experimental group, matched pairs were used so that each control group member matched a member of the experimental group. Pre-test marks of learners and their gender were used to randomly allocate learners to the control or experimental group in each school. The pre-test marks were used as experimental manipulation and gender was used as natural manipulation to allocate participating learners (see Privitera, 2017). The limit of variability was +/- 12.5, taking into cognisance that there were only eight reading comprehension questions. Then a coin was tossed to determine the group for participation in the study. According to Privitera (2017), the matched pair design is crucial in studying related samples. The first stage involved selecting participants, and later matching them by considering their

performance and gender. Then they were observed while using or not using manipulated texts so that the scores of the two groups in each participating school could be compared.

#### **3.2.5.4 Sample size**

The target population was approximately 50 000 fourth-year primary school learners (Standard 4 pupils) (Statistics Botswana, 2018). The accessible population was 304 Standard 4 pupils.

The sample comprised 16 learners for each group: eight boys and eight girls. Therefore, 32 learners were in the control and experimental groups from each primary school, so the study sample was 96 learners for the three regions. According to Schreiber and Asner-Self (2011), a quasi-experimental study should consist of 15 to 30 observations per group. The issue of gender was balanced by having an equal number of boys to girls because Kennedy (2008) & Oxford (2003) shows that generally, girls have better reading skills than boys.

#### **3.2.5.5 Systematic sampling**

Systematic sampling was used to select learners who would participate in the study. Using parental consent forms, an alphabetical list of learners was compiled, and the participants were systematically sampled. According to Ary et al. (2010), systematic sampling involves sampling by taking every  $K^{th}$  case from the eligible population. Here the choices are not independent, for example, if  $K = 3$ , choosing the number 2 means next 5 will be chosen and then 8. Then the participating names were selected randomly but taking into consideration their pretest scores to be paired so that there were matched pairs for the control and the experimental groups.

### **3.3 Data collection procedures**

According to Stille et al. (2016), for multilingualism to be embraced in the classroom, educators must experiment with different language strategies. Similarly, Lin (2013, p. 20) suggests that when conducting multilingual education research, we must adopt an approach that would ‘try- and see- and then document and retry another pattern’ and see what happens so that we can re-design future action plans. It is against this backdrop that this study adopted a quasi-experimental design. A questionnaire was first piloted to ensure its reliability and validity then it was attached to the parental consent form to fill in their child’s demographics. There was one behavioural question about the learners’ home language. The pre-test-post-test design was used, and the experimental and control groups were given the same pre-test in English, as this is the language they normally use.

Video footage was used to collect data on observable language practices while the learners attempted collaborative questions. Then a question-based open interview conducted through focus group discussions was conducted with learners in each school. The interview guide approach (see Patton, 1980), where the issues to be covered were outlined in advance and the interviewer sequenced the questions as the interview unfolded, was followed. Here, the intention was not to collect comparable data regarding the learners but to acquire information about how they react to monolingual learning material instead of bilingual material and vice versa.

Focus group discussions were considered important as it explores a collective view of learners on language practices as influenced by the language of the text. Because this can help the researcher gather data on participants’ attitudes and opinions (see Patton, 1980), this discussion was open but guided so that learners could voice their opinions as a group in their own words.

Piloting of the pre-test and post-test was analysed using correlation to ascertain reliability. The independent variable of the experimental group was manipulated by introducing bilingual texts. The instructions were clearly written on the cover page and before each pair of the eight questions. The questions were arranged in order of difficulty, from easy to more difficult. The experimental test was administered bilingually to the experimental group, while the control group received the same test monolingually in English. As shown in Table 3.1, the experimental group went through intervention as they were allowed to read English and Setswana and answer a set of questions in Setswana as guided by the language used to ask the questions. The exercises had no limited time, but time was recorded to note the starting and ending times for the first and last pupils to submit. This was done to allow learners to attempt all the questions.

**Table 3.1: Quasi-experimental design**

Group	Pre-test	Post-test intervention (bilingual texts)	Post-test (monolingual texts)
Control	√	X	√
Experimental	√	√	X

### 3.4 Validity and reliability

#### 3.4.1 Validity

The learners used their normal classrooms to maximise validity. The focus was not only on the learners' scores but also on how they engaged with texts to derive meaning. Methodology triangulation was employed to maximise internal validity. As described earlier, assessments for

learners' scores (quantitative), interviews and focus group discussions (qualitative), and observations (qualitative) for language practices were used to avoid bias and to give out a clear picture of the effects of bilingual texts in learning. The extensive contrast between the methods increased confidence in the results. Investigator triangulation was also employed so that the teachers checked the score allocation of the scripts. The correct instruments were selected to capture accurate and representative data. To ensure appropriateness and readability, the researcher opted to use the recommended primary fourth-year textbooks that were already in use. There were eight questions: two True/False, two completion, two structured and two collaborative. Matched pairs were used for the control and experimental groups to minimise invalidity. Moreover, to avoid type 1 error,  $\alpha = .05$  was applied to avoid rejecting the null hypothesis when it could be true. It also helped avoid error 2, which could result from accepting the null hypothesis when it could not be true (see Cohen et al., 2007). Moreover,  $\alpha = .05$  is commonly used in the social sciences as observed from authors in the literature review of this study, for example, Ellis and Hooper (2001), Spencer and Hanley (2003), Mgijima and Makalela (2016), Zhang and Webb (2019) and Botswana Examinations Council (2014). Representation of territorial multilingualism was ensured by selecting schools from Setswana predominant and minority language predominant villages and a city for external validity. Internal validity was maximised by ensuring the tests covered the relevant field of study and were relevant to the fourth-year primary school curriculum.

### **3.4.2 Reliability**

To maximise reliability, the researcher used equivalent texts and questions for the control and experimental group. The researcher knew that the instrument was high quality because the two instruments, the control and the experimental groups, had a high correlation during piloting.

For consistency, reliability was maximised by the split half method. This means the eight assessment items were split into two halves to ensure each half was matched in terms of content quality and then the marks of the pilot tests were correlated (Cohen et al., 2007).

### **3.5 Data analysis**

After marking the pre-test, the scores were analysed and compared for equivalence using SPSS Statistics before the experimental and control experiment. After treatment, another set of scores was derived from the learners' marks on the manipulated text, and another mark came from the control group. The marks from the two groups were compared using SPSS Statistics to test if there was a statistically significant difference between the means of the groups within and overall.

Qualitatively, focus group discussions, pre-tests and experimental and control data from observation were analysed using Wei's (2011) moment analysis approach, which views translanguaging as moving between linguistic systems such as speaking, reading and remembering. According to Wei's approach, moment analysis captures crucial moment action, what triggered it and any consequences. It can be analysed to see how multilinguals create their translanguaging space critically through creativity. This involved discussions with the students to record what they thought triggered their language practices and what they wanted to achieve by adopting specific language practices. This analysis method allowed the researcher to study language practices empirically without focusing on p-values, frequencies and language patterns only but also analysing individual's spontaneous actions. This included focusing on an individual's critical and creative language practices and analysing periods of time that are more significant than others. I, therefore, used moment analysis to study these spontaneous moments, their consequences and how other participants reacted to them. Here, data was collected from

language users' commentaries during interviews while watching their video play. The focus group discussion helped the researcher to find out how learners position themselves in data collected through interviews and discussions. This analysis resulted in a combination of narratives, observations and interpretations, and it was used as it focuses on the individual's interpretations and language practices in their creativity and criticality.

### **3.6 Ethical considerations**

Since this study involved human beings specifically minors, ethical clearance was sought from the Human Research Ethics Committee after attending a seminar on ethical clearance. The application was conditionally approved provided permission was obtained from the participating schools. As shown in the appendix, permission was granted by participating schools and consent forms as well as assent forms were completed by participating learners and their parents.

### **3.7 Limitations**

The most suitable type of sampling for this study would have been quota sampling. This would minimise the use of the one-size-fits-all approach to language policies, which does not promote inclusive language practices. It would also mean representation in accordance with the ratios found in the wider population. For cities, it could have been one school; for minority languages, it could be one school; for Setswana predominant areas, it would be eight schools since about 80% of Batswana speak Setswana as their first language (Zsiga et al., 2015). However, this would have been too expensive and time-consuming, even though it is ideal for collecting more meaningful data.

Eye-tracking devices can also be useful in this kind of study as they provide evidence of texts read to determine whether learners read monolingual or translated texts. They would help

determine whether they read the different texts more easily because the eye would return to previous words or sections more often if a reader finds the text difficult to understand.

Also, language practices and their effects are best studied using a longitudinal study like the six-year mother tongue project which was conducted for more than ten years. However, because of the limited time available to conduct this study, it employed a quasi-experimental design, which has the advantage that learners will be in their natural setting.

Finally, the researcher could have used classes from the lower levels of primary education, which are Standard 1, 2 and 3, one class from the middle level, Standard 4, and one class from the upper levels, Standard 5, 6 and 7 of primary education. This would give better results as science terminology differs in difficulty between levels but this was impossible because of the limited time available during the researcher's period of study. Nonetheless, middle primary, Standard 4 content is characterised by both abstract and context-embedded scientific terms.

### **3.8 Conclusion**

Chapter 3 explained the methodological approach that was employed in this study. It showed that this is an empirical study since it collected both data that could be directly observed and data that could not be directly observed to evaluate the effects of using bilingual texts in the study of science. Since the texts were translated using the relevance theory approach, interpretation of the stimuli was measured through comprehension questions and learners were assigned scores. This provided the first set of data, which was quantitative, and the results of observations, interviews and discussions provided qualitative data that were analysed using SPSS Statistics and critical moment analysis, respectively, to end up with both quantitative and qualitative results. These results are presented in the following chapter. Later, they will be discussed to evaluate the strength of the evidence they give regarding using bilingual texts in science lessons to comprehend content. This will also shed more information on how learners use the translanguaging space created by using bilingual texts. Finally, the limitations of the methodological approaches undertaken by this study were discussed and suggestions, such as using a longitudinal methodology or eye-tracking devices in a quasi-experimental design, were outlined. The following chapter presents the results that were realised after following the methodology discussed.

## **CHAPTER 4**

### **Presentation of results**

#### **4.1 Introduction**

This chapter presents the results of data collection, processing and analysis. The presentation includes the results of this study by addressing the study's hypotheses for each school and overall. The first section of the chapter presents the participant's demographic information: gender, age, and home language(s). Here, we see 48 boys and girls aged between 9 and 12 speaking different home languages. Then the chapter presents the results of the quasi-experiment by first presenting the effects of bilingual texts on the comprehension of science texts by comparing learners' scores for the control and experimental groups. The results per school follow an overview of the overall qualitative and quantitative results. These results address the study's first objective, which sought to determine the effects of bilingual texts on learners' academic performance. Later, in the third section of this chapter, the results addressing the effects of bilingual texts on collaborative work are presented. These are the quantitative and qualitative results obtained by analysing learners' scores in collaborative questions and analysing observed experiences, respectively. Learners' scores were not normally distributed, hence nonparametric tests were used. It must be noted that  $\alpha = .05$ ; therefore, to answer questions 1 and 2, this study both rejected and failed to reject the null hypothesis in some schools. The last section of this chapter presents results that show us how the use of bilingual texts can be applied in pedagogy to enhance learner performance in science. These results were drawn from analysing learners' experiences through moment analysis.

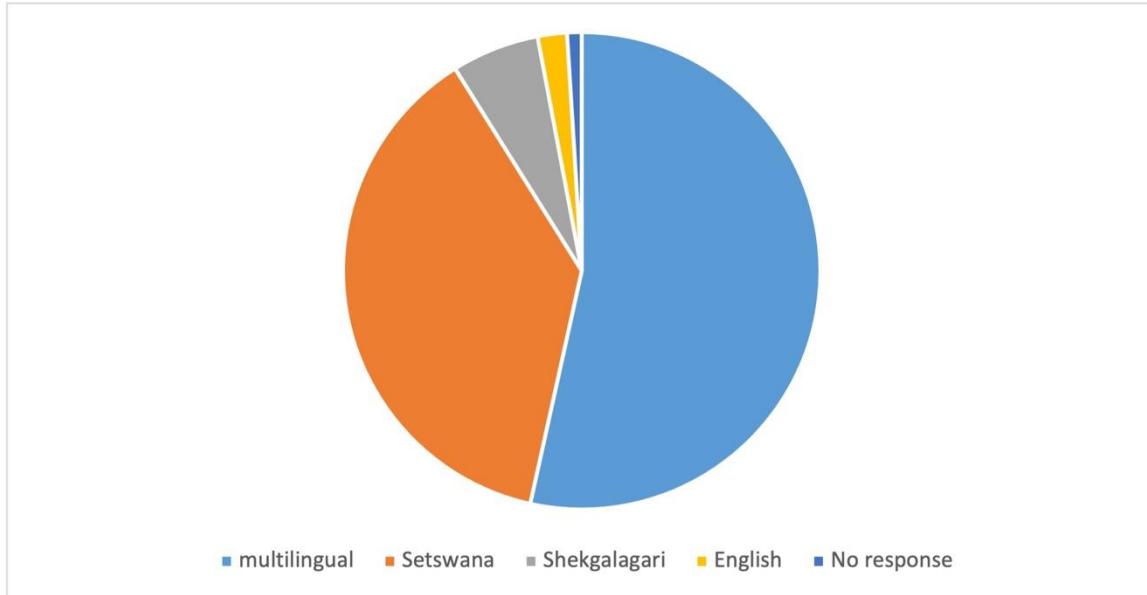
Statistical data were analysed using SPSS Statistics and qualitative data were analysed using moment analysis.

## **4.2 Study population**

To realise the study's aim, the main population, which consisted of pupils in the fourth year of primary education, was selected from three language groups in different localities; those in a village where Setswana is predominantly spoken (village A – Mmathethe Primary School), those in a city where the hegemony of English is prevalent (city – Mophane Primary School) and those in a village where a minority language is predominantly used (village B – Kang Primary School). This was necessary because of the territorial multilingualism in Botswana. The fourth year of primary education was used to represent primary school learners as this is the middle level where we find the use of some abstract terms, as well as context-embedded content. One experimental and one control group were selected through matched pairs from each primary school. All experimental groups received the same treatment of using bilingual texts for reading comprehension in the chosen science topic.

A sample population of 96 fourth-year primary school learners was selected and divided into three strata with an equal number of boys and girls in the experimental and control groups for this quasi-experimental study. A control and an experimental group were selected in each of the three primary schools, with 16 participants in each group, giving 32 participants per school. According to Schreiber and Asner-Self (2011), a quasi-experimental study should consist of 15-30 observations per group. The strata were based on the predominant language in the learners' environment, and the geographic location or the primary school they attend was used to divide the population into sub-groups. The size of the strata was not proportional to the number of language speakers in Botswana because the representation of Shekgalagari, a minority language, would be limited, and our findings may perpetuate biased representation of majority languages. Therefore,

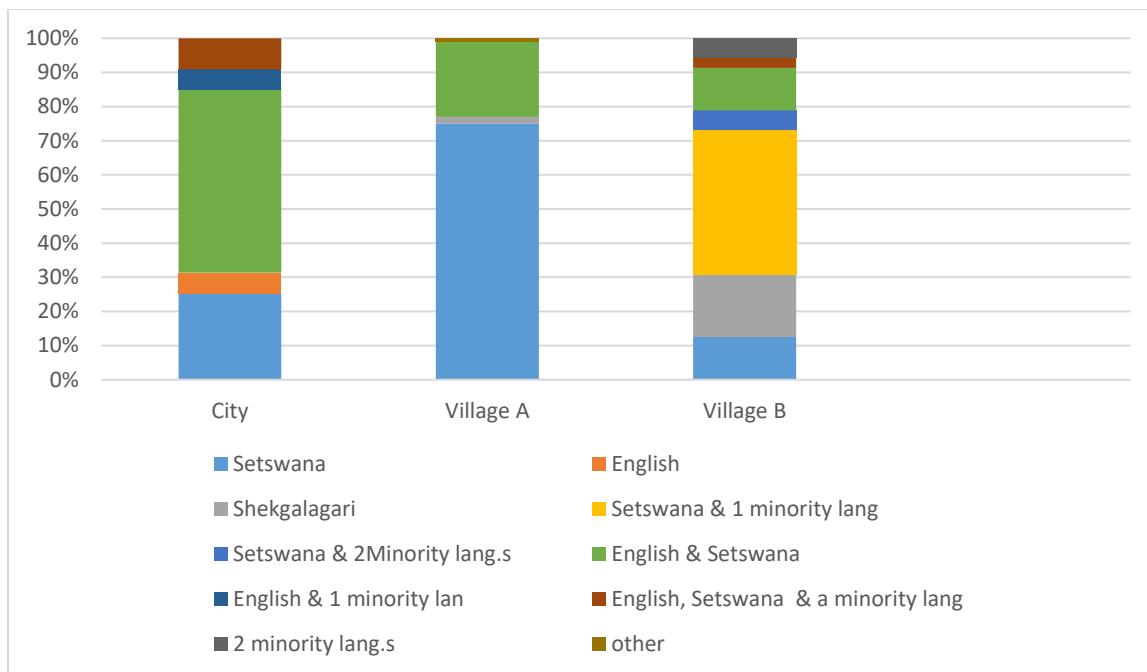
non-proportional stratification of the sample was employed to capture the linguistic characteristics of Batswana primary school learners.



**Figure 4.1: Learners' home language(s)**

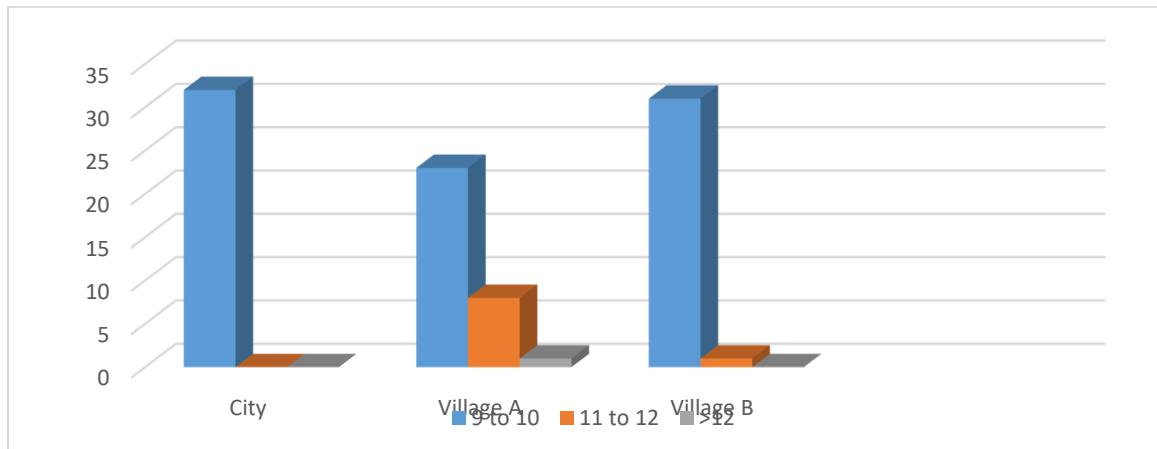
\*Note, multilingual here means the use of more than one language

More than 50% of the learners used more than one language at home, as shown in figure 4.1. Most of these learners had English and Setswana as their home languages, but only 5% of the total sample used three languages at home. Setswana was the next predominant home language spoken by about 38% of learners. However, The Mullis (2011) report on sixth-year Botswana primary school learners states that 85% of Batswana children speak Setswana when they start school and close to 26% of pupils speak English when they begin school. In the PIRLS report, speaking English is strongly correlated with achievement in reading.



**Figure 4.2: Diversity of learners' home language(s) according to their locality**

Kang Primary School learners in village B had varied home languages and Mmathethethe Primary School learners in village A, where Setswana is predominantly spoken, use only a few minority languages at home (Figure 4.2).



**Figure 4.3: Age of participants**

Most learners across localities were 9 to 10 years old (Figure 4.3). They generally start the first year of primary education at around the age of 6 or 7. However, in village A where Setswana is predominantly spoken, a significant number of learners were between 11 and 12 years because of late registration for the first year of primary education or because they were repeating the fourth year as a result of poor performance. In this regard, the Mullis (2011) report states that children who are admitted for the first year of primary education at the age of six and younger performed better than those who started school later.

### **4.3. Effects of bilingual texts on comprehension of scientific content**

#### ***4.3.1 How do bilingual texts affect comprehension of scientific content?***

Learners showed that the English-only monolingual tests were easier because they were short, even though they could not understand the meaning of some words. They deduced meaning by considering other words in context. To them, using monolingual texts was not too demanding despite the difficulty in understanding the meaning of some words. However, those who were using bilingual texts preferred to read the Setswana text and only referred to the English text when they felt their comprehension was inadequate.

##### Null hypothesis

$H^0$ : Bilingual texts will not enhance comprehension of scientific content tested at  $\alpha = 0.05$ .

##### Alternative hypothesis

$H^1$ : Bilingual texts will enhance comprehension of scientific content.

The performance of learners who used bilingual texts was not significantly different from that of learners who used monolingual texts ( $p = 0.15$ ). This study therefore fails to reject the null hypothesis. The scores were not normally distributed, and nonparametric tests were used.

Overall, the results show a higher average score in the experimental test and a lower average score in the control test, with a difference between the means of 7.17.

Each school had a different mean post-test score between the control and the experimental group (Table 4.1).

**Table 4.1: Mean scores of learners in the control and experimental groups**

School	Mmathethe Primary School	Investigation type	Post-test	
			Control	Mean
Kang Primary School	Mophane Primary School	Investigation type	Control	46.44
		Investigation type	Experimental	60.31
Mophane Primary School	Mophane Primary School	Investigation type	Control	44.81
		Investigation type	Experimental	65.00
		Investigation type	Control	82.25
		Investigation type	Experimental	69.69

There is a positive difference between the experimental and control group means for Mmathethe Primary School and Kang Primary School. Mophane Primary School had a negative difference between the experimental and the control groups (Table 4.1). It must also be noted that learners performed better in questions that required LOTS than in questions that required HOTS. This kept the learners' performance low

It must be noted that there was a significant difference between learners' performance when they used monolingual and bilingual texts at Kang Primary School ( $p = 0.01$ ) and therefore, the null hypothesis is rejected for Kang Primary School. Mmathethe Primary School showed an insignificant difference between the mean scores of the control and experimental groups ( $p = 0.15$ ) and Mophane Primary School showed an insignificant difference between the use of monolingual and bilingual texts at  $p = 0.09$ . Still regarding performance, there was a significant difference between the control means of Mophane and Kang/Mmathethe Primary

Schools ( $p < 0.001$ ) but the difference was not significant for Kang and Mmathethe Primary Schools ( $p = 0.49$ ). However, in the experimental tests there was no difference between the mean scores of the three schools ( $p > 0.42$ ).

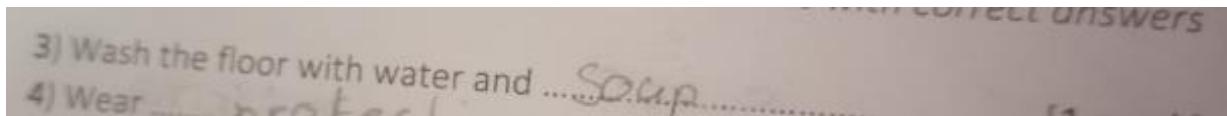
**Table 4.2: Performance of schools**

School	Questions	Control scores (%)	Experimental scores (%)
Overall (Mmathethe, Mophane and Kang Primary Schools)	LOTS	85	88
	HOTS	42	46
	Collaborative	43	46
	Overall	58	65
Mmathethe Primary School	LOTS	84	91
	HOTS	19	38
	Collaborative	19	38
	Overall	46	60
Mophane Primary School	LOTS	97	81
	HOTS	72	63
	Collaborative	78	63
	Overall	82	70
Kang Primary School	LOTS	75	91
	HOTS	28	38
	Collaborative	31	38
	Overall	45	65

#### **4.3.1.1 Mmathethe Primary School**

When using a monolingual English-only comprehension text, learners performed very well in multiple-choice and completion low-order thinking questions. However, learners' performance dropped when attempting high order thinking questions, which comprised individual and collaborative questions. The range of their comprehension was 65% because they performed the lowest in collaborative questions with an average score of just below 20% and an overall average score of just below 50%, which was below average when compared to the average score using the bilingual text, which was 60%.

However, in the experimental test using bilingual science comprehension texts, learners maintained the trend of performing very well in LOTS questions and poorly in HOTS questions that engaged their critical thinking abilities. The difference between objective and structured questions was 53%, which shows a slight decrease from when they used monolingual texts. However, it must be noted that learners performed twice as well in collaborative questions using bilingual texts than when using monolingual texts. Mmathethethe Primary school performed better than the overall average score of the three schools in the experimental LOTS questions (Table 4.2). Learners struggled to read in both English and Setswana and spelling errors were common (Figure 4.4).



**Figure 4.4: Common spelling mistake**

Overall, Mmathethethe Primary School learners performed better in the experimental test than in the control test in which they were using monolingual texts.

#### **4.3.1.2 Mophane Primary School**

In the control test, Mophane Primary School continued with the trend of high marks for the LOTS questions and lower marks for the HOTS questions. The difference between the LOTS and HOTS questions scores was only 25 % and the lowest of the three schools. Learners' performance using monolingual English-only texts in this urban school was especially good for collaborative questions. The average was the highest of the three schools (Table 4.2).

Likewise, the use of bilingual texts shows a trend of excellent performance in LOTS questions and a slightly lower than average score in HOTS questions with a range of 19%. However, it must be noted that learners performed 15% lower than in the control test using English-only texts. Some scripts showed instances of translanguaging using both English and Setswana.

It must be noted that learners' overall average was more than 80% in both monolingual and bilingual texts (Table 4.2).

#### **4.3.1.3 Kang Primary School**

Even at Kang Primary School, the same trend of better performance in the LOTS than the HOTS questions was observed. The range was not too wide, but learners' performance was low. Performance in collaborative questions was below 50% but better than their performance in monolingual texts (Table 4.2).

Kang Primary School learners in the experimental group using bilingual science texts for comprehension performed better in the LOTS and poorly in the HOTS questions. Their performance was similar to that of Mmathetha Primary School with a common difference of 53% between the total averages of LOTS and HOTS questions. For collaborative questions performance, the average was 50% but better than their performance using monolingual texts. Overall, there was an improvement of about 20% using bilingual texts (Table 4.2).

#### **4.3.1.4 General performance of the three schools**

Learners performed poorly in the structured HOTS questions in the control (Table 4.2). These questions included collaborative and individual structured questions to be answered on the scripts. They performed lower than 50% in the structured questions with a range of 44%. This

shows a significant gap between the average of LOTS and HOTS questions. Learners' performance for collaborative questions improved from average scores of 43% in the control group to 58% in the experimental group (Table 4.2).

Overall, the experimental group in the three schools performed better in the LOTS and worse in the HOTS questions. However, it must be noted that overall learners still performed very well in the HOTS questions with slightly higher results than the results of the control group in both sets of questions, and the range is very close (Table 4.2). Performance in the collaborative questions also shows a slight improvement. On average, performance using bilingual texts was seven points better than using monolingual English-only texts.

#### **4.4 Effects of bilingual texts on collaborative work**

##### **1. What are the effects of bilingual science texts on collaborative work?**

From moment analysis, it was realised that some learners found the pre-test and the control test difficult, but others found them easy as they pointed out that the texts were short and did not demand much reading. Learners at Mmathetho Primary School attempted the pre-test collaboration questions quietly as they struggled to read the questions. Even though they actively attempted collaboration in the bilingual experimental test, their dialogue was mainly monolingual, and they kept going back to the text to confirm their answers. One crucial moment action observed at Mmathetho Primary School was reading the texts in chorus. However, at Mophane Primary School, learners collaborated confidently and fluently in monolingual and bilingual texts using Setswana and English. At Kang Primary School, learners actively collaborated only when they were using monolingual texts, and they were hesitant to read the questions in Setswana. During collaboration, they used Setswana and later interpreted their own utterances.

### Null hypothesis

$H^0$ : Bilingual science texts do not have an impact on collaborative work tested at  $\alpha = 0.05$ .

### Alternative hypothesis

$H^1$ : Bilingual science texts have an impact on collaborative work

Quantitatively, learners in the experimental groups performed better than those in the control groups for collaboration questions, but there was no strong statistical evidence for the effect of bilingual texts on collaborative work ( $p = 0.65$ ). Therefore, none of the three schools showed a significant difference between the control and the experimental group. Hence, this study fails to reject the null hypothesis that states that bilingual science texts do not have an impact on collaborative work. The results were not normally distributed and therefore, nonparametric tests were used. There was a significant difference between the three schools in the control test ( $p = 0.001$ ). However, there was no significant difference in the experimental test between the three participating schools ( $p = 0.012$ ).

#### **4.4.1 Moment analysis**

**Table 4.3: Moment analysis of critical moments at the three schools**

<b>Critical moment</b>	<b>What triggered it?</b>	<b>Consequences</b>
Interpretation of own speech (Kang Primary School)	Bilingual texts	Inclusion of the other party Enhanced comprehension
Reading in chorus (Mmathethane Primary School)	Instruction for pair work	Participation of both parties
The use of vernacular to plan, organise and control the collaborative session (Mophane Primary School)	Peer work	Fluid communication
Use of gestures (all schools)	Peer interaction	Fluid communication
Use of home languages in the background (all schools)	Freedom, while the researcher is focusing on other participants	Temporal fluidity in communication

##### **4.3.1.1 Mophane Primary School moment analysis observations**

###### **Excerpt 1**

Control

**Learner A:** reads out question 7. Let's discuss

Tell me how ...tell me the fruits that can keep us can protect us from diseases in our bodies

*To learner B.* Talk loud so that I can hear you.

**Learner B:** The, the, the answer is, is vegetables, vegetables. Spinach, the pumpkins.

**Learner A:** The right answer...that we can protect our bodies against diseases is carrot and spinach.  
That's what I think we should write.

**Learner B:** Okay let me read number 8. How does water help our body? How does water help our body? Water can help our body through the eh the... we do not have to drink... dirty water can...The answer is 5-8 glasses of clean water a day.

**Learner A:** The answer ....

**Learner B:** Hah?

**Learner A:** My answer is 5-8 glasses a day

*They write down the answer*

Collaboration is fluid. Using interjections and turn-taking was observed. Learner A reads the first question and leads the discussion. Learner B voluntarily reads the following question and leads the discussion even though initially she was hesitant as she was not sure about her answer.

### **Excerpt 2**

Experimental

**Learner A:** *Reads out question 7* Bu-i-sa-nya- le yo o bapileng le-ene go-re mo-tho o ka ja-eng fa a sa batle go tshabelelwa ke malwetsi. Kwala karabo ya gago fa.

**Learner B:** *Reads from the handout* Morogo le maungo jaaka khabetšhe, spinach, delele maphutshe

**Learner A:** hah?

*They write down the answer*

**Learner B:** Reads out question 8

**Learner A:** Reading from the handout A dira gore dikarolo tsa mmele wa rona di bereke sentle. A dira gore dikarolo tsa mmele wa rona di bereke sentle

*They write down the answer*

Learner A starts reading the question syllable-by syllable, although she misses some syllables. The discussion is fluid even though they are reading hesitantly and quietly. They start by discussing the answers, then they confirm from the text.

### **Excerpt 3**

Pre-test

**Learner A:** *Reads out the question* What happens when blood dries? You wash your hands or skin.

**Learner B:** *(Nods her head)*

**Learner A:** The danger of infection is reduced.

**Learner B:** *Nods her head in affirmation.*

*They write down their answer*

**Learner A:** Is it safe to wash bloodstained clothes with your bare hands? It is not safe because you can touch the germs

**Learner B:** Nods in affirmation.

*They write own their answer*

Learner A controlled the collaborative exercise by reading the questions and suggesting the answer so that learner B could oppose or affirm. As they interacted on this exercise, they did not refer back to the passage to confirm the answers because learner B only accepted correct answers.

#### **4.3.1.2 Mmathethethe Primary School**

Control

##### **Excerpt 4**

**Learner A:** *Reads the whole passage aloud but hesitantly. He goes on to read the first collaborative question. Poor pronunciation was observed.*

The nutrients help us to grow and stay healthy. The main nutrient groups are fats, proteins, carbohydrates, vitamins and minerals.

**Learner B:** *Shakes his head to disagree with his partner. Then he points to the right answer which they copy down their books.*

**Learner A:** *Starts reading from the introduction of the passage.*

*They both copy down the answer to question 8*

**Learner B:** *Copies single words from the passage into his book.*

*They immediately turn over the pages to look for the answer.*

They discuss quietly mainly through gestures. Low proficiency in English was observed as the learners relied only on the text in the passage, which they could not read fluently.

##### **Excerpt 5**

## Experimental

*Both learners start by reading question 7 in chorus*

Learner A: Motho o ka ja merogo gore a seka a tshabelelwa ke malwetsi.

*They write down the answer*

*They read question number 8 in chorus*

Learner B: metsi a ka thusa.... *inaudible*

*They write down the answer*

### Excerpt 6

Pre-test

**Learner A:** *Reads question 7 but he is not audible*

**Learner B:** *Reads quietly*

**Learner A:** Speak aloud!

**Learner B:** It can....

You can touch to...bleeding...you can touch the blood to...

You can touch....

**Both Learners:** *Write down the answer*

**Learner A:** *Reads....Mh?*

**Learner B:** *Mumbles*

**Learner A:** Speak aloud!

**Learner B:** *Writes*

**Learner A:** *Reads Number 8 – It is safe to touch bloodstained clothes with your bare hands discuss with your partner and write down the answer.*

**Learner B:** It is used...with your bare hands. It is not safe to touch bloodstained clothes with your hands

*They write down the answer*

**Both Learners:** Re feditse

The discussion was not fluid. The learners were hesitant and answered the questions briefly. Poor pronunciation was observed.

#### **4.3.1.3 Kang Primary School**

##### **Excerpt 7**

Control

**Learner A:** *Reads question 7.* A re cheke! Let's recheck this side.

**One voice in the background:** Batho ba a discussa.

**Learner A:** Ehee! Here akere, ha, here. *Reads out the answer* protect our bodies against diseases. Let's find out from this side. We should write this one?

**Learner B:** *Nods his head in affirmation.*

**Learner A:** You are saying the answer is... *they write down the answer.*  
Are you finished?

**Learner B:** Yes

**Learner A:** Lets go to the next answer.

**Learner B:** *Reads the question.* How does the water help our body?

Here is water, here is water (*points to the section about water in the passage*) reads.  
Keeps all parts of our body working well. Ekae? This is the answer.

*They write down the answer*

**Learner A:** We are finished.

Learner A acts as the director as he leads the discussion session from the start. Translation is prevalent in his speech. Learner B is passive as he just affirms all the answers without any input.

##### **Excerpt 8**

Experimental

**Learner A:** *Reads the passage.* Buisanya, buisanya ...nya le yo o bapileng le ene gore motho o, o ka dira eng fa a sa batle go tshabelelwa ke malwetsi? Kwala karaboecess ya gago fa

**Learner B:** *Mumbles*

**Learner A:** Hee!

*Both learners write down the answer*

**Learner B:** *Reads question 8*

**Learner A:** Metsi a ka dira gore o.....

**Learner B:** Mhh?

**Learner A:** Metsi a ka dira gore re tsenwe ke mala

*They write down the answers*

The learners' speeches were fluid even though their voices were low. In the background, other learners were using Shekgalahathi, their home language.

### **Excerpt 9**

Pre-test

**Learner A:** What happens when blood d...drieses up?

**Learner B:** Dries

**Learner A:** bua!

**Learner B:** They leave germs on the floor

**Learner A:** Taps learner B to get his attention

**Learner B:** Mh?

**Learner A:** They dries

**Learner B:** They leave germs on the floor

**Learner A:** Germs on the floor?

**Learner B:** Mh?

**Learner A:** Ansara!

**Learner B:** Mh?

**Learner A:** Is it the answer?

**Learner B:** *Nods in affirmation.*

Wena what is your answer?

What is your answer?

**Learner A:** Mh? Sh?

**Learner B:** What is the answer?

**Learner A:** *Mumbles*

**Learner B:** Mh?

**Learner A:** *mumbles*

**Learner B:** Mh?

**Learner A:** *mumbles*

*They write down the answer*

**Learner B:** *Reads the question.* Is it safe to wash bloodstained clothes with, with your bare hands?  
Disc...discuss with your partner...

**Learner A:** ....partner and write down the answer. We must not touch one's bloodstained clothes with bare hands.

*They write down their answers*

**Learner B:** Sharp.

Learners' speeches show grammatical errors. They discuss content quietly with little confidence.

#### **4.5 Application of bilingual texts in pedagogy to enhance learner performance**

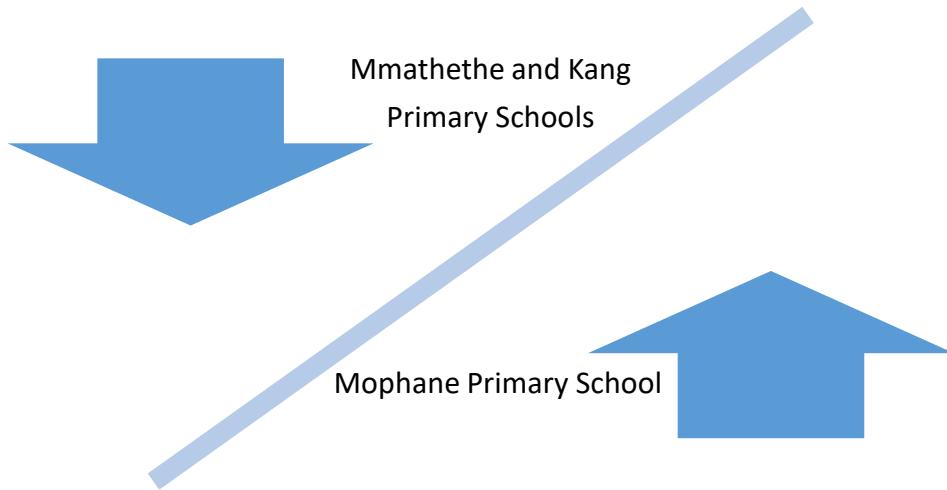
3. How can bilingual texts be applied in pedagogy to enhance learner performance in science?

To enhance learner performance through bilingual texts, learners showed that they must be given sufficient education on how to use bilingual texts and their benefits in content subjects.

Since bilingual texts support fluidity of language use in academic contexts, strict rules of how to use them may be irrelevant, but guidance may be provided. In this regard, learners also showed that the questions must be bilingual, so they are not compelled to use only one language.

Furthermore, the learners also suggested an option to translanguange as they answer the questions, but this must be regulated and planned to give the desired outcome. This will be specifically beneficial to learners in minority language speaking areas since the only significant difference was between Kang Primary School and the other schools (Table 4.2). Therefore, translation in this context, if applied strategically to facilitate translanguaging in teaching and learning, could close the performance and socio-cultural gaps between learners from diverse language situations.

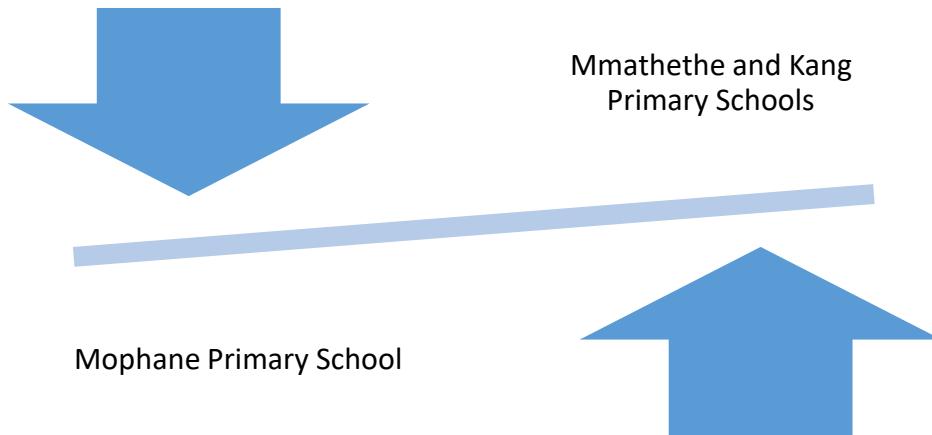
#### 4.6 Performance of learners in the control test



**Figure 4.5: Learners' performance when using English-only texts**

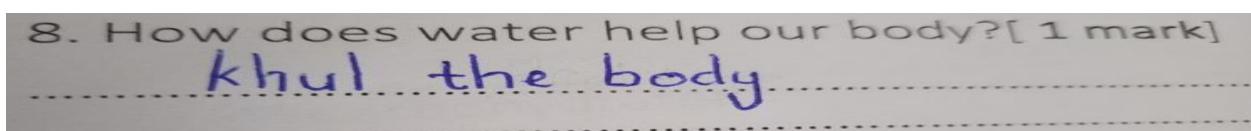
Learners at the fourth-level of primary education in Mophane Primary School in Gaborone city achieved high scores in the monolingual English-only comprehension test, which was the control test. They got more than 72% in each section of the exercise and an overall average score of 82%. This shows excellent performance without any intervention. However, learners in Mmathethe and Kang Primary Schools performed poorly in the monolingual comprehension exercise, scoring less than 50% in most of the set questions. Each of the two schools got about 46% as the overall average score.

#### 4.7 Performance of learners after intervention



**Figure 4.6: Learners' performance using bilingual texts**

In the experimental test where learners were using bilingual science comprehension texts, learners performed better as their overall average improved from 58% when using monolingual texts to 65% when using bilingual texts. This slight improvement was mainly due to enhanced performance of learners in village schools and a slight decrease in learners' average score in the city school. As shown in figure 4.6, the intervention, translation of monolingual (English) texts that were presented to learners in the control group, favours village schools and weakens the performance of the city school learners to end up with an overall average of 65% for all schools. Figure 4.7 shows that poor spelling was mainly due to nativisation of English words into Setswana



**Figure 4.7: Nativising English Spelling**

Therefore, leveraging learners' communicative repertoires using translation in multilingual contexts needs a bottom-up decentralised approach to assess the language situation of individual schools to allow for appropriately designed learning material.

#### **4.8 Conclusion**

Chapter 4 presented the results of this study. The participants' demographic results provide background information on their home languages, gender and age. Participants were multilingual boys and girls between nine and 12 years old. Even though all schools experienced a change in the mean scores, overall, there was no significant difference between learners' performance in the control test, which used monolingual texts for content comprehension, and performance in the experimental test, which used bilingual texts for content comprehension. Therefore, this study fails to reject the null hypothesis, which predicted that using bilingual texts will have no effect on the academic performance of learners. However, the results show that of the three schools, only Kang Primary School provided strong evidence that bilingual texts positively affect learners' academic performance, as there was a significant difference in the performance of learners who used monolingual texts and those who used bilingual texts. A comparison of performance in the control test in the three schools shows a significant difference between Mmathethe/Kang Primary Schools and Mophane Primary School, but the experimental results do not show any significant difference for the three schools. Learners' performance in collaborative questions shows a change in the means, but like in the overall learners' performance, the difference between the mean scores of learners in the control group and those in the experimental group does not show any significant difference. Therefore, this study fails to reject the null hypothesis, which states that bilingual texts do not impact collaboration. From observation, learners actively collaborated in the experimental group compared to the control group. A

significant difference was realised between Mmathethethe/Kang Primary Schools and Mophane Primary School in the collaborative questions of the control test, but there was no significant difference in the three means of participating schools in the experimental test. Moment analysis showed the following critical moments: translation of own speech, reading in chorus, management of pair work using Setswana, nativising English spelling (see Figures 4.4 and 4.7) and using gestures. Generally, the three schools showed limited translanguaging despite using bilingual texts to open the translanguaging space.

## **CHAPTER 5**

### **Discussion of results**

#### **5.1 Introduction**

Chapter 5 of this study delves into the meaning of the study's results by showing their importance and relevance to published works. It explains and evaluates the results by showing how they answer the study's research questions as it makes an argument to support the study's overall conclusion. The chapter starts by restating the research problem of the gap between Setswana language as a subject and the study of science in middle-level primary education. Then it restates the aim, which was to investigate the effects of adopting multilingual practices in the classroom on the cognitive development of Batswana learners at the primary school level. It sought to determine the relevance of bilingual texts in primary science education as it values both English and Setswana as part of Batswana learners' linguistic repertoires. This means the study investigated whether bilingual texts were optimally relevant to learners in science education. This was expected to open a translanguaging space and provide evidence of the effects of practising multilingualism in the classroom. The chapter then summarises the study's results and subsequently interprets these results by comparing them with existing research by explaining similarities or contrasting views or results.

It must be noted that the overall quantitative results of this study do not indicate a strong relationship between learners' performance and the use of bilingual texts and therefore this study fails to reject the null hypothesis, which predicts that bilingual texts will not affect the academic performance of learners in science. However, the mean scores of learners in the experimental test, which involved using bilingual texts, indicated some changes, both negative and positive, which suggests that a change in the stimuli led to a change in the interpretation of the texts. The

same trend was also realised in the statistical analysis of learners' performance in collaborative questions. To answer the second research question, this study failed to reject the null hypothesis, which predicted no effect of the use of bilingual texts on the performance of learners in collaborative work. This chapter goes on to suggest how bilingual texts can be used, drawing from published literature and the participants' experiences and suggestions. Subsequently it acknowledges the study's limitations, and finally, it comments on the practical application of the findings in education and the translation of educational texts. After restating the problem, the aim and research questions, the chapter starts by discussing multilingualism in the education system of Botswana, then it discusses the results according to the research questions that this study aims to answer.

## **5.2 The problem, aim and research questions**

From 2012 to 2021, primary school learners in Botswana performed better in Setswana as a subject than in science or agriculture. Despite the country's high literacy rate, this trend can be observed in the annual Primary School Leaving Examinations results (see Statistics Botswana, 2016). Since these learners are emergent multilinguals, this study sought to use Setswana, the national language, alongside English, the language of education in Botswana, to determine the effects of embracing multilingualism on Batswana learners' academic performance in science as a subject at the primary level. Since using translation as a pedagogical strategy has never been fully recognised as a useful way of scaffolding in lower levels of education, the translanguaging perspective was employed to determine the effects of bilingual texts in multilingual contexts. This was done to enhance comprehension of Standard 4 science texts using bilingual texts because, in the Botswana education system, translanguaging is usually practised as a communication strategy, but textbooks and assessments are printed monolingually in English

from Standard 2. The study acknowledged the benefits of both English and Setswana in the education system and on learners' cognitive development. Therefore, it employed relevance theory as a cognitive theory of communication in translation coupled with the translanguaging theory to develop bilingual science texts that could enhance pedagogic strategies for emergent multilinguals. This study was conducted to answer the following research questions: 1) How do bilingual science texts affect comprehension of scientific content?; 2) How do bilingual texts affect performance in collaborative work?; 3) How can bilingual texts be applied in pedagogy to enhance learners' performance in science? In answering these questions, research results are discussed under each question after discussing multilingualism in the education system of Botswana.

### **5.3 Multilingualism in Botswana's education system**

The Language-in-education Policy of Botswana prescribes using Setswana and English separately in the first year of primary education and from the second year, respectively, but as shown in this study, these learners are multilinguals as some of them bring their first language to school. Sometimes the teachers feel compelled to adhere to policy, but the situation on the ground compels them to use the learners' language or languages. This leaves a more noticeable gap in the learners' performance in content subjects. Therefore, some authors like Mokibelo (2014a & b, Bagwasi (2017) have considered issues of equality and equity in Botswana's education system. This is because language practices in the classroom have not accommodated learners' repertoires, negatively impacting their performance, as shown by Mokibelo (2014a). When language practices are improved through the translation of learning material to enhance translanguaging, learners do not fully participate, and this will only have a slight effect on their performance and their class participation, such as participating in collaborative work. As shown

by Batibo (2019), Setswana and English are the only two officially-recognised languages, and all other languages are marginalised as they are only spoken at home for family interactions.

According to Mokibelo and Pansiri (2021), preschool learners are taught in English and Setswana or their home language but not in the first year of primary education because communication problems limit learning in these contexts. Mokibelo (2016b) found that the transition is problematic even in the first year of primary education because of the lack of a common home language between the teachers and learners who speak different first languages. Furthermore, Mokibelo (2016a) shows that some teachers, especially in urban areas, only use English and those in rural areas often find it difficult to use Setswana only as learners struggle to comprehend instructions or content in the language they do not use at home. Others use Setswana to include learners who have not had any exposure to early childhood education.

Neither is communication in the second year of primary education fluid, as Mokibelo (2014a) shows that minority language-speaking learners usually drop out of school in the first or second year of primary education because of language barriers, as they always find a different language is used at school. This continues from primary school to secondary school as Khoe learners, for example, have poor comprehension of English texts as they find the vocabulary difficult (Mokibelo, 2010). Mokibelo (2016b) found that schools used some communication strategies such as consulting the cooks, other learners and teacher aides to interpret instructions or content so that minority language learners could understand. These interventions partly overcome the challenge of language barriers at primary school. However, Mokibelo (2016b) shows that these were not permanent solutions as learners could not use them when studying independently or at home. In this regard, Mokibelo (2014b) has shown that even though Setswana is used in Botswana's education system for national unity and identity, it has not

served any practical role in learning and teaching because of the language diversity that exists in Botswana. Mokibelo (2014b) also highlights that using English and Setswana for education in the minority language-speaking areas acts against attempts to improve relevance, quality and access to education because, in rural areas, learners bring their home languages to schools, but in urban areas, classes are multilingual as they admit foreign students.

Therefore, English in urban primary schools is a lingua franca. The government of Botswana is aware of the language barrier challenge at primary schools and is currently designing a mother-tongue education curriculum, but the challenge that might arise after its implementation is the negative attitudes of minority language speakers towards their home languages (see Batibo, 2019). Mokibelo (2014a) gives an example of San learners who drop out of school at any level of education as they speak minority languages that are greatly disadvantaged by the language practices in formal education. In this regard, Mokibelo (2014a) shows that most of the San children in the Central District were not proficient in their L1 nor in Setswana, the national language, as their L2. In a related study, Molosiwa and Mokibelo (2010) state that Batswana parents are not convinced about the role of the local languages in the learning and teaching processes. They point out that the parents do not see the benefits of mother-tongue education in the early levels of education in Botswana and the interviewed communities told the researchers that they preferred Setswana or English as they claimed that other languages did not carry any tangible benefits. This indicates a structuralist perspective that values only one language as a resource in the education system (see figure 2.3). Therefore, the parents' attitudes toward their languages highlights the need for a multilingual approach toward language-in-education issues so that all learners may benefit from the languages they bring to school in pursuit of knowledge.

Considering the multilingual nature of Botswana's repertoires, Bagwasi (2017) uses translanguaging theory to critique language policy and practices in Botswana. She shows that Botswana's approach is weak as it does not support multilingualism because it separates languages that exist in speech communities. Taking Bagwasi's (2017) perspective necessitates a departure from a diglossic perspective, which Arthur (1996, 2001) used to analyse language practices in the education system of Botswana when Setswana was used from the first year of primary education to the fourth year. Arthur (1996) observed that in this era, English was viewed as a prestigious language, and it was used from the fifth year of education as a language of learning and teaching. She shows that Setswana and other languages of Botswana are marginalised as she observed participant-related codeswitching used by teachers to control their classes, for example, to encourage learner participation. Since the diglossic perspective separates languages to allocate them to their specific domains, it may be necessary to apply the translanguaging perspective allowing us to analyse what the languages in the learner's repertoire can do in unison since translanguaging theory applies a unitary view toward the languages that the learner can speak. This is emphasised as this study finds that territorial multilingualism is prevalent in Botswana, with more than 50% of the participants using more than two languages at home. This indicates that most households are multilingual; therefore, translanguaging as a language practice in the education system in Botswana would not be a new practice but rather a way of accommodating learners' repertoires in the teaching and learning process.

Figures 4.1 & 4.2 show that Batswana learners are emergent multilinguals as they bring their home languages to school, and they also learn English and Setswana as compulsory subjects throughout basic education. García et al. (2008) define emergent bilinguals as learners who acquire English at school to become bilingual so they can function in their L1 and in

English as their L2. Since some Batswana learners bring their first languages other than English and Setswana to school. This study adapts the term ‘emergent bilinguals’ (García et al., 2008, p. 6) to ‘emergent multilinguals’ so that it captures the diversity of languages in Botswana to include minority language speaking learners. However, it must be noted that despite the multilingualism that is prevalent in the education system of Botswana, even languages that are already in the system, English and Setswana, continue to be separated, compartmentalised and studied as examinable subjects as their value in learning content subjects has not been explored. Even though policy is not the focus of this study, learners’ comments suggest that the current policy impacts communication and learning in the classroom as it limits the use of Setswana in the classroom. This has also been discussed by authors such as Arthur (1996) and Mokibelo (2014a, 2015). According to Arthur (1996:18), there is collusion in Botswana classrooms because teachers feel compelled to use English only for teaching and learning, and learners also know that they have to use English only in the classroom, so that they use their home languages as ‘backstage or offstage dealings’. In this regard, these learners often display negative emotions of fear and anxiety when using L2 (see MacIntyre & Gregersen, 2012, Liao & Wang, 2018, and Back et al., 2020). Similar to Arthur’s (2001) findings, some learners practised reading in chorus, indicating a fear of taking responsibility for any errors that could be realised while reading despite the translanguaging space that was opened through bilingual texts, which signalled accommodation of the learners’ languages. Some learners in this study only used bilingual texts to engage and interact with other learners in their translanguaging spaces, but to a limited extent, suggesting less creativity and criticality than anticipated. They seemed reluctant to draw from their linguistic repertoires to fluidly discuss the content they read from the texts even though

bilingual texts were made available to guide the use of learners' home languages from back-stage to centre-stage.

#### **5.4 Bilingual texts and their effects on comprehension of scientific content**

Low performance of learners in HOTS compared to LOTS kept the learners' performance low. With regard to comprehension this relates to the results found on the effects of bilingual texts on comprehension of scientific content as stated in the Mullis (2011) report for the sixth year of primary education in Botswana, which shows that Batswana learners performed the least well in PIRLS overall reading performance. The PIRLS report also states that even though Botswana is a multilingual country, only Setswana as a national language is used for teaching and learning in the first year of primary education, and the English language is used from the second year. Therefore, it was realised that pupils who speak English at home had a higher score than those who did not and 'this was due to the fact that those tests were in English and those children who knew the language were at an advantage' (Mullis report, 2011, p. 91). No significant difference in reading and writing skills after intervention were recorded in Fleisch et al. (2017b) who show that the Gauteng province's remedial programme to reteach reading and writing in English second language to Grades 4 to 6 effectively improved learners' proficiency in English, but the pre-test and post-test results did not show a significant difference between the control and the experimental groups. There was only a slight change.

Similarly, Ellis and Hooper's (2001) study, which tested the hypothesis that children who learn to read through a transparent orthography should learn to read faster than those who used opaque orthography, found no significant difference associated with the transparency or opacity of the orthography. Therefore, they concluded that differences in comprehension were likely due to the bilingualism of Welsh children. However, Hanley et al. (2004) investigated the impacts of

learning transparent orthography on the ability to learn an opaque orthography, comparing the reading skills of Welsh-speaking children with English-speaking children. They found that learning to read a transparent orthography does not result in any challenge in subsequently learning to read an opaque orthography. Conversely, in a similar study, Spencer and Hanley (2003) concluded that there was a significant difference ( $p < 0.05$ ) between the scores of Welsh children reading in Welsh (17.2/24,  $SD = 4.3$ ) and English-speaking children reading in English (19.1/24,  $SD = 4.3$ ).

In a similar study that was conducted by Mgijima and Makalela (2016), there was very strong evidence for the contribution of translanguaging intervention in learners' performance in isiXhosa ( $t = -9.831$ ,  $df = 60$ ;  $p < 0.005$ ) and English ( $t = -8.047$ ,  $df = 60$ ;  $p < 0.05$ ). The strongest evidence was on the learners' performance in their first language. Still on measuring the effects of translanguaging, Sefotho and Makalela (2017) concluded that Sotho, Setswana and Sepedi speakers can fluidly use these languages as there are few linguistic differences between them. They reached this conclusion after realising the following p-values in different tests that sought to assess learners' performance within cognate languages at  $\alpha = 0.05$ : listening comprehension ( $t = 3.406$ ,  $df = 29$ ;  $p < 0.05$ ); oral word-picture mapping ( $t = 1.793$ ,  $df = 29$ ;  $p > 0.05$ ); picture-word matching ( $t = 0.069$ ;  $df = 29$ ;  $p > 0.05$ ); and literal comprehension ( $t = -1.095$ ,  $df = 29$ ;  $p > 0.05$ ). Most of these results show insignificant differences between the performances of learners in mutually intelligible languages to give evidence that there are no linguistic differences between the languages, but in this study which promotes translanguaging in two languages from different language families, there is no significant difference between the overall mean score of the control groups that used monolingual texts and the experimental groups that used bilingual texts.

With regard to academic performance, Hornberger (2005) and García (2014) show that monolingual pedagogies can contribute to poor academic performance in multilingual contexts as they constrain the multilinguals' language skills by suppressing part of their repertoires. In this regard, Singhal (2020) states that second-language learners usually face the challenge of decoding the basic meanings of words and sentences, which can limit comprehension of a text. This study used a comprehension exercise to test the cognitive domain in the levels of knowledge to assess knowledge acquisition and comprehension and to assess learners' ability to recall, paraphrase, define and discuss. The instrument also tested application, synthesis and evaluation (see Bloom, 1956). Therefore, as shown by Oakhill et al. (2014), decoding is necessitated by reading comprehension as a task that is not straightforward as it involves different cognitive skills. In relevance theory, as shown by Sperber & Wilson (2012), even though the interpretation of an utterance is context-dependent, decoding is also crucial as the addressee should be able to decode the stimulus to infer the communicator's informative intention. This is why monolingual English texts were found to be less relevant, as the information they carried seemed not to interact with the audience's assumptions about their environment. Hence, observing learners while attempting the collaborative questions showed unnecessary processing effort, which tends to reduce relevance so that it falls below the accepted level even though the fourth-year primary curriculum contains strong explications.

To correct this, Velasco and García (2014) suggest using bilingual texts as extended resources since García and Kleifgen (2019) suggest that to open translanguaging spaces by designing instructions, teachers can give multilingual learners extended resources such as print material and media technology that support collaborative work to go beyond individual meaning-making. García and Kleifgen (2019) also suggest opening the translanguaging space by

encouraging the production of learning material and translingual writing through translanguaging reflection. This brings in the issue of orthography because, as shown by Schroeder (2013) and Rosebery (2008), it is easier to learn to read in a transparent orthography than in an opaque orthography like English, and this means Setswana, as a language of transparent orthography, may be easier to read than English. Therefore, if these languages are used concurrently in a reading passage, they may support translanguaging because, according to Spencer and Hanley (2003), opaque orthography supports semantic reading strategies while transparent orthography supports phonologically-based reading strategies. Therefore, combining both orthographies may support semantic and phonological skills to enhance reading for meaning, unlike monolingual texts, which support only one skill at the early stages of reading.

García (2020) warns against a monolingual view of literacy by showing that it ignores the plurilingual competencies of learners, while the translanguaging view towards literacy values verbal and written language, as well as multimodal discourses and life experiences; for example, using translated texts can enable learners to employ all their meaning-making resources while reading. Against this backdrop, this study sought to open a translanguaging space in the fourth year of primary education science classes by embracing multilingualism by translating science topics usually presented monolingually in English. After reading the passage, learners attempted an exercise to assess their comprehension and their scores were analysed to determine the effects of using bilingual texts on the learners' performance. As shown by García et al. (2019), translation is an effective pedagogical strategy and can therefore be used by primary teachers to empower multilingual learners to use their full repertoires for meaning-making. This study realised different results in the schools suggesting that in some cases, the learners' full repertoires may not have been fully utilised for making meaning.

Overall, this study did not find a significant difference in the comprehension of science texts between learners using monolingual texts written in English and those using bilingual texts presented concurrently in English and Setswana ( $p = 0.64$ ). Therefore, this study fails to reject the null hypothesis that predicted bilingual texts would not have an effect on comprehension of science texts. However, evidence gathered in this study shows a slight increase of about two points in the mean scores of learners using bilingual texts, and this suggests that a longitudinal study would probably reach a different conclusion if learners were given a longer period of exposure to translanguaging. The marginal increase in the mean scores also suggests a slight opening of the translanguaging space as the texts were made more accessible by enhancing the relevance of the information contained within. The results indicate that these learners are in an environment where differences between languages are highlighted and not affirmed; therefore, using bilingual texts to assess comprehension has not brought enough evidence on their effects on comprehension of content (Kleyn & García, 2019). It is worth noting that when using monolingual texts, Mophane Primary School's results stand out with a significant difference of  $p < 0.001$  compared to Kang/Mmathe Primary Schools (the significant difference between Kang and Mmathe Primary Schools was at  $p = 0.49$ , but there is no significant difference in comprehension of scientific content at the three schools when learners used bilingual texts).

As shown by the Mullins report (2011), English material only benefits learners who were privileged enough to have reached a high proficiency level at the time of assessment. This is proven in this study by the results of Mophane Primary School, which show that learners performed very well when they used monolingual texts printed in English. The overall result of no significant difference between using monolingual texts versus bilingual texts suggests a relationship to Fleisch et al.'s (2017b) results showing that a programme can positively

contribute to learning even though there is no significant difference. A slight change may give hope for improvement in future research.

Despite regression of the Mophane Primary School learners in the experimental test, this indicates that using bilingual texts can help create equitable learning spaces for minority learners (see Hamman, 2018).

#### ***5.4.1 Performance at Mmathethe Primary School***

Learners at Mmathethe Primary School are multilingual but most use Setswana as their home language (Figure 4.1). This school is in the Southern district where Setswana, the national language, is predominantly spoken, but learners at Mmathethe Primary School are emergent bilinguals like other Batswana learners at primary level (see García et al., 2008). Since the languages in the bilingual texts were English and Setswana, the texts accommodated the learners' linguistic repertoires to a large extent by engaging their plurilingual competencies. An improvement of 13.9% in the learners' mean scores after using translated texts suggests enhanced relevance of information in the bilingual texts. Other slight improvements were also noticed in how they attempted the HOTS, LOTS and collaborative questions. However, it must be noted that the language education policy counteracted the opportunity brought by the bilingual texts, as revealed by the learners who showed that they were not allowed to use Setswana. This indicates that even though the translanguaging space was opened using bilingual texts, the learners' repertoires continued to be suppressed to a certain extent by the policy. Therefore, we do not have enough evidence to claim that bilingual texts improved the comprehension of scientific texts for Mmathethe Primary School's learners since  $p = 0.15$ . In this case, this study fails to reject the null hypothesis, which predicted that bilingual texts will not have an effect on the comprehension of scientific content. This calls for a longitudinal design to

investigate the effects of bilingual texts because Gabriel et al. (2018) showed that after introducing textbooks that sought to address the transition challenges of moving from mother-tongue education to English only, learners were initially quiet when using the textbooks but later they felt free to discuss in class using both Kiswahili and English. Similarly, Fleisch et al. (2017b) indicate that the Gauteng province project of a remedial programme to reteach Grades 4 to 6 reading and writing English as their second language effectively improved learners' proficiency in English but the pre-test and the post-test results did not show a significant difference between the control and the experimental groups. This necessitates a longitudinal as well as a mixed approach.

The performance of learners in this school is similar to Fleisch et al.'s (2017b) study in which the pre and post-tests instruments tested language, vocabulary, spelling and comprehension, and they realised poor proficiency of learners in English. Fleisch (2017a) found that learners misspelt monosyllabic words, and L1 language interference and pre-grapho-phonemic errors resulted in poor reading skills. In Mmathetha Primary School, this was observed in spelling words such as "soap", which most learners presented as [soup], as shown in figure 4.4. This may be interpreted as transference of phonological features of the Setswana language, which has transparent orthography, into English, which uses opaque orthography. Even though this spelling mistake changes the meaning, learners could consider this the correct answer since they pronounce it correctly. This may indicate a problem learners encountered in abruptly transitioning from using Setswana for one year as a language of learning and teaching to English in the second year. Therefore, as suggested by Mukhopadhyay (2016), we need a fluid and dynamic approach in writing the second language by using the learners' knowledge of their first language because there is no need to treat learners' languages separately. Other scholars like

Alcock and Ngorosho (2003) show that spelling mistakes are common in reading comprehension tests because students do not recall the spelling of the words read. This may be due to a lack of language planning for the transition period at school because, as shown by Mokibelo (2016a), classes are always silent, with anxious learners hesitant to communicate because they fear making mistakes during the transition. This compromises performance in both languages reducing the significance of evidence that supports using bilingual texts in science education, but an improvement in the mean scores suggests a slight positive effect on content comprehension in bilingual texts.

#### ***5.4.2 Performance at Kang Primary School***

Contrary to Pym et al.'s (2013) claim that the contribution of translation is reduced when there is more than one first language in the classroom, this study indicates that in Kang Primary School, where there is English, Setswana and Shekgalagarhi, learners took advantage of the open space for translanguaging by maximising their communicative potential and engaging fully with bilingual texts. In this school, learners under observation drew linguistic features from both English and Setswana, but in the background, features drawn from English Setswana and Shekgalagarhi were audible. Shekgalagarhi is the learners' home language, and they learn English and Setswana as compulsory subjects at school. This shows that most of these learners are trilingual, mainly because of Botswana's education system. Similar to learners at Mmatethethe Primary School, these learners' performance in comprehension of the scientific text improved in all the tested aspects (see Table 4.1) since learners' performance in LOTS, HOTS and collaborative questions, as well as the mean scores of the control and the experimental test, improved. Contrary to Mmatethethe Primary School's results that do not show a significant difference between the control and the experimental groups, Kang Primary School's results

provide sufficient evidence,  $p = 0.01$ , that bilingual texts have an effect on comprehension of scientific texts. Therefore, for Kang Primary School, this study rejects the null hypothesis, which predicted that bilingual texts will not have an effect on comprehension of scientific texts.

Kang Primary School's results are similar to Turnbull's (2019) study, which shows that there was a significant difference between monolingual, weak translanguaging and strong translanguaging groups after learners were divided into groups to discuss and write compositions. The strong translanguaging groups scored the highest composition marks as they could draw on resources from both English and Japanese, but monolingual groups had incoherent discussions that were broken and indefinite. Mgijima and Makalela (2016) also present a similar case ( $p < 0.005$ ) in which they realised that translanguaging improves learners' comprehension as it enhances their inferential skills by supporting their application of background knowledge when reading. Kang Primary School's results could also indicate that including Setswana, the national language, in the curriculum (Mokibelo, 2014b) prepares the minority learners to such a level that by the fourth year of primary education, they can draw from features of Setswana in their linguistic repertoire to participate meaningfully in the learning process. This may be part of the reason parents of minority learners have indicated that rather than using minority languages for learning, their children should use Setswana or English (see Molosiwa & Mokibelo, 2010). Economically this can make planning for translanguaging in Botswana's education system realistic. Extensive research should therefore be conducted to determine the difference between learners' performance using their home languages versus using Setswana. It must be noted, however, that this study values multilingualism in Botswana, looking at unique properties that every language has, but it also embraces commonalities that can be exploited to enhance translanguaging, as shown by Sefotho and Makalela (2017), who realised that there was no

differential performance in reading comprehension between Setswana and Sepedi speakers.

Harmonisation of these languages would therefore work well for translanguaging.

#### ***5.4.3 Performance at Mophane Primary School***

Like learners in the other participating primary schools, students at Mophane Primary School are multilingual. This school is in the capital city of Gaborone where parents prefer to communicate with their children in English. As a result most learners at this school use English or English with another indigenous language as their home language(s). This is one of the schools in the city where learners are taught in English from the first year of primary education because they attended English-medium preschools (see Mokibelo, 2016b). Therefore, these learners' communication is mainly characterised by features of English, and they engage confidently with a text written in English. Their communication in English is very fluid, as shown by their outstanding performance in the control test, which was presented monolingually in English (see Table 4.1). It must be noted that even though the translanguaging space of these learners was enhanced using bilingual texts, the learners found monolingual Setswana questions difficult. This suggests suppression of learners' linguistic repertoire to some extent as the questions implicitly compel them only to use Setswana. This may have contributed to lower performance in all aspects of the experimental test (LOTS, HOTS, collaborative and overall).

Despite lower means in the experimental tests, the learners' performance at Mophane Primary School did not significantly differ between the experimental and control groups. The p-value of  $p = 0.87$  fails to reject the null hypothesis that predicted bilingual texts have no effect on comprehension of scientific texts. Therefore, in this case, the use of bilingual texts with monolingual questions indicates suppression of the learners' linguistic repertoire to some extent because, as shown by Kleyn and García (2019), when learners adopt a translanguaging

pedagogy, they should be assessed through a bilingual lens by being asked bilingual questions. Initially, bilingual texts opened the translanguaging space for learners as they engaged with the texts, but to these learners, monolingual questions did the opposite by compelling them to suppress their repertoires and narrowing the choice of features to use in answering the questions. Mophane Primary School's performance indicates that learners' comprehension of English monolingual scientific texts assessed in English is outstanding in both the pre- and control tests, but the experimental test, which used bilingual questions with monolingual Setswana-only questions presented lower mean scores. This means that the learners could comfortably draw features of the English language from their repertoires. To them, monolingual scientific texts written in English were favourable, and therefore the current policy of English-only textbooks is an advantage for them.

## **5.5 Bilingual texts and their effects on collaborative work**

The last two questions of the comprehension exercise were collaborative questions that required learners to apply the content they had read about in real life. These questions required learners to use their HOTS to discuss the questions by elaborating their answers and supporting them with an explanation, promoting collaboration. These questions gave the learners a chance to freely select and utilise the linguistic resources from the linguistic repertoires in the learning process. As a result, it was necessary to present the quantitative results from learners' scores together with qualitative results from moment analysis to obtain a balanced view of how bilingual texts influence collaborative work. In this regard, Chi (2009) points out that collaboration in science lessons can enhance learners' academic performance because if they read individually they may read without understanding. This shows the enhancement of

traditional teacher-centred learning through a progressive learner-centred approach that allows the use of different languages in student inquiry groups (Lin, 2013).

As suggested by Lewis et al. (2012a), collaboration should be organised by instructors for translanguaging and conducted by learners themselves for deeper understanding and co-construction of knowledge. This study followed this approach, and the researcher did not interfere in the learners' collaborative work session. This was influenced by Arthur (2001:355), who states that in Botswana, learners bring their home languages in through the 'back door' as they are not allowed to use their home languages freely in the classroom. It was therefore necessary to observe learners' behaviour and performance when they are allowed to utilise the features in their repertoires freely to study science. Arthur (1996:18) says that these learners use their home language as a backstage language since they use it with their peers and sometimes during collaborative exercises probably because, as stated by Wang (2016), learners can voice their ideas and suggestions in the language that they are proficient in. Hence the bilingual texts sought to open the translanguaging space by showing learners that English can function alongside Setswana, but still learners in the three schools showed a fear of using Setswana concurrently with English in discussions as they stated that they were not allowed to mix Setswana and English despite their low proficiency in English. At these three schools, fear prevented the use of translanguaging for meaning-making as it limited the learners' creativity and criticality, as shown by moment analysis in Table 4.2. The learners' critical moments and performance reveal that bilingual texts potentially opened a translanguaging space by translating the monolingual science topic into Setswana and presenting content in both languages simultaneously, but learners did not freely occupy this space to create their own translanguaging

spaces because of fear, as shown by learners' performance in collaborative questions at the three schools.

Overall, learners' performance in the collaborative questions does not provide enough evidence to reject the null hypothesis ( $p = 0.65$ ). Therefore, this study fails to reject the null hypothesis, which predicted that bilingual texts would not have an effect on the performance of learners in collaborative work. However, as in the overall performance of learners in the comprehension exercise, there was a slight improvement in learners' mean scores among those who used bilingual texts. This indicates that, as shown by Yafele (2021), translanguaging positively impacts collaborative work. However, the impact realised in this study was not significant. It must be noted that although the participating schools realised a change in the mean scores, none realised a significant difference between learners' performance in collaborative questions when using English only or when using Setswana-English bilingual texts. Nonetheless, comparing learners' performance using monolingual texts shows that Mophane Primary School stands out at  $p < 0.001$ . This is similar to the results for overall performance, but a comparison of the experimental groups shows no difference in collaborative work scores. This is another instance in this study that indicates how translanguaging can create an equitable space for learning, similar to that shown by Van Avermaet et al. (2018).

Even though learners' performance in the control and experimental groups does not differ significantly at the three schools, how learners interacted with their peers showed some differences in the critical moments of their actions and participation in the translanguaging space that was opened by bilingual texts. In the three schools, there were instances of gesturing to communicate, which ensured communication fluidity when engaging with a science topic. According to García and Lin (2014), bilinguals can draw non-linguistic features of

communication from their linguistic repertoires. As shown by Williams (2022), emergent multilingual learners can use gestures to communicate as they draw from their semiotic repertoires when they translanguag in content lessons like science. Williams (2022) also shows that the learners she observed used gestures to provide replacement, support, demonstration or imitation for meaning-making to replace academic words or everyday words. Therefore, gestures can be viewed as a critical moment in the study as it is a non-linguistic way of communicating. Although it was uncommon, learners considered it a safer strategy than explicitly using Setswana to communicate during lessons and in their normal classroom settings. Likewise the use of home languages was audible in the background when the video recorder focused on other participants. This marked the re-occurrence of what Arthur (1996 & 2001) viewed as the use of home language as a back-stage language, brought into the classroom through the back door. Even though it indicates partial utilisation of the translanguaging space created for learners, it slightly improved the mean scores of learners' collaborative work scores.

### ***5.5.1 Collaboration at Mmathethe Primary School***

At Mmathethe Primary School, where learners predominantly use Setswana as their home language, learners' collaboration was marked with fear and anxiety as they tried to discuss their viewpoints. These learners were expected to draw from their repertoire freely in the discussions, but they were hesitant to allow themselves to occupy the translanguaging space already opened by bilingual science texts. As shown in excerpts 4 and 6, learners struggled to read content and learners' utterances were characterised by grammatical errors during discussions when using monolingual texts. The effect of the video camera is acknowledged, but during the focus group discussions, learners stated they are only allowed to use Setswana during Setswana lessons, and they should strictly adhere to English in all other lessons to avoid punishment. This reveals a

‘hostile environment’, which Kleyn and García (2019) claim is where language differences are highlighted instead of affirmed, and in these contexts translanguaging pedagogy is likely to fail. This environment is also likely to trigger negative emotions, as Olsen (2000) claims that English-only classes can trigger negative emotions that can adversely affect the learning process. These emotions, including anxiety, apprehension and fear, usually lead to failure (MacIntyre & Gardner, 1994). Therefore, Back et al. (2020) suggest emotional scaffolding for emergent multilinguals through translanguaging. Teachers may support learners’ emotional well-being in education by using both verbal and non-verbal strategies.

At Mmathetha Primary School, reading in chorus was observed as learners tried to engage with the texts. They read the passage together and claimed that it was beneficial in ensuring the participation of both learners as a collaborating pair. Reading in chorus has also been observed by Arthur (1996). In this study learners showed that reading in chorus was triggered by peer work so that both parties could participate, but from observation, learners showed fear and other negative emotions that impeded fluid discussions among learners.

### ***5.5.2 Collaboration at Kang Primary School***

Most learners at Kang Primary School are emergent trilinguals as they bring their home language to school, where they learn Setswana as a national language and English as an official language of learning and teaching. Therefore, we may conclude that using only Setswana and English in the bilingual texts limited learners to drawing from two-thirds of their repertoire. Even though bilingual texts improved learners’ overall performance, there is no strong evidence for the positive effects of bilingual texts on collaborative work.

In this strata, bilingual texts triggered the critical moment of interpretation, which resulted in the inclusion of both parties’ linguistic competence and coverage of a significant portion of

the content, as shown in excerpt 7. It must be noted that these participants were using monolingual texts, but they voluntarily tried to translanguange while discussing content so they could answer the questions. They used translanguaging to share their views and control and plan their collaborative session. The learners were stretched between the reality of the current Language-in-education Policy (English only in science lessons) and employing their repertoire in occupying the translanguaging space to participate in learning. Therefore, they resorted to translation of their speech. According to García et al. (2019), translation has always been ignored in multilingual education systems in favour of communicative strategies of second-language learning, but it has been recognised in multilingual programmes for meaning-making. Homogeneity of English in Botswana's education has concealed indigenous languages as shown by Bagwasi (2017), and this has erased the multilingual nature of Botswana's schools. This creates a gap in pedagogy that can be filled using translation as an effective pedagogical strategy that allows learners to use their unitary semiotic repertoire for meaning-making and for the development of their agency as bilinguals (García et al., 2019).

### ***5.5.3 Collaboration at Mophane Primary School***

Collaboration at Mophane Primary School was fluid as learners engaged with the texts meaningfully. This school is in the capital city, where learners usually use English for learning from as early as preschool and they are usually taught in English from the first year of primary school for easier transition (Mokibelo, 2016a). Even though the learners' speech mainly displays features of English, they sometimes used Setswana to control the collaborative sessions, as shown in excerpts 7, 8 and 9. Here, learners engaged with the texts to fully command the collaborative session and practised turn-taking, as in who reads out the question and who prompts the other party to voice their views. Learners' discussions were very fluid when using

monolingual and bilingual texts. Learners were free to utilise features of their repertoires in meaning-making when engaging with the bilingual texts. However, when writing down their answers, the monolingual questions in the experimental study forced learners to monolingually present their answers in Setswana. This suggests repression of the learners' linguistic repertoire using monolingual questions after reading bilingual texts and discussing them bilingually.

According to Kleyn and García (2019), when planning for translanguaging, learners should be assessed through a bilingual lens by asking bilingual questions to avoid suppression of the learners' repertoires. Similarly, Rajendram's (2019) study, which sought to assess learners' collaboration in Grade 5, found conceptual, organisational and linguistic discursive affordances in collaborative exercises. In the current study, organisational affordances through translanguaging were observed. These were triggered by bilingual texts to open up the translanguaging space for utilisation of learners' whole repertoire. According to Zhan et al. (2010), collaborative learning could improve language comprehension and language production to benefit both low and high performers.

#### ***5.5.4 Application of bilingual texts in pedagogy to enhance learner performance***

Although translation acts as a bridge connecting two or more languages, it treats these languages separately as it deals with one language temporally and then moves on to the next (García et al., 2019). Despite this, García et al. (2019) view translation through the translanguaging lens and point out that translanguaging is indeed an effective pedagogical strategy as teachers in primary schools can use it to empower multilingual learners to put into use their semiotic repertoire so they can make meaning while developing their agency as multilinguals. García et al. (2019) also point out that the exclusion of translation in colonial

Africa allowed the hegemony of one language to erase the multilingual nature of indigenous people.

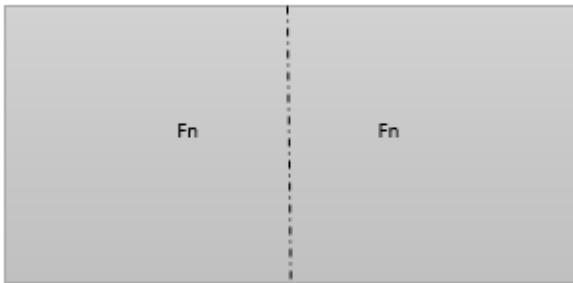
This is correct as it makes a case against using monolingual texts. For example, before the implementation of the 1994 Botswana's Language-in-education Policy, content in science textbooks was translated into Setswana and presented monolingually. In current practices, science texts are monolingually presented, but in English, from the second year of primary education. This shows compartmentalisation of language, even if in translated texts. Therefore, this study values translation, using a cognitive method from a relevance theoretical approach, to make bilingual texts useful in the study of science as the texts have shown promising improvement in learners' mean scores. Bilingual texts in print could allow readers to access both languages concurrently for meaning-making.

The experience at Mophane Primary School highlights the importance of assessing learners through a bilingual lens by asking bilingual questions, as suggested by Kleyn and García (2019). This is important because presenting a bilingual science text for learners to read and asking monolingual questions is like opening up a translanguaging space that allows learners to draw different features from their linguistic repertoires and closing it by suppressing the learners' repertoire through the questions. Although assessments are usually monolingual, taking a translanguaging stance is progressive as it works toward providing an equitable learning space for learners to leverage their linguistic resources in learning (Van Avermaet et al., 2018). One must be aware that learners may choose to use the language they are not proficient in because of attitudes towards indigenous languages, as shown by Arthur (1996). Thus, it may be necessary to use bilingual texts with bilingual questions and eye-tracking devices to ascertain the utilisation of bilingual or relevant texts in attempting bilingual questions or assessments.

As García and Kleyn (2016) show, when planning for a translanguaging pedagogy, it is important to ensure learning differentiation by avoiding a one-size-fits-all approach. This can be done by using the bottom-up approach, which starts by studying the learners and their linguistic context and developing a plan to provide them with an equitable learning space in which they will freely be allowed to draw from their linguistic repertoires in meaning-making. There should be differentiation of learning to avoid a situation as shown in figure 4.6, p.137 whereby the performance of a high-performing school declines when the low-performing school shows improvement. An instructor, teacher or lecturer who takes a translanguaging stance could design a translanguaging pedagogy and be ready to shift after moment analysis (García et al., 2017). Lin (2013:20) suggests that when doing this, we must adopt an approach that would allow us to “try-and-see and then document and re-try another pattern and see what happens and re-design future action plans”. This is applicable when using bilingual texts in pedagogy to enhance learners’ performance.

Finally, using bilingual texts in pedagogy to enhance learners’ performance is best studied longitudinally to ensure prolonged use of texts so that issues such as entrenched policy can only play a minimal or insignificant role in influencing the study’s results (Fleisch et al., 2017a, Gabrielli et al., 2018).

### **5.5.5 Languages in education when using bilingual texts**



**Figure 5.1: Multilingualism in the education system when using bilingual texts**

Figure 5.1 (compare it with figure 2.3) conceptualises multilingualism in Botswana's education system when using bilingual texts to open the translanguaging space for equitable learning.

According to Lin (2013), English second-language lessons only focused on teaching English using a structural approach that ignored other languages. This approach separates languages that could be used concurrently in meaning-making. As shown by García et al. (2019), even though translation has been ignored in multilingual education systems, it is an effective pedagogical strategy that could empower emergent multilingual learners to use their unitary semiotic repertoire in meaning-making. García et al. (2019, p. 84) state 'Translation bridges cultures and languages, whereas translanguaging dwells in the entanglements of cultures and languages.' This means that although translation allows access to another language, it keeps the languages separate like a bridge, but translanguaging treats languages in the learners' repertoire as a single entity as it accommodates them simultaneously in language practice. However, it must be noted that bilingual texts in pedagogy and in this study have opened a translanguaging

space that allows equitable access to learning (Van Avermaet et al., 2018) so that learners can draw features of named languages from their repertoire for meaning-making. This was realised in this study by the slight improvement in the mean scores of learners who used bilingual texts. Therefore, the perforated line in figure 5.1 represents bilingual texts that open the translanguaging space by bringing together the different features of the two languages. This line is not continuous because bilingual texts are presented separately in print and parallel. Therefore, bilingual texts, to some extent, separate languages, but, in this case, their presentation in print shows their presence simultaneously in both languages, unlike in figure 2.3, where languages remain boxed and compartmentalised as textbooks are presented monolingually, and language practices are ideally monolingual. The line is also perforated because, in this case, bilingual texts allow the learners to draw on the features of named languages from each compartment but to a limited extent. Perforations are not fully open because only a slight improvement was realised mainly due to what Kleyn and García (2019, p. 74) call a ‘hostile environment’ that does not affirm linguistic differences. Kleyn and García (2019) show that this environment makes it difficult to discover the benefits of translanguaging pedagogy. Therefore, the current study shows that translation, as a powerful translanguaging strategy, could create a “safe” space for translanguaging if conducted in a longitudinal design that would make bilingual texts a norm.

Using relevance theory in translating science content allowed the researcher (translator) to aim for optimal relevance by utilising different strategies for cognitive effects as intended by the source so that learners did not expend too much processing effort. As shown by Sperber and Wilson (1995), as learners read the comprehension, there could be derivations of textual implicatures, strengthening or erasing some assumptions. In this regard, Kleyn and García (2019) state that bilingual texts are important tools in enacting translanguaging to ensure that English

learning spaces accommodate emergent bilingual learners' language practices while they are learning English.

The languages are still compartmentalised or boxed to some extent because learners' language practices reveal negative emotions of fear and anxiety when they use some features from the other named language because they do not want to be punished. This means that although bilingual texts could enhance the translanguaging space in science lessons, the space has to be safe so that learners will feel free to occupy it and freely move within without fear of punishment. According to Pekrun et al. (2006), students' emotions in different academic contexts could affect their thinking, motivation and actions. Pekrun et al. (2011) reiterate this by showing that positive emotions always enhance academic performance, but negative emotions always lead to failure because they impede learning. As shown in the current study, although there was an improvement in learners' mean scores, it was only slight, and there was not enough evidence to reject the null hypothesis.

Removing the perforated line between the features of the two named languages in figure 5.1 requires a change from the structuralist approach, from separating languages to using a multilingual lens to design translanguaging pedagogy that embraces multilingualism to enhance learners' performance in science. Consequently, this will potentially open a translanguaging space and support learners' safety in the space and their interaction with the world around them. This study has realised that translation of monolingual material is the multilingual approach that could potentially open or create translanguaging spaces that learners can traverse to acquire knowledge in content subjects.

## **5.6 Relevance of content in bilingual texts**

In the fourth year of primary education in science, arbitrary terms are mixed with context-embedded terms. This means that content at this level requires learners to actively apply both their BICS and CALP in learning science. According to the interdependency hypothesis (Cummins, 2000), learners should use their first language for about five consecutive years from the beginning of primary education before they gradually switch to using their second language for learning. Cummins (2000) shows that if learners use a language before they reach a high level of proficiency in BICS, they are highly likely to perform poorly in tasks that are cognitively demanding. However, in Botswana, as stated by Mokibelo (2016a), learners abruptly switch to using English as a language of learning and teaching from as early as the first or the second year of primary education, and by this time, their proficiency in both L1 and L2 would be developing. In translanguaging theory, these learners are emergent multilinguals (see García, 2011). This means that by the time they reach the fourth year of primary education, their CALP and BICS may not have reached a level of proficiency required for learning. Therefore, in this case, a teacher who takes a translanguaging stance can design pedagogy so that both or all languages developing in the learner's repertoire are recognised and included in the learning process. Therefore, bilingual texts in some of the learning material could activate engagement with science texts for enhanced comprehension and academic performance, as done in this study. For example, the science topic for the control and experimental groups was Food and Nutrition, meaning that nutrients such as 'carbohydrates', may be viewed as an abstract term to learners who are used to 'energy giving foods', were part of the content. This shows an instance where proficiency in the academic language is required. Learners may not struggle to understand common words like "fish", which require the BICS. But content in general at this level of

learning requires applying BICS and CALP as these contents are not separated normally. Therefore, if the learners' BICS are well developed and the CALP is not, they may struggle to understand content that requires applying both skills. This may limit comprehension, leading to failure. Hence, for us to say bilingual texts influence learner performance, performance should be significantly different using monolingual texts compared to bilingual texts. This will suggest whether content in bilingual texts is optimally relevant or not.

According to relevance theory, in translation, the source text, the monolingual science text, and its translation, the bilingual text in this study, are related through interpretive resemblance and not through equivalence (see Gutt, 2000). Therefore, by translating the text while bearing in mind that learners also perform to their potential, the researcher (translator) aimed for optimal relevance by ensuring communicability of the translation so that learners could apply the least effort in pursuit of cognitive effects. According to Sperber and Wilson (1995), as learners are reading the comprehension text, the following benefits or cognitive effects may come differently in a manipulated stimulus compared to the source text 1) derivation of contextual implicatures; 2) strengthening of some assumptions; and 3) erasure of some assumptions. These make cross-language communication complete as the translated text could fill the gap in the original text (Gutt, 2014). Therefore, by developing bilingual texts through translation, the translator (researcher) sought to design a stimulus that resembles the monolingual text interpretatively to achieve cognitive effects. As shown by Gutt (2014), humans expect optimal relevance in communication, and if an assumption is relevant, it is highly likely to result in large contextual effects with minimal effort to process it.

A comparison of learners' performance when using monolingual texts with their performance when using bilingual texts only showed a marginal improvement, suggesting a

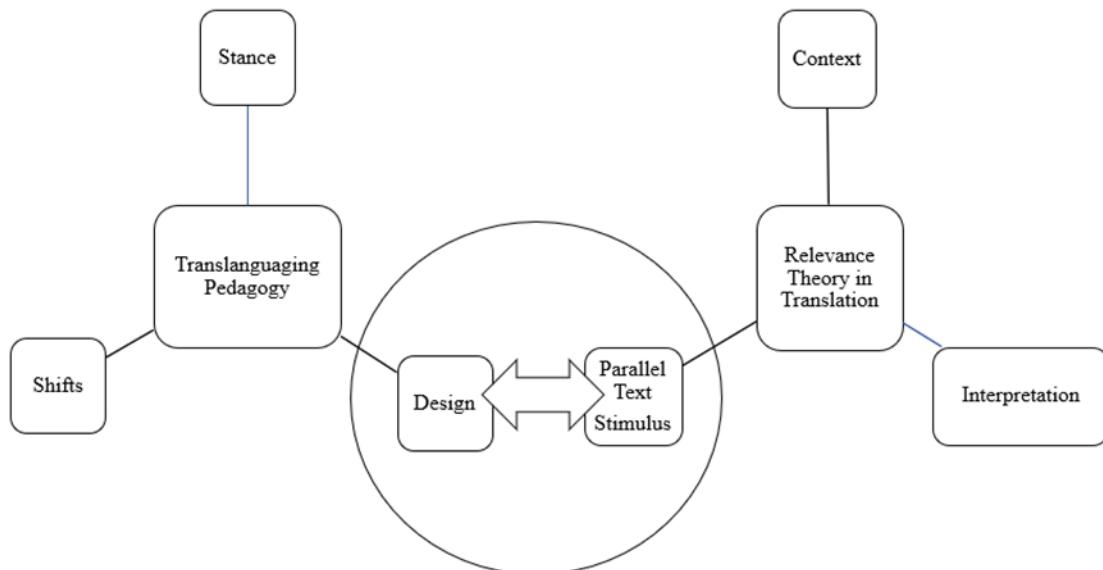
slight enhancement in the monolingual text's content relevance. It shows that learners experienced almost the same contextual effects that were experienced by those who were using bilingual texts. Therefore, this indicates that the content in bilingual texts was slightly more relevant than the content in monolingual texts. Since no significant difference was realised between learners' performance who used bilingual texts and those who used monolingual texts, this suggests that learners in both groups were similarly affected by other factors such as fear of using vernacular, which might have impacted on learners' cognition (see Rahmat, 2019). To enhance learners' performance significantly, this study endorses an ostensive multilingualism pedagogy approach that has the potential to bring science texts closer to the learner.

### **5.7 Ostensive Multilingualism Pedagogy**

The results of this study show that in multilingual contexts like in Botswana, the use of translated learning material presented in parallel texts can enhance learner performance to close the performance gap between learners who speak minority languages and majority languages. This was done by adopting the relevance theory of translation into translanguaging pedagogy. Replacing monolingual science texts with translated parallel science texts has proved the potential to enhance the academic performance of learners. This will not only serve as an instrument of inclusion for learners from diverse linguistic backgrounds but it also holds the potential to close the performance gap between learners from different linguistic backgrounds in Botswana. This study therefore uses translation to enrich translanguaging pedagogy which Goldberg (2008) states that can enhance learner performance. The challenge that this new approach to translanguaging pedagogy might bring is higher expenditure in the development of learning material.

In adopting the use of parallel translated texts in primary education science the system will adapt MacSwan's (2017) view of translanguaging which endorses named languages because education as a systematic programme has to adopt named languages even in translanguaging in order to allow the planning and management of language as a resource in the education system. Therefore this study only supports the weaker version of translanguaging which recognises named languages to allow planning and management of multilingualism in educational contexts.

Figure 6.1 shows the Ostensive Multilingualism pedagogy approach which recognises the necessity of enriching translanguaging pedagogy using translated parallel texts. This is the new approach to embracing multilingualism as it reconsiders the significance of translation in multilingual classrooms.



**Figure 5.2: Ostensive Multilingualism Pedagogy**

As stated by Garcia (2017), the characteristics of translanguaging pedagogy are stance, shifts and design. This study focuses on the design component which necessitates translation of

monolingual textbooks to enhance understanding and to contribute to the development of minority languages. The component of design in pedagogy involves the creation of plans and strategies that are compatible with the learners' language practices so that opportunities for language learning and understanding of content may be exploited by learners. Therefore viewing the languages of multilinguals as a unitary system calls for the use of parallel texts in multilingual contexts. This can be achieved through translation which places emphasis on the functionality of the target text as well as reduction of effort in interpreting the intended message conveyed through the text which in this case means the textbook. Applying a functional approach in conjunction with a relevance approach to translation has the potential to result in responsive pedagogy which is inclusive as it asserts that learners from diverse backgrounds should be able to participate in learning so that their higher-level thinking is promoted as they respond to the text. Accommodating learners' L1 is necessary in this regard.

Considering Kroll and Stewart's (1994) hierarchical model which states that words from two languages are linked at the lexical level but the link from the second language to the first language is stronger than that from the first language to the second language, it is crucial to consider the functionality of parallel texts in multilingual classrooms. Therefore to enhance the study of science using multilingual learning material it must be taken into cognisance that as stated by Roney et. al in Heredia and Altariba, (2001) the link between second language words and their meanings begin weakly but their strength increases as their fluency in the second language increases. This necessitates the use of the learner's first language to support leaning in multilingual contexts.

As mentioned in the theoretical framework of this study, the functional approach to translation cannot be ignored in the development of learning material through translation because as shown

by Bernard and Kamil (1998) for comprehension to be activated effectively there should be a minimum level of L2 proficiency because according to the interdependence hypothesis the content of bilingual's representations differs according to the learner's proficiency in a language. Additionally Sang (2022) suggests functional relevance as a principle of translation problem solving which necessitates strategising solutions in translation by ensuring resemblance of the explicatures and implicatures of the TT and the ST to fulfil the textual functions of the source text. This calls for systematic translation in translanguaging pedagogy which serves a vital purpose in a multilingual classroom. Hence it becomes necessary to view science textbooks as informative texts which represent facts that are translated using logical language as their main focus is the content to be shared with the learners and therefore explication has to be applied in translation to end up interpretive resemblance with the source text.

This study recommends the ostensive multilingualism approach to pedagogy which brings together translanguaging pedagogy and relevance theory in translation to open translanguaging spaces in science education. The new approach suggests designing a multilingual stimulus presented as parallel texts. In this case optimisation has the potential to work to obtain the benefits of understanding content in the textbook while reading. The assumption is that there is optimal relevance where relevant assumptions will result in more contextual effects without unnecessary processing effort. As shown by Sperber and Wilson (2012) interpretation of a stimulus that is considered as an inferential cognitive process in relevance theory can be viewed as an output of the intended meaning of the communicator's perspective. In this regard context is another crucial variable in relevance theory as it determines the interpretation of communication (see Sperber & Wilson 1986). Hence this is a psychological construct which is part of what the reader assumes about the world. That is why it is viewed as the set of premises used in the

interpretation of the stimulus in relevance theory. It is important to note that the stimulus in the relevance theory is designed by the communicator to achieve positive cognitive effects which can be the addition of new information, correction of the old information or the confirmation and clarification of information.

### **5.8 Conclusion**

This chapter has presented a discussion of the study's results in line with the study's problem, aim and research questions. It highlighted the problem by briefly exposing poor performance in science and good performance in Setswana language as a subject. This shows a disciplinary gap between Setswana language and science as a content subject. This study acknowledges the differences between these two disciplines but also supports language use to enhance learner performance in multilingual settings. To address this problem, the science topics were translated using a cognitive approach. These texts were presented bilingually for learners to read and answer comprehension questions to check their performance compared to monolingual texts. Bilingual texts intended to open the translanguaging space so that learners could draw different features of named languages, Setswana and English, from their repertoires in meaning-making as they read and answered the questions. The results of this study were used to answer the questions that sought to determine the effects of bilingual texts on the comprehension of scientific texts, and it was realised that, overall, there was no significant difference between the performance of learners using monolingual texts and those using bilingual texts even though there was an improvement in the mean scores. Therefore, the study failed to reject the null hypothesis, which predicted no effects on learners' academic performance. The second question sought to determine the effects of using bilingual texts on the collaborative exercise. Likewise, only a slight improvement of the learners' mean scores was realised; therefore, the null

hypothesis, which predicted no effects on collaborative work, was not rejected. This chapter also shows that by applying bilingual texts in pedagogy to enhance learner performance, learners may fear going against the English-only policy. Therefore, this study suggests using translation by using a cognitive approach in the development of bilingual texts and the assessment questions to end up with an ostensive multilingualism pedagogical approach. This could create a translanguaging space, potentially making a safe space as the printed word assures the learners that their language is also included in pedagogy. The chapter also suggests differentiation of learning by avoiding a one-size-fits-all approach and using a longitudinal design to study the effects of bilingual texts. Finally, the chapter closed by presenting a conceptual framework of multilingualism in the classroom when bilingual texts are used.

## **CHAPTER 6**

### **Conclusion**

#### **6.1 Introduction**

This final chapter summarises the results of the study by answering the research questions. It also gives an overview of the major findings of this study by synthesising all the main points. After that, it acknowledges the study's limitations and provides recommendations for future research.

#### **6.2 Summary of the results**

Botswana's approach to language issues in the education sector follows a structuralist model that separates and compartmentalises languages. Even in various disciplines of learning, language subjects are separated from content subjects, and the gap erases the importance of language in content subjects' pedagogy to enhance learner performance. Since 2012, Botswana learners have performed exceptionally well in Setswana, but they always have the lowest marks in the science PSLE, the examination they write in the seventh year of primary education before they graduate to secondary schools. Currently, English is used as a language of learning and teaching from the first or second year of primary education. This promotes the hegemony of English, which overshadows the indigenous languages that the learners bring to school to make the situation appear monolingual even though it is multilingual. It also suppresses the learners' linguistic repertoires as it does not allow them to draw from the features of languages available to them.

Using both English and Setswana in learning material means opening a translanguaging space that learners occupy to support their language practices for meaning-making and engaging with the texts. Therefore, translation as a powerful pedagogical strategy was used to develop

bilingual texts that were used to enhance comprehension and support collaborative learning in the study of science. The bilingual texts, which involved the use of English and Setswana, were translated based on a cognitive theory of translation known as relevance theory.

Even though most learners were not comfortable using both languages as prompted by the texts, their performance showed only a slight improvement, suggesting some occupation of a translanguaging space but in a limited way. This improvement does not provide enough evidence to reject the null hypothesis that predicted that bilingual texts would not affect the comprehension of scientific texts and therefore, this study failed to reject the null hypothesis. Likewise, regarding collaborative work, learners' mean scores showed a slight improvement in the experimental group. However, the difference between monolingual text scores and bilingual text score was not significant, meaning that this study failed to reject the null hypothesis that predicted that the use of bilingual texts would not affect learners' collaborative work. Findings from these tests were studied to address the third objective which sought to see how the use of bilingual texts can be applied in pedagogy to enhance learner performance. It was realised that assessment based on bilingual texts should always be bilingual so that it does not lead to the suppression of learners' repertoires. Also, there should be a differentiation of learning to avoid using a one-size-fits-all approach. This involves studying the learners' linguistic repertoires so that the multilingual texts may support the features of languages that they speak. It was also concluded that a quasi-experimental study that deals with the use of bilingual texts in an environment where the current policy is totally entrenched in the learners' minds should use a longitudinal study instead of a cross-sectional study.

Despite the insignificant difference between performance while using monolingual texts versus bilingual texts, this study values the slight changes realised because it shows that the

translanguaging space was opened. Some factors that may contribute to the minimal opening of the translanguaging space include fear of punishment for using a vernacular language in content lessons and an entrenched English-only policy, both of which are likely to result in poor academic performance or unsuccessful implementation of translation in pedagogy. Instead of fluid communication in the translanguaging space, learners were observed reading bilingual texts in chorus, and there were also quiet discussions and silence in some settings. This necessitates the creation of a space, or rather a safe space, for translanguaging in which learners' emotions will be positive as they engage with the texts.

This exposes a gap that can be filled by translation, which is a language practice that brings emergent multilinguals' languages together to support fluid communication. Additionally, translation supports the move from traditional pedagogical strategies to progressive strategies that support equitable learning spaces. It supports the ostensive multilingualism pedagogical approach as the newly suggested approach to education in multilingual contexts which has shown its potential as a guide to embracing multilingualism in the education system of Botswana. This approach reconsiders the necessity of translation in the enrichment of science pedagogy in primary schools therefore if applied well it can also renew our view on translation as a pedagogical tool in multilingual educational contexts.

Even though some scholars have claimed that translation separates languages, this study has realised that translating texts and presenting them bilingually could promote translanguaging as learners engage with the texts.

Despite these key findings, this study also experienced some shortcomings which had an impact on the results of the study. The first limitation is the study design, which was cross-sectional instead of longitudinal because of time constraints. A longitudinal study would have

allowed the researcher to observe change over an extended period after introducing bilingual texts. Another limitation was assuming that learners in the experimental group used bilingual texts when they might have chosen to read monolingually in Setswana or in English only. This calls for the use of eye-tracking devices that can identify the text that the learner is reading or using. These devices are expensive, but they are extremely useful in studying the use of translated texts. Finally, the use of non-proportional sampling limits the generalisability of the study's results.

On the use of translation in preparation of content subjects it has been realised that creation of parallel texts and reading time allocated to learners is time consuming and this will call for prolonged periods of science lessons.

### **6.3 Recommendations**

The following are recommendations for future research:

- Use a longitudinal research design
- Use eye-tracking devices to determine the utility of the bilingual texts
- Use proportionate or random sampling.

Fulfilling these recommendations will mean the expansion of this research, which sought to use translation of texts to enhance learners' access to scientific content. Therefore, any research in the future that would focus on even one recommendation will contribute to more knowledge around the topic of translation and the contribution of bilingual texts towards embracing multilingualism in education.

## **6.4 Conclusion**

This chapter presented the main findings of study, indicating that even though the experimental and control groups showed an improvement in the mean scores, the study failed to reject the two hypotheses that predicted that bilingual texts would have no effect on learners' overall performance and collaborative work. The chapter acknowledges a slight improvement in the mean scores as they indicate the potential of bilingual texts to enhance learning in multilingual settings. The results of this study suggested that applying bilingual texts in pedagogy, differentiating learning and presenting assessments bilingually may be considered to embrace multilingualism in education. The limitations discussed include the use of a cross-sectional study to observe language practices, lack of eye-tracking devices and non-proportionate sampling. Therefore, recommendations for future research suggest the use of a longitudinal design, eye-tracking devices and proportionate stratified sampling.

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## APPENDIX A: Clearance certificate



Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)  
R14/49 Tsolayakhumo

CLEARANCE CERTIFICATE

PROTOCOL NUMBER: H19/11/68

PROJECT TITLE

The effect of embracing multilingualism on the academic performance of learners in primary science education in Botswana

INVESTIGATOR(S)

Ms D Tsolayakhumo

SCHOOL/DEPARTMENT

School of Literature, Language and Media/

DATE CONSIDERED

15 November 2019

DECISION OF THE COMMITTEE

Approved  
Permission letters from schools required before data collection can commence

EXPIRY DATE

13 February 2023

DATE

14 February 2020

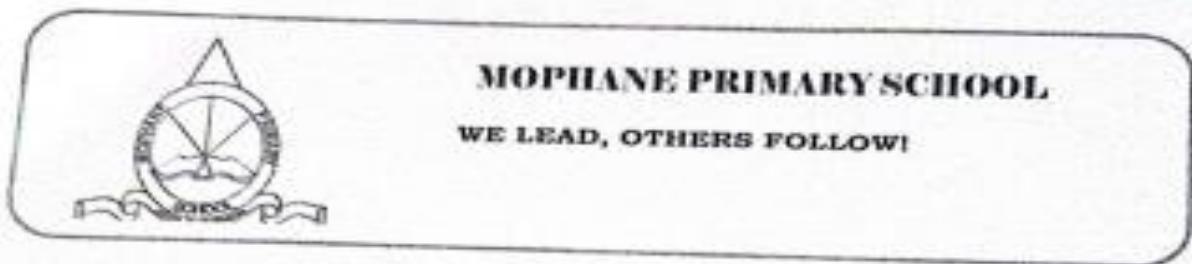
J J CHAIRPERSON

A handwritten signature in black ink, appearing to read "J. J. Knight".  

(Professor J Knight)

cc: Supervisor: Prof J Ingoe

APPENDIX B: Permission to conduct research at Mophane Primary School



P O BOX 25252  
GABORONE  
TELL: 3913450

DATE: 27 July 2020

University of the Witwatersrand  
1 Jan Smuts Avenue  
Braamfontein 2000  
Johannesburg  
South Africa

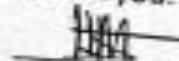
24 July 2020

TO: Prof Judith Inggs

RE: PERMISSION TO CONDUCT A RESEARCH

Ms. Dumelang Tselayakhumo a student at University of Witwatersrand in Johannesburg has been granted permission to conduct research study in the above mentioned school with effect from 09<sup>th</sup> March 2020 to 10<sup>th</sup> March 2021.  
The research is on "THE EFFECTS OF EMBRACING MULTILINGUALISM ON THE ACADEMIC PERFORMANCE OF LEARNERS IN PRIMARY SCIENCE EDUCATION IN BOTSWANA."

Thank you.

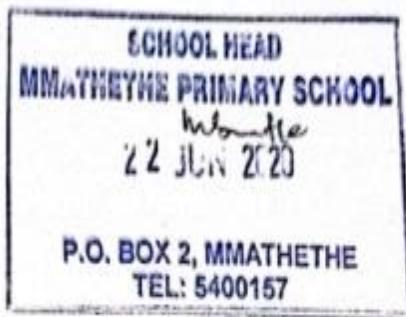
  
Leah Maele  
School head



APPENDIX C: Permission to conduct research at Mmathethe Primary School

Mmathethe Primary School  
P O Box 2  
Mmathethe  
22 June 2020

University of Witwatersrand  
1 Jan Smuts Avenue  
Braamfontein 2000  
South Africa



To: Dumelang Tselayakhumo

**RE: PERMISSION TO CONDUCT A RESEARCH**

Mrs. Dumelang Tselayakhumo a student at University of Witwatersrand in South Africa has been granted permission to conduct a research study in the above mentioned school with effect from 28 June 2020 to 2 July 2020.

The research is on '**THE EFFECTS OF EMBRACING MULTILANGUALISM ON THE ACADEMIC PERFORMANCE OF LEARNERS IN PRIMARY EDUCATION IN BOTSWANA.**'

Thank you

*M. Sentle*  
.....

Mavis Sentle (schoolhead)

APPENDIX C: Permission to conduct research at Kang Primary School

Kang Primary School  
P O Box 42  
Kang

07 September 2020

Dear Ms D. Tselenyakhumo

**REQUEST FOR PERMISSION TO CONDUCT RESEARCH – YOURSELF**

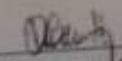
You are informed that your request to conduct a research on **The effects of using bilingual texts on the academic achievement of learners in Primary Science Education in Botswana** has been accepted.

You are permitted to do pre-interview on the **15 September 2020** and to collect data on **21 and 24 September 2020**. You will use the **standard 4 class** as envisaged.

We are grateful to be part of the study which may contribute to the expansion of Literature that can be used to develop relevant learning materials. You are welcome to Kang Primary School.

Thank you

Yours faithfully

  
Obamang C. Mothoteng (Schoolhead)

Contacts  
Office: 6517022  
Mobile: 73886842



## APPENDIX D: Participant information sheet – Parents

### PARTICIPANT INFORMATION SHEET (Parents)

University of the Witwatersrand  
1 Jan Smuts Avenue  
Braamfontein 2000  
Johannesburg  
South Africa

Dear Sir/Madam

I am Dumelang Tselyakhumo, a PhD student in Translation Studies at the University of Witwatersrand in Johannesburg. I have to undertake a research project as part of my studies to investigate the effects of using bilingual texts on the academic achievement of learners in primary science education in Botswana. The aim of the research project is to investigate the effects of adopting multilingual practices in the classroom on the academic performance of learners at primary school level.

As part of this project, I would like to invite you to answer the questionnaire and your child to take part in a semi-experimental study that will involve two science reading comprehension exercises. Each session is expected to take less than 60minutes. With your permission I would also like to video record your child in the classroom while they interact with the text and mark their reading comprehension exercise. The video will be recorded to clearly observe the language practices that learners use to answer collaborative questions. The learners' faces will be concealed in the video and they will use some generated codes instead of their real names for anonymity. The reading comprehension exercises are not real test but they will be used in the study to indicate level of participation and performance of learners in different linguistic contexts. During the study the videos will be kept in a locked cupboard and after the study they will be completely destroyed.

The learner is not going to receive any direct benefit from participating in this research, and they will not be penalized for not participating. You, or they may withdraw at any time or they may not answer any question if they do not want to. The experiment and the questionnaire will be completely confidential and anonymous as I will not ask for their names or any identifying information, and the information that you give to me will be held securely and not disclosed to anyone else. If the child may not feel comfortable they will be allowed to leave the class.

If you have any questions during or after the research, feel free to contact me on the details listed below. This study will be written up as a research report which will be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27 (0)11 7171408 email [Shaun.Schoeman@wits.ac.za](mailto:Shaun.Schoeman@wits.ac.za)

Yours sincerely



Researcher: Dumelang Tselyakhumo [2244358@student3.wits.ac.za](mailto:2244358@student3.wits.ac.za) +27 657 243 092/+26774478674  
Supervisor: Prof Judith Inggs [Judith.Inggs@wits.ac.za](mailto:Judith.Inggs@wits.ac.za) +27 11 717 4265

## APPENDIX E: Questionnaire

### Questionnaire Participant's information

**Title of project:** THE EFFECTS OF EMBRACING MULTILINGUALISM ON THE ACADEMIC PERFORMANCE OF LEARNERS IN PRIMARY SCIENCE EDUCATION IN BOTSWANA

**Name of researcher:** Dunselang Tselyashkumo

#### Introduction

After realizing that Botswana learners do not perform very well in Science like in Setswana at Primary School Leaving Examinations (PLSLE), this research study was proposed to investigate how bilingual (English and Setswana) texts could be used to enhance learners' performance in Science. The study will be quasi experimental and will involve the use of monolingual texts from prescribed textbooks. The monolingual texts have been translated into Setswana to be used alongside English by the experimental group. The control group will use monolingual English texts as usual. The experiment involves reading Science text and answering questions. One session of the control or experimental group is expected to take 40 minutes. A video camera will be used to capture language practices of learners as they engage with the text and other learners. The results of this study will contribute to literature on how translation can be employed to develop pedagogical strategies that can enhance learner performance in content subjects like science. After completion of the project the research data collected will be stored in a digital form without any identifying features and hard copies will be destroyed.

---

Mark the corresponding answer with a tick (✓) and fill in the blanks.

#### Demographic

1) Sex      Male       Female

2) Age (years)

#### Behavioral

3) Please list the languages that the learner speaks at home .....

The end. Thank you

APPENDIX F: Consent form – parents

Consent Form (Parents)

**Consent Form (Parents)**

**Title of project:**

THE EFFECTS OF EMBRACING MULTILINGUALISM ON THE  
ACADEMIC PERFORMANCE OF LEARNERS IN PRIMARY  
SCIENCE EDUCATION IN BOTSWANA

**Name of researcher:** Dumelang Tselayakhumo

I (parent's name)..... give (learner's name)..... permission to participate in this research project. The research has been explained to me and I understand what his/her participation will involve.

Please circle

I agree that the researcher may use anonymous quotes in her research report                    YES      NO

I agree that the experiment session may be video recorded                    YES      NO

I agree that his/her video recordings from the video may be used but their face should be concealed                    YES      NO

I agree that the researcher may take photos of the child's written assessment.                    YES      NO

..... (signature)  
..... (name of the participating learner)  
..... (date)

APPENDIX G: Assent form – Learners

**Assent Form Learners**

**Assent Form**

**Title of project:** THE EFFECTS OF EMBRACING MULTILINGUALISM ON THE ACADEMIC PERFORMANCE OF LEARNERS IN PRIMARY SCIENCE EDUCATION IN BOTSWANA

**Name of researcher:** Dumelang Tselayakhumo

I ..... agree to participate in this research project. The research has been explained to me and I understand what I am expected to do and the consequences.

Please circle

I agree that the researcher may use anonymous quotes in her research report                    YES    NO

I agree that the experiment session may be video recorded                    YES    NO

I agree that my video recordings may be used but my face should be concealed                    YES    NO

I agree that the researcher may take photos of my written assessment                    YES    NO

..... (signature)  
..... (name of participant)  
..... (date)

## APPENDIX H: Participant information sheet – Parents (Translated into Setswana)

### KITSISO GO BATSAWA KAROLO (Batsndi ba baithuni)

University of the Witwatersrand  
1 Jan Smuts Avenue  
Braamfontein 2000  
Johannesburg  
South Africa

#### Batsadi

Leina la me ke Dumelang Tselayakhumo ke dira PhD mo go tsa Botolokolodi kwa University ya Witwatersrand kwa Johannesburg. Ke dira dipatlisiso tse mogo tsone ke batlang go bona gore ditlamorago tsa go dirisa dipuo tse pedi mo padding ya dithuto tsa maranyane go ka thusa jang buna ba dikole tse di potlana go tokafatsa maduo a bone. Maikaeleo a dipatlisiso tse ke go kanoka maduo a go dirisa diteme ka go farologana mo thutong le mo go tokafatseng go tilhaloganya ga baithuti ba ba mo dikoleng tse dipotlana.

E le bontilha bongwe jwa dipatlisiso tse ke eletsa go lo kopa o feleletse potsoloso e e latelang. Gape ke kopa o letlelele ngwana wa gago go tsaya karolo mo tekeletsong e mo go yone go tlaa balwang padi ya Science pele ga tekeletso le morago ga yone. Karolo nngwe le nngwe ya tekeletso e ga e kake ya feta oura. Fa o ka mpho tetla ke eletsa go tsaya ngwana setshwantsho sa motshikinyego le go tshwaya tiro e a tla bong a e kwala. Sefathego sa ngwana se tlaa seke se boitdshiwe mo ditshwantshong gape o tla seke a dirise maina a gagwe fa a kwala teko.

Ga a na go duelwa ka sepe fa a tsaya karolo mo dipatlisisong tse mme ebile gape ga a na go boewa molato fa a ka seke o tseye karolo. Fa a sa eletsa go tswelela mo dipatlisisong tse o tla a letlelelwa go nama a tlogetse pele. Ga kena go dirisa leina la gagwe mo tekeletsong e. Ga ke na go bolelela ope fela mabapi le ngwana le tekeletso e. Fa e kare a ntse a le mo go yone a bo a sa batle go tswelela o letlelelwa go emisa tiro ya sekolo e a tlaa e fiwang a bo a tlogela.

Fa o na le dipotso mabapi le dipatlisiso tse phuthologa o bule le mna mo megaleng e e kwadilweng fa tlase. Dithuto tse di tla anywiwang mo dipatlisisong tse di tlaa kwalwa jaaka pego mme di tlaa gatisiwa mo maranyaneng a motlobo wa dibuka tsa Witwatersrand. Fa o batla tshoboko ya pego ya dithuto tse ke tlaa go e romelela. Fa o na le ngongora mabapi le tsamaiso ya dipatlisiso tse o ka ik golaganya le ba University Human Research Ethics Committee (Non- Medical), mogala wa bone ke + 27 (0) 11 717 1408 email [Shaun.Schoeman@wits.ac.za](mailto:Shaun.Schoeman@wits.ac.za)

#### Ka boikokobetso

Moithuti: Dumelang Tselayakhumo [2244358@students.wits.ac.za](mailto:2244358@students.wits.ac.za) +267 74478674/+27 657 243 092

Motlhathlelela dithuto: Prof Judith Inggs [Judith.Inggs@wits.ac.za](mailto:Judith.Inggs@wits.ac.za) +27 11 717 4265

## APPENDIX I: Questionnaire (Translated)

### Questionnaire

Motsayakarolo

**Setlhogo: TIRISO YA DIPUO KA GO FAROLOGANA E KA AMA JANG MADUO A BAITHUTI  
MO THUTONG YA MARANYANE MO DIKOLENG TSE DI POTLANA MO BOTSWANA?**

**Leina la motsamaisa tshekatsheko: Dumelang Tselayakhumo**

**Matseno**

E rile go lemogeng gore bana ba dikole tse dipotlana ga ba pase dithuto tsa maranyane jaaka ba pasa Setswana mo ditlhathibong tsa lokwalo lwa bosupa, go ne ga kopiwa teseletso ya go batlisisa gore go dirisa dipuo tse pedi kana go feta ( Sekgoa le Setswana) go ka thusa jang go tokafatsa maduo a bana mo dithutong tsa maranyane. Dipatlisiso tse e tlaa bo ele tsa ditekeletso mme go tlaa dirisiwa setlhogo sa thuno le padilwe e e kwadilweng ka sekgoa mo bukeng e e rebotsweng ke goromente go dirisiwa. Padi e e tlaa a ranolelwaa mo Setswaneng mme setlhophaa se sengwe sa baithuti ba tlaa e dirisa ga mmogo le ya Sekgowa go di bala ba bo ba araba dipotso. Setlhophaa se sengwe se tlaa dirisa sekgoa fela jaaka e le tiwaelo mme ba bo ba araba dipotso fela jaaka ba setlhophaa sa tekeletso. Karolo e le nngwe fela ya tekeletso e tlaa tsaya metsotso e ka ana masome a mane. Sekapa ditshwantsho tsa motshikinyego se tlaa dirisiwa go lepa tiriso ya puo mo ntlung ya borutelo ka nako e jaaka bana ba tlaa bo ba bala a bo ba buisanya. Maduo a dipatlisiso tse a tlaa dirisiwa go nonotsha dithuto tse di setseng dile teng gore go ranola dikwnlo go ka dirisiwa jang mo thutong go tokafatsa maduo a baithuti mo dithutong di tshwana le tsa maranyane. Morago ga ditshekatsheko tse tse di fitlhelletseng jaaka dipampiri tse nne bana ba kwalela mo go tsone le ditshwantsho tsa motshikinyego di tlaa bolokwa ka tsa maranyane a bo dipampiri di tshubiwa.

---

Tshwaa (✓) karabo e e maleba a bo o araba dipotso tse di latelang.

**Ka ga motsayakarolo(moithuti)**

1) Bong

Mosimane

Mosetsana

2) Dingwanga

**Tiriso ya puo**

3) Moithuti o bua dipuo dife fa a le kwa lwapeng?

---

Bokhutlo. Kealeboga.

APPENDIX J: Consent form – Parents (Translated into Setswana)

Consent Form(Parents-Setswana Translation)		
<b>Setlhogo:</b>	<b>Teseletso ya gore agwana o ka tsaya Karolo (Batsadi)</b> <b>TIRISO YA DIPUO KA GO FAROLOGANA E KA AMA JANG MADUD A BAITHUTIMO THUTONG YA MARANYANE MO DIKOLENG TSE DI POTLANA MO BOTSWANA?</b>	
<b>Leina la motsamaisa tshekatsheklo: Dumelang Tselayakhumo</b>		
Ke le (motsadi wa ngwana).....ke dumalana gore(Leina la ngwana).....o ka tsaya karolo mo tshekatshekong e ke setseng ke tihaloseditswe ka yone. Ke tihaloganya gore go tlaa diragals eng jaaka a tlaa bo a le emo tsaya karolo mo tshekatshekong e.		
<b>Geloka karabo e e tshwanetseng</b>		
Ke a dumalana gore o tlaa seke o dirise leina la moithuti mo tshekatshekong e	EE	NNYAA
Ke dumalana gore motsamaisa tshekatsheko e o ka dirisa mafoko a moithuti mme a sa mo nankole ka leina	EE	NNYAA
Ke dumalana gore tshekatsheko e e ka dirisa Sekapaditshwantsho tsa motshikinyego	EE	NNYAA
Ke dumalana gore lentswe la moithuti le ka dirisiwa mme sehatlhego sa gagwe se bo se fitlhilwe	EE	NNYAA
Ke dumalana gore tiro e a tlaa bong a e kwala e ka tsewa setshwantsho	EE	NNYAA
Ke dumalana gore se a tla se buang kana se a tla se kwalang se ka dirisiwa ke basekaseki ba bangwe mme go sa nankolwe leina la gagwe	EE	NNYAA
O sikana jang le moithuti? .....		
.....( saena) .....( leina la moithuti yo o tlaa bong a tsaya karolo) .....(letsatsi)		

APPENDIX K: Assent form – Learners (Translated into Setswana)

**Tumalano ya go tsaya Karolo(Moithuti)**

**Setibogo:** TIRISO YA DIPUO KA GO FAROLOGANA E KA AMA JANG MADUO  
A BAITHUTI MO THUTONG YA MARANYANE MO DIKOLENG TSE DI  
POTLANA MO BOTSWANA?

**Leina la motsamaisa tshekatsheko:** Dumelang Tselayakhumo

Ke le....., ke dumalana go tsaya karolo mo  
tshekatshekong e ke setseng ke tlhaloseditswe ka yone. Ke tlhaloganya gore go tlaa diragaia eng  
jaaka ke tlaa bo ke tsaa karolo mo tshekatshekong e.

**Goloka karabo e e tshwanetseng**

Ke a dumalana gore ke tlaa seke ke dirise leina lame  
mo tshekatshekong e EE NNYAA

Ke dumalana gore motsamaisa tshekatsheko e o ka dirisa  
mafoko ame mme a sa nnankole ka leina EE NNYAA

Ke dumalana gore tshekatsheko e e ka dirisa  
sekapaditshwantsho tsa motshikinyego EE NNYAA

Ke dumalana gore lentswe la me le ka dirisiwa mme  
sehatlhego same se sa bonale EE NNYAA

Ke dumalana gore tiro e ke tlaa bong ke e kwala e ka tsewa  
setshwantsho EE NNYAA

Ke dumalana gore se ke tla se buang kana se ke tla sekwalang se  
ka dirisiwa ke badiraditshekatsheko ba bangwe mme go sa nankolwe  
leina lame EE NNYAA

.....( saena)

.....( leina la moithuti wa motsayakarolo)

.....(letsatsi)

APPENDIX L: Pre-test

**Procedures to follow in case of a blood spill**

A blood spill usually occurs when there is a serious injury to a person. If someone is stabbed with a knife or sharp instrument, a lot of blood is released from the person's body.

Since blood may contain germs, you should be careful not to touch it with your bare hands. In order to avoid touching the blood directly, you should:

- Wear rubber or plastic gloves and boots when helping a bleeding person.
- Wash the floor with water and soap or disinfectant. The disinfectant will kill germs. Wear gloves when washing the floor.

If you do touch the blood with your bare hands or get blood on your skin, you should wash your hands or skin immediately with soap and water. As soon as blood dries, the danger of infection is reduced.

*Answer the following questions by ticking () True for the right answer or False for the wrong answer.*

- 1) It is safe to wash bloodstained clothes with your bare hands. True/False. [1 mark]
- 2) You should immediately was your hands with soap and water if you touch blood with your bare hands. True/False. [1 mark]

*Read the following sentences and fill in the blanks with correct answers*

- 3) Wash the floor with water and ..... [1 mark]
- 4) Wear .....clothing in case of a blood spill. [1 mark]

*Answer the following questions*

**5) Why should you avoid touching blood with your bare hands? [1 mark]**

---

---

---

**6) What should we do to avoid coming into contact with blood in case of a blood spill? [1 mark]**

---

---

---

*Discuss the following questions with your partner and write down the answers in the spaces provided.*

**7) What happens when blood dries? [1 mark]**

---

---

---

**8) Is it safe to wash bloodstained clothes with your bare hands? [1 mark]**

---

---

---

---

THE END

APPENDIX M: Experimental test

**O SEKA WA KWALA LEINA LA GAGO.**  
**PLEASE DO NOT WRITE YOUR NAME.**

**KWALA DINOMORE TSE DI SUPANG GORE O MANG  
FA:.....**  
**WRITE YOUR ID CODE HERE: ID.....**

**DITAELO**

**BALA PADIE E LATELANG MME O ARABE DIPOTSO 1 GO EMA KA 8.**

**INSTRUCTIONS**

**READ THE FOLLOWING TOPIC AND ANSWER QUESTIONS 1 TO 8.**

## **DUO LE DIKOTLA**

### **FOOD AND NUTRITION**

#### Matseno

#### Introduction

Fa re batla go itekanelo re tshwanetse go ja dijo tse di itekanetseng.

If we are to stay healthy we need to eat a good and well-balanced diet.

Dijo di na le dikotla tse di tlhokiwang ke mmele wa rona gore o gole, o sireletsege mo malwetsing le gore o nne le nonofo.

Food contains nutrients, which our body needs for growth, protection from diseases and energy.

#### **Thuto 1 Mefuta ya dikotla**

#### **Unit 1. Nutrients**

Ko mophatong wa boraro lo ithutile gore dijo di kgona go kgaoganngwa ka ditlhophha go lebilwe dikotla tse di mo go tsone.

In Standard 3 you learned that food can be put into groups according to the nutrients they contain.

Dikotla di dira gore re gole re nne re itekanetse.

The nutrients help us to grow and stay healthy.

Dikotla tse di botlhokwa thata ke mafura, dikotla tse di agang mmele, tse di re fang nonofo, divithamin le matswai.

The main nutrient groups are fats, proteins, carbohydrates, vitamins and minerals.

**Mebele ya rona gape e tlhoka moroko. Dijo tsotlhe tse di tswang mo dimeleng di na le moroko.**

Our bodies also need fiber. All plant foods contain fiber.

**Gore mmele wa rona o bone moroko re tshwanetse go ja maungo, merogo le dijo tse di sa ntshiwang moroko.**

We should eat fruit, vegetables and whole grains to get the fibre.

## **Moalo 1**

**Table 1**

<b>Dikotla Nutrients</b>	<b>Mosola wa dikotla Functions of the nutrients</b>	<b>Dijo tse di nang le dikotla Food rich in nutrients</b>
Tse di fang mmele nonofo -setache le sukiri dile mo teng  Carbohydrates -Includes Starches and Sugars	Di re fa nonofo  Give us energy	Borotho, setampa, phaleche, mabele, raese, tswii, dilekere, jeme  Bread, oats, samp, phaleche, mabele, rice, tswii, brown bread, cakes, sweets, jam
Tse di agang mmele	Di godisa mmele a bo di fodisa dikgobalo	1. Dijo tse di tswang mo diphologolong

<b>Proteins</b>	For healthy growth and to help repair injuries	jaaka nama, tlhapi, phane, mashi, chese 2. Losika lwa dinawa jaaka dinawa, letlhodi, manoko  1. animal products, such as meat, fish, caterpillars, milk, cheese 2. Legumes such as beans, lentils, groundnuts
<b>Di vithamene le matswai</b>	<b>Di sireletsa mmele mo malwetsing</b>	Merogo le maungo jaaka khabeche, spinach, rothwe, delele, maphutshi, digwete, maungo  Vegetables and fruit-cabbage, spinach, rothwe, delele, pumpkin, carrots, guava, apple, oranges, grapes, moretiwa, morula, mmilo
<b>Vitamins and minerals</b>	Protect our bodies against diseases	
<b>Mahura</b>	<b>Di re fa nonofo</b>	Mahura a apayang, batha, dijo tse di mahura jaaka dichipisi le nama

**Lebelela Moalo 1 a bo o araba dipotso tse di latelang**

**Use table 1 to answer the following questions**

*Tshwaya (✓) Ee fa seele e le boammaaruri kana Nnya fa seele e se nnete*

1. Borotho bo re fa nonofo. Ee/Nnyaa [ 1 mark]
2. Merogo ere sireletsa mo malwetsing. Ee/Nnyaa [ 1 mark]

*Feleletsa diele tse di latelang o dirisa lefoko le le tshwanetseng*

3. .....ke sekai sa dijo tse di agang mmele.[ 1 mark]
4. .....ke sekai sa dijo tse di dirang gore mala a bereke sentle.[ 1 mark]

*Araba dipotso tse di latelang*

5. Kwala sekai sa dijo tse di re fang nonofo **[1 mark]**
- .....

6. Kwala sekai sa dijo tse di re sireletsang mmele **[ 1 mark]**
- .....

*Buisanya le yo o bapileng nae a bo o kwala dikarabo tsa gago fa tlase.*

7. Motho oka ja eng fa a sa batle go tshabelelwa ke malwetsi.  
Kwala karabo ya gago fa **[ 1 mark]**
- .....
- .....
- .....

8. Metsi a thusa jang mmele wa rona? **[ 1 mark]**
- .....
- .....
- .....

**WRITE YOUR ID CODE HERE: ID.....**

**PLEASE DO NOT WRITE YOUR NAME.**

**INSTRUCTIONS:**

**READ THE FOLLOWING TOPIC AND ANSWER QUESTIONS 1 TO 8.**

## **FOOD AND NUTRITION**

### Introduction

If we are to stay healthy we need to eat a good and well-balanced diet. Food contains nutrients, which our body needs for growth, protection from diseases and energy.

### Unit 1 Nutrient groups

In Standard 3 you learned that food can be put into groups according to the nutrients they contain. The nutrients help us to grow and stay healthy. The main nutrient groups are fats, proteins, carbohydrates, vitamins and minerals.

Our bodies also need fiber. All plant foods contain fiber. We should eat fruit, vegetables and whole grains to get the fiber.

**Table 1**

<b>Nutrients</b>	<b>Functions of the nutrients</b>	<b>Food rich in nutrients</b>
<b>Carbohydrates</b> - Includes starches and sugars	Give us energy	Bread, oats, samp, phaleche, mabele, rice, tswii, brown bread, cakes, sweets, jam
<b>Proteins</b>	For healthy growth and to help repair injuries	1. animal products, such as meat, fish, caterpillars, milk, cheese 2. Legumes such as beans, lentils, groundnuts

Vitamins and minerals	Protect our bodies against diseases	Vegetables and fruit-cabbage, spinach, rothwe, delele, pumpkin, carrots, guava, apple, oranges, grapes, morethwa, morula, mmilo
Fats and oils	Gives us energy	Cooking oil, butter, fatty foods such as chips, meat
Fiber	Keeps our intestines working properly	Fruit, vegetables, whole grains
Water	Keeps all parts of our body working well	Five to eight glasses of clean water a day

Use table 1 to answer the following questions

Write (✓) **True** for the correct statement and **False** for the incorrect statement

1. Bread gives us energy. True/False [1 mark]
2. Vegetables protect our bodies against diseases. True/False [1 mark]

Read the following sentences and fill in the blanks with the correct answers

3. ..... is an example of food that provides our bodies with proteins. [1 mark]
  4. ..... keeps our intestines working properly.[1 mark]
- .....

*Answer the following questions*

5. Write down one (1) example of food that gives us energy. **[1 mark]**

.....  
.....

6. Write one (1) example that protect our bodies against diseases. **[1 mark]**

.....  
.....

*Discuss the following questions with your partner and write down the answers in the spaces provided.*

7. What can someone eat if he or she wants to protect his or her body against diseases? **[1 mark]**

.....  
.....

8. How does water help our body? **[ 1 mark]**

.....  
.....  
.....  
.....

## APPENDIX O: Comprehension results

### DEPENDENT T-TEST

#### 1. All schools control group

Table @: Normality for pre-test and post-test for all students

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.113	96	.004	.957	96	.003
Post-test	.139	96	<.001	.944	96	<.001

Table @: Wilcoxon Sign-Rank Test for pre-test and post-test for all students

	Mean	Z	p-value
Pre-test	62.2		
Post-test	61.4	0.532	0.596

#### 2. Mmathethe Primary School

Table @: Normality for pre-test and post-test for Mmathethe Primary School

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.143	32	.095	.951	32	.159
Post-test	.182	32	.008	.930	32	.039

a. Lilliefors Significance Correction

Table @: Wilcoxon Sign-Rank Test for pre-test and post-test for Mmathethe Primary

	Mean	Z	p-value
Pre-test	49.0		
Post-test	53.4	-1.506	0.132

#### 3. Mmathethe Primary School control group

Table @: Normality for pre-test and post-test for Mmathethe Primary School control group

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.159	16	.200*	.968	16	.807

Post-test	.263	16	.004	.789	16	.002
-----------	------	----	------	------	----	------

\*. This is a lower bound of the true significance

a. Lilliefors Significance Correction

Table @: Wilcoxon Sign-Rank Test for pre-test and post-test Mmathethe Primary Control group

	Mean	Z	p-value
Pre-test	47.9		
Post-test	46.4	-0.104	0.132

#### 4. All schools experimental group

Table @: Normality for pre-test and post-test for all schools experimental group

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.140	48	.020	.943	48	.021
Post-test	.181	48	<.001	.935	48	.010

a. Lilliefors Significance Correction

Table @: Wilcoxon Sign-Rank Test for pre-test and post-test all schools experimental group

	Mean	Z	p-value
Pre-test	63.2		
Post-test	65.0	-0.475	0.635

#### INDEPENDENT T-TEST (POST-TEST RESULTS)

Comparative performance of the control and the experimental groups in each of the three schools e.g., at Mmathethe Primary School, the difference between the control and the experimental group is significant p-value

		Schools		
		Mmathethe	Kang Primary	Mophane
		Primary School	School	Primary School
		Mean	Mean	Mean
Post-test	Investigation type	Control	46.4	44.8
		Experimental	60.3	65.0
				69.7

## 1. Mmathethe Primary School

Table @: Normality for control and experimental groups at Mmathethe Primary School

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.139	96	<.001	.944	96	<.001

Table @: Mann-Whitney U test for the control and experimental groups at Mmathethe Primary School

	Post-test
Mann-Whitney U	956.500
Wilcoxon W	2132.500
Z	-1.451
Asymp. Sig. (2-tailed)	.147
Grouping Variable: Investigation type	

## 2. Kang Primary School

Table @: Normality for control and experimental groups at Kang Primary School

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.204	32	.002	.925	32	.029

Table @: Mann-Whitney U test for the control and experimental groups at Kang Primary School

	Post-test
Mann-Whitney U	61.500
Wilcoxon W	197.500
Z	-2.552
Asymp. Sig. (2-tailed)	.011
Exact Sig. [2*(1-tailed Sig.)]	.011 <sup>b</sup>

## 3. Mophane Primary School

Table @: Normality for control and experimental groups at Mophane Primary School

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.177	32	.012	.897	32	.005

Table @: Mann-Whitney U test for the control and experimental groups at Mophane Primary School

	Post-test
Mann-Whitney U	83.500
Wilcoxon W	219.500
Z	-1.711
Asymp. Sig. (2-tailed)	.087
Exact Sig. [2*(1-tailed Sig.)]	.094 <sup>b</sup>

## INDEPENDENT T-TEST (POST-TEST RESULTS) CONTROL VS EXPERIMENTAL

		Post-test
		Mean
Investigation type	Control	57.83
	Experimental	65.00

			Post-test
			Mean
Mmathetha Primary School	Investigation type	Control	46.44
Kang Primary School	Investigation type	Experimental	60.31
Mophane Primary School	Investigation type	Control	44.81
		Experimental	65.00
		Control	82.25
		Experimental	69.69

### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.139	96	<.001	.944	96	<.001

a. Lilliefors Significance Correction

### Test Statistics<sup>a</sup>

	Post-test
Mann-Whitney U	956.500
Wilcoxon W	2132.500
Z	-1.451
Asymp. Sig. (2-tailed)	.147

a. Grouping Variable: Investigation type

**a) Compare pre-test results of the three schools to determine performance before the experiment**

School			
Mmathethe Primary			
School	Kang Primary School	Mophane Primary School	
	Mean	Mean	Mean
Pre-test	49.0	60.4	77.2

**Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	.113	96	.004	.957	96	.003

a. Lilliefors Significance Correction

**Test Statistics<sup>a,b</sup>**

Pre-test		
Kruskal-Wallis		24.567
H		
Df		2
Asymp. Sig.		<.001

a. Kruskal-Wallis Test

b. Grouping Variable: School

**Mmathethe VS Kang**

**Test Statistics<sup>a</sup>**

	Post-test
Mann-Whitney U	493.500
Wilcoxon W	1021.500
Z	-.253
Asymp. Sig. (2-tailed)	.800

a. Grouping Variable: School

**Mmathethe/Kang VS MOPHANE**

**Test Statistics<sup>a</sup>**

	Post-test
Mann-Whitney U	232.000
Wilcoxon W	760.000
Z	-3.812
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: School

**c) Compare the control results of the three schools**

		Schools		
		Mmatethe Primary School	Kang Primary School	Mophane Primary School
		Mean	Mean	Mean
Post-test	Investigation type	Control	46.4	44.8
		Experimental	60.3	65.0

**Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.133	48	.034	.928	48	.006

a. Lilliefors Significance Correction

**Test Statistics<sup>a,b</sup>**

	Post-test
Kruskal-Wallis H	18.585
Df	2
Asymp. Sig.	<.001

a. Kruskal-Wallis Test

b. Grouping Variable: School

**Mmatethe VS Kang****Test Statistics<sup>a</sup>**

	Post-test
--	-----------

Mann-Whitney U	109.000
Wilcoxon W	245.000
Z	-.731
Asymp. Sig. (2-tailed)	.465
Exact Sig. [2*(1-tailed Sig.)]	.491 <sup>b</sup>

a. Grouping Variable: School

b. Not corrected for ties.

### Mmathethe/Kang VS Mophane

**Test Statistics<sup>a</sup>**

	Post-test
Mann-Whitney U	29.500
Wilcoxon W	165.500
Z	-3.791
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>

a. Grouping Variable: School

b. Not corrected for ties.

### d) Compare the experimental results of the three schools

**Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post-test	.181	48	<.001	.935	48	.010

a. Lilliefors Significance Correction

**Test Statistics<sup>a,b</sup>**

	Post-test
Kruskal-Wallis	1.736
H	
Df	2
Asymp. Sig.	.420

a. Kruskal-Wallis Test

b. Grouping Variable:  
School

**APPENDIX P: Collaborative exercise results**

**Descriptive Analysis**

		Collaborative work score		
		.00	50.00	100.00
School	Mmathethe Primary School	16	14	2
	Kang Primary School	17	8	7
	Mophane Primary School	7	5	20

		Collaborative work score		
		.00	50.00	100.00
Investigation type	Control	23	9	16
	Experimental	17	18	13

Collaborative work score			
Investigation type	Control		42.71
	Experimental		45.83
	Mmathethe Primary School		28.13
School	Kang Primary School		34.38
	Mophane Primary School		70.31

Collaborative work score			
School	Mmathethe Primary School	Control	18.75
		Investigation type	37.50
		Total	28.13
	Kang Primary School	Control	31.25
		Investigation type	37.50
		Total	34.38
	Mophane Primary School	Control	78.13
		Investigation type	62.50
		Total	70.31
Total	Control		42.71
		Investigation type	45.83
	Total		44.27

**Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Collaborative work score	.269	96	.000	.774	96	.000

a. Lilliefors Significance Correction

### CONTROL VS EXPERIMENTAL (Mann-Whitney U test)

#### 1. All schools

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	1093.500
Wilcoxon W	2269.500
Z	-.457
Asymp. Sig. (2-tailed)	.647

a. Grouping Variable: Investigation type

#### 2. Mmathethe Primary School

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	90.000
Wilcoxon W	226.000
Z	-1.610
Asymp. Sig. (2-tailed)	.108
Exact Sig. [2*(1-tailed Sig.)]	.160

a. Grouping Variable: Investigation type

#### 3. Kang Primary School

**Test Statistics<sup>a</sup>**

	Collaborative work score

Mann-Whitney U	113.000
Wilcoxon W	249.000
Z	-.622
Asymp. Sig. (2-tailed)	.534
Exact Sig. [2*(1-tailed Sig.)]	.590

a. Grouping Variable: Investigation type

#### 4. Mophane School

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	100.000
Wilcoxon W	236.000
Z	-1.225
Asymp. Sig. (2-tailed)	.221
Exact Sig. [2*(1-tailed Sig.)]	.305

a. Grouping Variable: Investigation type

#### 1. All schools without considering whether student belongs to control or experimental (Kruskal) check means in Table 3 for each school

	Collaborative work score
Mmathethe Primary School	28.13
School Kang Primary School	34.38
Mophane Primary School	70.31

**Test Statistics<sup>a,b</sup>**

	Collaborative work score
Chi-Square	17.564
Df	2
Asymp. Sig.	.000

a. Kruskal-Wallis Test

b. Grouping Variable: School

#### Mmathethe VS Kang

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	487.000
Wilcoxon W	1015.000
Z	-.371
Asymp. Sig. (2-tailed)	.711

a. Grouping Variable: School

**Mmathethe/Kang VS Mophane****Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	289.500
Wilcoxon W	817.500
Z	-3.214
Asymp. Sig. (2-tailed)	.001

a. Grouping Variable: School

**c) Compare the collaboration control results of the three schools**

	Collaborative work score
Mmathethe Primary School	18.75
Kang Primary School	31.25
Mophane Primary School	78.13
Total	42.71

**Test Statistics<sup>a,b</sup>**

	Collaborative work score
Chi-Square	14.573
Df	2
Asymp. Sig.	.001

a. Kruskal-Wallis Test

b. Grouping Variable: School

### Mmathethe VS Kang

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	116.000
Wilcoxon W	252.000
Z	-.526
Asymp. Sig. (2-tailed)	.599
Exact Sig. [2*(1-tailed Sig.)]	.669 <sup>b</sup>

a. Grouping Variable: School

b. Not corrected for ties.

### Kang VS Mophane

**Test Statistics<sup>a</sup>**

	Collaborative work score
Mann-Whitney U	62.000
Wilcoxon W	198.000
Z	-2.767
Asymp. Sig. (2-tailed)	.006
Exact Sig. [2*(1-tailed Sig.)]	.012 <sup>b</sup>

a. Grouping Variable: School

b. Not corrected for ties.

### d) Compare the collaboration experimental results of the three schools

	Collaborative work score
School	Mmathethe Primary School
	Kang Primary School
	Mophane Primary School
	Total

**Test Statistics<sup>a,b</sup>**

Collaborative work score	
Chi-Square	4.005
Df	2
Asymp. Sig.	.135

a. Kruskal-Wallis Test

b. Grouping Variable: School

**b) Compare pre-test results of the three schools to determine performance before the experiment**

		Collaborative work score
	Mmathethe Primary School	37.50
School	Kang Primary School	39.06
	Mophane Primary School	82.81

**Tests of Normality**

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Collaborative work score	.232	96	.000	.797	96	.000

a. Lilliefors Significance Correction

**Mmathethe/Kang VS Mophane**

**Test Statistics<sup>a</sup>**

Collaborative work score	
Mann-Whitney U	199.000
Wilcoxon W	727.000
Z	-4.510
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: School

## APPENDIX Q: Moment Analysis- Collaborative work

### 1) Kang Primary School

Critical moment	What triggered it?	Consequences
Interpretation of own utterances	Bilingual texts	Inclusion of the other party
	Context conducive for multilingualism	Enhanced comprehension
	Researcher used Setswana to greet participants	Active participation
Use of gestures	Lack of equivalent form in learners' L2 vocabulary	Enhanced understanding of verbal communication
Use of home languages in the background	Background taken as 'backstage'	Enhanced interaction among learners
	Researcher's absence in that context	

## 2) Mmathethe Primary School

<b>Critical moment</b>	<b>What triggered it?</b>	<b>Consequences</b>
The use of vernacular to plan, organise and control the collaborative session	Peer work	Fluid communication
Use of gestures	Peer interaction, learners' usually practice it in day-to-day interaction with peers	Fluid communication
Use of home languages in the background	Freedom, while the researcher is focusing on other participants	Temporal fluidity in communication

### 3) Mophane Primary School

Critical moment	What triggered it?	Consequences
The use of vernacular to plan, organise and control the collaborative session	Peer work	Fluid communication
Use of gestures	Peer interaction, learners' usually practice it in day-to-day interaction with peers	Fluid communication
Use of home languages in the background	Freedom, while the researcher is focusing on other participants	Temporal fluidity in communication