TEACHERS' EXPERIENCES OF TEACHING NATURAL SCIENCES IN A SECOND LANGUAGE: A CASE OF PRIMARY SCHOOLS IN MOPANI EAST DISTRICT

by

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DEDICATION

I dedicate this degree to my late mother **Jeaneth Baloyi** who, despite health problems worked so hard in ZZ2 farms from 2000-2006 to bring me to where I am today. I wish that she could have lived to see the results of her efforts and dedication. Thank you, Mother, for persevering through rain and shine, for working as hard as you did to reach the farmer's stock target while committing yourself to prepare the best future for me. Although God took you too soon, and before you could enjoy the fruits of your intentions', in the little time we spent together I was appreciative of and grateful for your hard work and parental support which always inspired me to achieve more. I know that were you still alive, my studies would be in your daily prayers. May your beautiful and loving soul rest in perfect peace, dear Mother.

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DECLARATION

I, Chauke Basambilu, declare that the dissertation entitled, Teachers' Experiences of Teaching Natural Sciences in a Second language: a case of primary schools in Mopani East District, is the work of my own hands and that all the sources used or quoted are acknowledged through a reference list.

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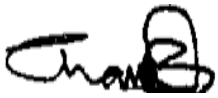
Signature:  Date: 03 February 2023

ABSTRACT

This study explored teachers' experience of teaching Natural Science in second language in primary schools of the Mopani East District. The study was conducted in four primary schools within four out of five circuits of Mopani East District, using qualitative design. Four grade 7 and three grade 4 Natural Science teachers were purposefully sampled. Data was collected through semi-structured interviews and lesson observations. Interviews and observations were audio recorded, the audio recorded interviews were transcribed and analysed using thematic content analysis through the help of Qualitative Data Analysis (QDA) software. Content analysis was also applied to analyse lesson observation field notes. Following the sociocultural theory of second language acquisition and constructivism theory of science learning, data analysis and discussion of this study indicates that teachers experience learners' inadequate language proficiency as the cause of their inability to hear, speak, read and write in a second language in Natural science classrooms. This is due to the use of a particular language of instruction in the foundation phase, societal factors, learners' school entry age, as well as exclusion of a specific English language use in teachers' development workshops. From these findings recommendations for teachers' training, and a motivation to revisit language in education policy, were suggested.

KEY TERMS: Second Language, Science, language of learning and teaching, experience, inadequate second language proficiency, language of instruction, societal factor, code switching, translation, and poor performance.

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CHAPTER 1
INTRODUCTION AND BACKGROUND OF THE STUDY

1.1. Introduction

The intention of this study was to explore teachers' experience in teaching Natural Sciences in a second language. Language is a systematic means of communicating by the use of sounds or conventionally coded symbols or a set of patterns or structures produced for communicating ideas (Hoque, 2017). The South African Curriculum and Assessment Policy Statement (CAPS) describes language as the means by which a person learns to organise experience and thoughts; it stands at the centre and shapes learning. In South Africa African children are taught in their home language as a language of instruction during the first four years of study and there after English or Afrikaans becomes their language of instruction (Gudula, 2017).

In the Intermediate Phase, learners are introduced to the language of learning and teaching (LoLT) which is either English or Afrikaans. LoLT refers to the medium of instruction via which learning and teaching for all subjects is facilitated (Tikly et al, 2018). However, LoLT in a school is determined by the School Governing Bodies (SGB), who select LoLT in their schools according to section (6)(2) of the South African Schools Act (SASA). The transition from mother tongue to a second language, as the language of learning and teaching from fourth grade, is a challenging process (Tikly et al, 2018). Second language refers to any other language learned or acquired, or a language not learned in the person's mother tongue (Hoque, 2017).

For learners to study science as an analytical and functional practise that includes the systematic study of the physical and natural world's nature and action they need to observe and experiment (Davies & Sawyer, 2017). There is a need for signature knowledge and collaboration in order for them to gain a conceptual awareness of what science is; this can only be accomplished by listening, learning, reading and communicating. Science education generates a profound awareness of nature and technical product (Weintrop et al, 2016). by creating scientifically literate individuals who can cope with fundamental socio-economic and technological issues, wherein

research leads to societal progress. Science underpins an understanding of evolution, nature, climate change, and population genetics. It is therefore used as a basis-line to connect current encounters with previous founded models, and describes those (Hernán & Cofré, 2018). It is therefore necessary to use the language of instruction (LoLT) in science literature to affect the transition of knowledge from educators to learners, and it is also necessary to have science literature written in LoLT (Gordon, 2018). According to (Mtsi, 2016), there are knowledge differences in natural science research and teaching that have increased the outcomes of effective learning. The comprehension of learners is dependent on their ability to interpret the language of instruction; for instance, a greeting in English ‘good morning’ won’t sound the same as ‘Avuxeni’ to a Xitsonga speaker. Despite various proposed explanations and solutions South African learners’ science achievements have remained poor (Gudula, 2017). Therefore, this study aimed to investigate the experiences of teachers teaching natural science in second language at primary schools in Mopani East in the Limpopo province.

1.2. Rationale for the study

The rationale for this research study drew largely on personal and contextually based evidence. The researcher’s experience of teaching Natural Sciences in the primary level formed a personal basis for the study, and the exposure to different schools in different circuits of Mopani District had given the researcher more knowledge concerning the use of second language in teaching Natural Sciences at the primary level. During the learning and teaching phases, the researcher faced difficulties of teaching Natural Sciences to second language learners; these difficulties included: teaching the language of science and the language of instruction at the same time, translating the language of science into the learners’ first language, spending more time on one instructional content/lesson resulting in the inability to meet clear educational objectives, and the inability to offer effective science education resulting in higher failure rates.

"Doing science" is fundamentally complicated, requiring encounters with intellectual constructs, cognitive systems, epistemic frameworks, linguistic constructs, and social experience engagement (Naude, 2015). The complexity of the Natural Sciences

increases the need to use a much simplified and more familiar language to be taught or understood. It should be condensed and articulated in a manner that is convenient for learners to understand. There is a need for adaptation due to the changes in the environment; this is in relation to (Weintrop et al, 2016) who claim that our daily lives are guided by science and technology as science education has become a significant, critical and vital role in education globally. Therefore, understanding Natural Sciences as it impacts their daily lives is important for the learners. The research subscribes to the idea that science teachers should be able to recognise the right way for learners to study science in order for them to be successful. Useful theories of learning, description of the subject's substance, order and variety are also dependent on the appropriateness of the language of instruction to be used (Kaya & Akdemir, 2016).

Unfortunately, learners struggle with the language of learning and teaching (LoLT) science during the learning and teaching process; for example, some of their difficulties include: failure to comprehend what is taught, failure to understand what is learned, an inability to read and write; as a result, learners use African languages or home language to address science test questions (Argidag, 2010).

TIMSS Developments in International Mathematics and Science Research results are used in the collection of data to examine patterns within the South African education system, and are analysed every four years. Out of 16 countries South Africa (SA) was found to be the fifth lowest performing country in mathematics at the primary level (Mullis & Martin, 2017). The numeracy assessment results, according to TIMSS, is due to a lack of capital, inequalities across the community of learners, and the country's linguistic diversity. The study also reveals that the lowest overall score was found in South African primary schools. Media studies also suggest that enrolment rates in South African primary schools are increasing annually, but the low standard of science education remains a persistent trend (Robinson, 2019).

The reasons above provided motivation to research teachers’ experiences of teaching natural science in a second language.

1.3. Problem statement

Science forms the foundation for the learning of skills for primary-level learners, and trains them for the acquisition of potential skills in subjects such as physical education, earth science and agricultural science (Obe, 2018). Educational vocabulary is seen as an information divide that makes it impossible for instruction in life sciences to be passed from instructor to learner. For starters, vocabulary is used in classrooms to make it impossible to engage in appraisal tasks and activities and to learn from them (Weintrop et al, 2016). Language was raised as a critical issue in science learning and teaching in South Africa in a number of provinces, with Limpopo schools ranked within the lowest performing provinces in Mathematics, Science and Technology (Motshekga, 2019). Therefore, language problems in South African primary schools for science learning and teaching, needs attention and corrective action, in order to deliver quality work (Gordon & Harvey, 2019).

1.4. Research questions

The following main research question together with sub questions that align with the research purpose and objectives was used to guide the proposed study.

Main research question: What are primary school teachers experiences of teaching natural science in the second language?

- What are the challenges of using second language in teaching Natural Sciences to primary school learners?
- How do these challenges affect the learning and teaching of Natural Science?
- How effective is English to second language primary school learners?

1.5. Aim and objectives of the study

The proposed study aimed to investigate primary school teachers' experiences of teaching Natural Science in the second language in selected primary schools of the Mopani East in Mopani District.

The study aimed to achieve the following objectives:

- To identify the challenges of using English as a second language in teaching Natural Sciences to primary school learners.
- To interrogate how these challenges affect the learning and teaching of Natural Science.
- To explore the effectiveness of (English) second language use in Natural Science teaching.

1.6. Significance of the study

The study explored primary school teachers' experiences of second-language teaching in Natural Sciences with the aim of improving language practices in relation to the language of instruction appropriate to the teaching of science at the primary school level. Research provides information to policy makers, when they research and debate educational topics (Creswell, 2012). Creswell further argues that researchers offer results that can help policy makers weigh various perspectives on issues important to constituencies. Therefore, the outcomes of this research aimed at assisting South African education policy makers to make necessary and appropriate amendments to policies regarding official language of learning and teaching not only in Natural Sciences, but also in other learning areas content.

1.7. Preliminary literature review

The rationale for the study demonstrated why the subject was chosen, and the literature review offered the researcher important links between existing knowledge and the research topic being studied. The goal was to clarify the course of previous research and how it applies to this analysis. Several research papers and studies on the subject of language in science education have been conducted in South Africa. To ensure that the researcher stays focused on the experiences of primary school teachers in teaching second-language natural sciences, a variety of literature was reviewed.

1.7.1. Educators' content knowledge

DeBoer (2019) argues that primary school educators are generally unwilling to teach science. He cites two reasons for this, these being a limited knowledge of science content, as well as a limited knowledge of scientific pedagogical content knowledge (PCK). DeBoer's studies frequently show that issues with primary science education are a manifestation of the limited science knowledge held by primary school teachers.

Primary school teachers traditionally approach science teaching as activity-based and work from concrete ideas of activity (Anwer, 2019). Anwer clarifies that it is therefore not surprising that most primary school teachers have limited knowledge of both science content knowledge, considering that few primary school teachers are experts in science disciplines. Due to incomplete content awareness, Foundation Phase teachers may distrust their abilities to teach (Nolan & Molla, 2017). Those who lack confidence appear to engage in behaviours of avoidance, such as not teaching science at all or teaching a version of science that more closely resembles subjects such as language and social studies.

1.7.2. Constructivism in the science classroom

In teaching-learning processes, constructivism primarily referred to how individuals understand and explain what she /he learnt and what they know about the nature of knowledge (Kaya & Akdermir, 2016). Kaya and Akdermir (2016) further indicate that theory claims that people can create new understandings, or they can combine knowledge constructs, ideas, events and activities they already know and believe in, in a manner of mutual interaction.

An important restriction in education is that teachers cannot simply transmit knowledge to the learners; learners need to actively construct knowledge in their own minds (Bada & Olusegun, 2015). Therefore, if learners carry their perceptions, ideas and viewpoints into learning environments, in order to obtain an accurate understanding of the principles, the philosophy of constructivism may be put into practice (Kapur, 2019). Bada and Olusegun (2015) argues that in the learning environment, it is the teachers' responsibility to encourage learners to use experiments and real-world problem solving to create more knowledge, and then to communicate what they are doing and

how their understanding is changing. Learners are therefore expected to formulate their own strategies and goals, but in order to ensure that they are on the right track, they need to take ideas and feedback from their educators (Barak, 2017).

Bada and Olusegun (2015) asserts that the primary characteristic of constructivism is that teachers and learners share authority. The teachers' role is primarily that of a tutor and guider or facilitator of knowledge while the learners' role increases and they become actively involved in their learning (Kaya & Akdermir, 2016). According to Kapur (2019) verbal communications between learners and teachers are regarded as of utmost significance for learning to take place in an operative manner. He further argues that understanding among the individuals is enriched by promoting social interaction and that the major aspects of social interaction are, giving and receiving information, questioning, providing explanations, challenging and offering timely support, assisting and giving feedback. Teachers and students contribute to strengthening each other's awareness and understanding through interaction (Bozkurt, 2017).

In order to obtain a deeper understanding of science concepts and to reach academic goals in the constructivism learning, learners need to be inspired to carry out assignments (Bantwini, 2017). Learners are often engaged on an ongoing basis in self-directed instruction to increase their skills and abilities. They are granted freedom to bring the activities and strategies relevant to their needs and requirements into effect, but they must collaborate with their teachers and fellow students in cooperation and integration.

In conventional learning, learners can work on an individual basis, but they must also work in groups in constructivist learning (Kapur, 2019). In the science classroom, this approach promotes social and communication skills by creating an environment emphasising collaboration and an exchange of ideas (Bada & Olusegun, 2015). Constructivist teaching-learning processes help students become autonomous in improving their learning, developing interactive skills, and establishing shared terms and relationships with others, i.e., teachers and fellow students (Shah, 2019).

1.7.3. Skills development in Natural Science lessons

Skills acquisition is essential to every student for effective communication in the Natural Science classroom (Sitsebe, 2012) and the improvement of a student's social skills is one of the goals of natural sciences as outlined in the Revised National Curriculum Statement. A few critical aspects of the method include educational goals (knowledge, social and learning skills, values), educational goals, lesson patterns, and a student's needs. Research indicates that there are distinct views between students and teachers about the patterns of lessons (Set, Hadman & Ashipala, 2017).

The Education Philosophy of Latvia emphasises that the purpose of the educational process is to provide each learner with an opportunity to develop mentally and physically and to create a solid, free, responsible and creative personality. Considering the above we can conclude that when various modes of research are added, the effectiveness of Natural Science lessons increases. Teaching then becomes centre stage in science learning and achievement (Bantwini, 2017) and the ability to develop learners' scientific knowledge and understanding in the classroom helps to achieve the aims of effective learning and teaching.

1.7.4. Learners discourse in a Natural Science classroom

Discourse is a certain type of communicative or social activity performed either by individuals within social groups (Yang & Sun, 2010). The use of language in a particular setting is termed discourse (Gee, 1996) and presently the socio-cultural setting is the Natural Sciences classroom in the primary level. In each instance of usage, debate, with some history, predictions of future behaviour, and ideological commitments, is constructed between learners and teachers in the classroom environment.

The wider contexts of social classes, cultural norms, and interpersonal aims need to be considered when deciphering meaning in the Natural Science classroom, as discourse requires more than ideational communication (Charamba, 2020a). Via discourse processes, social norms, perceptions, and practices are constructed and, in turn, shape ways in which discourse is evoked in each case, thus demonstrating the symbiotic relationship of discourse and sociocultural practices in the classroom

(Charamba, 2020a). In the Natural Sciences classroom, discourse is central to how groups develop norms and standards collectively, identify shared knowledge for the community (learners), develop affiliation, provide access to disciplinary knowledge, and invite or restrict participation (Kiemer 2018). Therefore, language is the means to construct interactions in the natural sciences classroom and is therefore central to scientific literacy (Sitsebe, 2012).

1.7.5. Language, identity and science

A significant part of our sense of who we are, of our identity, is the language we use. In recent times, as clearly attested to in the literature, there has been increased interest in identity as a topic of inquiry in social and behavioural sciences. It has been developed in language and identity literature that the language we use forms an essential part of our sense of who we are, of our identity (Muchnik-Rozanov & Tsybulsky, 2019).

South Africa has12 official languages and is a language-diversified region. Therefore, the different languages that learners speak constitute different identities, cultures and norms. In the Natural Science classroom for example, learners bring with them a diverse array of experiences, understanding of the world around them and ideas from their native cultures (Shaffer, 2007). Since they construct meanings by relating new information to concepts, they already know, each learner would diversely relate scientific concepts according to what they know within their culture.

According to Language in Education Policy (LiEP), South African learners irrespective of their language, identity or culture, are expected to study science in either Afrikaans or English. Sibanda (2013) argues that learners learn effectively in languages they understand and command. In Mopani district, which is the chosen area of the proposed study, the majority of the learners are fluent in Xitsonga which is their mother language, but are taught in English which is their second language. Based on my instructional experience, each learning field is unique since each consists of its own vocabulary, material, meaning and terminology. As such, knowing its language is the key to understanding a subject. For the teacher and the learner, language plays a crucial role in effectively understanding each other in the classroom. The ability to read well is central to successful learning across the curriculum (Mabusela, Ngidi & Imenda,

2016). Therefore, in the Natural Science classroom, learners are expected to understand science language through the medium of English, which is their second language. Learners, for whom the language of instruction is a second language there is an added burden of translating the language of instruction into their home language when being taught (Gudula, 2017).

Yet science relies on different aspects for interaction of words such as diagrams, images, graphs, tables, equations and charts yet learners' inability to understand the language of instruction (English) may find it difficult to understand the information conveyed by these aspects (Heyworth-Dunne, 2018). As Heyworth-Dunne suggests, owing to the failure of learners to grasp the language of learning, science educators face difficulties teaching science material and principles. The same author suggests that the use of home language to illustrate science principles results in educators presenting erroneous knowledge to learners and not being able to correct the learners' assumptions. In comparison, the failure to include specific science information or illustrate the principles gives the instructor a distorted impression of the failure to educate. Sibanda (2013) argues that culture contributes to learning as the direct influence of learners understanding of science.

1.7.6. Language of Learning and Teaching (LoLT) and language policy.

South African democratic education has contributed to greater reforms in educational legislations and policies based on the country's constitution, in order to address educational problems from the apartheid period. Different initiatives were designed to usher in a quality education structure, based on justice, the redress of discrimination, non-racialism and non-sexism (Mabusela, Ngidi & Imenda, 2016).

Language in Education Policy (LiEP) and the National Curriculum Statement (NCS) advise educators to use mother tongue as a language of instruction in the Foundation Phase grades (R-3) and then turn to English or Afrikaans in grade 4 to enable schools to make language of learning and teaching decisions (Hofmeyer et al, 2016). When children begin the intermediate stage, they experience a very demanding phase of the science curriculum that requires a smooth progressive transition from the curriculum's Foundation Phase (Naude, 2015). The country's language of instruction is a crucial

challenge (DBE, 2019). The DBE further indicates that the process of learners' transition from home language to the target medium of instruction, is not treated well.

It is stated clearly by (Tikly et al, 2018) that transitioning from mother tongue to second language as the language of learning and teaching from fourth grade is a challenging process. The paper however indicates that the adjustment difficulties can be reduced by using English as a language of instruction from the early years of schooling. on the other hand, there is a broad understanding that in South African schools it is difficult for non-English speaking learners to incorporate English as a means of instruction.

Tikly et al (2018) posit that meaningful learning and understanding are more likely to result from learning and teaching in learners' home language. To support Tikly et al's argument an analysis was carried out by the BBC news (29 January 2016), where 400 learners at a primary school in the Limpopo province, were asked in their mother tongue to work out mathematical problem, 7 x 17. Learners were to drew 17 sticks and counted them seven times to sort out the problem. According to the newspaper, only 130 learners out of 400 achieved the correct answer, but, when the same question was posed in English terms, the results were worse. According to (Prinsloo et al, 2018), the language of instruction (English in this case) in schools is associated with science teaching, learning and achievements in South Africa, while language policy is unfair to the majority of the learners.

1.8. Chapter outline

Chapter 1

- Orientation and background to the study. This chapter introduced the study topic. It outlined the rationale for the study showing the importance of the research and how the research contributed to science education and thereby improving science learning and teaching.

Chapter 2

- Literature review. The researcher will review the literature on the study topic.

Chapter 3

- Research methodology. This chapter describes the methods used to collect and analyse data, indicates the sampling methods and shows how the samples were chosen.

Chapter 4

- Discussion and analysis of the research outcome. The researcher discusses the results and provides the data analysis and conclusions.

Chapter 5

- The chapter outlines research results, limitations, final conclusions and recommendations.

1.9. Definition of key concepts

The following are the key terms of the study:

Experiences: The impression of the interaction between the individual and other individuals or of the environment on the individual. Lived experience comprises the activities that leave their mark on the individual and that cause a change in the individual's behaviour, while gained experience comprises all the activities at the end of the interaction between individuals (Kaya and Akdermir, 2016).

Natural Science: This is the study of the facts of nature. Based on the study of nature, Natural Science is divided into two fields – physical science and biological science (Bhagat, 2018).

Teaching: Teaching is the action undertaken with the intention of bringing about learning in another, it involves face to face encounter and the teacher's actions are conducive to bringing about student's learning (Rajagopalan, 2019).

Science: Science is an analytical and functional practice that includes the systematic study of the physical and natural world's nature and action through observation and experiment (Davies & Sawyer, 2018).

Learning: Learning is the acquisition of knowledge or skills through experience, study or by collaborating with others; it is the acquisition and mastery of what is already known by an individual.

Language: Language is a systematic means of communicating using sounds or conventional symbols, or the set patterns or structures produced for communicating ideas (Hoque, 2017).

Second language: Any other language learned or acquired, or a language not learned from the person's mother tongue (Hoque, 2017).

Scientific Language: A specialised language that constitutes or characterises scientific symbols and terms that are used as a tool used to comprehend the natural phenomenon (wellington & Osborne, 2001) to express our own ideas and to acquire scientific knowledge (Aduriz-Bravo et al, 2015).

Everyday Language: Language that encompasses familiar vocabulary or words that are generally used in our everyday life communication (Blown & Bryce, 2017).

1.10. Conclusion

Chapter 1 above presented and explained the background of the study by elucidating the rationale to explore teachers' experience of teaching primary Natural Science learners in second language in the Mopani East district of Limpopo province. The personal observation of learners' struggles to use second language in the Natural Science classroom, and language being raised as a serious matter in numerous provinces of South Africa that leads to poor science performance, underpinned the formulation of this research problem statement, research questions, aims and objectives. The chapter also defined the key concepts of the study and outlined in detail what other chapters entail, in order to answer questions of the study. Literature will be reviewed in the following chapter.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

The researcher provided an overview of the entire study in the previous chapter by noting the research goals, problem statement, and questions to be answered. It also considered the aim and objectives, and definitions of the study as well as what each chapter holds.

The researcher did a thorough literature review in this chapter to engage with teachers' experiences when teaching Natural Sciences in a second language. The first section of the chapter delved into the meaning and importance of language in science classroom learning and teaching. Secondly, it considers the theoretical framework that supports the research project. The elements that influence the employment of a second language in the science classroom, as well as the difficulties of doing so, are examined. Finally, the study looks at how effective English is as the second language of learning and teaching.

2.2. The role of language in science learning and teaching.

Before digging into the details of the study topics, it was critical to consider how various types of literature define the role of language in science learning and teaching. The reason for this was that language and how it is used in ordinary classroom interactions between learners and teachers, as well as in various societal topics, is a source of concern (Sibiya, 2017). Furthermore, learning science is comparable to learning a language, so the two cannot be separated (Umezinwa & Ngozi, 2018).

This simply means that learners will not learn science in the classroom unless they are familiar with the language used in the teaching of science (English in this case) and of its structures (Suparsa, 2017). This is because language is a means of communication that learners utilise to attain their requirements (Oyoo, 2017). Oyoo also stresses that when a learner communicates well, he or she has an appropriate tool for effective science learning. English plays a key part in describing science

concepts and facts, and it is, therefore, regarded as a complete tool for the transfer of knowledge and information (Ngozi, 2016). It is used in a variety of fields, including science, literature, the arts, engineering, technology, and computer science (Umezinwa & Ngozi, 2018. Hismanoglu (2019) also contends that language works to construct the knowledge that one wishes to communicate, rather than simply acting as an interacting source of what is on one's mind. As a result, language helps learning and teaching by performing the roles of informing, expressing, and leading (Shiksha Sadan, 2020).

Schmidt-Unterberger (2018) suggests that only learners who have a strong command of the learning and teaching language can fully participate in all classroom activities. Such learners may readily interact and exchange diverse perspectives, feelings, and discover solutions to numerous concerns if they have strong language skills (Soya, 2017). People's ability to contribute to the world is contingent on their ability to work together and communicate effectively (Piacentini, 2017)

Influenced by literature (see Mammino, 2021; Hismanoglu, 2019; Sibiya, 2017; Surpasa, 2017 & Oyoo, 2017) on the importance of language in education, it can be determined that all learning and teaching activities in the classroom require a fundamental understanding of the language, particularly the language of instruction. This is because, in any subject, teacher-learner contact is essential for teaching, learning, thinking, and understanding (Mammino, 2021). Furthermore, science is a practical subject (Oyoo, 2015), and language is one of its actions (Ncube, 2018). Language is a mandatory tool for teachers to define what they are doing and for learners to seek clarity during the lesson delivery process (Oyoo, 2017).

2.3. The study theoretical framework

2.3.1. Sociocultural theory of second language acquisition

Vygotsky's Socio-Cultural Theory (SCT) was used as the theoretical framework of the study. Lev Vygotsky established sociocultural theories (SCT) as a theory of language acquisition in the 1920s and 1930s (Mazlina Che Mustafa, 2017). According to the SCT language development is built on learners' social, cultural, and historical artifacts. As a result, second language learners in science classes adapt to what their cultures teach them, and typically do what their cultures do best. Learners' traditional culture,

oral descriptions, as well as the social and environmental setting in which they live, according to Maluleke (2020), are all factors that influence their learning. According to (Vygotsky, 1978) in sociocultural theory, language develops through social contact, and learners can then only reach a high degree of knowledge through interacting with others (in their mother tongue).

The theory claims that engaging in various social activities (attending various events where an individual interacts with other people) improves one's reasoning abilities. Language and its accessories, according to Wang et al (2011), are culturally and socially formed instruments that play a significant role in fostering societal and cultural interaction and the development of intelligent patterns in individuals. According to Vygotsky, the learning progression in the classroom has three components: language, culture, and zone of proximal growth (ZPD).

Each child's cognitive development is addressed by ZPD. The zone of proximal development, according to Vygosky (1978), is the variation between things that learners are able to do on their own without help, and things they are able to do with help from another person (peer or teacher). According to Eun (2019), ZPD is an important notion since learners' development is predicated on how good and frequent their external forms of public interconnection are that are congruent with their potential capacity.

The most significant instrument in the learning and development process for learners, according to Vygotsky (1979), is language. It is regarded as a critical and most significant element through which learners can be either richly or poorly involved with learning opportunities and in making sense (Robertson & Graven, 2020) of science lessons. Science curriculum requires students to be able to recognise issues, find potential solutions, and make judgments using critical thinking skills (Smagorinsky, 2018). Smagorinsky also stresses that higher-order cognitive abilities include critical thinking.

Learners' independent ability to solve problems in the science classroom, according to (Smagorinsky, 2018), indicates that the learner is already at the actual capability level, whereas learner inability to solve problems without the assistance of teachers or classmates who are more knowledgeable about the problem indicates that the learner is at the potential capability level. As a result, science lessons should be balanced

between the actual and potential abilities of learners (Simamora, Saragih, & Hasratuddin, 2019).

2.3.2. Constructivism theory

According to constructivism theory, learning is described as the process whereby learners build their self-understanding of the world using different experiences around them and reflecting on those experiences (Ncube, 2016). Kaya and Akdermir (2016) argue that from constructivists' point of view, learners construct or create new meanings using the knowledge they already have, based on their current and previous social and environmental experiences. It is contended that individuals construct their own reality and therefore, the ways of knowing and describing things are similarly authentic (Hoque, 2017).

In the process of learning and teaching, therefore, constructivism is mostly aligned to how an individual understands and explains what she /he learned based on the nature of knowledge (Kaya & Akdermir, 2016). The most significant point in the science classroom is that knowledge cannot just be conveyed to the learners by the teachers, but that learners themselves should actively construct knowledge in their minds (Bada & Olusegun, 2015). Therefore, if learners bring into the classroom their own experience and knowledge, concepts, and views in order to obtain correct understandings of the principles, the idea of constructivism may be put into practice (Kapur, 2019).

Bada and Olusegun (2015) argues that it is the responsibility of the teacher in the classroom to motivate and inspire his/her learners to create additional knowledge using everyday/practical problem solutions and experiments. In addition, it is the teacher’s responsibility to discuss what learners are doing and how their understanding is developing (Bada & Olusegun, 2015). Learners in the science classroom therefore are expected to formulate their own strategies and goals, while they take ideas and feedback from their teachers to make sure that they are doing the right thing (Barak, 2017). Bada and Olusegun (2015) further assert that the primary characteristic of constructivism in the science classroom is that both teachers and learners share authority. (Kaya & Akdermir, 2016) outlines this authority as teachers'

ability to primarily instruct and guide learners while the learners' authority is to become actively involved in their learning.

According to Kapur (2019), for functional learning and teaching to take place in the classroom, discussions and interaction between learners and teachers are viewed to be of great significance. He further argues that by promoting classroom communication, understanding amongst learners and their teachers is developed. The main features of classroom communication include: conveying and receiving information, asking questions, giving instructions, guiding and inspiring, providing support, mediating, and providing answers. In the constructivist science classroom therefore, teachers and learners contribute to strengthening each other through interaction (Bozkurt, 2017).

In constructivism learning, learners need to be inspired to do different activities on their own which is crucial for understanding science concepts and terminologies and in reaching the academic goals (Bantwini, 2017). In addition, learners should regularly be involved on an ongoing basis in independent instruction to increase their capabilities and skills. Furthermore, in constructivism learning they are granted the freedom to suggest relevant activities and strategies that may cater to their needs and requirements, but always in collaboration and integration with their classmates/peers and teachers.

In constructivism learning, learners basically work in groups (Kapur, 2019) and in the science classroom this approach creates a conducive environment that encourages teamwork, where learners are able to share ideas to develop social and communication skills (Bada & Olusegun, 2015). In support of the author’s argument, Shah contends that constructivist learning and teaching develops learners' ability to self-improve their learning, develop communication skills, and encourage collectiveness and connections amongst themselves and amongst learners and teachers in the classroom (Shah, 2019).

2.4. Factors that determine the use of the second language in Natural Science teaching

2.4.1. Learners' intellectual capacity

In his theory of multiple intelligence, Gardner (2000) defines intelligence as a person's ability to reason, learn and produce information from experience, solve problems, and adjust to changing circumstances. Intelligence also refers to a person's conceptual ability to learn quickly, identify problems, and theoretically come up with ideas to solve problems through self-directed logical understanding and critical thinking (Parankimalil, 2014). Parankimalil argues that intelligence is not acquired, but is a natural gift. According to Lawton (1973), the ability to communicate through language is unique to each learner and is based on each one's mental ability. Learners with higher intelligence levels are therefore more adept at learning a second language (Hoque, 2017) compared to those learners with lower levels of innate intelligence. When academic information is given to learners with intelligence quotients (IQ) above the norm, they quickly absorb the information, making it easier for them to learn a second language. According to Mammino (2015), the comprehension of language is based on learners' capacity to recognise text and comprehend the information it conveys. She argues that scientific education and learning in the classroom are founded on the students' ability to think critically. Gudula (2017), on the other hand, emphasises the importance of language and learners' thinking in the science classroom in terms of their ability to build knowledge of how to solve problems in the classroom.

The ability for learners to think abstractly and elaborately is influenced by how they used language as children, particularly spoken language (Awofala et al., 2012). Second-language students in science classes have to adapt their thoughts into the language of teaching because their reasoning power is channelled by the language with which they are most comfortable. This highlights the significance of a person's intellectual ability in the communication process (Hoque, 2017).

However, Oyoo (2009) makes the case that scientific understanding is based on learners' understanding of technical and non-technical science words, not on their level of instruction language. As a result, learners' understanding of two-component

words is based on the level of the language in which they are written. In addition, learners' failure to understand the language of teaching makes it difficult to comprehend technical and non-technical terminology, as well as a challenge to grasp scientific concepts. As a result, learners' intellectual capacity plays a fundamental role in their ability to grasp the content and context of science (Gudula, 2017). It is for this reason that learning science is based on the learners' language of instruction-level (Mammino, 2010).

2.4.2. Teachers' language capacity and pedagogical content knowledge

South African schools employ a different language for learning and teaching to most scientific instructors' native tongue (McKinney & Tyler 2019). As Essien (2018) demonstrates, language is a source for instructors to outline and explain terminology and procedures, as well as a tool for identifying and resolving text and issues. Both teachers and learners must develop different language use to enhance the meaning and making process in the science classroom (Larsson & Jacobsson, 2020) because, it is an important tool for intervention practices, particularly in how it is applied by teachers (Ncube, 2016). Oyoo (2015) contends that teachers' language is important in creating a conducive atmosphere for operational science learning.

As a result, outstanding science language instructors are critical of the effectiveness of science learning and teaching in the science classroom (Ncube, 2016). Teachers must employ an appropriate level of LoLT (Gudula, 2017) relevant to the learners' language level for those learners whose LoLT is not their native language, in order for them to effectively engage in the classroom. Teachers must also examine how technical and non-technical terms are employed in a scientific setting, as well as understanding learners' cultural, economic, educational, environmental, and language backgrounds (Oyoo, 2014). According to Garuba and Irwin (2008), instructors' use of language that is unsuitable for the learners' language level leads to language difficulties in the classroom, which is problematic, particularly for second-language learners.

2.4.3. Language learning environment, family's educational and economic background

The majority of learners in South Africa are exposed to their second language (English) in the classroom during lesson delivery by their teachers. However, learners communicate among themselves during learning and school breaks using their home languages (Maodi, 2018). Most of them irregularly make use of the English language outside of the classroom environment (Mavuru & Ramnarain, 2019).

According to Desai (2016), this is because most African language learners come from low-income families and attend overcrowded, under-resourced schools where English is not spoken outside of the classroom. Furthermore, many parents work far from their homes, and as a result, many learners live with their unlettered grandparents who are unable to support their grandchildren in all aspects of second language usage and growth (Steyn, 2017).

Due to poverty and their lack of resources, students have no or limited access to LoLT outside of the classroom (Gee, 2014). In response to Gee's (2014) assertion, learners' limited circumstances prevent them from positive exposure to many supportive avenues, such as TV, radio, magazines, newspapers, books, etc. (Steyn, 2017) that may otherwise have helped them acquire and comprehend their second language. Low-income families' chances of having direct access to materials that will help their children improve their language talents are little to none, which has a direct bearing on learners' learning (Bantwini & Feza, 2017). As a result, learners who have limited exposure to the English language outside of the classroom have a near insurmountable LoLT barrier, which includes difficulties following directions, understanding words, and pronouncing words correctly (Kotze, Van Der Westhuizen & Barnard, 2017).

Unlike learners from underprivileged families, learners from advantaged backgrounds have access to different supportive materials (TV, radio, magazines, newspapers, books, etc.) (Steyn, 2017). Most of the privileged learners speak English as their first language at home, and are familiar with the use and application of the language in (Barwell, 2009) and outside of the science classroom.

Furthermore, science learning materials are written in English, which according to Gee (2014) is non-beneficial to English Second Language learners. This because learners fail to correctly interpret the learning materials (Jantjies & Joy, 2016) that are written in English which is the basic tool to access all learning materials (Stroupe, Moon & Michaels, 2019). Developing science learning while concurrently improving second language acquisition could be achieved by preparing investigative activities that spread out beyond the classroom and into the community (Fathman, 1992). However, such practises become impossible (Kotze et al, 2017) because most of the learners fail to get assistance from their parents due to their parents' inability to interpret and comprehend the second language of the schoolwork (Kadbey, Dickson & McMinn, 2015). Financial situations at home profoundly affect all learning, as it determines the level of learning resources available (Longueira, 2016). Based on different research findings, it is natural to posit that it becomes difficult and problematic for underprivileged learners to use the English language correctly, to communicate with teachers as well as to read and write it, without exposure to it outside of the classroom. (Maluleke, 2020).

2.4.4. Language diversity and culture

Culture can be accurately defined as the customs, skills, ideas, resources, and arts that describe a specified group of human beings in a particular period (Hoque, 2017). According to Keegan (1999) "Culture includes both conscious and unconscious values, ideas, attitudes and symbols that shape human behaviour and that are transmitted from one generation to the next". It is a control and memory tool of a given society (Baeker et al. 1997). In the science classroom, therefore, it is the framework within which learners exist, reason, feel, and interrelate to each other (Hoque, 2017). Learners' culture is very important in learning (Suardana et al, 2018) because how learners learn is largely determined by their cultural lifestyle, values, societal beliefs, as well as customs and traditions. South Africa is a country that consists of 12 official languages including South African Sign Language (Charamba, 2020a), and is a language-diversified region with diversified cultures. In the Natural Science classroom, learners are drawn from polyglot cultures (Mavuru & Ramnarain, 2019) and are often combined in a single class (Songxaba, Coetzer & Coetzer, 2017).

In the development of an additional language, culture is referred to as a very essential mechanism, however, learners' acquisition of an additional language is also the acquisition of additional culture (Hoque, 2017). Societal languages are precise methods of language used by a particular group of individuals in order to relate to a definite worldview under certain conditions and cultural settings (Planas, 2018). Therefore, learners' traditional views and cultural experiences are influential in learners' learning and development (Baker & Taylor, 1995) of the second language.

2.4.5. Classroom language of instruction and language policy

South Africa's democratic education has contributed to further changes in educational legislation and policies based on the country's Constitution, in an attempt to solve educational issues created during the apartheid era. In compliance with the country's Constitution of 1996, ground-breaking efforts were instituted to lead to an inviolable educational system based on justice, the abolition of discrimination, and the elimination of racism and sexism (Mabusela, Ngidi & Imenda, 2016). Nonetheless the Language in Education Policy (LiEP) is unfair to the majority of learners in South Africa, as alluded to earlier (Gudula, 2017). The reason for its unfairness according to Hofmeyer et al (2016) is that the policy and the National Curriculum Statement (NCS) advises teachers to adopt mother-tongue teaching in the Foundation Phase grades (R-3), while from Grade 4 onwards learners transit from their home language instruction to English language instruction which is for most African learners a 'foreign' language. (Desai 2016; Mckinney & Tyler, 2019).

Learners are expected to develop their use and understanding of English as a first additional language from Intermediate Phase onwards so as to survive and thrive in their educational journey (Childs, 2016). The sudden change in Grade 4 from learners' home language teaching to English second language teaching adversely affects learners' academic journey and even their working industry (Prinsloo & Harvey, 2018) and as such is regarded as a daunting process (Tikly et al, 2018). Instead of a smooth progressive transition from the curriculum's Foundation Phase into the Grade 4 science curriculum, learners experience a very demanding phase. (Naude, 2015). It is a struggle which, according to Maodi (2018), is caused by a variety of factors, including a shift from learners' native language education to English language

education, a shift from a single-teacher classroom setting to a multi-teacher classroom setting, and a shift from familiar learning areas to new learning areas.

Additionally, in the Foundation Phase learners depend on teachers to acquire knowledge (Maodi, 2018) while in the Intermediate Phase they are expected to be independent investigators, elaborators, innovators, and critical thinkers for inquiry learning (DBE, 2011). The transitional process itself, along with science learning, has been likened to expecting learners' who are used to eating soft porridge being expected to eat bones (Steyn, 2017). Therefore, the country's language of instruction is regarded as a crucial challenge that requires teachers to assist learners in making the transition from home language to the target medium of learning (DBE, 2019).

However, Tikly et al (2018) suggests that all difficulties that occur as the results of this transition can be reduced by using English as a language of learning and teaching from the early years of schooling. Alternately, there is broad consensus that non-English speaking learners find it difficult to incorporate second language learning in South African classrooms (Childs, 2016; Sibiya, 2017; Mavuru & Ramnarain, 2019). According to Mckinney and Tyler (2019), mother-tongue instruction in the early years of schooling denies access to learning and restricts learners' access to English in particular. According to Harvey and Prinsloo (2018), the issue of language policy is therefore unfair to the majority of English second language learners.

2.4.6. Natural Science curriculum

Mulenga (2018) defines curriculum as the basic planning of what is needed to be taught in school, and includes the content to be covered, time allocated for each content sub-topic, resources to be used as well as the assessment activities to be given per term. The curriculum outlines all aspects needed to be taught and assessed in a particular subject area and particular grade. All school teachings should follow the curriculum which is formed at national, provincial, and or district level (Charamba, 2019). South African teachings, therefore, rely on the curriculum (Charamba, 2021) that is set at the national level reflecting the constitution and the education policy (Longueira, 2016). The country had been exposed to four curriculum revisions (C2005, NCS, RNCS, and CAPS) since the introduction of social equality (Janak, 2019) in 1994.

According to Childs (2016), the curriculum document and teacher practice is influenced by the lack of language understanding. Furthermore, teachers' difficulties in understanding the curriculum itself and the terminologies used have a negative impact on learners (Gudula, 2017). To avoid challenges when delivering their lessons, teachers need to effectively understand the curriculum (Nkanyani, 2017).

Natural Science is defined as the subject that studies the planetary, geological, chemical and biological issues of the world (Shahajan, 2020). According to the author, the subject considers the prediction, explanation and understanding of the natural aspects through experimental evidence. Due to the Outcome Based Education (OBE) that was implemented as one of the transformational teaching programme (Khanyile, 2016) in 1997, Natural Science is integrated with Technology in the intermediate grades (4-6) and as an individual subjects in the senior grades (7-9) (DoE, 2011). However, the subject is compulsory for all grade 4-9 learners (DoE, 2011).

Teaching Natural Science both in the intermediate and senior phase grades constitute four strands; life and living, matter and materials, energy and change as well as the planet Earth and beyond (DoE, 2011:12). According to the literature, each strand should be taught 10 weeks per term with three and half hours per week. The subject as in the DoE (2011:11) aims to achieve the tabulated specific aims and objectives below.

Aims	Objectives
Doing science and technology	Learners should be able to consolidate their ideas about nature by being investigative, with the ability to analyse problems in order to develop practical ways and abilities to solving natural science problems
Understanding and connecting ideas	Learners should be able to make connections within the subject content in order to understand scientific, environmental, and technological knowledge
Science technology and society	Learners should be able to interrelate content in a new context and be competent in science practices to understand the uses of indigenous knowledge and Natural Sciences in the environment and society

When CAPS came into practise, each learning area including Natural Sciences in all class ranks, were covered by a complete and summarising document that provided guidelines of what is expected to be taught and assessed by teachers (Janak, 2019). All schools are expected to conform to this English-only curriculum, making the use of English schoolbooks and evaluations mandatory (Mckinney & Tylor, 2019) and is intended counter intuitively to meet the needs of several and diverse capability learners in their schoolrooms (Bantwini & Feza, 2017). The not unexpected consequence is that second language learners struggle to apply the English language when acquiring knowledge and expressing themselves, which delays their academic performance and potential to learn (Sibiya, 2017).

Consequently, the science curriculum excludes issues of concern such as the values and significance of the language of instruction as it is used in classroom learning and teaching (Oyoo, 2017). Instead, it offers English as the only language by which to access science learning, which hinders learners who lack or have a poor English proficiency by curtailing their full learning of natural science (Mavuru & Ramnarain, 2019). Due to its English medium support, the Natural Science curriculum is exclusive of African language learners but inclusive of first language learners (Gudula, 2017).

According to Gudula (2017), the curriculum's omission of essential language features places the burden of dealing with any difficulties arising from the use of English in the classroom on teachers. The scientific curriculum, which is difficult in many ways, leaves instructors unable to satisfy the needs and desires of African students while still adhering to the program's standards (Childs, 2016).

Learners consequently under-achieve in their tests and examinations as a result of their lack of self-confidence, depression, and discouragement caused by incompetence in the language of instruction (Childs, 2016). In addition, African languages exclusion in the curriculum becomes an exclusionary experience for both second and third language teachers and learners.

2.5. Challenges of using the second language to primary science learners

In many parts of the world, English has become the *lingua franca* of commerce, international diplomacy, science, technology and aviation. (Chen, Ren & Lin, 2020). It is also the dominant language of instruction in most African Educational systems

(Nyika, 2015) including South Africa. Regardless of South Africa's 12 official languages, English alone is viewed as a language of instruction for first, second, or even third additional language learners (Mavuru & Ramnarain, 2019) in Primary, Intermediate and Senior Phases of school. About 65% of learners in science classrooms use English as their second language of instruction and only less than 10% of science learners are first language learners (Hlabane, 2014). Consequently, there are numerous difficulties experienced due to the non-use of learners' home language (Perez & Elioto, 2018) in primary school science learning. Following Kotze et al's (2017) research, classroom use of the second language by both teachers and or learners poses many challenges.

Teaching science in English when students are still struggling to grasp the LoLT (Ferreira, 2011) is a negative experience faced by many English second language teachers. For the expansion of scientific understanding and knowledge, teachers are commonly forced to focus on learners' reading and writing (Charamba, 2019) rather than on content and concept knowledge. Therefore, classroom use of English as the language of instruction is an impediment as learners should first understand the LoLT for fruitful science learning to take place (Ncube, 2016). Teachers are also expected to accommodate all learners regardless of their capability differences in the second language (Mudaly, 2010), for they come to the classroom with different experiences to the LoLT outside of the school environment and different language proficiencies (Ncube, 2016).

The usage of English in South African science classrooms deprives many African students of a comprehensive scientific grasp of terminology, resulting in poor educational outcomes (Charamba, 2021). In addition, according to the author, learners who lack English competence memorise terms/concepts without fully comprehending their meaning. Furthermore, such practice is problematic because, if a learner happens to forget a word used in one of the terminologies/concepts, all of the previously packed knowledge evaporates. Consequently, learners who cram without understanding usually perform poorly compared to those who read with understanding (Donovan, Figlio & Rush, 2007).

Cramming does not only result in poor performance, as Donovan et al (2007) demonstrate, but creates pressure on learners to absorb all that they learned in the

scientific classroom making it difficult for such learners to prepare for tests and examinations. Furthermore, learners later fail to remember the acquired knowledge for future usage. As such, teachers are then forced to teach science skills (observing, comparing, sorting and classifying, planning, investigation, etc.), content, and language at the same time (Kadbey et al., 2015) to develop learners' language of learning for effective learning and teaching. Following the authors' research interview responses, teachers show that language in science teaching is a considerable obstacle hindering learners' ability to outline the basics of science terminologies or terms due to poor proficiency in the English language of instruction. Since the primary school learners' language of instruction development is a process, it is appropriate to postulate that their measure of proficiency is at a very low level (Maluleke, 2019). Consequently, they often face difficulties in using the additional language (English), to effectively express their ideas (Leong & Ahmadi, 2017).

Furthermore, learners' English proficiency is often so parlous that they cannot answer higher-order questions, and in that way, teachers resort to using lower-order questions to complete the curriculum content timeously (Pun & Macaro, 2019). However, natural science formal assessment tasks are set and moderated at the district or provincial level by the subject specialists (DBE, 2011) with more higher order questions that require descriptive answers. Such questions negatively affect numerous learners' opportunity to interpret and elaborately provide answers. They therefore become passive learners (Maluleke, 2019).

2.5.1. Poor language proficiency

According to Cummins (1979), there are two levels of language proficiency: the Basic Interpersonal Communication Proficiency (BICS) and the Cognitive Academic Language Proficiency (CALP). BICS as Cummins (2008) explains refers to the language abilities needed to interact in public situations. According to the author, BICS is regarded as an important language proficiency, and as the level required for an individual's daily communication. Cummins (1979) defines CALP as the educational formal learning, wherein proficiency covers speaking, reading, listening, and writing the particular learning area content. Cummins further asserts that, for the learners to grasp and understand the content subject, to read, be able to answer subject

assessments tasks, and to participate in classroom and group discussions, they need proficiency in cognitive academic language. Learners' lack of cognitive academic language proficiency becomes disadvantageous (Cummins, 1979). Several South African second language learners' achievement in science is poor due to insufficiency in CALP (Mavuru & Ramanrain, 2019). As the authors add, such instances are to be expected for second language learners taught by second language teachers.

Communication in the classroom is the conventional manner of conveying information between the teacher and the learners (Piacentini, Simões & Vieira, 2017). As such, classroom effective communication requires both the teacher and the learner to have good proficiency in the language to be able to understand each other flawlessly (Charamba, 2019).

According to Oyoo (2015), there is a common postulation that all learning easily operates when learners have good ability in the language of learning and teaching. Charamba (2021) argues that learners' language abilities must have a relationship with the context in which the science teachings occur. In South African Primary Schools, however, science learning and teaching takes place in the English language in which neither learners nor teachers are competent in (Msimanga, Denley & Gumede, 2017). Consequently, learners' poor language proficiency in science classrooms affects their content expression and understanding. Probyn (2015) argues that second language learning and teaching frequently restricts learners’ access to the curriculum. Nyika (2015) notes that poor proficiency in the language of learning and teaching can affect comprehension of content and thereby the learners' performance in different subjects including in science. Poor language proficiency can be regarded as the major challenge of using the second language not only by primary school learners but by learners at all levels of schooling, according to Al-Khawaldeh, Bani-Khair, and Al-Edwan (2016), which automatically leads to the challenges listed below.

2.5.2. Difficulty in understanding science language or literacy

In the science classroom, teachers generally use books that constitute two academic language components: technical language component and non-technical language component (Oyoo, 2009). The technical language component which, as Oyoo explains, consists of technical science words or terms that are science specific. The

words may sound familiar to the everyday language, but they have different scientific meanings (Smith-Walters et al, 2016). The non-technical components as further outlined by Oyoo are build up by non-technical words. The words become identifiable to be similar to the language in which science learning and teaching materials are written.

As such science is regarded as a distinct language (Oyoo, 2017) because its language (technical language and non-technical language) is different from everyday language (Ncube, 2016). According to Mavuru and Ramnarain (2019), science language is particularly the case for second language learners. The difficulty is caused by their need to understand the meaning of the words in a science context rather than adopting its dictionary meaning as the same meaning in science, Ncube (2016) indicates. Although the difficulty of the words in the science context is seen to be common to both first and second language learners (Oyoo's (2015), science words (technical and non-technical) are a presentation of different words in the English language (Wellington, 1994). Therefore, learning through an additional language becomes problematic especially when learners first need to learn it as the language of instruction (Mudaly, 2010).

Learners need not only to understand the LoLT but also need to comprehend the science language for functional learning to occur in the science schoolroom (Rollnick, 2000) which is seen as the vehicle to science learning and achievement (Wellington & Osborne, 2001). For learners to be able to differentiate between the everyday meaning of words and their science meaning, they must understand the meaning of words in the science context in which the words are used (Ncube, 2016). The question may be how could learners understand the meaning of words in a science context without first having overall proficiency in the language in which the words are written? This promotes the fact that learners need to be proficient in English as both a second languages of general instruction and as a science language (Garuba & Irwin, 2008) to develop science literacy in the science classroom. Science literacy plays an important role in increasing learners' level of understanding of the subject content, without several additional difficulties (Karlsson, Nygård Larsson & Jakobsson, 2019). It helps to obtain scientific understanding and skills (Taboada 2012) which according to Lemke (1990) progressively develop through use of the scaffolding process. The author

further shows that as learners use verbal language in the science classroom, certain word links will develop, and increasingly they adopt words which will develop toward scientific language and terminologies.

Consequently, learners' lack of scientific language and literacy in science classrooms results in their inability to comprehend the meaning of ordinary terms used in science contexts (Oyoo & Semeon, 2015). As a result, science language and literacy have become a community disablement for all learners (Smith-Walters, Mangione, & Bass, 2016), preventing them from achieving deeper scientific knowledge and success. Based on the many arguments presented above, it is appropriate to infer that second language learners in natural science classrooms will struggle to understand the language of learning while also needing to master science terminologies.

2.5.3. Difficulty of conceptual and content understanding

Learners must well understand the language of learning and teaching to be able to comprehend the concepts or terminologies of a particular learning area (Cummins, 2008). They must also have access to relevant textbooks written in a language they can speak, read, write, fully understand, and in which they have proficiency (Charamba & Zano, 2019). As in any other learning area's content, science also has terms and concepts specific to the subject (Smith-Walters et al, 2016). The authors further posit that science is naturally full of new knowledge and complex ideas making the terminological load for any learner overwhelming. The science terms and terminologies are built using science-specific language components and their English level is much higher when compared to the learners' English proficiency (Kadbey et al, 2015) in the primary phase. Therefore, to learners for whom English is their second or third language, understanding science concepts will unquestionably be a difficult task (Smith-Walters et al, 2016), since it is evident that learners' understanding of science content and concepts is based on their language proficiency level (Charamba, 2020b).

Ncube (2016) argues that understanding the language of learning and teaching will result in effective learning of science concepts. Subsequently, learners' inability to understand the language used to teach science, leads to difficulty in understanding the science concepts and terminologies (Gudula, 2017). Mavuru and Ramnarain's

(2019) argument is that if the language of learning and teaching is not similar to learners' home language, understanding scientific terms and concepts becomes difficult. Most scientific terms are derived from Latin, therefore explaining the technical or science words in learners' language is a translation from Latin to English and from English to African languages which reduces the original meaning of the concepts. The translation consequently reduces the quality of science education in the classroom. The reason being that second language learners are expected to understand the new concepts simultaneously with the language of instruction (Baker & Tylor, 1995). This according to Mavuru and Ramnarain (2019) requires teachers to interpret science concepts into learners' mother tongue which is complicated as certain scientific concepts are not simply changeable into African languages.

2.5.4. Reading and writing difficulty

Successful learning across the curriculum depends on learners' ability to read well (Mabusela, Ngidi & Imenda, 2016). In every learning area, literacy (reading and writing) is a core part of learning within each subject, content meaning in each learning area is only made through reading and writing (Charamba & Zano, 2019). Therefore, for the learners to express themselves in ways that are relevant to each subject using content-specific language, reading and writing skill is valuable (Flores & Rosa, 2015). Speaking, reading, and writing play an important role in developing learners' cognitive skills in the science classroom (Henderson & Ingram, 2018). Not only is it important to developing learners' cognitive skills but, reading and writing are significant abilities they must apply as they read and answer in writing assessment science activities (Hlabane, 2014) in the schoolroom. Consequently, with second or third science language learners, the inability to understand the language of science or inept language literacy becomes a barrier to their reading and writing competently in the science classroom.

According to Webb (2010) writing plays an important role in the science classroom for effective teaching and learning. Reading and writing are academic twins that cannot be separated, in that case one cannot develop without the other (Zaitar, 2020). In contrast, it is difficult to build reading skills in learners who are unable to write (Raja & Selvi, 2011). Such learners frequently struggle to comprehend the language of

teaching, the language of science literacy, and, of course, the science content. Rosenthal (1996) supports this argument by claiming that reading and writing go hand in hand in the development of students' science literacy. It is believed that science would not exist without language and the socially expressive means of interacting with these writings (Sørvic & Mork, 2015). This is borne out by the reality that Natural Science learning and teaching materials are written in English for which the majority of the learners have poor proficiency, with many not able to read nor completely apprehend the language. (Charamba & Zano, 2019). Learning through the use of a second language consequently hinders learners' literacy development (Makalela, 2018). Learners who cannot read and write understandably encounter difficulties when interpreting assessment questions and providing answers (Stroup et al, 2019).

According to Hlabane (2014), in order to study science successfully, students must comprehend the language of teaching, which includes fundamental reading and writing skills as well as science literacy. In the Natural Science classroom, learners must have a thorough understanding of a text through good reading, allowing them to effectively write about the text content (Bantwini, 2017). Encouraging learners to read during the learning process develops their communication abilities and helps them understand what they have been taught (Albadi, Toole & Harkins, 2017). Reading and writing according to Sørvic and Mork (2015) ensures greater quality learning and teaching, not only in science lessons but also in different school learning areas. According to the author, it is vital that science teachers guide their learners through the reading and writing process, to properly develop reading and writing skills if they are to successfully achieve in their learning (Albadi et al, 2017) in the science classroom.

Since a large number of South African learners in primary schools do their learning through English first additional or second language, it is relevant to suggest that language is a reason for poor reading and writing, especially for second language learners (Pretorius & Klapwijk, 2016). It is the reason Perez and Elieto (2018), suggest that science content teaching, reading, and writing be done in a language in which the learners are proficient.

2.5.5. Teachers' shortage of information on the application of diverse language.

The South African education system is maintained by the country's constitution which is responsible for the needs of all people in the country. The usage of 12 official languages, which includes sign language, is recommended by the constitution. It also emphasises that children have the right to an education. According to Kotze et al (2017), the acknowledgement of various languages by the country's constitution has consequently led to many challenges for the teachers. In the language diversified classrooms, teachers are expected to account for every learner's needs, including the need for instruction in their native tongue (Kotze et al., 2017). Scientific teaching, according to Lee, Quinn, and Valde (2013), has a large linguistic foundation and is inextricably related to language teaching, which essentially implies that science instructors are also language teachers. It is argued that teachers' verbal language which daily occurs in the classroom is the heart of science learning and teaching (Roaf, et al, 2013).

The quality of learning, teaching, and learners' performance are all dependent on instructors' content expertise (Lee et al, 2016). According to the DBE (2011), natural science is a wide learning domain with 4 learning strands (life and living, matter and materials, energy and change, planet Earth and beyond). Within it, the strands represent many learning areas including life sciences, technology, geography, physical sciences, chemistry (DBE, 2011). For effective knowledge conveyance and to handle all the strands, Natural Science teachers need to be well qualified in the language and content of the subject (Nkanyani, 2017). However, many teachers do not specialise in any of the mentioned learning areas and it is uncommon to find a teacher with the content knowledge of all strands, nonetheless they are teaching natural sciences. Therefore, there is a gap between the Natural Science teachers pedagogical content knowledge and the requirement to meet learners' needs in the Natural Science classroom. This led to training programmes stressing the subject content knowledge and instructional knowledge (Roaf et al, 2013) and developments of educational aspects in general. As the author adds, the training programmes excluded teachers' needs for verbal instructional language. Furthermore, the ignorance of teachers' training on the use of English as a LoLT mainly where it is the

second language is inappropriate. This is because, science teachers generally lack awareness on how to use language in science learning (Oyoo, 2017). They are also not knowledgeable and are without enough skill to use the diverse languages in one schoolroom by one teacher (Kotze et al, 2017). Therefore, teachers do not only need development in the pedagogical content knowledge but, also need to be experienced in the pedagogical use of language (Essien, 2018).

Teachers' language workshops are crucial since learning and teaching in the classroom are dependent on both subject material knowledge and pedagogical language usage (Metzler & Woessmann, 2012). The quality of teaching in the Natural Science classroom largely depends on special pedagogical practices; wherein one of the greatest significances is the pedagogical application of language for creating and managing an inclusive learning atmosphere (Msimanga & Erduran, 2018). This is because, the successful teaching of science cannot be accomplished without language (Ngozi, 2016), which is identified as the vehicle through which knowledge is developed and organised (Serrano-Torregrossa, 2015). It is also recognised to be one of the teaching and learning barriers in science education in various academic literature (see Ridge et al 2013; Gudula, 2017; Serrano-Torregrossa, 2015, and Mammino, 2015).

It therefore can be concluded that pedagogical language training for teaching second language learners is required, regardless of the subject training programmes offered to natural science instructors. Because teachers need to deal with the diversity of language in the classroom, use suitable teaching approaches, effectively communicate, and properly use language properties to engage learners' full attention (Msimanga & Erduran, 2018), teacher development training and workshops on how language should be used in science learning and teaching are critical (Larsson & Jakobsson, 2020).

2.6. English second language impact in learning and teaching of Natural Science in the classroom.

Learners' knowledge development in different learning areas that use English as a language of instruction is limited, mainly because of teachers' and learners' inability to use English proficiently (Maluleke, 2020). Such incidents frequently result in difficulties

in the acquisition and transmission of information in South African classrooms. According to Perez and Elioto (2018) understanding the language of instruction itself becomes a burden to learners who are yet to develop the language of learning and teaching. In support of the authors' assertion, such learners find it difficult to access science content knowledge through English (Mavuru & Ramnarain, 2019). The use of English which is different to African languages, negatively affects the learning and teaching process (Childs, 2016), and deteriorates learning in science which is a learning area with its own language (Harvey & Prinsloo, 2018). This follows research that evidenced the challenges of language on learners' educational achievement in a situation where a variation between learners' language and language of instruction exists (Wei 2018).

Science learning and teaching, according to McKinney and Tyler (2019), is a collection of activities that happen when learners interact with one another in the classroom using language they understand. Furthermore, for effective learning and teaching to occur, teacher and learner must be able to follow each other flawlessly using the language they speak, read and write well (Gross & Dewaele, 2018). This is because learning science is based on world views consisting of distinctive ways of thinking and writing (Bharuthram & Clarence, 2015). Collaborative inquiry is recognised in the science classroom for the development of knowledge and understanding, which should be carried out via classroom interaction and debate on relevant topics (Fathman, 1992).

Science teaching aims to develop learners' higher-level skills and qualities such as communication, group work, and problem-solving (Holman, 2017). These high-level skills should be developed by allowing learners to identify investigative questions, make hypotheses and create predictions, develop descriptions, build and use representations to communicate their findings (Constantinou, Tsivitanidou & Rybska, 2018). Learners are therefore expected to share responsibility for analysing and participating in different activities (Maluleke, 2020; Fathman, 1992) in the Natural Science classroom. Consequently, second language teaching negatively affects productive, effective, and meaningful learner participation (Msimanga & Lelliott (2014), during classroom discussions. The result of this impediment means that although teachers may implement a learner-centred approach, the learners inevitably become

passive listeners due to the learning obstacle caused by their limited English proficiency (Preece, 2019) when English is the language of instruction.

Learners' ability to construct knowledge with regard to their world views in science learning is strongly determined by their language proficiency (Prinsloo & Harvey, 2018). According to the authors' argument, learners' poor English proficiency prevents them from effectively engaging in science discussions during the content learning and teaching process. It is burdensome for learners to effectively participate in classroom discussions or to be productively deliberate through scientific concepts using English (Msimanga and Lelliot, 2014). The use of English as a language of learning and teaching according to Jessani (2015) results in the majority of the learners needing support as they are unable to independently work with science activities. Teachers are forced to translate all the English statements they make during teaching into learners' home language (Maluleke, 2020) for the learners to comprehend the lesson. As Maluleke argues, the translation affects the smooth running of lessons by slowing down the process of conveying knowledge, which makes it tedious. Furthermore, the slow progression of the lesson, delayed by the teacher’s need to translate and the learners’ slow ability to take in what is being translated and taught, results in teachers' failure to cover the all the content as expected by the syllabus.

2.7. Effectiveness of teaching science in English

According to local and global research findings, there is consensus that using English language in science teaching is not effective as it poses more challenges than solutions to the learning and teaching of science. African language learners' academic journey is negatively influenced (Harvey & Prinsloo, 2018), by their inability to understand the second language (Kotze et al 2017). Educational challenges that result from English language use (Kotze et al, 2017) proves its ineffectiveness in science learning and teaching (Charamba 2020a).

The majority of science teachers and learners use their home languages in their early years of primary schooling in South Africa, which provides them with the ability to easily negotiate language and conceptual capability (Charamba. 2020c). The continuation of African languages or learners' home language throughout the primary school years may result in positive outcomes in science learning (Heugh, 2013)

because, as it currently stands the transition from learners' home language to English in Grade 4 obscures their connection to their home language (Childs, 2016).

Using additional language rather than home language in the science classroom can be considered unsatisfactory or delaying (Childs, 2016), whereas using learners' familiar language instead of unfamiliar English is proven to be effective (Charamba, 2020c). According to Wei (2018) using learners' language during the lesson delivery process helps them develop better subject content understanding, and improves teacher-learner connection, and improves the quality of learning and teaching (Childs, 2016).

The use of learners' home language, according to Perez and Elioto (2018), is beneficial to their cognitive development. According to Charamba (2020c) using learners' language may be an appropriate mechanism for teachers to hook learners' interests, and generate opportunities for learners' conceptual understanding. Additionally, the use of learners' home language instead of English helps to clarify and review the scientific content, maintain classroom practices, and construct and upsurge learners' involvement during the learning and teaching processes. Furthermore, the use of learners' home language rather than English leads to the improvement in their ability to argue (Charamba, 2020c), discuss, answer questions, and explain ideas (Maluleke, 2019).

Moreover, the advantage of using learners' home language, according to Jantjies and Joy (2016), is that it also helps learners gain self-confidence and acquire knowledge through a complete understanding of the topic and the ability to describe its content. There is local and global agreement of the recent research that demonstrates that the acknowledgment and use of learners' home language could be effective in enhancing academic performance, as compared to the results shown through the use of English, which poses many learning and teaching challenges (see Charamba & Zano, 2019; Mckinney & Tylor 2019, Charamba 2019a, 2019b; 2020a, 2020b, 2020c).

Most of the researchers in African countries see English as ineffective as the language of learning and teaching. Following Ghanaian research results by Owu-Ewie and Eshun (2015) that shows that teachers use the learners' first language (Ghanaian) and the first additional language (English) in the classroom because lessons taught in

English only is challenging to the learners. In their research interviews one of the learners proved the inefficacy of English by saying:

"*Menntse adze biara a me tikya kyerɛ no borɔfo mu ase na ɔnam dɛ munntum nnka borɔfo ntsi asɛm biara ɔbɛka no meka dɛ matse ase. Naaso sɛ me tikyadze Fantse kyerɛ adze a, metse ase yie. [Eng. trans - I do not understand anything taught by my teacher in English and since I cannot speak English everything he says, I say, yes sir. But I understand the lesson better when my teacher uses Fante to teach me]* "(Owu-Ewie & Eshun, 2015:77)

Following Charamba's (2020a) South African research on organic translanguaging in science classrooms, some of the participant teachers in the interview said:

"*Most of my students underperform, not because their IQ is low but because of their low proficiency in English. English is not the home language for all my students and myself. That is why I prefer using their home language to explain some scientific concepts. When I use their home language, I have realized that my students perform better compared to when I use one language". (Charamba, 2020a: 124).*

"Every time I stick to using English only; my students always complain that they did not understand what I will have taught them. However, when I use translanguaging pedagogy, most of my students perform well, and their class participation is good. They appear motivated to learn". Charamba, 2020a: 126)

The participant's responses above prove the inefficacy of the English language for science second language learners. Therefore, various researchers suggest using translanguaging and code-switching as the pedagogies by which to provide learners with greater opportunity to actively participate in the classroom activities, and to express their views during content learning, rather than using limiting and monolingual unfairness (see Charamba & Zano, 2019; Charamba 2019a, 2019b, 2020a, 2020b and 2020c; Karlsson, Nygard Larsson & Jakobsson, 2019; Gijima & Childs, 2016, Maluleke, 2019, 2020). However, regardless of the deleterious effects English has in the science classroom, it is vital to the learners as it helps them associate globally with the outside world and offers them unlimited opportunities in the future (Khati, 2016) as it is the international language of commerce, technology, and trade (Khati, 2016; Yunus & Sukri, 2017). It is of principal significance in aiding a nation to develop to its

highest level and thereby retains its world-class effectiveness and productivity in the global arena (Yunus & Sukri, 2017).

2.8. How learning science in a second language in other countries is experienced.

More like South African Education Policy in Education, Number of countries such as Ughanda, Zimbabwe, Botswana, Nigeria and Ghana, Pakistan, China, Indonesia and more use mother tongue instruction to learners in the foundation phase schooling and transit to English medium of instruction when they get to certain grades (see: SSentanda, 2014; Marungudzi, 2009; Tom-Lawyer et al, 2021). Consequently, second language science learners' learning in different countries is reported to be hindered by English language that hampers their full participation, restricts them to ask and answer questions and deprive them the understanding of the subject matter (Murungudzi, 2009; Ssentanda, 2014; Babirye, 2018; Tom-Lawyer et al, 2021; Siddigui, 2022; Pun & Jin, 2022 and An & Macaro , 2022). Learners usually find it difficult to respond in English in their assessments and end up using home language which lead to poor performance since writing should be in English (Babirye, 2018). The mentioned challenges according to the author is due to learners poor reading, speaking and writing difficulties. Apart from the above-mentioned challenges due to poor language proficiency (Siddiqui, (2022), learners have difficulties to effectively participate in group discussions and bound to use their home language and also find it difficult to contextualise clues to infer the meaning of unknown words (An & Macaro, 2022). Not only does language of instruction proficiency hinder learners' scientific knowledge acquisition, but also influences their achievement in science (Pun & Jin, 2022). In Pakistan, the use of English is suggested to be supplemented by mother tongue to improve learners' attitude towards (Papoola & Ayodeji (2022) science subjects. Due to its global status, English has now become the language of instruction to variety of content subjects in different countries (Pun & Jin, 2022). Nevertheless, it has been declared challenging by every country that uses it as a LoLT (Tom-Lawyer et al, 2021).

2.9. Conclusion

The chapter above discussed the meaning and significance of language in science learning and teaching. It also deliberated on the supporting theoretical framework of the research study, the factors that determine the use of the second language in the science classroom, and the challenges of using a second language in science teaching. The study reviewed how effective the use of English is as the language of instruction. The following chapter outlines the research setting, methodology applied, population and sampling, data collection techniques and how data was interpreted and analysed.

CHAPTER 3

RESEARCH METHODOLOGY AND DESIGN

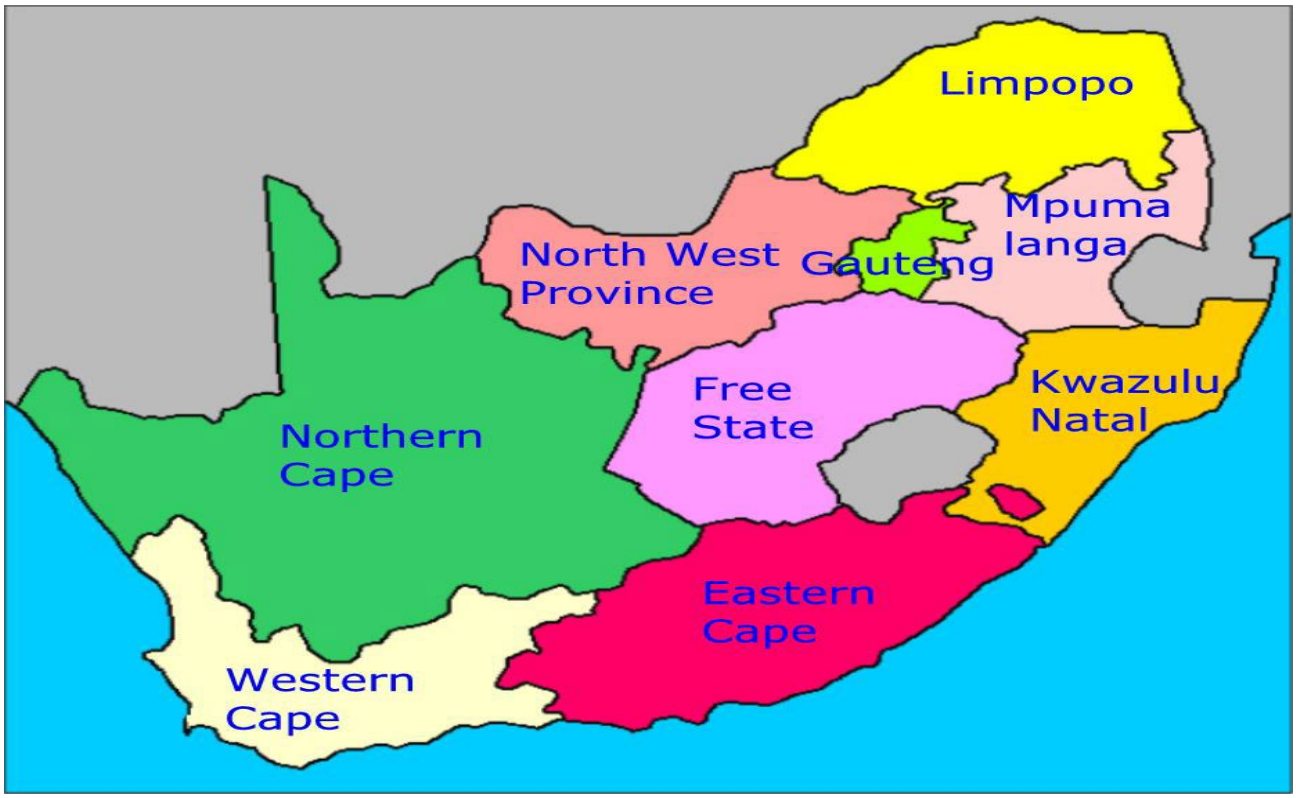
3.1. Introduction

In the previous chapter the researcher reviewed various literature with the aim of understanding the existing relevant research debates on the topic under study. Before different aspects of the research methodology and design are outlined, the chapter provides an overview of the research. It then deliberates the design and research strategy used to collect data from the target population and explores how it was interpreted and analysed. It outlines the research population sampling criteria, population size and how their ethics were considered. In further delineation, two sources of data collecting were used, which are: In-depth interviews and lesson observation. The chapter concludes by considering processes used to collect and analyse data.

3.2. Research setting

The research setting is described as an environmental layout of the research field in terms of its physical, social and cultural background in which a researcher conducts the study (Given, 2008). Since qualitative research generally studies participants in their respective settings in order to make sense of the investigated phenomenon (McMillan & Schumacher, 2014), it is of significance to give the overview of the environment where the research took place. Considering the geographical location, the study was conducted in the Northern part of the Limpopo Province (see Figure 3.2.1.) of South Africa.

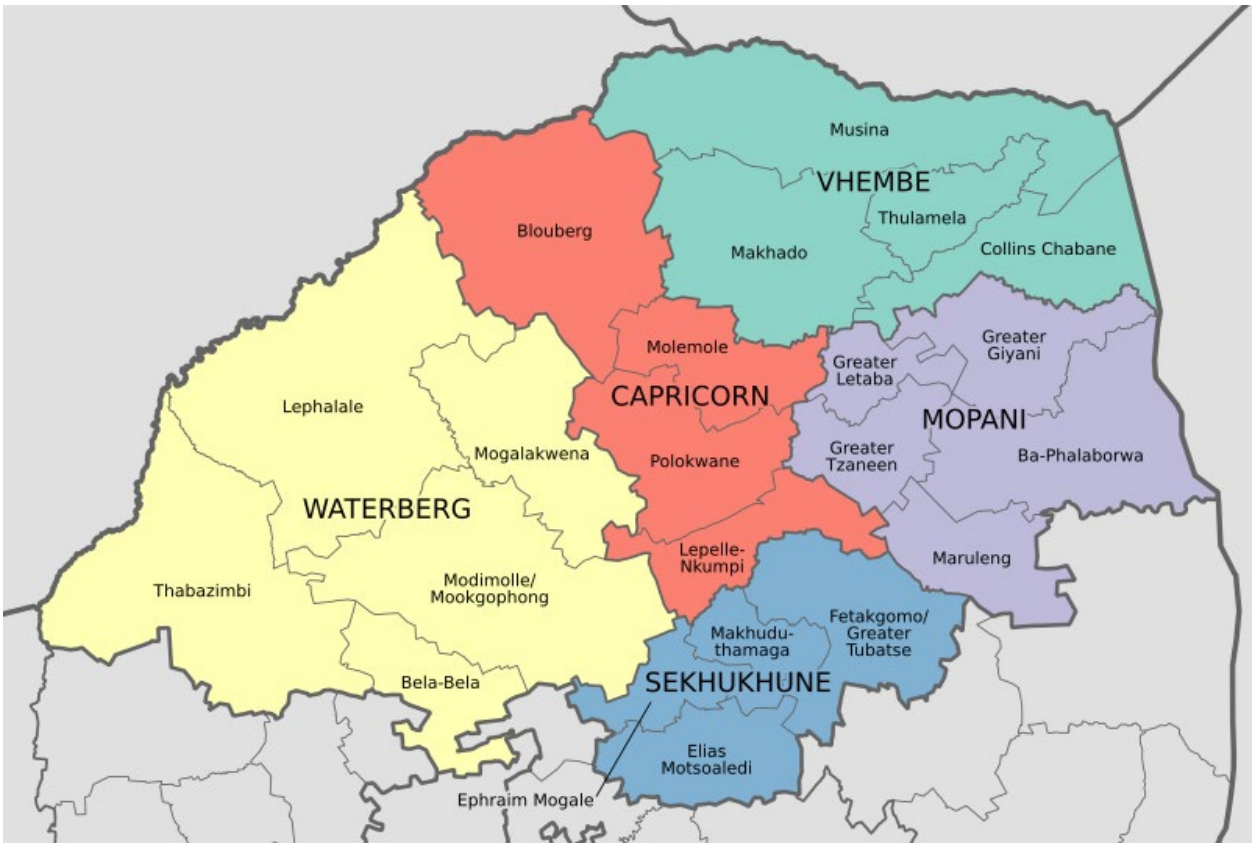
Figure 3.2.1. South African Map showing the Limpopo Province (the province where the study was conducted)



Source: https://www.southafrica.to/provinces/provinces.php

The province consists of five dividing districts (see Figure 3.2.2.) of which Mopani was chosen to be studied. The district as in the figure below is also sub-divided into five local municipalities: Ba-Phalaborwa, Maruleng, Greater Letaba, Greater Tzaneen and Greater Giyani. Greater Giyani Municipality, also known as Mopani East, was identified as the suitable setting to answer the study's research questions. For educational structuring, the setting constitutes five circuits which encompass a number of primary schools (see Table 3.2.1.).

Figure 3.2.2. Limpopo Provincial Map showing its five sub-dividing districts and local subdividing municipalities



Source: https://upload.wikimedia.org/wikipedia/commons/8/81/Map_of_Limpopo

Table 3.2.1. Showing 5 educational circuits of Mopani East District (Greater Giyani).

Circuit	Number of primary schools
Nsami	15
Klein Letaba	18
Groot Letaba	18
Man'ombe	23
Shamavunga	20
Total	**94**

Source: Greater Giyani municipality Integrated Development Plan (IDP) 2019/2020

Before the rationale for selecting the research setting is outlined, it is important to consider the use of a second language in the South African Education System. The country's educational structure constitutes the primary, secondary and tertiary levels of schooling (WENR, 2017). The primary school wherein the study took place consists of the Foundation Phase (Grd R-3), Intermediate Phase (Grd 4-6) and Senior Phase (Grd 7). The setting has a large number of Xitsonga speaking inhabitants with Xitsonga being the home language of the majority of primary school learners. However, there are a few immigrants from the nearby areas who speak other languages such as Northern Sotho, Venda and Sepedi but who have adopted the language of the majority. The primary school Foundation Phase (Grd R-3) promotes Xitsonga home language learning and teaching, as encouraged by the country's Language in Education Policy (LiEP) and the National Curriculum Statement (NCS) (DBE, 2010). Yet according to the LiEP of the country, learners from Grade 4 onwards irrespective of their language, identity or culture, are expected to receive their education in either Afrikaans or English.

It is believed that use of home language in the Foundation Phase improves learners' content understanding, develops teachers' flexibility and creativity in their lesson preparations and teaching process, and stimulates parental involvement leading to the enhancement of learners' achievements (Salie & Moletsane, 2021). According to different literature (Salie & Moletsane, 2021; Mavuru and Ramnarain, 2019; Moadi 2018; Makalela, 2018; Gudula, 2017 and Frans, 2016) the adoption of English as the language of learning and teaching from Intermediate Phase onwards in South African public schools is declared to be a struggle for second language learners and teachers. To investigate the experiences of teachers on teaching science in second language to primary school learners, such primary schools using second language were identified and selected as suitable settings for the study. In addition, it was believed that the settings chosen were appropriate to provide in-depth, rich and relevant information to answer the research questions. Moreover, the setting falls within the researcher's residing area making it easier and more affordable to travel between the schools during the data collection process.

3.3. Research methodology and design

3.3.1. Research strategy

A variety of literature (see Kumar, 2018, McMillan & Schumacher, 2014; Creswell, 2008) identify a number of strategies a qualitative researcher can use which include: ethnographies, action research, grounded theories and case studies. Research strategy according to Saunders, Lewis & Thomhill (2009), is a researcher's overall processes or direction to answer the study questions. Yin (2003) suggests choosing a research strategy based on the number of factors which include among others the format of questions posed; "what", "who", "where", "how" and "why". Therefore, based on the study methodology used, the nature of the research problem and research questions and sub-questions posed in Chapter 1 are likely to be proper for the case study method (Yin, 2003).

A case study is described by Kumar (2018) as the enquiry used to discover, interpret and comprehend complex individual/ group issues through the application of qualitative research in a given area. The strategy allows for a wealth of information with regard to the study topic, making it easy to understand and interpret (Abutabenjeh & Jaradat, 2018). The application of the case study was very useful to explore teachers' experiences thoroughly and closely in using second language in primary school science classrooms. The strategy was used because of the need to discover different challenges teachers experience when using second language and to demonstrate how the challenges affect science learning and teaching. It helped to obtain an in-depth perspective of how teachers deal with the many challenges resulting from the use of English, and to determine their insights of the effectiveness of second language in their daily science teaching. Since qualitative research provides participants access to express their ideas and feelings (Abutabenjeh & Jaradat, 2018), teachers were able to propose some recommendations to mitigate the challenges of using second language in their science teaching to second language learners.

3.4. Study Population and sampling

3.4.1. Population

Abutabenjeh and Jaradat (2018) define a research population as people who participate in the research study required by a researcher in order to answer the research questions and produce a report. The population of this study was comprised of 94 primary schools in the Mopani East District, out of which five schools were selected. One primary school in each of the district's circuits (see Table 3.2.1) was selected with the aim of acquiring teachers' in-depth experience of language use in science classrooms, examined from different environmental settings and under different supervisory regimens. Though the study aimed for five schools that fall within Mopani East District, one school removed themselves from the research in the middle of the data collection process. The selected five schools although using the same curriculum, maintained by the same Constitution and Language in Education Policy, were in different circuits so as to garner comprehensive data from different perspectives to answer the research questions.

The study targeted 298 Grade 7 Natural Science teachers out of which two teachers (one Grade 4 and one Grade 7, male and female) per school participated in the production of data. However, during the study setting observation, which is seen by Majid (2018) as playing a significant role in detecting potential practical challenges that may influence the research findings, and to give time to pre-empt them effectively before the formal data collection process starts, it was identified that in the schools selected only one teacher either male or female was responsible for the entire Grade 4 or Grade 7 classes based on the school's learner enrolment. In addition, one of the selected schools (School A) was identified as having one teacher who was accountable for both Grades 4 and 7. Furthermore, from the targeted population, more male teachers were found to be dominant than female teachers. However, to pre-empt the challenges identified, one teacher from Intermediate Phase (Grade 4) and one teacher in the Senior Phase (Grade 7) per school were purposefully selected regardless of their gender. Since the main aim of the study was to obtain teachers' experiences of teaching Natural Science using a second language, three years and more experienced Natural Science teachers in the classroom were the identified

population. However, one teacher in School A who was teaching both Grades 4 and 7 was also identified as having had only six months working experience, resulting from the teacher who was responsible for the grades receiving a promotional position in another school. Nevertheless, other participants were determined as qualifying for the research and thereby would provide enough information by which to draw the research conclusion, due to their years of experience working in second language science teaching.

3.4.2. Sampling

Majid (2018) describes sampling as the process of selecting participating individuals from the target population. Since the research aims, questions, significance and procedures were communicated with the school principals, the school principals helped to communicate information directly to the target population (Natural Science teachers) within their schools, or, indirectly through the Departmental Head (DH) teachers. The principals or DHs gathered their respective Natural Science teachers for a briefing by the researcher, but one school preferred to be given all research information to read on their own claiming that a formal meeting would be time consuming and would disturb school activities. After the face-to-face briefing, the teachers identified to participate were decided by the principals and DHs in the absence of the researcher. The identified teachers were reminded of their right to choose to participate or not in the study, and were offered time to ask questions for clarity on the research process. The final purposeful sampling of teachers from the four selected schools were four Grade 7 teachers (three males and one female) and three Grade 4 teachers (two males and one female). In all South African schools, grade 4-6 Natural Science is integrated with Technology as per the NS & Tech CAPS (DoE, 2011) document. Therefore, teaching Natural Science and Technology in the intermediate phase requires a suitable Pedagogical Content Knowledge (PCK). Such, purposeful sampling allowed the researcher to use Natural Science teachers as participants who provided relevant data with regard to the research topic (McMillan & Schumacher, 2014). The use of purposeful sampling, as in Patton (2015), was to select teachers who were able to produce rich insights and full understandings about their experiences of the use of second language in their Natural Science classrooms.

3.5. Research instruments

The study adopted qualitative research which enabled the researcher to deeply explore the experiences of participants in their working environment. Two research instruments were employed, being observations and semi-structured interviews. During the observations, data was obtained through participants' observations, while in the semi-structured interviews, data was gained through participants' in-depth interviews. Creswell, (2018) describes the data collection process as a consequence of the researcher's actions (of gathering relevant information) to answer the research questions. Therefore, to explore in-depth teachers' points of view, experiences, feelings and perspectives with regard to teaching Natural Sciences using English as a second language with primary school learners, the employment of face-to-face interviews and classroom lesson observation were applied.

3.5.1. Semi-structured interviews

This interview technique was used due to its ability to provide much more detailed information as compared to other forms of data collection techniques (Showkat & Parveen, 2017).). It helped to uncover more detailed and in-depth information about teachers' experiences and perspectives in teaching Natural Sciences to primary school second language learners (Showkat & Parveen, 2017). Arrangements were made with the participants regarding the time schedule of the interviews and they agreed to use their administration times to avoid interruptions of the learning process. To ensure that all interview questions worked as intended it was checked by the researcher's supervisor and by the university review board for approval.

The semi-structured interviews had a list of 18 questions that constituted seven open ended and 11 probing questions that permitted the discussion to deviate if interesting aspects arose that required a tangential freedom to explore. A thorough review of the interview questions was carried out to increase the participants' response rates (Drennan, 2003). The interview process took place in the noise free school premises and all participating individuals (Teachers W1, W2, X1, Y1, Y2, Z1 and Z2) were provided with sufficient research information in Xitsonga (see Appendix 10B); Xitsonga being the language they declared to fully understand before data was collected, so as to ensure that their decision on whether or not to be informants was cogently made.

To ensure that there was detailed discussion and clarifications about relevant aspects of the research process between the researcher and the participating individuals, consent forms (see Appendix 11A & 11B) written in English and in the participants' language were issued for them to sign, which proved their agreement to have understood the study terms and conditions. Before the formal interviews commenced, the researcher introduced herself to the participants and assured them that their participation would be anonymous with pseudonyms given instead of their actual names. The reason for doing the introduction was to gain the participants' trust and to help them feel safe in disclosing to the research their feelings, insights and any sensitive information. Using pseudonyms was the assurance given to ensure protection of participants' confidentiality (Ruth, Allen & Janine & Wiles, 2015) and so that they felt comfortable to reveal relevant information to be used in drawing the research conclusion.

Since qualitative data are conveyed through words and text (Maxwell, 2012), seven (three Grade 4 and four Grade 7) Natural Science teachers were physically interviewed. An interview is a method of extracting more detailed information or gaining a deep understanding of a topic from the participant by a researcher, using one-on-one discussion (Showkat & Parveen, 2017). Two teachers (one from the Intermediate Phase and one from the Senior Phase) in schools B, C, and D, and also one teacher in school A who happened to be teaching both Grades 4 and 7, were physically interviewed. The reason for interviewing two teachers in the afore mentioned schools (schools B, C and D) as in Gentles (2015) was to acquire data that was important for understanding of the complexity, depth, or situation surrounding a phenomenon, rather than to represent the teacher population. In addition, qualitative research is demanding and time consuming (Mason, 2010), so interviewing fewer teachers per school eased the time constraints and simplified the data analysis process.

Each participating teacher interview took approximately 30-40 minutes to conclude after responding to all 18 questions, the aim of which was to acquire enough data to answer the research questions. Participants' responses were dual audio recorded. The instruments were checked and fully charged to ensure their proper functionality before the commencement of the interviews. The aim of using the dual recordings was

that should a recorder encounter a capturing problem, the other recorder would be available as back up. The recorder helped the researcher pay attention to the interview rather than being distracted by taking notes (Flick, 2017). As in King, Horrocks and Brooks, (2018) audio recording interview data produced high quality recordings that were easily transferred to computer for transcription and storage.

3.5.2. Lesson observations

Classroom observation was conducted to directly witness, learn and reflect on various aspects of using second language in teaching Natural Science to primary science learners. This type of data collection technique helped to attain direct information about the topic being studied (Bilash, 2019). Observing participants' experiences directly in their setting permitted the researcher to make discoveries instead of making assumptions of what happens in the context (Bryant, 2015). Observing participant teachers during their lesson delivery provided data on how the teachers interact with their learners in the natural science classroom, using second language.

The study proposed observing five Grade 7 teachers (one teacher per school) during their teaching, and due to the reason that qualitative research is time consuming (Saunders, Lewis & Thomhill, 2020), observing one teacher per school therefore aimed to save time and to circumvent thin analyses and poor conclusions, implications and recommendations for the study (Silverio et al, 2 020).

Ultimately four out of seven teachers sampled were Grade 7 teachers and only three (TX, TY1 and TW1) were observed during their Term Two Natural Science lesson delivery, this despite the study aiming to observe all four teachers. One teacher was not comfortable to be observed. Participants gave their full consent to be observed and similarly parents' consent granting permission for the researcher to observe their children was given, written in their home language (See Appendix 12A & 12B). In addition, the lesson observation schedule was made available to the participating teachers to familiarise themselves with the different aspects to be observed during their teaching. Observations were arranged and carried out on the same day as the interviews with each respective teacher. The aim of doing the interview and the observations on the same day was to avoid the researcher inconveniencing teachers' school activities. The observed teacher and their learners' second language use was

observed by checking for non-verbal expressions of feelings, determining who communicated with whom, and grasping how participants communicated with each other (Kawulich (2012). The use of second language by the teachers and the learners in the Natural Science classroom was assessed and noted using a lesson observation schedule. The schedule had different items to be observed which helped in making informed field notes that answered the study's research questions. Not only field notes were taken during the lesson observation, but also the session's verbal interaction was recorded on the audio recorder. According to Tessier (2012), recorded data can be replayed making it possible for the researcher to retrieve and examine information in a more flexible manner. Therefore, not relying only on field notes was significant to acquiring more accurate data which is not open to interpretation as the verbal information is static. In addition, employing an audio-recorder was useful for recalling missing verbal cues that would be important in drawing research conclusions. Furthermore, the recordings provided an opportunity for repeated and accurate reflection based on the recorded reality of what happened during the learning and teaching processes, rather than relying on the vagaries of making and using field notes. The recorder was fully charged and its volume maximised to ensure that verbal interactions between teachers and learners were accurately captured.

3.6. Data analysis and interpretation

After the data collection process, the audio-record and field notes were analysed and interpreted for the compilation of the research report. Data analysis is the process whereby a researcher systematically examines and arranges the interview transcripts and field notes, to understand the phenomenon studied (Agresti, 2018). Thematic content analysis was used to analyse the study data. Thematic content analysis is a method of identifying, analysing and relating qualitative themes from the interview text to develop a research report (Neuendorf, 2019). Thematic method analysis was used because it is accessible and flexible (Braun & Clarke, 2012) to be used within a range of research questions and is suitable to analyse data that seeks to comprehend experiences, thoughts and behaviours of data in details (Varpio & Kiger, 2020). To a new qualitative researcher, it provided a teaching tool of coding and analysing of qualitative data (Braun & Clarke, 2012). In reference to Braun and Clarke (2012) the audio-recorded raw data was analysed based on six procedures of thematic analysis.

3.6.1. Transcripts familiarisation

The audio recorded data for each interviewed participant was replayed in a slow reticulation sensibly listened to, to produce intelligent transcription (See Appendix 3A-3G). Intelligent transcription is a process of transcribing every participant word, but making some interpretation to omit repetitions, breaks in proceedings, pitching while possibly correcting the grammatical errors (McMullin, 2021). The aim of intelligent transcription was to improve the readability of the transcripts. When the transcriptions were completed, each word transcript was then read several times in order to understand what was actually within the data and to identify participants' merging ideas (Varpio & Kiger, 2020). For each research question, the researcher took notes of data identified to merge, relevant and related. All relevant answers, words, expressions and sentences were marked (Neuendorf, 2019).

3.6.2. Marking initial codes

Initial coding was done per interview transcript to find patterns in the data using QData miner Software. A set of interview transcripts were inductively coded based on the research questions. Inductive coding according to Linneberg and Korsgaard (2019) is a process of deriving qualitative research codes from the data by using study participants' expressions or words instead of the researchers' language. Although the research was directed by the constructivism theory of science learning and sociocultural theory of second language acquisition, the aim of using inductive coding was to avoid the researcher's ideas and prior comprehension from influencing the findings; codes stay connected from the data, so as to reflect what is essentially in them (Linneberg & Korsgaard, 2019).

3.6.3. Examining themes

In reference to Neuendorf (2019) regarding the marked or labelled codes, the researcher identified relevant information; grouped them into similar themes and concepts. Following the initial coding, codes for each transcript were compared and combined according to interview questions and to create preliminary themes.

3.6.4. Theme segmentation and review

After preliminary themes were developed, meaningful themes were identified, with same themes combined and compared (Varpio & Kiger, 2020). Codes within each theme were reviewed to ensure they were consistent with the themes and modifications made using the researchers' vocabulary and terms where necessary. Finally, the themes were reviewed to ensure they represented the interview data. Themes that appropriately answer the research questions were reviewed and refined to check if each had backup data.

3.6.5. Naming themes and defining of themes

The reviewed and refined themes that answered the research questions were finally named and defined based on the study context. A detailed content analysis of each theme was developed to determine whether one data obtained was more significant than another, and were then given descriptive names to be used for the study discussion. Once data was analysed, it was kept in a safe place so that it couldn't be accessed by others without authorisation (Creswell & Poth, 2007).

3.6.6. Report writing

As indicated above, themes were discussed based on the research findings while referring to similar and dissimilar literature while the research report was constructed based on the researchers understanding of the research questions, to reach the study aims as well as its objectives. Research findings were reported by the researcher in the form of a research dissertation (Schabenberger, 2017).

Using content analysis, the raw data field notes collected during the lesson observation were documented (saved and listed). This type of analysis was defined in Chapter 1 of the study, as a process of conceptualising, coding and categorising textural data in order to identify the similarities, relevancy and relationships of the participants' used words (Marying, 2000). Important concepts from the notes were identified and refined. To examine relationships, links, relevancy and similarities these were categorised and grouped according to the research questions to be interpreted. Data of relevant information were then grouped into similar themes and concepts. The

themes were then to be synthesised, discussed and reported together within the interview data as a research dissertation.

3.7. Reliability and validity

It is significant that the research data collection instruments are planned and measured in a way that effectively enhances reliable and valid research findings (Kubai, 2019). The author describes reliability as the measurement of the research instrument over a specified number of times, and validity as the ability of research instruments to measure what is developed. Naim et al (2019) delineates both reliability and validity as ways of stipulating and communicating the accuracy of research procedures, and the trustworthiness of research outcomes. The same author asserts that research trustworthiness is determined by the research questions, how the research information is collected - including when and from whom, how the data is analysed, and what conclusions are drawn.

Therefore, reliability and validity of the current study was ensured by the researcher configuring the unambiguous interview questions and lesson observation schedule in the language that the participant understood (Mohajan, 2017). In addition, the research tools (Interview questions and lesson observation schedules) were checked by the researcher's supervisor and the University Review Committee for its efficiency and truthfulness. Interview questions and lesson observation schedules were also checked by the science teachers and principals of each participating school. Furthermore, participants were permitted an opportunity to assess and authenticate the information they provided during the data collection process to assess what was deviated or not.

3.8. Research ethics

When the ethical certificate (Ref: 2021/10/13/58246614/17/AM) was issued by the University of South Africa's Ethical committee, the researcher applied for permission to conduct the study at to the Limpopo Department of Education. When permission (see Appendix 7) was granted by the provincial Department, application letters were sent to the prospective circuit managers (see Appendix 8) and principals (see Appendix 9) at the selected schools. Once permission was granted, arrangements

were made with the school principals and the target population to physically discuss the aim and importance of the study. Since the top priority of a research, according to Iphofen and Tolich (2018), is the well-being of its participants, in order to abide with the research ethics, the researcher was guided by the following ethical procedures:

3.8.1. Confidentiality

To protect the confidentiality of the participating individuals, schools and teachers' names were not disclosed; pseudonyms were used instead. Furthermore, a guarantee not to disclose participants' information was clearly indicated in the research information sheet. In agreement with the participating teachers and school principals, schools' actual names were replaced by referring to School A, B, C and D, while participating teachers were identified as Teacher W1, W2, X, Y1, Y2, Z1, and Z2. No identifying names were mentioned throughout the research study. As previously noted, data was audio recorded, with the obtained recorded data stored in the researchers' personal laptop, and safely held in a passworded one cloud storage where only the researcher had access to it. With reference to McMillan and Schumacher (2014), these measures were to ensure that the data could not be linked to any person nor circulated to unauthorised individuals who were not participants of the research**.**

3.8.2. Full disclosure

The success of research requires the researcher to disclose all the procedures that are entailed by the research (Creswell, 2018). Therefore, before data was collected a formal briefing session was held with the participants to disclose the research specifications, processes, its aims and its importance. As in Cresswell (2018), during this session participants were given a platform to ask questions based on the research process. The reason for attending to participants' questions was to help them manage any anxiety caused by the potential research situation, so they could make an informed decision of whether to participate or not.

3.8.3. Voluntary participation

According to McMillian (2014) participants should willingly participate in data collection, and should not be coerced. Since the researcher was in contact with the participants, following Akaranga and Makau (2016), it was her responsibility to explain in detail the purpose of the study, and its benefits. Therefore, using Xitsonga, which is the participants' language, the researcher clearly explained to the school principals, teachers and the School Governing Body (SGB) the research specifications, processes, aims and the educational benefits of the study. This was to ensure that the school and its stake holders had a full understanding of the research study. They were assured that they would be given a platform to make any inquiries as the basis for making an informed decision as to whether they wished to participate in any data collection activity. However, some schools preferred to be given participants' information sheets, consent forms, parents' consent and learners' assent forms to read in their own time, claiming that briefing with the researcher would be too time consuming. Regardless of this, clarity seeking questions were requested by the researcher to determine participants' understanding of the research process. Participants were also openly informed that no financial remunerations were to be given to any of the participating individuals. This was to ensure that participants didn't expect financial compensation after the data collection process. Participants signed and dated the consent forms, based on their authentic feelings. The consent forms were effectively read aloud in Xitsonga to ensure their full understanding of the study commitment.

3.8.4. Informed consent

According to Nijhawan et al (2013) for any research involving social informants for the collection of data, informed consent is compulsory. Informed consent is a tool guaranteeing that participating individuals have effectively understood what they had committed themselves to, so they can make an informed decision whether to be informants or not (Phillippi & Lauderdale, 2018). As such, besides the researcher's verbal briefing on all aspects of the study, participants completed the consent form which was designed by the researcher and approved by the University's Ethical Committee. Participants gave consent based on the information regarding their rights

and freedoms to participate. To ensure full comprehension of the study's procedures, processes and expectations, English participant information sheets and forms were translated into and explained to the participants in their mother tongue. This was to avoid participants' withdrawal before the conclusion of the study, due to misunderstanding the research information (Nijhawan et al, 2013). Participants were also provided enough time to read the consent form and ask questions for clarity to ensure informed voluntary participation. Participants signed and dated their consent forms.

3.9. Conclusion

This chapter provided an overview of the research setting, deliberated the design and research strategy used to collect data from the target population, and noted how it was interpreted and analysed to draw the research conclusion. The research population, sampling criteria and two sources of data collection techniques including interviews and lesson observation, were examined. Procedures on how ethics were considered for participants' involvement were clarified. In the following chapter participants interviews and lesson observation data were analysed and interpreted to draw the research conclusion and recommendations.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1. Introduction

The data analysis and interpretation in this chapter aimed to address the purpose of the study, which was to investigate the experiences of primary school teachers teaching Natural Science in the second language (English) in selected primary schools in Mopani East within the Mopani District of the Limpopo Province of South Africa. In terms of Natural Science practical teaching experience, the participating Grade 7 teachers expressed a variety of opinions and in-depth views. Respondents' identities were protected by using pseudonyms when discussing the data. The categorisation of data was initiated by assigning codes to participating teachers' similar responses. To make data analysis easier, emerging themes were appended to each transcription.

The researcher transcribed the collected audio interview recording data. Next, initial coding was performed to find patterns in the data. Following the initial coding, codes were compared and combined to create preliminary themes and sub-themes. After initial themes were developed, codes within each theme were reviewed to ensure they were consistent with the themes, and modifications were made where necessary. Finally, the themes were reviewed to ensure they represented the interview data. Content thematical analysis was carried out using qualitative QData Miner software.

4.2. Semi-structured interviews

Seven (three Grade 4 and four Grade 7) Natural Science teachers were interviewed. The interview protocol followed consisted of seven structured interview questions and 11 probing questions (see Appendix 1). The interviews were conducted in a noise free classroom at the four respective schools. Pseudonyms were used throughout the process to ensure teachers' confidentiality and identities were protected.

4.2.1. Biographic information form

To understand the subject content identified as important biographic information was captured during participating teachers' interviews. The experience and qualification of

participating teachers are relevant to providing context for teaching science. In addition, the biographic information permits researchers to do comparative analysis across literatures. The demographic analysis revealed five participating teachers were male, followed by two females as indicated by Table 4.2.1 Six participating teachers indicated having Bachelor of Education qualifications while one teacher indicated his qualification was a Bachelor of Science with an Agriculture and Post Graduate Certificate in Education (PGCE). Three of the participating teachers indicated that they taught Natural Science in Grade 4, and three were teaching Grade 7 while Teacher X was responsible for teaching Natural Science for Grades 4 and 7. Four respondents, indicated to be in post level one (PL1), two in post level two (PL2, Departmental Head) and one in post level three (PL3, Deputy Principal). The teachers' years of working experience in their ascending order starts from Teacher X who has six months experience, followed by Teacher W2 with five years' experience, Teacher Z1 with 11 years' experience and Teacher Z2 with 28 years' experience while Teachers Y1, W1 and Y2 have more than 30 years working experience. All participants reported to be Xitsonga home language speaking teachers.

Table 4.2.1.: Demographic results of respondents' teacher

Teacher and school Pseudonyms	Qualification/s	Designation	Teaching Experience in years	teaching Grade	Gender	Area of Specialisation	Home Language
Teacher X (School 1)	Bachelor of Science in Agriculture and PGCE	PL1 Educator	6 Months	4 & 7	Male	Economic and Management Science	Xitsonga
Teacher Y1 (school 2)	Bachelor of Education	PL3 Educator (Deputy principal)	33 years	7	Male	English and Geography	Xitsonga
Teacher Y2 (school 2)	Bachelor of Education	PL1 Educator (Educator)	31 years	4	Male	English and Biology	Xitsonga
Teacher Z1 (School 3)	Bachelor of Education	PL2 Educator (Departmental Head)	11 years	7	Male	Physics and Maths	Xitsonga
Teacher Z2 (School 3)	Bachelor of Education	PL1 Educator	28 years	4	Female	Xitsonga and Natural Science	Xitsonga
Teacher W1 (School 4)	Bachelor of Education	PL2 Educator (Departmental head)	33 years	7	Female	Physics and Maths	Xitsonga
Teacher W2 (School 4)	Bachelor of Education	PL1 Educator (Educator)	5 years	4	Male	English and Life Orientation	Xitsonga

Source: Primary data

4.2.2. Participating teacher Interviews

The interviews lasted between 30 and 40 minutes using semi-structured interview methodology, focusing on major challenges, effects thereof and the effectiveness of

using second language in teaching Natural Science to primary school learners. Content analysis was performed on the interview data. To create meaningful patterns based on the data's divergences and similarities, the inductive content analysis technique (Krippendorff, 2013) was used. The goal of the content analysis is to examine the acquired data in a way that explains the relationships between the data (Flick, von Kardoff, & Steinke, 2004).

The researcher used interview transcriptions (see Appendix 3a-3g) to identify recurrent patterns in the data in order to find common codes (see Appendix 5) that were relevant to the study and aligned with the goal of finding challenges, effects thereof and effective use of second language Natural Science teaching. The researcher read each transcribed data set, and determined a code based on the participants' word choices, and sentence or clause that aligned with the stated goals of the study.

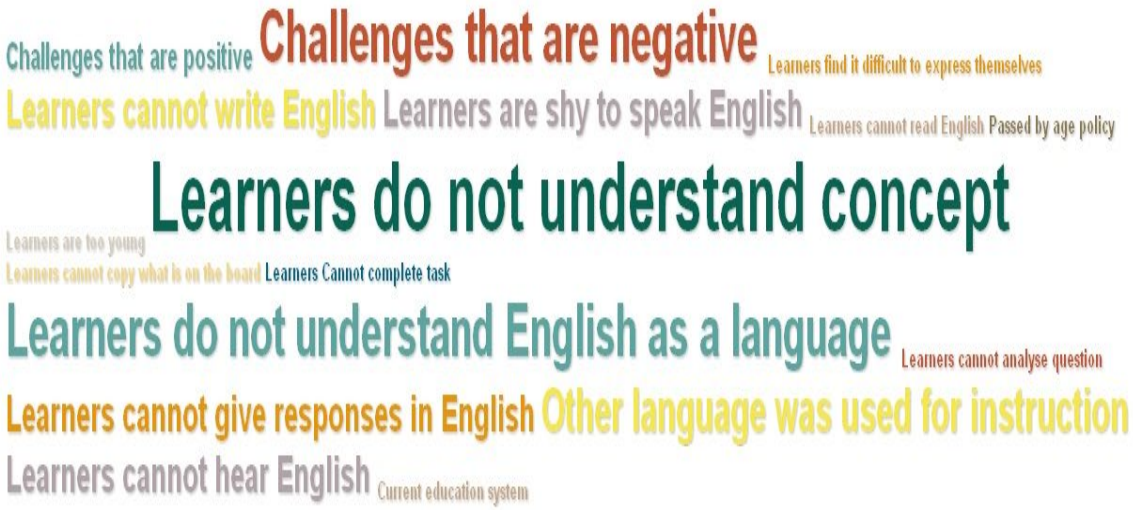
Created codes were grouped together and examined to identify recurring patterns among them, to begin to identify broader themes (see Appendix 4). Themes were generated by combining several codes to form a single theme. Furthermore, themes where reviewed and modified to ensure accurate and coherent representation of the data set and alignment to research questions. Finally, all generated themes (see Appendix 4) were defined to clarify the essence of each theme, to categorise sub-themes and to show how they interact and relate to the main theme and sub-themes.

In the current data, the initial coding was done per interview questions as indicated on Appendix 5 (e.g., codes reflecting on challenges were generated for interview question 1). The codes were compared across interview questions. The patterns on generated codes were carried out across research questions and aligned with predetermined themes (see Appendix 4) that were used based on an existing theory per interview. Some of the themes that could not be linked with predetermined themes were either used as themes and some as sub-themes. The data is presented and analysed based on the identified themes mentioned under each heading below:

4.3. Challenges of using second language in teaching Natural Sciences to primary learners.

Firstly, teachers' thoughts on challenges experienced when using second language with primary science learners in Mopani East of Limpopo Province are presented in this data. Thematic analysis of participating teachers' reflections on the challenges experienced, revealed word cloud codes as indicated in Figure 4.3. According to the data analysis, the negative expressions on second language were accounted for by participating teachers, as is clearly virtualised with the use of word clouding analysis in Figure 4.3. The challenges expressed by teachers revealed a central theme: **inadequate second language proficiency** as discussed below. The theme can generally be summed up under "Learners' active participation in classroom" which is one of the cornerstones of constructivism theory of science learning.

Figure 4.3: The word cloud on learners' challenges accounted for by participating teachers.



4.3.1. Inadequate second language proficiency

Inadequate second language proficiency in the current study context refers to the learners' incompetence to speak, read and write using English. The following perspectives gathered from participating teachers are the stated challenges

experienced by them when second language is used as a language of learning and teaching:

According to data analysis of participating teachers' responses learners are shy to speak English, have difficulty expressing themselves, and cannot give responses in English. This emphasises the inability of learners to speak English. (Figure 4.3). These insights can be categorised under the theme of inadequate second language proficiency by learners, which is evident from their incompetence in speaking in the second language.

In supporting the theme 'inadequate second language proficiency by learners' participating teachers reflected that learners cannot read English, and cannot hear English as per analysis of data in Figure 4.3. The stated expression is an element of the theme under learners' incompetence to read using the second language.

Furthermore, thematic analysis of the data revealed that learners' challenges are identified by participating teachers, learners not being able to understand English, copy what is on the board and cannot analyse the assessment questions (Figure 4.3). Moreover, a high number of participating teachers indicated that learners find it difficult to understand science concepts when the second language is used as the language of learning and teaching. Teaching in the second language is consequently difficult for teachers since the majority of their learners will not be able to accurately hear nor understand what is being taught in English.

Inevitably learners are expected to apply the knowledge acquired during learning as proof of their lesson comprehension. Such application is done through informal and formal written assessments such as class work, homework, tests and examinations. As expressed by the participating teachers, learners find it difficult to make use of second language when writing. In addition, most of the learners are shy to speak the second language. Since learning and teaching take place through an interaction between teachers and learners, or amongst learners themselves, it is obvious that learners' shyness to speak English compromises their learning. When learners are shy to speak, they also find it difficult to express themselves. In the constructivism

learning environment, the ability to reflect and construct own knowledge and understanding using personal responses, play an important role. Teachers are able to assess learners' level of understanding through verbal interaction and formal written assessments. Difficulty in expressing own knowledge through the use of second language is an indication that numbers of native language speakers' effective participation and ability to take their role of being a centre of learning and teaching in the classroom is hindered.

Learning and teaching in the constructivism classroom is rooted in reading study materials, texts, and assessment questions written in the second language. Therefore, learners' inability to read second language study materials or assessment questions in classwork, homework, tests and examinations obviously has a negative impact on their performance. In addition, learners are expected to properly analyse questions in order to understand them and to correctly provide answers using the acquired second language knowledge. As correctly indicated by one study participant, learners' inability to analyse and correctly understand assessment questions can lead to poor performance. The inability to analyse and interpret questions is closely linked to their inability to complete tasks. This should be considered when learners fail to complete tasks which can be attributed to their spending time in an attempt to read, understand and analyse questions written in the second language. Their work completion would be expedited had the second language not been a challenge. As a result of which a high failure rate is likely to occur should learners not receive support.

Learners' participation in all class activities plays a major role in learning. Their inability to copy what is on the board could be influenced by various factors which require teachers to identify and provide necessary intervention. This could indicate that learners did not acquire the necessary writing skills in the Foundation Phase irrespective of the effects of second language learning. Aliyu (2020) posits that writing skill plays an important role in a learner's academic success.

Inadequate second language proficiency is reflected by Teacher Y1 who said that "The main challenge is that some of the learners cannot understand English, they cannot even write, nor try and are even shy to speak in English". Such assertions highlight

the difficulty learners encounter when expected to use second language for learning Natural Sciences in primary schools.

It can therefore be deduced that primary school second language learners have a serious second language comprehension challenge, which was explicitly outlined by respondents during their interviews. Learners use language in the science classroom to reason, contest their points, and express their insights, as well as to acquire information from their educators. Therefore, inadequate second language proficiency means incapability to apply/use English language in any situation within the classroom.

4.4. English Second language impact on learning and teaching of Natural Sciences in the classroom

During data collection process participants were required to express their experience on how the central challenge mentioned above affect the teaching and learning of science. Themes below are analysed based on the challenges that affect the teaching of Natural Sciences and those that affect the learning of Natural Sciences.

4.4.1. English Second language impact on Natural Science learning

The analysis of English as a second language below was based on the impact it has on learners' classroom performance, all of which forms the basis of the five E's of constructive learning i.e., engage, explore, explain, elaborate and evaluate. Six of the participating teachers agreed that the use of English language in teaching Natural Science has an unintended negative consequence on learners' ability to learn science content, whereas one of respondents indicated that the use of second language English has no bearing on learners' ability to learn science content. Contrary to this Teacher Y1 reported a positive impact of using second language English in teaching Natural Science from Grade 4 onwards. The factors listed below were mentioned by respondents who raised them as impacts of second language English usage in teaching Natural Science from Grade 4 onwards.

English impacts on learners' science learning are discussed under the following themes below:

4.4.1.1. Poor understanding of the subject, assessment questions and poor performance
4.4.1.2. Poor classroom discussion.

4.4.1.1. Poor understanding of the subject, assessment questions and poor performance.

Poor understanding of the subject content is conceptualised as learners' inability to fully comprehend the scope of work falling under the Natural Science subject, while poor understanding of assessment questions refers to learners' inability to meaningfully read and interpret tests or examination questions that eventually leads to poor performance. As in the data analysis, five participating teachers expressed that most of the learners have challenges in understanding Natural Science.

Such expression is clearly stated by Teacher X, who said "Most learners find it difficult to understand science as it is being taught in a language that is foreign to them".

A learning outcome of each lesson is for learners to acquire knowledge by the conclusion of the lesson, meaning that if learners fail to comprehend what is taught that lesson is unproductive or meaningless. According to Semeon and Mutekwe (2021), learners' difficulty in understanding science is caused by teachers' inability to clarify science and non-science concepts during teaching.

Commented by Teacher W1 who revealed that "Sometimes some learners will be sleeping because they get bored of something they do not even hear". Another example of how learners are affected negatively came from Teacher Z1 who said that the "Learners can't understand the question written in second language, as a result thereof the learner has already fallen off asleep". Besides second language being a barrier to learners understanding of the subject, it is also important that a science teacher consider different learning styles in order to accommodate the diverse intelligences in the classroom. Teachers' failure to accommodate learners of different styles might be the cause of some learners becoming restless and disinterested and disengaging from the lesson, as they feel excluded, bored and end up sleeping during

teaching and learning process. It is important that teachers also plan their teaching lessons that focuses on specific content and keep learners engaged rather than budging into the classroom unprepared which may lead to inappropriate content delivery. Teachers' unpreparedness may also lead to repetition of the information and making use of the allocated time of teaching to something not learner beneficial. Therefore, learners sleeping in the classroom can be an indication that teachers do not prepare their lessons.

The inability of learners to write is raised sharply by respondents who argue that as it affects learners' performance, it can be said that the inability of learners to be involved in the lesson affects them negatively. Questioning is one of the characteristics of constructivism theory of science learning. This is manifest by asking thoughtful, open-ended questions and encouraging thoughtful discussion among learners. Based on the learners' responses to these questions the teacher is able to assess whether learners understand the subject content or not.

In the analysis low performance marks were registered by Teacher W2 as "It affects them in a very bad way as even learners who seem to be better or good students find themselves getting low marks, because of some of the questions they could not understand due to the language barrier". Such poor performance as explained by Teacher X is due to "Learners' inability to understand assessment questions and they end up not performing".

Although reading with comprehension is mentioned to be one of the learners' barriers due to second language use, learners' inability to understand assessment questions that lead to poor performance, it might be an indication that teachers are unable to follow the Bloom Taxonomy levels of questioning. In addition, it can be an inferred that though teachers know about the Bloom Taxonomy levels, they are unable to use the correct wording for learners to easily understand the questions. Furthermore, it can be deduced that though teachers can use both the correct levels and wording, they might not be able to use the subject assessment framework to guide them on how many marks to allocate for each level of questioning.

4.4.1.2. Poor classroom discussion

Poor learner participation and classroom discussion is contextualised as learners' inability to completely access and internalise part of the lesson activities and classroom discourse as a result of second language reading, writing and speaking difficulties. According to the analysis, 5 teachers note that learners' performance during learning and teaching is affected when English language is used.

It was conveyed by teacher X as **"**When English is used learners find it difficult to comprehend most of the aspects when you interact with them. They are not able to clearly articulate themselves when English is used and (are) not confident enough. They always shy away from participating but when their first language is used is where they fully participate".

In the constructivism classroom learners should be able to actively engage in science topics, scenarios or questioning. Furthermore, they should explore science content by investigating through the reading of texts, or by research, and to be able to explain their innovative ideas by answering questions or solving given science tasks, and to share through discussion with their peers their new ideas, and finally, to elaborate and evaluate their findings. Through these activities they own their learning. Unfortunately, learners' difficulty in reading, writing and speaking the second language hinders their ability to effectively participate in classroom discussions. This may indicate that discussions are ineffective due to learners' failure to individually go through the process of enquiry.

Although some teachers indicated that learners' inadequate language proficiency causes them difficulties in classroom participation and discussion, Teacher Y1's response was positive, by stating that "I told you of the different learners in the classroom, so being not the same it means there are those learners who are even shy although they use their own language. They are always shy as long as they are talking to someone". According to the participant above learner participation in classroom discussion depends on the teacher himself, lack of learner motivation to fully participate though speaking regardless of their language difficulty they will speak.

Learners' shyness to speak during classroom discussion even when home language is used might be an indication that a learner has poor self-esteem. It can also be an

indication that there is an underlying factor within the classroom which can be assumed to be caused by the teacher's lack of classroom management.

4.4.2. English Second language impact on teachers' classroom performance

The teachers' classroom performance refers to a set of attitudes and behaviours that create conducive environments for learning. It is generally said that the more learners are able to learn, the more the teachers' performance is judged be good. As illustrated by data, five teachers rated classroom performance as being highly affected by failure to finish, or to perform to the expected level, and by more time being spent in teaching the content than is recommended. Due to learners' inadequate English proficiency, teaching time and curriculum coverage was identified to be the theme mentioned as impact on teacher classroom performance by participating teachers.

4.4.2.1. Teaching time and curriculum coverage.

Participating teachers indicated that more time is required to complete lesson plans than was originally allocated; as a result, teachers fail to cover the curriculum as required. Teaching time refers to allocated standard time for planned lessons, either in minutes or hours. Curriculum coverage means that science teachers teach all Natural Science topics and content as outlined in the Curriculum Assessment Policy Statement (CAPS). One of the impacts on teachers' performance is when in using second language for teaching Natural Science the lesson has to be repeated, which, as mentioned by Teacher Z2 is that "It affect(s) my performance because there is no way I can teach a lesson once and for all, but instead I will have to repeat it again and again".

Teachers' classroom performance can be measured by their ability to finish the prescribed subject curriculum within the specified time frames. Unfortunately, in situations where second language English is already a challenge, teachers cannot merely focus on finishing the subject curriculum without learners fully understanding it. They are compelled to spend more time explaining science concepts and transcribing to the vernacular language. Hence five of the participating teachers indicated classroom performance as being affected when covering the subject curriculum. 'The impact on teachers' performance when using second language English to teach Natural Science is on lagging behind time'. This was recorded by

Teacher X who indicated that he “Sometimes spends longer time than what is recommended on a certain chapter in order to help learners fully grasp the content”. This means that teachers’ performance in the Natural Science classroom is generally set by their learners’ pace of understanding the lesson. It might also mean that second language Natural Science teachers are unable to complete the curriculum content set due to following the learners’ pace of understanding. It can also be deduced that learners pass from one grade to the other without a complete knowledge required to undertake knowledge of the next grade.

Teachers’ classroom performance can also be measured by how most of the learners perform during assessments. Two participating teachers indicated that their classroom performance is affected by learners’ performance or pass rate. Meaning that the higher failure rate reflects on teachers as poor teacher performance, while a high pass rate represents best teacher performance. When teachers’ performance is affected, learners’ performance is also affected and vice versa.

4.5. Perceived factors influencing learners’ understanding of English second language

The researcher further probed participating teachers on underlying factors perceived to influence learner`s understanding of English as a language of instruction. The following themes were derived from this interrogation:

4.5.1. language of instruction in the Foundation Phase
4.5.2. School entry age
4.5.3. Societal factors
4.5.4. Exclusion of English language in teachers’ development workshops.

The above-mentioned themes can generally be summed up as sociocultural theory of second language acquisition and learners’ active participation in the classroom. These being the basis of the constructivism theory of science learning. The most salient factor arising from the data analysis was that the language of learning and teaching in the Foundation Phase, followed by societal factors, were the most impactful on teachers and learners responding negatively to the second language (in this case English).

4.5.1. The language of instruction in the Foundation Phase

The study contextualises the language of instruction in the Foundation Phase as the language used to teach the Foundation Phase subjects' curriculum. According to the Language in Education Policy (LiEP) of the country Foundation Phase teachers (Grade R-3) use learners' home languages to teach the Foundation Phase subjects and this includes: Home language, Life skills and Maths excluding English.
Data analysis identifies five participating teachers who indicated that the South Africa LiEP contributes negatively towards learner's ability to understand English as a second language. In Figure 4.3 above the word cloud shows the language of instruction in the Foundation Phase reflected other language. As indicated by participants, the use of learners' home language in the Foundation Phase as a language of instruction was indicated to be the main contributing factor for Grade 4 and 7 learners' inability to use second language for Natural Science learning.

Participating teachers clearly identified the following issues as the cause of learners' scholastic challenges: learners being taught in their home language for three years; learners then being expected to adopt a second language of instruction in Grade 4; learners simultaneously learning the new language while trying to learn the subject (in this case science) content. The concern is that while home language teaching facilitates learners mother tongue proficiency, it makes transitioning to the new and unfamiliar language difficult. Failure to develop the academic language of instruction in the Foundation Phase (Grade R-3) creates confusion for the learners, as they are expected to obtain science knowledge from Grade 4 in English, while being entirely unfamiliar with it. The challenge is exacerbated by the learners having to simultaneously conceptualise science content. The use of Xitsonga as LoLT in the Foundation Phase grades, while it is also used by learners at home, may ultimately hinder learners' scholastic progress since from the intermediate grade only English second language is used as the language of teaching. There is consensus that interaction with the environment helps learners' development of the second language and is consistent with sociocultural theory of second language acquisition. Nonetheless, in the Foundation Phase Grades (2-3) learners come into contact with

English in the classroom environment for about three to four hours per week as per English CAPS grade R-3. Compared to the use of home language in Mathematics, Xitsonga and Life skills which is about 21 to 22 hours all together, it could be deduced that there is a lot mastery of home language than second language. This could be an indication that learners' inability to read, write, speak and hear (comprehend) English in the intermediate-senior phase Natural Science classrooms is caused by the insufficiency development of English vocabulary in the foundation phase.

Another policy that was mentioned as problematic only by Teacher Y1 is what he called, "The issue of allowing learners' progression by age is something implemented by the department and seemingly is causing higher failure rates, drop-outs and even poor performance". Learners' progression by age is the advancement of a learner to the next grade due to the fact that the learner is older than his/her classmates, who are progressing to the next grade. This is a challenge because such learners are unable to cope with the scope of work of the grade to which they are progressed. It can be assumed that these learners are those who fail to read, write and speak, thereby hindering their active participation in the second language science classroom. It can also be inferred that these learners fail to adapt to the environment wherein they are progressed to, making it difficult for them to copy from the board, and take a long time to finish the tasks due to their inability to understand, analyse and interpret science content.

4.5.2. School entry age

The age at which South African children are permitted to start school in Grade 1 is five years. Even though it was expressed by only one participating teacher that school entry age is a challenge, it is a point worth noting. This insight was provided by Teacher Y2, who although he was teaching Grade 4 Natural Science for the first time, was a veteran teacher of more than 30 years teaching experience. He indicated his concern by stating that "I do not know if maybe it is because of Term 1, but what I can say is that these learners are too young to be in Grade 4, I am telling you. I say this because they can't hear me, some cannot even copy what is written on the board. They can't even complete a simple task that you give them". Looking at the school entry age prior to the amended SASA Act 84 of 1996, learners were required to start schooling in

Grade 1 at the age of 7 years, and to enter Grade 4 when they were ten years of age, but, after the amendment of the Act, they now start schooling in Grade R at the age of five and achieve Grade 4 when they are eight or nine years of age. Although this may seem to be only a slight difference, yet in child development the few years makes a difference to maturity for learning. Thus, concerns of learners entering the school system too young could be a point of concern to consider, as this coincides with their intellectual capability and emotional resources to do so.

4.5.3. Societal factors

In this context study, societal factors are common issues that negatively affect learners' ability to understand English as the language of learning and teaching in the science classroom. These include: the physical environment, biological/demographic factors, educational factors, economic background and political/departmental factors. Participant teachers in the current context suggest that Grade 4 and 7 learners struggle to use second language as a result of the societal or environmental factors in which they find themselves.

According to the data analysis the societal factor was counted four times by Teachers X, Y1, Y2 and Z1. Some of the societal factors stated by participating teachers includes learners' family educational and economic background. The environment in which learners interact is a primary source of their second language acquisition, according to the socio-cultural theory of second language acquisition. This means if learners only speak home language at home while they are only exposed to the second language at school, it might be the cause of poor enthusiasm for their English language development. Inability to practise the second language at home may be an indicator that their parents or guardian(s) are not educated, or have the same language difficulty so are unable to help their children. Schools usually provide text books as one of the learning resources for learners to carry at home however, with parents not being educated, the textbooks become resourceless as learners cannot use them independently without help. It can be assumed that the same instance with textbooks happens when learners are given home assessment activities such as homework, projects and assignments. Due to language difficulty which is the same with their parents', learners could end up not being able to write their home assessment activities whenever given. It can be assumed that learners' inability to write home

assessments hinders learners practice and development of the language itself and writing abilities which can also result in poor performance. It can also be inferred that teachers end up prioritising classroom assessments than home assessments. Looking at the economic background mentioned by the participants, some learners are disadvantaged only because they are coming from poor families which other than textbooks offered by the school, their parents could not manage any other resources to help them develop English.

4.5.4. Exclusion of language use in teachers' development workshops

One of the characteristics of constructivism theory for science learning is that a teacher acts as a facilitator by encouraging learners to explore their innovative ideas. This can only occur when learners are proficient in the language of instruction. Based on data analysis all the participating teachers confirm their intention to attend science development workshops. However, workshops do not indicate how second language should be used to circumvent the language barrier experienced by learners in the classroom.

As confirmed by Teacher Y1 who said, "*Yes, we do attend science workshops but not specific to the workshop you are talking about. I have never even heard of any workshop of such a kind anywhere around Mopani District".*

This might be the indication that exclusion of language in teachers' development workshops contributes to learners' inability to acquire second language, since teachers are only trained on the pedagogical aspects, while the expectation is that they should also be teaching a language of which they have no experience. In addition, it might be a clear indication that content subject teachers should be capacitated in the same way as language teachers are. Furthermore, it might be a sign that training teachers to overcome the challenges of using the second language in the Natural Science classroom is too heavy a burden for the department to address.

4.6. Strategies in managing challenges caused by English language in the classroom

Respondents were also requested to provide insight on some of the strategies that they used to circumvent the limitation caused by the use of English in their science

classrooms. The analysis of strategies to mitigate challenges is important for the current study in formulating recommendations. The following themes were generated:

4.6.1. Code switching and translation
4.6.2. The use of practical experiments and examples.

Overall, from coding at least 6 strategies were proposed with code switching and translation as well as the use of practical examples and experiments preferred.

4.6.1. Code switching and translation

Code switching in this context is defined as an action where teachers' shift from English to Xitsonga during learning and teaching, while translation refers to the process of converting English into Xitsonga in a way that the English meaning conveyed can be well understood by learners. According to the analysis, five participating teachers used second language translation as a strategy in their classrooms. Participants revealed the use of second language translation as a possible solution in their classes.
An assertion was raised by Teacher Z2 who said, "What I normally do is to explain and translate in learners' home language for understanding". One of the participating teachers indicated that he used simplified English and encouraged science learning using home language. By his own admission Teacher Y1 encouraged learners to rehearse what he taught them. Teacher Z2 provided an example of how English as a second language is translated to Xitsonga, saying "For instance, I will say when they talk about a leaf they mean 'rikamba' in Xitsonga".

The assertion by participants confirms that second language science classroom teachers are bound to convert the body of Natural Science terms that are used with a particular technical application into learners first language (Xitsonga), to help them understand the meaning of concepts. This, according to Teacher Y2, is itself problematic, "My challenge is that the translation also becomes problematic to me because I did not specialise in Xitsonga in my college education". It might be a clear indication that the inability of some teachers to effectively translate information into Xitsonga affects the meaningful learning and teaching of science. As far as the

translation of Natural Science concepts is concerned, the biographic information of some of the participants show that they do not have Natural Science qualifications. As such, it can be inferred that teachers lack of pedagogical content knowledge of the subject might be the cause of difficulties they have when translating science concepts since science has its own language. In addition, the translation challenge asserted by Teacher Y2 above might be a clear indication that for effective code switching and translation during science teaching, teachers should have the suitable PCK and proficiency in learners home language as well as English language of instruction. In addition, the translation of concepts might muddle the science meaning and thereby lead to misconceptions and misinformation being given to learners.

From the data, some of the teachers emphasised allowing learners to use dictionaries that are provided in the class, and where necessary, to consult with elders at home. A strategy that was referred to by Teacher Z1 is that “We normally advise these learners to use dictionaries … if you can see there (bookshelves) we have sets of dictionaries”. Teacher Z1 further recommended that there is a need for the development of science terminologies and dictionaries in our home language so that learners learn and understand better the use of second language as a language of learning and teaching. All of these approaches clearly indicate that there is no one shared solution of helping learners comprehend second language in the science classroom; it is each educator’s own responsibility to identify a strategy that is workable for him/herself. A point to consider is that when learners are encouraged by some teachers to use first language in science learning the learners’ opportunity to develop an understanding of the second language is hindered.

4.6.2. The use of practical experiments and examples

The constructivism theory of science learning emphasises the requirement to engage the learners actively in learning through practical and investigative activities of various kinds. This study contextualises practical examples, experiments and procedures that teachers use to test hypothesis, abstract or real-world, and includes demonstrations as part of the scientific method that aims to improve second language (Xitsonga speaking) learners’ understanding of science content.

Five respondents from the data indicate the use of practical examples and experiments to remedy the situation of understanding science content in the English

LoLT classroom. It was mentioned by Teacher W1 who said, “When I see that my learners do not understand how I teach them a particular topic, I use practical examples as science is all about practical experiments. The experiments help them comprehend a topic I will be teaching”.

Although teachers indicated to be using practical examples and experiments to enforce concepts and content understanding of learners in their classrooms, the concerning issue is that experiments do not develop learners’ reading, writing and comprehension of English language. As such it can be inferred that though practical experiments are used in the science classroom it does not solve the problem of inadequate second language proficiency. The reason being that learners should be assessed to determine their understanding of the content taught which will require their reading with comprehension to interpret assessment questions and writing ability to write responses. One of the teachers was adamant and reluctant in providing possible solutions. Given his many years of teaching experience, this is a concern. He stated only that, “changes should come from the department”.

4.7. Effectiveness of teaching Natural Science in English.

Based on their teaching experience, participants were asked to express their views on the effectiveness of English language as the language on instruction in the Natural Science classroom and the following themes were identified:

4.7.1. Ineffective in learning and teaching science
4.7.2. Effective in learners’ futuristic outlook.

4.7.1. Ineffective in learning and teaching science

The analysis of views expressed by teachers on the effectiveness of the use of second language English in teaching science in primary schools in Mopani East district, revealed a mostly negative response. Of interest from the current study was the question of the efficacy of using English for learning and teaching which seems to have diverse meanings to different teachers, irrespective of their position and expertise. However, the efficacy of second language in the science teaching situation was based on learners’ involvement, their ability to express their views or ideas, and

self-confidence/esteem when English is used compared to the use of Xitsonga during classroom discussions.

According to the analysis English is said to be ineffective in learning and teaching when compared to the use of first language in the Natural Science classroom. According to the participants there is no interaction when second language English is used, with learners harbouring negative feelings and displaying a lack of confidence while their interaction is energised when first language Xitsonga is used. The focus here is on the use of second language English as the LoLT. That interaction is pertinent is based on constructivism principles of knowledge that promotes social interactions between and among learners as being central to the building of knowledge by individuals.

No interactions when second language English is used: In cases where there is no interaction evident during the learning environment it may be an indication of the absence of learning. An observation confirmed by participating teachers during Natural Science classroom teaching, was that most learners are affected negatively on a personal level, expressed as ‘learners do not have confidence’, ‘are shy’ and ‘lack of self-confidence’ are descriptions repeatedly used by participating teachers.

Learners’ lack of confidence and shyness expressed by participants might not only means it is the use second language, but, an indication that the learner may have some emotional issues, or learners’ personality could be that he/she is cautious, or he/she is not used to speaking in public. In addition, it might be a sign of a teacher’s negative attitude or harshness towards the learner. Furthermore, there might be a lack of teachers’ motivation for learners to trust themselves and poor efforts to uplift learners’ self-esteem wherewith to handle challenges.

Learners harbouring negative feelings: These identified harboured negative personal feelings of the learners was explained convincingly by Teacher Z1 who said “These learners are aware that they are not good in second language so it makes them shy. When you pose questions, they are reserved to answer because they know they are sometimes struggling”. Of concern from Teacher Z1 is “The tendency of others to laugh at other learners for example; some want to say something and when they hear that he/she has failed to pronounce it properly they will laugh at that learner. Such

instances affect those with lower self-esteem but to those who have high self-esteem they do not have a problem. There are few learners who can speak English fluently".

It is evident that it is the teachers' responsibility to ensure that learners develop an interest in learning through their considering different aspects such as the learning environment, teaching techniques, classroom management, and lesson planning, as well as the selection of learning materials. Therefore, learners' negative feelings may be a clear indication that some of the aforementioned aspects have not been considered by the teacher e.g., the issue of learners laughing at each other clearly shows that there is poor classroom management which may negate learners' motivation to learn.

Interaction rejuvenates when first language Xitsonga is used: "English itself makes them look like they are very much disciplined, meanwhile they are not. Let's say we have a group discussion as you are saying, they will be too quiet and so passive, but immediately I say you can use your home language to talk about these things then I can hear voices.

The comments by participating teachers confirm poor learning and teaching processes when second language is used, compared to the use of first language that elevates learning and teaching in terms of learner participation and classroom discussion. However, the resigned approach underpinning teachers' opinion seems to emanate from the idea that the policy decision was made by the department with no possibility for discussion and change.

The learning and teaching process is said to be effective when the learning content outcomes are achieved by the end of the lesson, meaning that when teachers fail to achieve the lesson outcomes, due to the use of second language, the lesson is consequently ineffective. Therefore, as deduced from teachers' responses, this failure can be attributed to primary science learners' use of the second language.

4.7.2. Effective in learners' futuristic outlook.

As articulated by some participants in the study English is a global language used in different governmental, commercial and entrepreneurial industries. It is the language of choice for learning and teaching at many academic institutions worldwide and in South Africa, and is a prerequisite for schooling. It is viewed as illuminating learners' educational journey and prepares them to build their future. English is employed globally as a means of communication.

As expressed by one of the participating teachers, "To me English is effective because we are teaching these learners to be independent in life, and to be able to compete with the rest of the world, they need this English. It is effective, as we know that English is a language of instruction and it is globally a common language of communication".

In order to exchange information amongst a group one requires the English language as a communication tool. These views provide a clear indication that without English as their second language, learners could not proceed with their educational journey, nor would they be employable. Based on participating teachers' comments, it can be deduced that English is not effective enough in the classroom as it results to some challenges. Regardless of its unworkability to reach effective teaching process, its use in the global environment plays an important role that could not be avoided.

4.8. Lesson observation

Lesson observations were arranged in order to have a practical insight on the challenges of using a second language in teaching Natural Science to primary school learners. As such 4.8.1. to 4.8.4 below analyses the results of the lessons observed.

4.8.1. Classroom interaction

Teachers X, and Y1 mostly used second language by which to interact with learners, and only switched to first language when it was clear that the learners did not comprehend what was said. It was noted that Teacher W1 relied more on home

language teaching than on second language during learning and teaching. An interesting observation made regarding learners in all classes was that they only used their first language to interact with each other. In Teacher X's class learners sing-song chorally answering questions in English making it impossible to identify who could not understand what was said by the teacher. Furthermore, the lesson appeared be a revision of what was already previously taught during the class. It should be noted that when learners sing together it is difficult to determine who is having difficulties, as they vocally follow each other's lead. However, the observer, by lip reading, could pinpoint who was merely singing rote and incorrectly. Peer-peer discussion was practised by Teacher X where learners were given an opportunity to choose items around them by which to identify various physical properties that make the item fit for purpose. The discussion in Teacher X's class was observed to be effective because learners were actively talking and listening to each other using their Xitsonga language.

There were no full interactions and discussions during the teaching lesson observation of Teacher Y1. The observer noticed passive learner interaction apparently due to Teacher Y1's mostly total use of the English second language. Most of the learners in Teacher Y1's class were very quiet and very few responded to the educator's questions. Many seemed to be left behind in the lesson due to their inability to comprehend what the teacher taught mostly in English as the LoLT. However, learners were allowed to discuss as a group possible answers to the questions raised during the class, although the seating arrangements and the class size were not conducive to facilitating meaningful discussion. The class discussion was generally observed to be ineffective because only a few learners managed to offer suitable answers. Tellingly most of the learners struggled when they were given a chance to express their views to their peers in English, and only those with some English knowledge managed to share their ideas, and benefitted from the discussion. The learners seemed confused and were passive when English second language was used, but became active when the educator switched to their first language. Learners were permitted to discuss amongst themselves using first language what they thought would happen when margarine is placed into a microwave and heated. Learners were interested and engaged due to the materials, and because the language used was familiar to them.

4.8.2. Use of practical examples and experiments

The observed lesson delivery mechanism was the use of English and Xitsonga by all teachers and included the use of practical examples and experiments by Teachers X and W1 which helped the learners easily develop an understanding of the subject content. However, the way in which learners responded to Teacher X suggested that they were trained or previously taught the content prior to the researcher's observation date. An example provided by the observer to substantiate this claim is when the participating educator asked, “What is the physical property of the materials?”, the learners responded in a sing-song chorus saying, “It is something about the materials that is used to describe how it behaves, feels, and looks”. It was therefore obvious to the observer/researcher that the learners were given time to practise the lesson answers to avoid challenges that may have been identified by the observer had their answers not been rehearsed. Due to Teacher W1’s large class size and time constraints, learners were not easily divided into groups, so practical experiments were not effective as it benefitted only those learners who were physically alongside Teacher W1.

4.8.3. Code switching

The use of Xitsonga and English and mixed codes were mostly observed when learners struggled to comprehend the use of English second language as the language for learning and teaching. Mixed codes were used even though learners were not receiving the lesson for the first time. As per observation, there were times where the language became difficult; for example, learners were asked to explain what it means when a material is said to be flexible. The learners failed to provide the answer, and participating Teacher X was bound then to use learners' home language. A similar observation was made during Teacher Y1’s lesson in that the majority of learners had difficulty with the second language questions, so the teacher was compelled to translate the questions into the learners' first language so they could understand and answer them. According to the teacher, most of the questions were based on what they had already learnt, but participation in English as the second language was still very poor. Based on what was observed as is reported above, the manner and language in which questions are framed, influenced learners’ performance. This is not only because of the language used, but a change in question format also resulted in failure to comprehend what was required. For example:

A mixture made up of a solid that can dissolve in water is called _____. When sugar dissolves in water, the mixture is called a _____.

The learners failed to understand what was required until the question was clarified in Xitsonga in a format with which they were familiar. The same difficulties in understanding assessment questions were observed in Teacher W1‘s class where some learners wrote answers in Xitsonga while others copied the questions as they were. This may indicate that the high science failure rate in primary schools is due to the second language barrier experienced by learners.

4.8.4. Non-Verbal information

For non-verbal lesson information observation, use was made of **lesson planning**, **learning and teaching support materials (LTSM), classroom management,** and the general **learning environment**. These elements were observed because they play a vital role in learners’ behaviour, participation, interaction and interest in effective constructivism learning. All the classes observed showed good classroom management, consequently teachings were carried out without lesson planning to direct learning activities. However, both Teachers X and W1 used some LTSM to enhance learners understanding of the content topic they taught. Teacher Y1’s class was relatively clean but overcrowded with ±85 learners who were accommodated in the school’s mini hall, and not in a classroom. The teacher was stationed at the front, and did not move around to the learners. These factors could have a compound negative effect causing learners’ inattention during lessons. Teacher X despite his limited experience nonetheless appeared most capable of mastering and applying professional procedural knowledge and skills; he continuously moved around the class, making sure that every learner was directly engaged in the learning process. An educators’ movement around the class plays an important role in learner participation. By the educator standing at one fixed point the more restless learners may be distracted and become distractable to others. By moving around the learners Teacher X identified which learners were not focused on their work. The researcher observed that in Teachers W1’s class, although it was overcrowded, she tried to foster learners’ participation by moving around her class

4.9. Data interpretation and discussion

Data interpretation and discussion is based on the constructivism theory of science learning that shows that learners construct or create new meanings using the knowledge they already have, based on their current and previous social and environmental experiences. It also makes use of sociocultural theory of second language acquisition which believes that learners' acquisition of second language lies in their social, cultural and environmental factors. The data interpretation and discussion of the study will be built from the themes identified during the data analysis.

4.9.1. Challenges of using second language in teaching Natural Sciences to primary learners.

The data analysis of the research study revealed that learners' inadequate English language proficiency (inability to speak, read, write and comprehend the language) as the main challenge in the Natural science classroom. The challenge is therefore discussed below.

4.9.1.1. Inadequate language proficiency

What emerged from this study is that teachers experience learners' inadequate language proficiency when teaching Natural Sciences to primary school learners. Meaning that second language learners have difficulty in speaking, reading and writing in their second language in the science classroom. In reflection Teacher Y1 commented that "*Learners do not hear, write or speak English which is used as a language of instruction for all; obviously when these learners cannot read nor write, what do you expect?"*

Language is acknowledged as a tool to access knowledge and information in the classroom by Mohohlwane (2020), and also as an instrument that permits learners to explore diverse ways of thinking (Barana et al, 2019). Unfortunately, the majority of second language Natural Science primary school learners cannot read, a very few of them can read haltingly, or they read without understanding (Fesi & Mncube, 2021). This is emphasised by teacher

This means that effective learning and teaching in the constructivism classroom is driven by verbal interaction between the teacher and learners. From the participants' responses it is evident that learning and teaching in the second language science classroom is hindered by learners' inability to speak, read and write their second language. This is agreed by Teacher Z2 who emphasised that "learners find it very difficult because many of them cannot even read a single English due to the language barrier". In agreement to Teacher Z2, Teacher W1 show that "it is difficult to those who cannot read this second language with understanding. Some can't read in grade 7, some can't even write their names". This is in agreement with Charamba and Zano (2019) and Pretorius and Klapwijk (2016) who also found that English learning to second language primary school learners is a reason of their inability to read and write. Findings of this current study supports Gudula (2017) who argued that in South Africa's Natural Science classrooms learners are bewildered and confused during the learning and teaching process when the second language (English) is used, due to their failure to grasp and comprehend (hear) what teachers say. Furthermore, lack of language proficiency is a stumbling block prevent learners' ability to articulate, seek clarification, and request explanations, and to ask questions. Coinciding with the current study Robertson and Graven's (2020) results indicated that without being able to read, write and speak and without the ability to use the language of instruction, learners' ability to reason, think, argue and defend their thinking is hindered. This is echoed by Rivard, 2004, who posits that reading, writing and oral interaction are part of the meaning making process between a teacher and a learner (Rivard,2004). Adding to the disadvantages resulting from learners' inadequate proficiency in the language of instruction, Presloo, Rogers and Harvey (2018) aver that learners are delayed in the acquirement of science literacy, which is substantiated by Larsson and Jakobsson (2020). In their study, they argued that there is a close connection between language use and knowledge building in the science classroom. They argue that adequate proficiency in the language of instruction enables learners to move between the language itself and the scientific language, which increases their ability to understand the subject content in depth; unlike limited proficiency that leads to incomprehension of the subject content and poor performance, as is argued by Nyika (2015). The same findings by UNESCO (2016) shows that the inability to apply (speak,

read and write) the second language as LoLT impedes learning opportunities in learners.

4.10. English Second language impact on learning and teaching of Natural Sciences in the classroom

The data analysis of the research study revealed that English has a negative impact in the science classroom, therefore 4.10.1 and 4.10.2. discusses how the challenges affect learning and teaching of Natural Science in English as a second language.

4.10.1. English second language impact on Natural Science learning

According to participants' responses, English is the central cause of learners' poor understanding of the subject content and assessment questions which lead to poor performance as discussed below.

4.10.1.1. Poor understanding of the subject, assessment questions and performance

Second language learning and teaching is said to be the core barrier to learning Natural Sciences for many learners in South Africa (Prinsloo, Rogers and Harvey; 2018). This is due to the fact that they are expected to simultaneously acquire a new language and to learn the subject content (Kim & Wai (2007). One of the study findings reveals that learners' inadequate second language proficiency poses negative consequences for learners learning ability which results in a poor understanding of the subject content, assessment questions and performance. To corroborate this finding, teacher Z1 states, "*It does affect learners' performance because if they do not understand the language itself, obviously they will not provide the right answer as expected. This literally means they are not going to do well if they do not understand the questions. They do not perform well in science because of the second language"*. In agreement with the comment above, Gudula, (2017); Prinsloo et al (2018); Thobejane (2018) and van Zyl, Bezuidenhout & Adefuye (2020), avow that poor proficiency in the language of instruction has had a great impact on the science curriculum with learners experiencing many learning challenges due to poor language proficiency. In support of the authors argument Oyoo and Nkopodi (2020) assert that effective learning takes place only when learners are proficient in the language of

instruction. Since science materials, assessment questions and lessons are presented in second language (Charamba and Zano, 2019), learners experience difficulty in comprehending second language science materials and the content presented by their teachers in the classroom (Al Zumor, 2019). The complexity of second language in study materials and assessment questions does not only affect primary science learners but also impacts university students (van Zyl et al, 2020). In his research Thobejane (2018) argued that learners' inability to understand speak, read and write the second language restricts them in all subjects. (Netshivhumbe & Mudau, 2021). The subject also requires learners to examine information given in the form of illustrations and to present such information in writing (Nuangchalerm & El Islami (2018) such as the knowledge of scientific theories and how to apply them (Nethivhumbe & Mudau 2021). It is a burden for learners with second language reading and writing difficulty to easily absorb and internalise science language, its concepts and content, together with the language in which it is taught.

In their research Malebese, Tlali and Mahlomaholo (2019) and Shaturaev (2021) support the current study finding by showing that language proficiency has a profound impact on learners' science performance. This is believed to be caused by the complexity of second language vocabulary (Panganiban & Mandrigal, 2021) that denies learners the ability to correctly produce what they know and understand (Ledesma 2021) and denies them their opportunity to correctly construct words, syntaxes as well as sentences to express their knowledge in writing (Panganiban & Mandrigal, 2021). Similar findings are revealed by Al Zumor (2019) showing that second language science assessment questions are so difficult for learners to comprehend and answer that they feel pressured, nervous, distressed and discomforted, which leads to poor performance delivery. According to Shaturaev (2021), the higher the learners' second language proficiency, the higher their involvement in the learning process and the better their performance. Regardless of learners' difficulty in the second language, assessment questions should adhere to suitable standards for learners' proximal development (Bennet and Dunne, 1994). As such Natural Science formal assessments have proper standards to accommodate a variety of cognitive levels that are suitable for learner's age and progressive grades (DBE, 2011). In addition, learners are expected to apply their cognitive skills to answer

low, middle and high order questions. Furthermore, within these cognitive levels learners should be able to express in writing their science knowledge and application, uncover their understanding of the subject and be able to evaluate, analyse and synthesise scientific knowledge. The language obstacle may possibly lead to learners having difficulty in understanding the examination questions. This is emphasised below by Teacher W1 who confirms the difficulty of second language assessment questions to second language learners.

" Many learners can't read, though some can read but cannot understand what they read, even in writing it becomes problematic. As a person you can only write what you understand so that what you write can make sense. Some just copy the questions as they are in their answer sheet. So obviously they cannot perform as they can't understand what is required from them. In so to say they poorly perform. In so to say they poorly perform". In agreement to Teacher W1, Teacher X show that" *Learners are unable to understand assessment questions and they end up not performing".* However, this is in contrast to teacher Y1 who commented that *"the difficulty that learners experience actually depends on the one (teacher) who is actually giving them information. Whenever I give them assessments, I make sure that I explain all the terminologies and all what they must do. So let me say No, they don't find it difficult.".*

Based on the teacher's comment above, it is the researchers view that school-based assessment questions tend to ignore high order questions in order to cater for learners' language deficit which denies them the development of cognitive skills while delaying effective learning. It is also clear that learners cannot read with understanding in the science classroom nor correctly interpret assessment questions to provide correct answers. This is in agreement to Maluleke (2020) who found that most learners are unable to interpret and elaborately to provide answers in high order questions. It is also emphasised by Pun and Macaro (2019) who also found that second language learners cannot answer higher-order questions and in that way, teachers have to use lower-order questions to quickly finish the content of the curriculum.

However, natural science formal assessment tasks are set and moderated at the district or provincial level by the subject specialists (DBE, 2011) with more high order questions that require descriptive answers. As such, meaningful reading is crucial for learner's academic science performance (Malebetse & Mahlomaholo, 2019). It is also

believed from recent literature that learners' reading in science is a significant instrument that determines learner performance; reading matters more than the subject itself and requires high contemplation in science learning and teaching (Zhu, 2022). Learners' inability to read the second language science texts with understanding obviously decreases their chances to perform optimally in almost all science assessment activities. To confirm the statement above, one of participating learners in Nkengbeza, Zulu and Shilunga (2018: 18) commented that, "*Sometimes I don't understand when being taught by the teacher and sometimes I don't know what the questions mean because it is in English and sometimes do not, know what to answer*". Unfortunately, the difficulties that second language learners experience during examinations results in them answering questions incorrectly, which lowers their marks to a mere pass mark (Charamba, 2019) or a fail. Poor concepts comprehension (Sikhombo, 2018) is another challenge for learners to answer any questions resulting in underperformance (Letshwene & du Plessis 2021). Based on different statements arising from this study it is evident that lack of competence in the second language is the cause of learners' poor performance.

4.10.1.2. Poor classroom discussion.

Teacher and learner interaction in the science context is interlinked with achieving all science learning and teaching outcomes (Stinken-Rösner et al, 2020). Based on the literature, learners do not come into the classroom as *tabula rasa* but with personal schemata acquired from their environment that is used to understand the world (Bennet & Dunne, 1994). Learning in a constructivism classroom is centred and built on learners' background knowledge and experience (Milena & Petra, 2021) in order to construct their own knowledge. Therefore, learners should ideally use language proficiency to reason, contend and preserve their insight (Robertson, 2017). Through teachers' guidance, learners should collectively engage in discussion (Isik-Ercan, 2020) to make connections between their background experience and the new knowledge (Bennet & Dunne, 1994). The teachers' role is not to transfer knowledge but to direct, develop, encourage and engender self-esteem by guiding the learners in constructing knowledge based on what they already know (Jampel et al 2018). Encouraging learners to construct knowledge based on their own experience is crucial for the development of learners' evaluation, analysis, synthesis, exploration and

interpretation skills (Leasa, Corebima & Batlolana, 2020). It is also thought to provide learners with an opportunity to think critically (Lubben et al, 2010). Building on prior knowledge is also important for learners to structure their ideas, make decisions and solve the different socio-scientific problems they may encounter on a daily basis (Nair, Chugani, & Thangavel, 2020). In their research on classroom discussion Murphy, Firetto, Lloyd, Wei and Baszczewski (2020) declare that classroom discussion endorses learners' understanding of texts, scientific reasoning, collaborative capability, language proficiency skills, and elevates their understanding of the subject content. However, what has emerged from the current study is that inadequate second language leads to poor learner discussion. In evidence of this, teachers' comment that *"Let's say we have a group discussion as you are saying, they will be too quiet and so passive, but immediately I say you can use your home language to talk about these things then I can hear voices".* The Language chosen for communication is vital to enhance learners' involvement (Liwanag & Labor, 2016) in the science classroom. Teachers' comments reveal that learners' inability to participate in classroom discussions during science teaching is due to the second language barrier. Based on the researcher's observations and on teachers' insights, difficulty in the second language results in learners being unconfident, insecure, nervous, and shy to speak. To reinforce this statement, Teacher X said *"When English is used learners find it difficult to comprehend most of the aspects when you interact with them. They are not able to clearly articulate themselves when English is used and not confident enough. They are always shy away from participating but when their first language is used is where they fully participate.* Teacher W1 also agreed with Teacher X showing that *"learners cannot even interact in English as it is a barrier. They discuss fully when Xitsonga is used. When you ask them to translate what they discuss about into English, they can't "*. In agreement with the current study's finding, one of the participating teachers in the Namibian research by Nkengbeza et al (2018) confirmed that shyness is one of the obstacles hindering learners' ability to share their ideas and to be self-assured in their science content knowledge and responses. In addition, the authors' participants avowed the same as the current study with participants showing that there is a tendency of some learners to laugh at others' language mistakes, which shames the learner and discourages their attempts to express themselves. As a result, only those few learners who can interact will be involved in the learning process,

resulting in teachers avoiding classroom discussions, (learner-centred) and relying on traditional teaching (teacher-centred). In agreement with the current study findings Quansah et al (2019) show that due to the second language barrier, learners fail to express their views or to exchange their scientific experience. In addition, language hindrances impact negatively on learners' attention and motivation, while it injects a negative attitude towards learning. In that way second language becomes an obstacle that hinders many learners' classroom discussions. In his research Al Zumor (2019), avers that second language usage denies learners the ability to communicate and engage in inquiry learning. Conversely it is avowed by Robertson and Graven (2019) that learners' ability to use second language allows them opportunities to participate in classroom interaction by harnessing learners' curiosity, creating more focus, and encouraging them comprehensively on expressing their inputs with their peers and teachers. Based on the current research finding the researcher contends that group discussion is not properly implemented and unworkable in primary science classrooms, because learners cannot comprehend what their teachers say. According to Milligan (2020) learners with English language barrier could not even hear what their able peers say due to the English second language barrier. In addition, it is inequitable and problematic to place learners at the centre of learning, when, by trying to grasp the second language, they grapple with the fear of being incompetent, which damages their aptitude, self-confidence, self-esteem and intra-motivation. As a consequence of placing this burden on them, learners become passive receivers of knowledge placing teachers at the centre of learning. In agreement to this, Teacher W2 said: "*Let's say we have a group discussion as you are saying, they will be too quiet and so passive, but immediately I say you can use your home language to talk about these things then I can hear voices"* In contrast to Teacher W2, Teacher W1 indicated that "*They participate fully when Xitsonga is used than when English is used. They also enjoy answering questions in their home language but when English is used many of them withdraw and become quiet"*. Although some participants indicated that classroom discussion in Xitsonga is fruitful, this is counter argued that for science learning to be successful discussions should be learner centred to be prolific and sense making, which does not happen when the second language is employed in the lessons. In their research Syarifuddin and Atweh, (2021) argued that putting teachers at the centre of learning (which takes place when science teaching is in the second

language [English] repudiates learners access to independent learning and interactions to share ideas with each other. The lesson audio recorded data of Zhou and Mann's (2021) research revealed that the complexity of learners' ideas to share in the second language leads to them rejecting the second language to use their first language (Mandarin) in the science classroom. The researcher's current study findings corroborate this, as stated by a participating Teacher X who remarked that, *"Only when Xitsonga is used during discussions, that is when the learners fully participate and the discussion will be very interesting and fruitful, unlike when we use second language".* This confirms that although some teachers successfully make use of classroom discussions in the second language, in general, they usually use learners' home languages, thereby denying learners' the opportunity to develop the second language. This encourages mastery of their first languages while diminishing the second languages' contribution to the majority of their academic subjects.

4.10.2. English second language impact on Natural Science teaching

As indicated in 4.10, not only does English as the language of instruction in the Natural Science classroom poses negative impacts on learners learning but, it is also said to lead to teachers teaching time consumption for curriculum coverage. The impact is discussed below.

4.10.2.1. Teaching time and curriculum coverage

Outlined in chapter 2, Natural Science constitutes four strands; Life and living, Matter and materials, Energy and change, as well as Planet Earth and beyond. Each strand is allocated a ten-week period in which it is to be taught per term (DBE, 2011). The Curriculum Assessment Policy Statement (CAPS) clearly gives the topic framework to be covered in each strand, and it enumerates the number of hours teachers are to spend on each. To ensure that teachers adhere to the stipulated curriculum per term, school subject Departmental Heads (DH) together with science teachers draft and implement subject policy that clearly outlines the number of informal activities to do per week and states which informal activities to do per term. Teacher's curriculum coverage is monitored by checking their learners' books for the number of assessment activities carried out, and by the topics covered by DHs.

The current research demonstrates that learners' inadequate proficiency (inability to read, write and speak) in English leads to teachers' failure to cover the curriculum and results in their lagging behind the pacesetter, leading them to rely on translation and code switching as a strategy to promote and support learners' understanding of the subject content. Teachers believe that the time used for this strategy to enhance learners understanding in this manner takes longer than it should for curriculum delivery. As Teacher W2 remarked that, "*Due to learners' inability to understand what we usually teach in second language, I fail to finish or perform to the expected level. Then it has come to me that the aim is not to cover the curriculum but to deliver quality education, so the issue of translating everything hinders my performance".* In agreement to Teacher W2, Teacher Z1 emphasised that "*the performance is somehow affected in such a way that I cannot deliver as expected in a time. There is always a time delay as a result of learners in ability to understand the second language used and that means I will have to consolidate and integrate between language and subject content*". However, in disagreement with the two teachers Teacher Y1 said that " *You know I use English and my learners do pass a lot and I like it. To me it is very good and doesn't affect my performance anyway".* Based on the above comments by participants, the researcher argues that due to teachers' inability to finish up with the curriculum set for each term, learners progress from one grade to the other with the knowledge gap. As such failure to fill in the gap creates a failure loop hole in learners' science study route. It is researcher's pleasure therefore, to argue that the causes of failure rate in the Further Education and Training Grades is usually due to a huge knowledge gap created from learners' intermediate-senior phase grades (4-9).

In agreement with the research finding, Netshivhumbe and Mudau (2021) confirm that the time allocated for the Natural Science curriculum learning and teaching process, which also includes practical experiments, is insufficient compared to its overload time demand. In addition, with learners inadequate second language proficiency making it difficult for them to easily comprehend concepts, teachers are bound to translate into the home language, which means that the lesson progresses more slowly to accommodate the learners' level of understanding. Such practices as a result of LoLT, and curriculum overload has a negative impact on teachers' performance stratagem to cover the subject curriculum (Netshivhumbe & Mudau, 2021). Based on the above statement the researcher argues that teachers' efforts to keep in line with the allocated

time for each topic strand in the curriculum, while providing as many activities as possible, may result in learners receiving poor quality science education. Consequently, teachers teach for quantity rather than for the quality of education that the Limpopo Department of Education aims to provide. It has also been observed in the lesson observations that teachers do not bother themselves in preparing for lessons, but take along the Annual Teaching Plan (ATP) as their main LTSM. This practice, according to the research, may be due to the burden lesson planning for science in the second language places on teachers. Understanding of Natural Science in the constructivism classroom is a process of gathering knowledge realities, science terminologies, ideologies, and models (Laksana, 2017). Natural science learning, according to the author, is no longer about memorising. The current study view is that for meaningful learning and teaching, the subject requires proper planning. Planning assists teachers in managing the time allocated for the learning and teaching period, covers different learning activities including assessments, and effectively presents the subject content to ensure that learners develop new scientific knowledge, while also considering intervention strategies to solve learning challenges identified through lesson reflection during the learning and teaching process (Magano, 2009). Therefore, regardless of the fact that teachers suffer from curriculum overload, poor performance may be caused by their lesson unpreparedness. Furthermore, it is observed that learners are not permitted an opportunity to construct their own knowledge or to ask questions since teachers only read and rely on the ATP, resulting in teacher centred learning which can also be the result of unpreparedness.

4.11. Perceived factors having an influence on learners understanding of English as a language of Instruction

Participants were asked to outline their views on the factors that lead to learners' inability to speak, read, write and comprehend English as the LoLT, the identified factors are discussed below.

1.11.1. The language of instruction in the Foundation Phase

With regard to the perceived factors that influence learners' understanding of the second language as a language of instruction in the Natural Science classroom, the findings of the study revealed that most teachers concur that "South Africa's education

policy allows learners to be taught in their home language until they get to Grade 4, so by the time they switch to using the second language as a language of learning, it becomes challenging for them as it is not a language they are familiar with".

South African public schools use learners' home languages for learning and teaching in the Foundation Phase Grades R-3, with English first additional language taught as a subject (Wildsmith-Cromarty & Balfour, 2019). Teachers' reality as evidenced in this study is reinforced by Gudula (2017) who asserts that home language use in the Foundation Phase appears to be advantageous to learners, but the problem is when they proceed to Grade 4 where they are expected to transition to English as the second language for learning and teaching. This places learners at an extreme disadvantage as their experience of learning and teaching is of their first language usage. Resultantly learners cannot read and write in second language (Fesi & Mncube, 2021). Consequently, many learners progress to Grade 5 without a comprehensive knowledge of the English and science language. Wildsmith-Cromarty & Balfour (2019) argued that indigenous LoLT in the Foundation Phase negatively affects learners' second language comprehension and interpretation. It is interesting to note that these arguments above, and the argument of this thesis, concur, in contrast to literature that believes that using home language in the Foundation Phase constitutes a positive educational impact, for example Nomlomo and Katiya (2018), argue that learners' home language development advances the development of the second language, suggesting that the exclusion of learners' home language in the early stages of schooling impedes their cognitive abilities and language growth. In agreement with the authors' findings, Mashige, Cekiso and Meyiwa (2019) argued that knowledge development in one language provides input to understanding in other languages. Furthermore, home language in the Foundation Phase is likely to better learners' performance. According to Salie and Moletsane's (2021) assertations, for a smooth transition between home and second language, the use of learners' home language is vital. The authors point out that home language teaching promotes learners' full participation and rapid development of literacy skills. The findings by Botha (2022) who's argument disagrees with the current findings shows that the use of home language in the Foundation Phase helps learners to effortlessly access the curriculum content and assists them understanding every word in the classroom without having to translate into their languages. The author further avers that home language teaching

creates a movable pathway for a learners' educational journey. According to the sociocultural theory of second language acquisition, language develops as individuals interact with their surroundings, including home languages that are spoken by learners. It is researchers' insights that language develops more favourably at an early age. Therefore, although first language is confirmed to have advantages in learners' learning, introducing English language at an early age might allow them an opportunity to practise and more readily develop better second language proficiency. In confirmation Teacher Y2 said that "In Xitsonga we say 'Rigogo ri songiwa raha tsakama' (which in this context means, it would be easy if learners can be allowed to learn English at their early age than when they are grown), for this I argue that the root of the problem is in the Foundation Phase, here is where the solution must come from. It is not easy to resolve the language issue in the upper grades because already learners have soaked the use of Xitsonga". This is also agreed by Teacher X who emphasised that "the introduction of second language as soon as learners start with their schooling to put them in a position where they can learn the language early to enable them to understand the science content" This is agreed by Tikly et al (2018) and Mcknney and Tyler (2019) who also found that all challenges of using second language can be reduced through the implementation of English from learners' early years of schooling. It is important therefore that English be introduced earlier in learners' Foundation Phase education.

4.11.2. School entry age

Another important finding of the study brought to light the issue of South Africa's school entry age, which is viewed as a factor leading to learners' inability to understand second language. This researcher's informed view is that while it is usual for education departments to establish an entry age for when learners begin their basic education, countries differ on which age is ideal. Education departments manage and control the entry and progression of pupils from one grade to another (Skedsmo, & Huber, 2022).

According to the South African school admissions policy, learners' entry to Grade R, which is the first primary schooling grade, requires that a child be four years old and turning five by June (Government Gazette, DBE, 2021). The country's Foundation Phase education covers grade R- 3, these grades constitute learners aged from 5 to nine years (Janse van Rensburg, 2015). According to the author, it is in this phase/age

group where learners develop multiple useful skills for official schooling including; counting, talking, attainment of identity, and writing. In later years, the aforementioned skills are used to develop second language to learn, communicate, read, write (Janse van Rensburg, 2015) and obtain knowledge.

Based on the researcher's extensive interpretation on the aspect of learners' entry age, although learners completed Foundation Phase education and are believed to have acquired the basic official schooling requirements as stated by Janse van Rensburg (2015). The need for second language use in the Grade 4 science classroom seems to be beyond learners age capabilities. To emphasise a statement above, Teacher Y2 said that "What I can say is that these learners are too young to be in Grade 4, I am telling you". Learners seem to have entered school very early to be too young in Grade 4''. According to Janse van Rensburg (2015), the effectiveness with which learners understand the subject content in formal learning and teaching is measured by their level of learning readiness. In agreement with the current study results, Marcenaro-Gutierrez and Lopez-Agudo (2021) argued that the youngest learners in the classroom, due to their early entry age, show inferior educational attainment in relation to the older learners. This impediment is reduced as learners progress in age and exposure to learning. Based on McMurray's (2021) findings of the Irish context, children at the age of four and five might not be prepared for official primary education or classroom lessons. It is emphasised that learners who begin formal learning at an age younger than their peers (those born after June) struggle educationally. These effects tend to continue during the course of the learners' education. In their research on the South African context of early learning experiences, school entry skills, and later mathematics achievement, Visser, Juan and Hannah (2019) disagree with the current study findings by concluding that early age learning stimulates learners' cognitive development.

However, the South African context doesn't have enough researched literature to agree with or argue the current findings. However, one of the interviewed participants in Gudula's (2017) research on the influence of language on the learning and teaching of Natural Sciences in Grade 7 identifies age as a causative reason for learners' inability to comprehend second language in the science classroom. Regardless of scarce literature on the South African context of early learning in this current theme,

comparing the experience here to what is happening in Spain, Ireland, and Chile, it is evident that school entry age has an impact on academic achievement. It is often the case that learners who start schooling early struggle to cope with the second language, while those who start later, achieve it effortlessly. This situation changes as children mature neurologically in their later school years.

4.11.3. Societal factors

The findings of this study reveal that societal aspects are perceived to be hindering learners' acquisition of second language. According to the sociocultural theory of language acquisition, learners' language development is constructed by means of the different environmental factors around them. These may include their cultural beliefs, socio-economic and educational backgrounds and parental involvement among others. It is proven by a decade of literature that learners' environments play a significant role in their linguistic developmental skills (Spaull, 2012). It is also agreed by recent studies that learners background and socio-cultural experiences are a foundation to their language development (Malebese, Tlali & Mahlomaholo, 2019). Nevertheless, learners' environments are not providing effective support for the attainment of the language used for teaching and learning except in the classroom. The reason for ineffective support is that most of the learners live with their uneducated grandparents, while some are from disadvantaged backgrounds to help them with suitable resources for language development. Emphasised by Teacher Y1 "*You know, the main factor that leads to the learners' inability to understand English is their environment. The background where these learners come from is the main factor. The way they play and even what they usually watch on TV seems to be of no positive influence in their lives, simply because they cannot hear what they say in the different programmes they watch"*. In agreement to Teacher Y1, Teacher Y2 said "*I can say where they are coming from, the environment (their families) and even the lower grades they were is the cause*". This is agreed by Maodi (2018) and mavuru and Ramnarain (2019) who found that the majority of second language South African learners rarely use English language outside the classroom environment but, get exposed to it only in the classrooms with their teachers. Various literature in agreement with the current research findings such as Thobejane (2018) makes the

incontrovertible point that second language learners are not exposed enough to the language outside of the institution of learning.

In concord with this notion UNESCO (2016) reports that learners from disadvantaged backgrounds are unable to speak the language of the classroom which inevitably limits their learning, and according to Grissmer's (2003) findings, the parents' level of education is the greatest factor in encouraging and motivating a learner's performance. It is highlighted by Okey (2020) that whatever influences the learners' developmental setting will potentially have, either positively or negatively, will affect their personality or even their academic performance. In addition, parents' academic experience has a profound impact on the learners' language development. According to Salameh and Sathakathulla (2018), it is inevitable that parents' knowledge and experience of education will impact on their role as their children's co-teachers, and with a good general knowledge and exposure to the second language they can provide the necessary materials and tools that their children need to achieve in a second language science classroom. Therefore, learners whose parents are highly educated tend to achieve better results than learners from a family of unlettered parents (Okey, 2020).

The view that social aspects are an influence in second language acquisition is acknowledged not only in the South African context, but also in other countries internationally. A Bangladeshi research report states that the outcomes of the study by Pinilla-Portiño (2018) on the social aspects of influence on learners; argues that the socioeconomic status of learning English as a foreign language proves the substantial variances of results based on the learners' socioeconomic status and their opinions on second language acquisition. For instance, pupils from socioeconomically underprivileged families were cognisant of the significance of learning English as a second language because of English's variable benefits. Conversely, the research discovered that scholars did not understand the influence of the worth of English due to the unfortunate educational circumstances of their rural schools (Pinilla-Portiño, 2018).

It is the researchers' considered view that culture is also an aspect of influence of learners' second language development. Based on the researcher's cultural and traditional experience, speaking English at home, especially in rural villages, is

considered pretentious. This cultural attitude is an obstacle delaying second language development for many learners. Those who speak the second language at home may suffer the consequences as their community may ostracise them, claiming that they exhibit self-pride. As a result, such learners revert to their first language and rely on schools as their only source of developing the second language (Robertson & Graven, 2020). Relying on schools as the only source of exposure to the second language is not enough for learners to fluently develop second language proficiency. This is because for language to develop effectively, learners need sufficient communication opportunities in that language with their peers (International Conference on Global English, 2012). Argued by Sun (2019) individuals' cultural traditional perspectives may lead to positive or negative attitudes. The author avers that attitude is comprised of four aspects: 1: The intellectual aspect where the person has certainty in something that needs to be done (that is, to learn the second language); 2: The ability to learn the second language; 3: The passion to achieve learning the language; and 4: conation being the intent followed by the action to achieve. In addition, attitude drives the imagination and enhances the mental capacity of the learner in second language. It is the propensity of learners' reasoning, sentiment and willingness to act in acquiring the second language. Therefore, approach certainly has an imperative part in learning the second language. After a decade of literature in bilingual research, Baker (1988) has accentuated the connotation of approach. It is therefore noteworthy to conclude that the attitude of Xitsonga culture towards the second language is negative and consequently confers negative impacts on learners' second language development. In support of this conclusion of sociocultural theory the current research emphasises that learners' interaction with their environment and culture play a crucial role in helping or hindering them in development of a new language. According to Thobejane (2018) learners are not given adequate support at home for second language development; they rely on schoolteachers as their only source of the second language acquisition. Therefore, it can be stated that learners lack of exposure to second language in their societies hinders language development, and is a cause of learners' lack of confidence and ensuing grammatical problems (Nkengbeza, Zulu & Shilunga, 2018). Essentially, it becomes the school's responsibility alone to promote the second language in the sole environment available to and conducive for second language learning and proficiency (Nkengbeza, Zulu & Shilunga, 2018). It is thus teachers'

responsibility to cater for learners' language challenges through the zone of proximal development where learners' knowledge is used to support and improve their second language competence.

4.11.4. Exclusion of language use in teachers' development workshops

In the constructivism science classroom learners are expected to be the centre of learning while teachers become facilitators. Instead of learners being passive receivers of information, they are actively involved in the construction of their own questions, interact in classroom debate to solve different science problems, and answer questions while they also innovatively explain their views. However, the consequence of second language barriers means that learners are compelled to passively absorb the knowledge transferred by teachers which changes the dynamic from child-centred learning to teacher-centred learning. This situation has been observed by the researcher where teachers are impelled to use the 'old' teacher-centred approach - where learners were denied an opportunity to be fully engaged in learning.

Aside from previously identified causes, it is also due to teachers' lack of training in integrating language literacy into their daily science teaching (Asaph Mogofe & Kibirige, 2013). It is the researchers' interpretation that exclusion of second language use in primary science workshops also affects Natural Science teaching. This finding is reinforced by a Teacher Y1 who commented that, "*Yes, we do attend science workshops but not specific to the workshop you are talking about. I have never even heard of any workshop of such a kind anywhere around Mopani District".* In agreement to teacher Y1, Teacher Z2 emphasised that "*On language practice no. but we are trying to make the learners understand the language some can hear us".* However, this is in contrast with Teacher Z1 who said "*Yes, all the terms we go for workshops. We are trained and also advised to teach science in second language as it is the language used to assess them".* In agreement to the current study findings, Robertson and Graven (2020) also concluded that teachers professional development workshops ignore the use of the second language in the classroom and thus leads to poor teaching techniques and low language responsiveness. Teaching workshops are believed to be the most significant tool in helping develop teaching strategies and skills

(Posamentier & Smith, 2020) in the classroom. Robertson and Graven (2020) believe that the incorporation of second language teaching techniques can be achieved when teachers have appropriate teaching strategies to accommodate a diversity of learners (Taole, 2020). The integration of language enrichment in all subjects is the ideal. (Gudula, 2017). However, it is rare to find teachers with both language and science teaching techniques. In their research Hindman, Marrison, Connor and Connor (2020) focused on developing pre-service teachers with a belief that they need scaffolding tactics to implement reading skills in their classrooms.

It is the researchers conclusive view that not only new teachers need the development in language teaching but that all teachers need to be capacitated with different language instructional methods. The reason for this is clearly mentioned by Lopriore (2020) who confirms that language integration in content teaching requires careful attention to determine learners' challenges. This requires teachers to be metacognitively developed in order to manage the different challenges they encounter in their classrooms. Hindman et al (2020) also assert that for science teachers to impart effectively and efficiently reading abilities to learners they need training. It is also emphasised by Robertson (2017) that both new and experienced teachers need continuous training enrichment to specifically develop and expand their linguistic understanding. An assertion by Webb (2010) shows that effective learning and teaching should emphasise reading, writing and speaking as significant components of doing science. In a constructivism classroom therefore, learners need teachers' help to learn and independently apply the LoLT (Snow, 2010) in creating meaning, using their own knowledge. Nevertheless, participating teachers' evidence suggests that primary science workshops do not consider the challenges of using second language in the science classroom. In agreement with the current research findings, Robertson (2017) showed that there is an inadequate attempt by the curriculum officials to develop teachers' different approaches to deal with the challenges of using the second language in the classroom. In agreement with Robertson's (2017) findings, this current research accentuates teachers' development in integrating language in the primary second language science classroom, and asserts as a prerequisite that this needs immediate consideration for meaningful learning and teaching.

4.12. Strategies use in managing the challenges caused by second language (English) in the classroom

It has been delineated by participants during the study analysis that during their teaching process, they make use of different strategies that help them circumvent the challenges caused by learners' inadequate second language proficiency. The identified strategies are discussed below.

4.12.1. The use of practical experiments and examples

In the constructivism classroom, learners bring their own experience and knowledge, concepts, and views into the lesson, in order to obtain the correct understanding of the principles (Kapur, 2019). The learning and teaching process becomes a complex aspect that involves different techniques for successful content delivery (Shana & Abulbdeh, 2020). Practical experiment is commonly used as one of the techniques because of its importance in learning science (Asaph Mogofe & Kibirige, 2013) to enhance learners' subject content and terminologies understanding. Similar findings by Mkimbili (2019) asserts that the use of hands-on practical activities and everyday life examples are beneficial approaches for operative science learning and teaching in a diverse classroom. It was reported by Science Community Representing Education (SCORE) (2008: 10) that *'science without practical experiments is like swimming without water'*. In this regard the current study promotes the use of practical experiments and examples as the best way to develop learners' conceptual understanding in their science teachings.

In line with the findings of the current study Shana and Abulbdeh (2020), Darby-White, Wicker and Diack (2019), Heeralal (2014) and Woodley, (2009) acknowledged the use of practical experiment as important to developing learners' science conceptual understanding. Science concepts are believed to be multifarious to learners' level of comprehending (Shana & Abulbde, 2020). Therefore, practical experiments are of greater significance in encouraging learners' interest and engagement in science lessons, developing their understanding of terminologies and their diversity of science knowledge and skills (SCORE, 2008). Science practical experiments act as a link that enables learners make connections between observable science aspects and real objects, in order to reinforce their understanding (Bryson et al., 2002). Performing

practical activities is acknowledged as a compulsory element in fostering learners' scientific conceptual understanding and clarifications (Miller, 2004) in a constructivism classroom. It creates a scientific approach that examines hypothesis and develops scientific illustrations (Shana & Abulbdeh, 2020). It is the researcher's conclusive view therefore, that practical experiments play an important role in developing learners' conceptual understanding in the second language Natural Science classroom. However, experiments are argued to be followed by interpretation, description and explanation of data, either in the form of report writing and or discussion, of what was observed and measured, within the activity (Miller, 2004). Practical activities, however, require enough time and suitable resources (Stiller, Stockey & Wilde, 2017).

Considering the challenges of teaching Natural Sciences to primary school second language learners with the need to interpret, describe, analyse and report the practical activity findings using second language, raises a question by this study that asks whether practical activities are inclusive enough of all second language learners? This is because as the challenges revealed learners' difficulty in reading and writing, all the assessment and observational report to be given to the learners should be in writing. In their research Gya and Bjune (2021) contend that the efficacy of practical science activities is based on learners processing of the new information obtained from the practical activities, and of the rigorous educational quality these activities entail. In their research Niyitanga, Bihoyiki and Nkundabakura (2021) revealed different aspects that affect learners' and teachers' implementation of practical work in the science classrooms. Chief among the reasons is the challenges with English as a language of instruction that hinders learners' implementation, as well as inadequate teachers' in-service training on the implementation of such practical work. It is researchers pleasure therefore to conclude that for effective implementation of practical experiments in the science classrooms, teachers in-service training that include language use should be considered.

4.12.2. Code switching and translation.

According to Charamba (2020c) learners' poor results are associated with inadequate language proficiency in the language of instruction, and it is cited as the biggest problem in South African Natural science classrooms; educators are then obliged to

use alternative measures such as code switching between learners' home language and the second language (Mavuru & Ramnarain, 2019) and translation. Code switching or mixed coding is identified as a useful strategy according to the current research as attested to by participants who argue that it is a method by which to manage the challenges caused by the application of the second language in the Natural Science classroom.

As Teacher Z1 remarked, *'Yes, normally when you realise that learners are not grasping what you are teaching about, we do try to use their language, English and mixed code'*.

Mohhammadi et al (2019) corroborate this discovery by stating that using learners' home language during learning and teaching is important for learners' academic accomplishments. Based on the authors' view, allowing code switching provides learners with additional prospects to be able to use the second language. It gives learners an opportunity to better grasp concepts or to understand any assessments activities they are given to do during learning and teaching (Mohammadi et al 2019; Thobejane, 2018; Gudula, 2017). To confirm the authors' assertion above, one of the current study participants' (Teacher W1) insights delineate that "*I do not just use Xitsonga but use it where I see that my learners do not comprehend what I am teaching them. I mostly use Xitsonga where the content is full of terminologies*". A similar argument that confirms the above is asserted to by Memory, Nkengbeza and Liswaniso (2018) and Muluneh (2019) avers that swapping between English and the home language ought to be in order to emphasise vital concepts or challenging topics to aid learner's comprehension. According to Maluleke (2020) code switching is a bridge between the two languages where teachers have inadequate terminology. However, in his research Thobejane (2018) declares that code switching should be for the illustration of concepts and not for simplifying them. A literature by Probyn (2006) shows that teachers have different reasons to code switch in their second language science classrooms which includes: the clarification of new ideas, explaining of some statements and some questions, accentuation of opinions, connection with learners' pre-existing knowledge as well as for teaching space organisation and classroom discipline. Making use of mixed code is believed to give learners an opportunity to participate confidently and to be motivated, which results in advanced reasoning

commitment when it comes to subject content (Charamba 2019). Teachers in Memory, Nkengbeza and Liswaniso (2018) data, proved that it is of vital importance to translate the lesson conclusion for every lesson in the classroom, because it aids learners to memory of what they learnt.

However, in contrast to the current study's participating teachers' views on code-switching, some teachers in Shinga (2019) research claim that code switching results in learners' sluggishness to individually acquire the necessary terms to elevate their proficiency in the second language. Alkadir (2018) also spoke of code-switching being the cause of learners' loss of concentration during lesson presentations, that makes translation necessary. Furthermore, he claims that code switching negatively affects learners in terms of content comprehension (Alkadir 2018).

Other than code switching or code-mixing strategies used to bolster learners' understanding of the subject content, teachers in the current study confirm that the use of the Xitsonga language in explaining science concepts in the primary science classroom is a necessary strategy. According to Panganiban & Madrigal (2021) learners inadequate literacy results in their inability to comprehend scientific terminologies. As indicated above Mavuru and Ramnarain (2019) believe it is the teachers' responsibility to conjure with mitigating strategies to enhance understanding. However, it is researcher's view that many second language teachers find it problematic to translate English general words into their home language, which is exacerbated when the words are science terminologies. Meaning, effective code switching in science classroom requires a teacher to be proficient in learners' home language, science language and the language of instruction so as to move from one language to the other. Being proficient in one language or two may result in misconceptions being delivered to the learners. To emphasise this, Teacher W2 showed that "I also do a lot of code switching wherein I use a lot of mother tongue although it is not always easy as science is full of terminologies that are not easily translated". In agreement to Teacher W2, Teacher Y2 said that "My challenge is that the translation also becomes problematic to me because I did not specialise in Xitsonga in my college education". In agreement to the current study, Mashegoane (2017) found that learning and teaching difficulties in science terminologies is caused by the indigenous language lacking a matching vocabulary for core scientific

translations. It has also been identified by Sibomana (2022) that teachers have insufficient second language abilities to move between second language and learners' home language (Mavuru and Ramnarain, 2019; Mashige, Cekiso & Meyiwa, 2019) making it difficult to appropriately explain scientific terminologies (Quansah et al, 2020) to increase learners' comprehension. Gudula (2017) in his findings stated that due to insufficient language proficiency teachers provide incorrect concept explanations. This is compounded when learners move from one grade to the next with the misconceptions of science concepts acquired from their teachers (Gudula, 2017). Although a strategy can be regarded as useful by some teachers, translating concepts to learners' home language is also seen as a challenging strategy since teachers are not trained in translation (Mashige, Cekiso & Meyiwa & 2019). According to Mavuru and Ramnarain, 2019), the strategy can be a good practice but teachers become pedagogically challenged with its application. Richards and Pun (2021) proclaim that science teachers with a deficiency in language instruction take advantage of the strategy to improve their language difficulty. In agreement with Richard's and Pun's assertion, the researcher argues that the majority of second language science teachers or subject content teachers in general also struggle to effectively use the second language in their teaching and consequently code switch for their own benefit. It is often the case that instead of switching between the two languages, teachers rely on home language although it cannot clarify or emphasise the science content and terminology. Consequently, lessons are conducted more in home language than in second language, hindering learners second language acquisition and full exposure to English as LoLT. This is emphasised by Teacher W2 who said that "I end up *teaching science in Xitsonga as a result of our learners' inability to hear us. You find that I end up "tsongalising" (to use Xitsonga almost in every English word) in my every science teaching"* As a result, learners tend to answer assessment questions in their home language which is then marked incorrect in their classwork, homework, projects, tests and examinations, leading to their under achievement in the subject. Teacher W1 reinforced this statement by commenting that "*Whenever I code switch for their understanding's sake, they grab it and use their language to answer in assessments questions".* This impacts negatively on learners' independence making them dependent on their home language and on their teacher's input. According to Vygotsky's socio-cultural theory learners develop and acquire language through

interaction with their social environment. The researcher's judgement is that language in the form of writing, reading and speaking improves with practise. Therefore, code switching in the science classroom might be the cause of learners' inability to interact, read or write using the second language. The code-switching strategy is a time constraint that holds teachers' back from finishing the set curriculum plan. This may mean that learners progress from one grade to the next without sufficient knowledge, creating a science content knowledge gap.

4.13. Effectiveness of teaching Natural Science in English

Lumpkin (2020) view effectiveness teaching as a process that constitutes five steps. As the author indicates, teachers are expected to organise the content of the subject to teach, communicate and convince learners to listen and learn, use variety of learning and teaching support materials as well as approaches to deliver knowledge and interact learning activities with the learners. Moreover, effective teaching is determined by teachers' ability to assess learners so as to check their understanding of the content delivered while learners are expected to apply the skills and knowledge taught in different actions. Taking into account the importance of effective teaching process as in Lumpkins literature, the effectiveness of English in teaching and learning science is important and it is discussed below.

4.13.1. Ineffective in science learning and teaching.

Another important finding of the current study is the ineffectiveness of second language in science learning and teaching which is determined by experience in comparing the use of both second language and learners' home language. In comparison use of English in the learning process is confirmed to cause learners lack of confidence or self-esteem, nervousness, disinterest, distractibility, poor participation, difficulty in tackling assessment questions, and poor performance. Unlike English second language, home language in science learning and teaching is argued to be effective (see Charamba, 2019; Márquez & Porras, 2020). According to the authors, learners' home language allows them an opportunity to construct their own knowledge, share ideas and solve scientific problems. Different literatures (Prinsloo el al, 2018; Charamba & Zano, 2018; Oyoo & Nkopodi Nkopodi, 2020, Maluleke, 2020,

Mavuru & Ramnarain, 2019, Malebetse et al; 2019, Lestshwene & du Plessis, 2021, Robertson and Gravern, 2020) show the negative impact second language has on science learning and teaching. However, contesting this view Husarida and Dollete (2019) confirm the effectiveness of the English language in learning and teaching by outlining the positive impacts it has in mathematics and science. The authors argue that English helps learners improve their writing and reading proficiency. Moreover, it has been identified as useful in the classroom (Husarida & Dollete, 2019) for meaningful learning and teaching. Based on the researcher's observations and on the participating teachers' experiences of the disadvantages that second language brings to bear on learners' and teachers' performance, it is the researcher's preference to argue that English as a second language is ineffective as a language of instruction for science learning and teaching.

4.13.2. Effective in learners' futuristic outlook

Although identified as an ineffective means for science learning and teaching, English as a second language is a vital instrument for communication and relations among individuals (Isnaini, 2021), and is employed as a way for people to express their feelings, emotions and sentiments. Moreover, as noted previously English is the *lingua franca* of commerce and trade, mathematics and science among others, and as such has become essential due to globalisation and developments taking place in the world for the establishment of unrestricted trade (Isnaini, 2021). It is recognised by parents as being important and influential to their children's potential success in most professions (Maluleke, 2020).

The understanding of teachers in the current study is that although English may be ineffective in learning and teaching science, it is regarded as the beacon that lights the learners' future and their educational pathway. This research finding agrees with Fesi and Mncube (2021), who's claim is that English is a channel to higher instructive institutions, employment and to a better quality of independent life. Mohamadaid and Rasheed (2018-2019) and Saneka and Witt (2019) on the other hand dispute the literature stating that English is a global language and advantageous globally for all.

According to some, the advantages of learning English second language is that it is used as an instrument of communication that incorporates individuals around the world

and is the key language of globalisation and intercontinental occupation and trades. Moreover, it plays a vital role in legislation formulation, for mediation purposes and for computer science language use and on the internet (Mohamadaid & Rasheed, 2018-2019). Renh (2021) said that people learn English as a second language in order to enhance their standard of living.

In his research Kola (2018) argues that the unity, solidarity and growth of a country is managed and administered through the use of English. In the South African context, according to the author, English was chosen as the LoLT in order to resolve multilingualism. Also, in agreement with the current study findings, Rao (2019) proclaims that in order to live in an expanding, reachable and sharable 21st century world, everyone should have access to using English as a mutual language. Moreover, worldwide relations in science, technology, business, education, travel, tourism are preserved through the use of English as a common language and thus it is encouraged in higher education institutions.

It is the researcher's argument that higher institutions of learning are constituted of diverse people where a common language is a prerequisite. In addition, English is a tool used by individuals to market themselves and as a means to an improved education. It is imperative in the workplace due to the fact that there are people of varying dialects, most of whom though can communicate in English. Furthermore, speaking English is necessary for any graduate to be employable. Moreover, it is a valuable competency in order to write or verbally give a report, negotiate with different stakeholders and participate in all business and social activities. English as it is introduced at school is important for the learners' futures, in business, career and social life. In support of the researcher's argument above, Teacher X remarked "*English as a medium of instruction empowers learners for the real world. Using English as the language of instruction learners are equipped with tools, they will need later in order to become functional and active members of the society. When moving around the world they will be able to familiarise themselves with it. It is a tool to a better future because wherever they go with the language, they can be able to interact with other people and be empowered to better their future. The language is also crucial in opening the doors of their lives in future".* In agreement with Teacher x, Teacher W2 emphasised that *"The benefit part of it is that when a learner proceeds with his/her*

studies she/he will be able to communicate with fellow students since English is used as a common language of communication. It is also useful for the answering of interview questions". This is also in agreement with Khati (2016) and Yunus and Sukri (2017) who found that regardless of its challenges in the classroom, English it is the international language of commerce, technology, and trade due to its effectiveness and productivity in the entire world.

4.14. Summary

The thematic analysis in this chapter, which was supported by participating teachers' verbatim narratives, revealed that the main challenges affecting Natural Science teachers using English second language learning and teaching at primary school was due to the need to use codes, categories, and themes to make the learning clear to those learners who cannot understand the second language. The learners' inadequate second language proficiency, which is believed to be caused by the language of teaching in the Foundation Phase, as well as by sociocultural factors such as attitudes towards the second language, and the exclusion of language use in development workshops, were overlapping issues. Use of practical examples and experiments, code switching and second language translation are all possible techniques to mitigate the identified problem in the Natural Science classroom. Poor understanding of the subject content, assessment questions and poor performance were identified as the negative impacts of using second language in Natural Science learning while teachers' teaching time and curriculum coverage is also affected. Recommendations for future research and conclusion will be given in the following chapter.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

As indicated in Chapter 1, this study aims to investigate the experiences of primary school teachers teaching Natural Science using (English) second language in selected primary schools of Mopani East in the Mopani District. The study set out to identify the challenges of using second language and exploring how these challenges affect learning and teaching. Scholarly literature was reviewed in Chapter 2 of the study, and poor language proficiency, difficulty in understanding science language or literacy, difficulty of conceptual and content understanding as well as reading and writing difficulty, were identified as the challenges of using the second language in teaching science to second language learners. Chapter 3 outlined the methodology used and the processes of data collection, while the Chapter 4 analysed and interpreted data findings of challenges experienced by teachers when teaching Natural Sciences to primary school second language learners. This chapter, Chapter 5, aims to draw a summary of the research findings, discusses the limitations of the study and interrogates the study recommendations to circumvent the challenges of using second language with primary learners in the Natural Science classroom. The researcher also indicates new avenues for further research regarding the use of second language with primary second language learners.

5.2. Summary of research findings

This research study revealed teachers' experiences of using second language with primary science learners in Mopani East District. The study used qualitative research approach to answer the following question: What are the challenges of teaching Natural Science using English as the second language to teach science to primary school learners?

The findings of the research are thoroughly discussed based on the following topics.

5.2.1. Challenges of using second language to primary science learner

5.2.2 English second language Impact on learning and teaching of Natural Science in the classroom

5.2.3. Effectiveness of teaching Natural Science in English

5.2.1. Challenges of using second language to primary science learners

Firstly, the study explored Natural Science teachers experience of using second language in primary schools within the Mopani East District, to address the question: What are the challenges of using second language in teaching Natural sciences to primary learners? The findings exposed learners' inadequate language proficiency as the major challenge. It is revealed that learners' inadequate second language proficiency which impedes their ability to hear, speak, read and write in the classroom is the main hindrance against effective and meaningful science teaching. Teachers indicated that when learners fail to speak, read, write or comprehend what they teach, it is an expectation that no positive learning will result. This is because learners' comprehension in the classroom is dependent on their ability to interpret the language of instruction (Khensani, 2018). This refers back to Cummins' (1979) identification of CALP, which states that learners' ability to understand any subject content, effectively participate in different classroom interactions, comprehensively read different texts and to be able to answer assessment questions, requires proficiency in cognitive academic language, hence learners who lack cognitive academic language proficiency will be scholastically disadvantaged (Cummins, 1979).

Secondly, interrogating the topic more deeply in answering the question mentioned above and identifying mitigations of the challenge mentioned, the research disclosed teachers' experiences and managing strategies. Mopani East primary school teachers stated that they use code switching and translating from the second language to learners' home language as a strategy in their teaching to deal with learners' inability to hear (comprehend), speak, read and write the second language in the Natural Science classroom. Science is synonymous with terminology, and comprehension thereof requires a complete understanding of its concepts. Moreover, learners are expected to prove in writing their understanding of the lessons. Furthermore, learners should be able to construct their own knowledge and own their learning while the teacher facilitates. Unfortunately, it appears that the use of code switching or home language does not entirely solve the challenges, but instead adds a greater burden on teachers of interpreting science concepts into learners' mother tongue, which is not

efficacious since scientific concepts and terms are not simply interchangeable with African languages (Mavuru & Ramnarain. 2019). Such methods also deny learners' cognitive development through processes of enquiry learning. Learners' inability to apply second language during learning and teaching results in less meaningful science teaching.

It is also revealed that the use of practical experiments and concrete examples is another way of managing learners' second language difficulty. According to (Shana & Abulbdeh, 2020) science is a challenging subject that requires practical examples and experiments to establish the concept understanding. However, irrespective of its vital role in science learning and teaching, experiments demand time, resources and learners' proficiency in a second language, which under the current system in South Africa is not viable. Hence, regardless of its importance, the implementation of experiments is hampered by a lack of resources, time and learner (and often teacher) second language proficiency.

Thirdly, delving into the roots of teachers' experiences in using second language teaching of science content with primary science learners, the study identified factors perceived to lead to learners' inability to hear (comprehend and grasp), speak, read and write English. Contributing factors revealed were the language of instruction in the Foundation Phase, learners' societal factors (learners' environmental background and parental education), exclusion of language use in teacher development workshops, as well as learners' school entry age.

It is indicated in this research that the use of LoLT in the Foundation Phase lays a negative foundation for the native language speaking learners of Mopani East, resulting in their experiencing challenges to understanding the second language (English) in their Intermediate and Senior Phase education. The research showed that permitting learners to use their home language at school hinders their second language acquisition. In reference to the sociocultural theory, second language acquisition is based on how a learner acquires the additional language as LoLT (Aimin, 2013). Therefore, the use of learners' first language in the early years of schooling prevents them from having an opportunity to meaningfully learn in the second language, and it specifically limits their access to English as the second language (Mckinney & Tyler (2019).

Social factors on the other hand has been indicated to be one of the contributing factors that leads to learners second language difficulty. Second language Natural Science learners of Mopani East are from Xitsonga speaking families, with unschooled parents, and are dependent entirely on their schools to develop their language attitudes and aptitudes. According to the sociocultural theory, second language develops better when it is learnt in its usual places (such as at home or in school) or through interaction with first language speakers. This means that the Mopani East learners who depend on the school environment as their only exposure to English, are disadvantaged in their acquisition of the language.

It is revealed by the study that Natural Science officials (Subject Advisors) conduct in-service training to develop teachers' pedagogical knowledge which are said to be effective. Nevertheless, teachers appear not to have been capacitated in second language use. In order to deal effectively with second language challenges, teachers need to be *au fait* with and apply second language techniques (Robertson & Graven (2020) developed through teaching workshops (Posamentier & Smith, 2020). Hence language use in teachers' development training and workshops in science learning and teaching are critical (Larsson & Jakobsson, 2020).

The research also identifies learners' school starting age as a cause of learners second language difficulty. According to this study's findings the need for second language use in the Grade 4 science classroom is beyond learners' abilities for their age. Consequently, learners who begin formal learning at a young age may struggle educationally, with the challenges continuing through the learner's scholastic and academic journey (McMurray's, 2021).

5.2.2. English second language Impact on learning and teaching of Natural Science in the classroom

To address how learners' inadequate second language affect the teaching and learning of Natural Science? It is revealed that the use of second language negatively affects science learning which results in learners' having difficulty in understanding science content, poor understanding of assessment questions, culminating in poor subject performance. It is also disclosed that second language causes poor learner classroom discussion during the science learning and teaching process. Learners'

comprehension of science content and concepts is predicated on the level of proficiency they have in the LoLT (Charamba, 2020b) meaning, the higher the LoLT proficiency, the greater the comprehension of the subject content and vice versa. This inadequate proficiency in science content in Mopani East primary schools also becomes an obstacle in learners' interpretation and understanding of tests and examination questions which leads to poor performance, which indirectly affects teachers' performance reputation as it is judged according to learners' achievements.

The findings of the study also confirmed that there is poor classroom discussion in the Natural Science classroom due to learners' second language difficulty. In the constructivism classroom, learners are expected to share diverse learning responsibilities and even to participate in different activities (Maluleke, 2020). However, their rights and roles as the centre of learning are not realised due to their lack of self-assurance, fear, inability to share their views, and pressure caused by the challenge of having to use the second language. In an attempt to encourage learner participation and to improve their ability to argue, discuss, answer questions and explain ideas teachers rely on the use of the mother tongue (Xitsonga) in their lessons. (Charamba, 2020c).

The findings also reveal teachers struggling to manage the challenges caused by second language use in their classrooms leading to their time to cover the curriculum being constrained, and lag behind the pacesetter. Teachers mentioned their use of code switching and translation as methods to enforce learners' understanding of science in their classrooms. Unfortunately, translation is time consuming and affects the timeous running of lessons, by slowing down the knowledge exchange process (Maluleke, 2020) and curtails the meaning of the knowledge conveyed because science terms are not readily interchangeable with African languages. Another complicating factor is that teachers in adjusting the demands of the learners for code switching and translation are compelled to follow learners' pace of understanding (Maluleke, 2020). Natural Science is perceived to be an overload subject because the various strategies and interventions to make it accessible to the learners leaves teachers with less time for teaching (Netshivhumbe & Mudau (2021). Therefore, the result of adjustments and strategies used are indicated to negatively affect teachers' ability to finish the set subject curriculum as outlined in the CAPS document.

5.2.3. Effectiveness of teaching Natural Science in English

Through teachers reported and recorded experiences of using English as a second language in the primary grades of science teaching, the study delved deeper into determining the language's effectiveness, to tackle the question of how effective is the use of English to second language primary school learners? It was exposed that second language is ineffective in teaching science, but is essential for learners' futuristic outlook.

Second language use is stated to be ineffective in the Natural Science classroom within the Mopani East district. The study findings regard second language as unworkable due to the negative impacts it has on learning and teaching processes, as compared to using learners home language. English poses numerous learning and teaching problems (Charamba & Zano, 2019; Mckinney & Tylor 2019,). It limits learners' participation in their classroom discussions and understanding of science terminologies (Msimanga & Lelliot, 2014). It is for this reason many learners are unable to do science activities independently without support (Jessani, 2015). It therefore becomes teachers' responsibility to translate second language into learners' language of comprehension (Maluleke, 2020).

No matter how ineffective English is as a second language for teaching science in the primary school classroom, it is also identified that it imperative to enhance learners' entire scholastic and academic journey, and is the key for better employability. English offers learners unlimited opportunities for a more successful future globally (Khati, 2016). It is the only way to enter institutions of higher learning and to achieve a better employed independent life (Fesi & Mncube, 2021). It is a vital tool of communication that connects individuals throughout the world and is crucial for global careers (Saneka & Witt, 2019).

5.3. Research Conclusions

The research explored the experiences of teachers' teaching Natural Sciences in second language primary schools within the Mopani East District. The study set out to establish answers to the question 'What are the challenges of using the second language in teaching Natural Sciences to primary school learners?'

The research results indicated that the use of second language leads to learners' inadequate language proficiency, evidenced by their inability to hear, speak, read and write the second language (which is English in the current research). The cause of challenges to second language proficiency are identified as the use of first language in the Foundation Phase, learners' early school entry age, societal factors and the exclusion of language use and training in teachers' developmental workshops.

The study also sought to answer the question 'How do these challenges affect the learning and teaching of Natural Science?' The challenges were indicated to be the source of learners' poor understanding of the subject content, assessment questions and poor performance, as well as poor classroom discussions. It is also indicated to be the cause of teachers' failure to cover the curriculum and results in the teacher lagging behind the pacesetter.

Moreover, the study aimed to answer the question "How effective is the use of English for second language primary school learners?' The result of the research indicated that English is ineffective in the Natural Science classroom but effective for learners' future.

5.4. Recommendations

- Districts, with the help of schools, should run community awareness programmes that will provide parental awareness on the challenges experienced by teachers in their classrooms with regard to the use of second language. The champaign should ensure that parents are made aware of the essential role of second language in their children's academic achievements and future. Parents will be a resource for learners so that they do not have to rely on schools as their only source of second language acquisition, but be motivated even at home to read different English texts.
- The National Department should revisit the Language in Education Policy (LiEP). Instead of English being taught as a subject from Grade 1, it should rather be used as the language of learning and teaching from Grade 1, while Xitsonga becomes a subject to be taught. This practise will help learners develop second

language at an early age and stage of schooling, and will enter Grade 4 with adequate proficiency for second language learning.

- Teachers should be trained by the Department on how to implement code switching and translation methods in the science classroom. Training will assist teachers to make use of the methods in an effective manner, allowing for the original and meaningful transmission of science concepts and content knowledge.
- Department officials' teacher development workshops should consider introducing language practices. The inclusion of language will help teachers develop the knowledge of how to tackle different learning and teaching challenges caused by the use of second language in their classrooms.
- Teachers should be trained by the Department officials on the proper implementation of meaningful practical experiments. Since '*Science without practical experiments is like swimming without water'* (SCORE, 2008: 10) practical activities should be a compulsory element to foster learners' scientific conceptual interpretations and understanding (Miller, 2004). Training teachers on the application of practical experiments will help them convey the knowledge to the learners while also considering learners' language difficulties.

5.5. Avenues for further research

- Research on home language Foundation Phase education and on learners who received English Foundation Phase education in the science classroom, in order to determine the impact of home language learning on learners' acquisition of the second language.
- Research on factors that affect the inclusion of language use in teacher training workshops, to reduce the challenge to teachers of using second language in the Natural Science classroom.
- Further study will be carried out on the effectiveness of the science curriculum and its effect on teachers' and learners' performance.
- Research on factors that hinder the development of reading and writing skills in the Foundation Phase in order to reduce learner reading and writing difficulties in the Intermediate Science classroom.

5.6. Limitations of the study

The research proposed to study 5 circuits of the Mopani East District where one school per circuit was to be involved. Inopportunely, during the data collection process, one of the proposed schools chose to refrain from the study. It was also proposed by the study to collect information from two Grade 7 teachers (male and female) per school, with the aim of exploring the experience of using second language with primary science learners from both male and female teachers' perspectives, to avoid gender influenced results. Subsequently, due to schools' post establishment, which is reliant on learner enrolment, it was identified that one teacher either male or female was responsible for the entire Grade 7 classes. Nevertheless, the researcher decided to interview one Grade 7 Natural Science teacher and one Grade 4 Natural Science teacher per school regardless of their gender. The decision to involve lower grade teachers was to explore and compare the experiences of using second language in Natural Science teaching between the Intermediate and Senior Phase teachers. It was identified that one of the schools unfortunately has one teacher for both grades (Grades 4 and 7). All these unexpected changes may have influenced the findings of the study. In addition, the study concentrated only on the selected primary schools of Mopani East District and the sample was small, consequently it is not illustrative of a broader population within the province. Moreover, the study was of a short duration, therefore, it did not provide a complete understanding of the entire situation.

5.7. Concluding remarks

Conducting a research study is not a simple matter, but is rather a difficult journey that requires special characteristics. Outside of the research world, partaking in research was like reading the vowels a, e, i, o and u to me. Copying every information related to the research topic was thought to be the correct practise until I had a defining experience with my Chapter 2. Based on my understanding, I directly copied some authors work and acknowledged them through referencing. Unfortunately, this was serious plagiarism that returned my work back to me many times to start afresh. The confusion of not knowing where to start, the pressure of academic writing and the workload that writing a chapter entail was a burden which resulted in nightmares and

sleepless nights. The only solution to ease this burden was to quit the endeavour. Luckily, a wish to pursue the studies kept on burning in my mind and overtook the heart. The burning flames elevated day and night until it produced a whispering voice that stated, ‘If you quit you are paving a way for losers in your entire generation’. Immediately, a spirit of anger to win arose within me and I decided to continue with the research study. Regardless of the motivation, my physical health wasn’t completely in support of the study’s hard work, but that did not bury my dream to complete my Master’s Degree. Significantly, undertaking this research study was a valuable experience that helped me improve my self-trust, improved my ability to liaise with different stake holders, increased my ability to work under pressure, supported my hardworking abilities, and entrenched my self-commitment. It has also developed my research skills and independent learning abilities.

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Appendixes

Appendix 1: Interview questions scheduled for grade 4 & 7 natural science teacher

SECTION A: INTERVIEWEE BACKGROUND

Name of school: _____

Name of teacher: _____

Qualifications: _____

Position held: _____

Teaching experience: _____

Grades teaching: _____

Date:

_____

SECTION B: INTERVIEW QUESTIONS

- What challenges do you experience when using second language with primary science learners?
- What perceived factors have an influence on learners' understanding of English as a language of Instruction?
- Have you been trained in second language practices for science teaching to primary learners, if yes was it effective?
- What strategies do you use in managing the challenges caused by the use of the second language (English) in your classroom?
- What do you think can be done to resolve the challenges caused by the use of the second language in the science classroom?
- Does the use of second language affect Natural Science teaching, If yes how?
- How does the use of second language affect your performance as a teacher in the classroom?

- Do learners find it easy or difficult to understand the subject content and the assessment questions in the second language?
- In cases where learners find it difficult to interpret assessment questions, how do you go about helping them?
- How does the second language influence learners' interactions during classroom discussions?
- How do you help your learners learn scientific terms in the second language?
- How does the second language (English) affect learners' performance?
- Is the use of the second language as the language of learning and teaching effective or ineffective for primary school learners? Explain
- Do you in some circumstances use Xitsonga, English and mixed code in your teaching?
- Under what circumstances do you use Xitsonga, English and mixed code in your teaching?
- How are learners' participating when English is used during teaching compared to when their mother tongue (Xitsonga) is used?
- How do you enhance understanding of the subject content in a situation where learners cannot grasp what you are teaching as a result of the second language?
- What do you think are the benefits of using second language as the language of instruction in the science classroom?

Appendix 2: Lesson observation schedule.

Date of lesson observation	**:**	
Name of observer (Researcher)	:	
Name of teacher to be observed	:	
Level of learners to be observed	: Grade 7 Natural Science learners	
Level and name of subject	: Grade 7 Natural Science	
Topic of lesson	:	
Lesson plan	:	
Learning and teaching resources	:	
Lesson objectives	:	
Classroom management	:	
General observable learning and teaching activities	**Descriptive Notes**	**Reflective Notes**
How do participants interact using second language? • Teacher-learner interaction • Learners' interaction		
How is the lesson delivered?		
How are learners undertaking the lesson?		
Learners' participation/ how are they engaged?		

Who is talking/listening?		
Non-verbal information		
Use of Xitsonga, English and mixed codes		
Is there a classroom discussion?		
Is the discussion effective and useful for learning?		
How are learners learning from the discussion? (e.g., peer-peer discussion, group inquiry etc.)		
How are assessments undertaken? • Understanding the questions • How is feedback given to the learners?		
What is the evidence to show that learners have achieved expected learning outcomes?		

Appendix 3A: Interview transcript

Interviewer: Chauke Basambilu

SECTION A: Interviewee background

Name of school: **School A**

Name of teacher/interviewee: **Teacher X**

Gender**: Male**

Qualifications: **Bachelor of Science in Agriculture and Post Graduate certificate in Education (PGCE)**

Area of specialisation**: Economic and Management Sciences**

Position held: **Post level 1 educator (PL1)**

Home Language: **Xitsonga**

Teaching experience: **6 Months**

Grades teaching: **4 & 7**

Date: **12/04/2022**

Time**: 10:15**

Venue**: School Mini Hall**

INTRODUCTIONS (Before the interview starts)

Interviewer (Researcher): Good morning, Sir, I know we have been speaking for some time now but it is good that I introduce myself first before we start. My name is Chauke Basambilu, a researcher from the University of South Africa. I am here to do the research interviews as we agreed. For confidentiality you are called Teacher X of school A. Sir, we arranged to do the interviews and lesson observation today, are there any changes?

Interviewee (Teacher X): There are no changes that's what we will do.

Interviewer (Researcher): Okay, no problem before we get into the business of the day Sir, you are participating in this study voluntarily, and your name for confidentiality is Teacher X, so please do not be surprised to be called by that name.

Interviewee (Teacher X): No problem, Ma'am its fine and you are warmly welcome and please make yourself comfortable.

Interviewer (Researcher): Thanks, Sir. May we please start?

Interviewee (Teacher X): With pleasure, without waste of time.

SECTION B: Interview Process

- **Interviewer (Researcher):** Mr. X let's start with question one and it reads: what challenges do you experience when using second language to primary science learners?

Interviewee (Teacher X): The difficulty for most learners is to understand the concepts as they are in the language they do not understand. It is also difficult to express themselves during discussions and to seek clarity in some of the content they do not understand.

- **Interviewer (Researcher):** What perceived factors have an influence on learners understanding of English as a language of Instruction?

Interviewee (Teacher): The policy of South Africa allows learners to be taught in their home language until they get to Grade 4, by the time they switch to using second language as a language of learning, it becomes challenging for them as it is not a language, they are familiar with. They must first learn the basics of the language which takes time and simultaneously have to understand the content of science. Secondly these learners only use English in school.

- **Interviewer (Researcher):** Since you have started working, I know you are new in this field, have you been trained on second language practices for science teaching to primary learners, if yes was it effective?

Interviewee (Teacher X): No

- **Interviewer (Researcher):** You said there are challenges that you usually come across in the classroom, so what strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

Interviewee (Teacher X): What I do is that I code switch between learners' home language and second language to help the learners grasp the content in a language they are in a better position to understand, however this is time consuming and not all science concepts can be clearly explained in the learners first language. Wherever I pick up they have difficulty understanding I try to explain in Xitsonga. I also make use of practical examples or experiments where possible for example; in a topic about differences between dicotyledons and monocotyledons plants, I used different plant leaves for learners to observe the parallel and branching veins of the leaves which are the characteristics that help to differentiate the mono and di cotyledons plants. I also allow learners to work in pairs so that they can assist each other.

- **Interviewer (Researcher):** Based on the challenges that you usually experience, what do you think can be done to resolve the challenges caused by the **use of second language in the science classroom?**

Interviewee (Teacher X): The introduction of second language as soon as learners start with their schooling to put them in a position where they can learn the language early to enable them to understand the science content and concepts during teaching.

- **Interviewer (Researcher):** Does the use of second language affect Natural Science teaching? If yes, how?

Interviewee (Teacher): Yes, it does affect it, most learners find it difficult to understand science as it is being taught in a language that is foreign to them and when learners are struggling, it affects the teaching since time which should be used for teaching and learning is wasted on strategies used to help them learn.

- **Interviewer (Researcher):** How does the use of second language affect your performance as a teacher in the classroom?

Interviewee (Teacher X): Sometimes I spend longer than the recommended amount of time on a certain chapter in order to help learners fully grasp the content. Even during the teaching and learning process learners fail to articulate on aspects that they need clarity on because they cannot do it in the second language. You also find that during the assessments learners do not understand what is required of them and end up not performing well. It also affects me in moving along with the allocated content of the term as a result of trying to move based on the learner's pace. Making all the translations also is time consuming.

- **Interviewer (Researcher):** Do learners find it easy or difficult to understand the subject content and the assessment questions in second language?

Interviewee (Teacher X): They find it difficult because most of the time when you give them assessments you will see them raising hands to say they do not understand what is required of them and end up not performing. So, you are always expected to translate the questions in their home language, however, they also find it difficult to give the right answers that are expected because of failure to write meaningful answers in the second language.

- **Interviewer (Researcher):** In cases where learners find it difficult to interpret assessment questions, how do you go about helping them?

Interviewee (Teacher X): I read the questions for them and explain in their first language, trying to simplify it for them.

- **Interviewer (Researcher):** So, if what you are explaining is the case, how does second language influence learners' interaction during classroom discussion?

Interviewee (Teacher X): Learners are not confident to raise their hands and answer questions being asked or to ask for clarity where they don't understand. Only when Xitsonga is used during discussions is where they fully participate and the discussion will be very interesting and fruitful, unlike when we use second language. Only few learners will understand what you want them to do.

- **Interviewer (Researcher):** Science has terminologies, Sir, … I mean concepts, how do you help your learners to learn scientific terms in second language?

Interviewee (Teacher X): I explain the concepts and break them down to what they mean in the simplest way possible for learners. I also make use of daily life examples or things that usually happen in their lives and there they will show more understanding and some will say okay this is what we saw the other day.

- **Interviewer (Researcher):** How does second language (English) affect learners' performance?

Interviewee (Teacher X): Learners are unable to understand assessment questions and they end up not performing. They are not even confident enough to raise their hands to seek clarity or answer questions they are asked. Though as a teacher I might be sure that they know what they are asked about, but they fail to provide right answers

due to second language difficulty. You can see that they have the knowledge of what they must write but they fail to put the words in a meaningful order. So, that affects their performance.

- **Interviewer (Researcher):** So Mr. X is the use of second language as the language of learning and teaching effective or not effective for primary school learners? Explain

Interviewee (Teacher X): It is ineffective, learners struggle with the language and this negatively impacts their performance in science. Not necessarily because they do not understand science but they do not understand the language used to learn this science. Because understanding the language first is important for expression, writing the answers that can be asked.

- **Interviewer (Researcher):** Do you in some circumstances use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher X): Yes, I do I resort to using the first language to help learners understand the content or concepts.

- **Interviewer (Researcher):** Under what circumstances do you use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher X): There are circumstances where during the teaching and learning process learners fail to understand what you are teaching because of the language used so whenever my learners struggle to understand the concepts explained in second language and when they cannot understand the assessment questions to make emphasis.

- **Interviewer (Researcher):** Sir, I know you spoke about your learners' participation when English is used but explain to me the learners' participation when English is used during teaching, compared to when their mother tongue (Xitsonga) is used?

Interviewee (Teacher X): When English is used learners find it difficult to comprehend most of the aspects when you interact with them. They are not able to clearly articulate themselves when English is used and they are not confident enough. They are always shying away from participating but when their first language is used is where they fully participate.

- **Interviewer (Researcher):** So, how do you enforce understanding of the subject content in a situation where learners cannot grasp what you are teaching as result of second language? I mean how do you make sure that they understand what you are teaching in cases where they are not understanding because of the language difficulty?

Interviewee (Teacher X): What I normally do is to use concrete examples or practical examples, of which I always prefer daily life examples. I also make use of group work, working in pairs and also, I explain using their first language**.**

- **Interviewer (Researcher):** The last question of our interview sir, what do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (Teacher): English as a medium of instruction empowers learners for the real world. Using English as the language of instruction means that learners are equipped with tools, they will need later in order to become functional and active members of society. When moving around the world they will be able to familiarise themselves with it … it is a tool to a better future because wherever they go with the language, they can be able to interact with other people and be empowered to better their future. The language is also crucial in opening the doors of their lives in future.

CONCLUDING REMARKS

Interviewer (Researcher): Before we go for the lessons, Sir, please allow me to use this opportunity to thank you for participating in this study. I know there is something that you were to be doing though for now you are free. Thank you, Sir, I really appreciate all the sacrifice you have made for this research.

Interviewee (Teacher X): No problem, Ma'am, you are welcome. Your success in this study is also my success.

THE END

Appendix 3B: Interview transcript 2

Interviewer: Chauke Basambilu (Researcher)

SECTION A: INTERVIEWEE BACKGROUND

Name of school: **School B**

Name of teacher/Interviewee: **Teacher Y1**

Gender: **Male**

Qualifications: **Bachelor of Education**

Area of specialisation: **English & Geography**

Position held: **Post Level 3 or PL3 (Deputy principal)**

Home language: **Xitsonga**

Teaching experience: **33 years**

Grades teaching: **7**

Date: **19/04/2022**

Time: **08: 00**

Venue**: School B premise (Staff Room)**

INTRODUCTIONS (Before the Interview starts)

Interviewer (Researcher): Good morning DP, my name is Chauke Basambilu, I know we haven't seen each other because all was done by the principal in my absence. Did you manage to understand all the research processes?

Interviewee (Teacher Y1): Yes, all the documents were given to me and they are signed including the learners' consent forms. Apologies we did not manage to see each other, … is just that we are not doing things the way we want but according to how the employer wants.

Interviewer (Researcher): So, is there anything you want to be clarified on? But before you come up with what you may have. I want to ensure you that your confidentiality is safe. Pseudonyms for the school and you will be used instead of the

real names and you are now Teacher Y1 of school B. Again, be informed that you are free to pull out in case you no longer feel comfortable to be part of the study with no penalty. So, is there anything that you seek clarity on?

Interviewee (Teacher Y1): No, I am fine, I have read everything concerning the project and I am fine Ma'am. We can start so that we catch the class time.

Interviewer (Researcher): Okay thank you.

SECTION B: INTERVIEW PROCESS

- **Interviewer (Researcher**): The first question, Sir, is what challenges do you experience when using second language with primary science learners?

Interviewee (Teacher Y1): The main challenge is that some of the learners cannot understand English, they cannot even write nor try and are even shy to speak in English. Obviously when these learners cannot read nor write, what do you expect? They are those learners who according to our education do pass by age. So, if they pass by age, it is obvious that there is nothing much to expect from them.

- **Interviewer (Researcher)**: So, what perceived factors do you think have an influence on these learners understanding of English as a language of Instruction?

Interviewee (Teacher Y1): You know, the main factor that leads to the learners' inability to understand English is their environment. The background where these learners come from is a main factor. The way they play and even what they usually watch on TV seems to be of no positive influence in their lives, simply because they cannot hear what they say in different programmes they watch.

Interviewer (Researcher): So, according to you, the only factor here is the background?

Interviewee (Teacher Y1): Yes, that is the main to me.

- **Interviewer (Researcher)**: Have you been trained in second language practices for science teaching with primary learners? If yes, was it effective?

Interviewee (Teacher Y1): Yes, we do attend science workshops but not specific to the workshop you are talking about. I have never even heard of any workshop of such a kind anywhere around Mopani District

- **Interviewer (Researcher)**: You mentioned that you experience challenges when using second language with your Grade 7 learners, so, what strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

Interviewee (Teacher Y1): The strategy that I do use is to give them a lot of activities to write so as to develop their second language. Remember when we speak about a normal class it must constitute 3 types of learners: Gifted, average and slow. As such some will develop English understanding as they will also seek help from their brothers and sisters at home, while some will not.

Interviewer (Researcher): Sorry, Sir, is it possible to resolve the challenges you mentioned by giving them more tasks to do?

Interviewee (Teacher Y1): The main aim of the tasks is to help them develop the language, so to some it helps but to some no as I have mentioned that these learners are not the same.

- **Interviewer (Researcher)**: So, in all that is happening concerning the use of second language, what do you think can be done to resolve the challenges caused by the use of second language in the science classroom?

Interviewee (Teacher Y1): You know that one let me say I do not know, because that one is up to the department. I can say 1, 2, 3 and 4 but, if the department is not doing what is suggested, then our suggestions become useless. The issue of allowing learners' progress by age is something implemented by the department and seemingly causing higher failure rate, dropouts and even poor performance. So, we can come up with something positive, but we cannot manage to change what the department has shaped it.

Interviewer (Researcher): Don't you think there must be a solution to this problem, Sir?

Interviewee (Teacher Y1): Ma'am we need to be realistic here, we can come up with something but if the Department itself does not do anything it become useless. The Department implemented the age cohort progression but on the other side you expect those learners to pass at the end of the day; no it won't work … the Department here is not helping at all.

- **Interviewer (Researcher)**: The next question, Sir, is does the use of second language affect Natural science teaching, If yes how?

Interviewee (Teacher Y1): You see, the use of English is not bad at all, I cannot talk about the negative but positive move. It does not negatively affect the teaching of science anyhow because, is it that which they learn a chain? They learn from this grade and such lesson will continue in the next grade. So, I think English is not a problem it's just that if we do have learners who understand it and pass in the truthiness of the word pass then it does not have a problem at all. Even if it was not English if learners do not know anything they do not know but if they know they know. Although they were using their home language as the language of instruction, difficult understanding learners will remain un-understanding. To me language has nothing to do with learners understanding of science. Perhaps we can talk about the issue of language in the Foundation Phase.

- **Interviewer (Researcher)**: How does the use of second language affect your performance as a teacher in the classroom?

Interviewee (Teacher Y1): You know I use English and my learners do pass a lot and I like it. To me it is very good and doesn't affect my performance in any way.

Interviewer (Researcher): Meaning it does not affect you as a teacher?

Interviewee (Teacher Y1): Not at all.

- **Interviewer (Researcher)**: Do learners find it easy or difficult to understand the subject content and the assessment questions in second language?

Interviewee (Teacher Y1): You know, the difficulty that learners experience actually depends on the one (teacher) who is actually giving them information. Whenever I give them assessments, I make sure that I explain all the terminologies and all what they must do. So let me say No, they don't find it difficult.

- **Interviewer (Researcher)**: So, as you indicated that some learners cannot understand English, in cases where learners find it difficult to interpret assessment questions, how do you go about helping them?

Interviewee (Teacher Y1): As I indicated above, once you explain to the learners the terminologies and the meaning of difficult words and everything that you should want, you will not have any problem at all. The main thing is explanation, do you explain to

them? Do they understand you? Do they know exactly what you expect from them? Do you go to them being prepared? Do you know exactly what you are doing? Then if you know there is no problem at all because, is it that you are the key role player once you get to the class. As a teacher I have to explain to them that which I want, what I expect them to do and then I do not give them terms or difficult words that they will not understand to avoid difficulties.

- **Interviewer (Researcher)**: How does the second language influence learners' interaction during classroom discussion?

Interviewee (Teacher Y1): I told you about the three types of learners in the class, the gifted, average and slow learners. With the gifted no problem, average problem here and there but with the slow learners some are shy to speak. They are not shy because they do not know how to speak the language, but mostly because they are shy about themselves. They usually lack self-confidence. Shy as they are some are able to express their views because you must allow them to speak as a teacher even though they speak the broken language. Is it that the main thing is to speak out their ideas, the main thing according to me is the understanding of what they are trying to convey.

- **Interviewer (Researcher)**: Science is full of terminologies; how do you help your learners to learn scientific terms in second language?

Interviewee (Teacher): By terminologies you mean…? Please clarify …

Interviewer (Researcher): I mean concepts … let's say you are talking about photosynthesis as a term which was in Term 1, how do you help them understand the terms?

Interviewee (Teacher Y1): Whenever I teach, for example, let's say I teach about separating mixtures, I will come with different items and put them on the table. I will put different pens of different colours, books or any other hand-on items and allow my learners to separate them. When they do separate the items then I will explain the method of separation they applied. For separation of soil and water as another example I will go with the filter paper, water and soil. We will mix the water with soil and do the experiment in class. As they pour the mixture on the filter paper placed on a funnel to a small bowl, the water will go through the paper allowing the soil to remain on it, thus will help me explain filtering as a concept or separation method. The same

when I explain magnetism, I will go with a magnet, iron filings and wood to the class so that we do practical examples. The iron filings will be attracted by the magnet and that is another concept. The same applies when we do evaporation, separating water and salt. We will mix water and salt together, then we boil water for a particular time. As the water evaporates it will allow salt to remain in the receptacle we are boiling in. I use practical examples and hands-on experiments to explain terms or concepts to the learners.

- **Interviewer (Researcher)**: The next question, Sir, is how does second language (English) affect learners' performance?

Interviewee (Teacher Y1): This question to me comes for the second time, but you see it is mostly Xitsonga here which is being done, but the rest of the learning areas are in English. If they learn social science is in English, Maths is in English, and EMS in English, Life skill in English and even English as second language being taught. Don't you see that English will always be taught and learners will always gain as long as we do what we supposed to do as teachers?

- **Interviewer (Researcher)**: So, based on your experience, Sir, do you see the use of second language as the language of learning and teaching effective or not effective for primary school learners? Explain

Interviewee (Teacher Y1): To me English is effective because we are teaching these learners to be an independent in life, and to be able to compete with the rest of the world, they need this English. To me it is very effective because once we say it is not effective how did learners pass from the other grades since it is used as language of instruction? Although I sometimes use Xitsonga which is learners' language it does not mean that English is ineffective.

- **Interviewer (Researcher)**: When presenting your lessons, Sir, do you in some circumstances use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher Y1): Yes, sometimes it is necessary and it is not bad. You have to.

- **Interviewer (Researcher)**: Based on the previous question, under what circumstances do you use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher Y1): But I think I have already hammered the next nail before it was hammered down. As I indicated to you about the three types of learners we have in class, there is time where you are bound to use Xitsonga, English and mixed code in your teaching so that all slow learners can be able to understand what you are teaching. Sometimes you must use Xitsonga which is learners' first language so that they can understand what you are conveying very well. When we are discussing or explaining certain terms for example; since they are not at the same level of understanding, I put an emphasis on what I am explaining using learners' home language which is necessary. So, I use Xitsonga mostly to clear all what learners do not understand, and for emphasis.

- **Interviewer (Researcher)**: Sir, how are your learners' participating when English is used during teaching, compared to when their mother tongue (Xitsonga) is used?

Interviewee (Teacher Y1): I told you of the different learners in the classroom so, being not the same it means there are those learners who are even shy although they use their own language. They are always shy as long as they are talking to someone. Yah, to me the participation? They do participate. Participation also depends on the teacher himself, do you as a teacher motivate learners to speak? If you motivate them to speak then they will, even if it is a broken language. The main thing is not the broken language learners may use but their ideas is what we want to hear. They participate regardless of the language we use.

- **Interviewer (Researcher)**: In a situation where learners cannot get what you are teaching as result of second language, how do you enforce understanding of the subject content?

Interviewee (Teacher Y1): Once I discover that there is something my learners do not understand it means I must put emphasis on that. If it's a scientific term for example, I must find the means to communicate with the learners. Giving an example, I once asked the question about the instrument used to measure the temperature. Some understood me but most were totally lost. I then used the practical example and said have you ever been to the clinic or hospital? They said yes, on that note I explained to them that there is something that they usually put under your tongue when you are sick. They all said "ina ha xitiva" (yes, we know) and I said that what they put

under your tongue is a thermometer used to measure how hot or cold you are. So, in so to say I mostly use practical examples to enforce understanding. Sometimes I even give those who are gifted to help explain to the slow learners for better understanding.

- **Interviewer (Researcher)**: The last question, Sir, but not least, what do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (Teacher Y1): Is it that these learners must be competed and be sure of themselves, develop confidence and self-esteem? English therefore is beneficial, it helps those that were not sure of themselves to be bold, be sure and help them participate wherever they are. To me English is very beneficial and effective.

CONCLUDING REMARKS (AFTER THE INTERVIEWS)

Interviewer (Researcher): Thank you, Sir, our interview questions end here. We are done with our first assignment and the next will be the lesson observation. So let me use this time to say “thank you” for the effort you have put into this study. I know you should have been attending school matters at the moment, but you put all aside for this study. I really appreciate it, thank you.

Interviewee (Teacher Y1): Pleasure we can now go attend to the learners.

THE END

Appendix 3C: Interview transcript 3

Interviewer: Chauke Basambilu (Researcher)

SECTION A: INTERVIEWEE BACKGROUND

Name of school: **School B**

Name of teacher/Interviewee: **Teacher Y2**

Gender: **Male**

Qualifications: **Bachelor of Education**

Area of specialisation: **English & Biology**

Position held: **Post Level 1 (PL1)**

Home language: **Xitsonga**

Teaching experience: 31 **years**

Grades teaching: **4**

Date: **19/04/2022**

Time: **10: 35**

Venue**: School B premise (School Lab)**

INTRODUCTIONS (Before the interview starts)

Interviewer (Researcher): Morning Sir, my name is Chauke Basambilu, a researcher from University of South Africa. I know everything was communicated by the principal, but I would like to assure you that your particulars remain confidential, as such you are called Teacher Y2 in this study of School B. In addition, you are voluntarily or willingly participating in the study and free to pull out if it happens that you no longer want to form part of it. Again, I am not intending to take a long time though we have 18 questions, but it won't be long. Anything you need clarity on?

Interviewee (Teacher Y2): No, it is fine.

Interviewer (Researcher): Can we proceed to the interview session?

Interviewee (Teacher Y2): Yes ma'am.

SECTION B: INTERVIEW PROCESS

- **Interviewer (Researcher):** Our question one, Sir, is what challenges do you experience when using second language with primary science learners?

  Interviewee (Teacher Y2): Let me say this year is my first year of teaching science Grade 4, I do not know if maybe it is because of Term 1, but what I can say is that these learners are too young to be in Grade 4, I am telling you. I say this because they can't hear me, some cannot even copy what is written on the board. They can't even complete a simple task that you give them.

- **Interviewer (Researcher):** Okay, so what do you think are the perceived factors that have an influence on learners' understanding of English as a language of Instruction?

  Interviewee (Teacher Y2): I can say where they are coming from, the environment (their families) and even the lower grades they were in, is the cause. This is because they are used to the mother tongue from Grade R-3. When you speak in English, they cannot hear you and you are bound to translate each word into their mother tongue.

- **Interviewer (Researcher):** Sir, have you been trained on second language practices for science teaching for primary learners? If yes, was it effective?

  Interviewee (Teacher Y2): Yes, it was helpful

- **Interviewer (Researcher):** You mentioned the challenges that you usually come across in the classroom, so what strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

  Interviewee (Teacher Y2): I explain whatever that I will be explaining to them in English, and ask if they get what I say. If not understood, I then explain in Xitsonga which is their language. I use both the languages, allowing them to rehearse what I tell them.

- **Interviewer (Researcher):** With regard to all the challenges caused by the use of second language, what do you think can be done to resolve the challenges caused?

Interviewee (Teacher Y2): Eish, when I try to check I have found that the children looking at their age is totally different with how we started schooling. They are too young to be in this grade. I cannot say the department needs to add some years for a learner to be in Grade 4, but maybe from Grade 1 up to Grade 3 let these learners use English as the language of instruction, instead of using the mother tongue.

- **Interviewer (Researcher):** Sir, does the use of second language affect Natural Science teaching? If yes, how?

Interviewee (Teacher Y2): I can't say that it affects Natural Sciences Grade 4 but I think the issue here is learners are not used to English itself. Even in Grades 5, 6 and 7 they are also having the same challenge although they may have different levels. The issue with Grade 4 is that they are not use to the language. They are also not used to the way of doing things, having more than one teacher for different subjects while in the Foundation Phase they were used to one teacher for all the learning areas. For now, they are totally blank and confused. The issue of pushing learners to hear what we teach is where the teaching of science is negatively affected. It is impossible to complete the term work as a result of moving with the learners' pace.

- **Interviewer (Researcher):** As a science teacher how does the use of second language affect your performance in the classroom?

Interviewee (Teacher Y2): My challenge is that the translation also becomes problematic to me because I did not specialise in Xitsonga in my college education. Due to the learners' inability to understand what we usually teach in second language, I fail to finish or perform to the expected level. Then it has come to me that the aim is not to cover the curriculum but to deliver quality education, so the issue of translating everything hinders my performance.

- **Interviewer (Researcher):** The eighth question, do your learners find it easy or difficult to understand the subject content, and the assessment questions, in second language?

Interviewee (Teacher Y2): Very difficult, because for a lesson you will have to repeat it more than once whereas science lessons are arranged in such a way that we must do a specific lesson for a particular day/date.

- **Interviewer (Researcher):** In cases where learners find it difficult to interpret assessment questions - as you said they have difficulty in understanding the language of instruction - how do you go about helping them?

Interviewee (Teacher Y2): I am bound to use their home language to interpret wherever they find difficulties. I use Xitsonga to speak the truth or else they won't understand anything.

- **Interviewer (Researcher):** In cases where you have classroom discussions, how does second language influence learners' interaction?

Interviewee (Teacher Y2): These learners as I told you, when it comes to second language it is difficult for them, they cannot discuss in English. For them to understand what you need them to discuss about I let them use their home language as long as they understand what we are discussing about.

- **Interviewer (Researcher):** Science has concepts, I mean definitions, how do you help your learners to learn scientific terms in second language?

Interviewee (Teacher Y2): I allow them to say the concept in English then ask them what they understand about it. I write it on the board, let them read the meaning of the concept. Explain the concept in their home language and sometimes let them do the rehearsals by reading, reading while not looking on the board where the concept is written.

- **Interviewer (Researcher):** So, how does the use of second language (English) affect your learners' performance, Sir?

Interviewee (Teacher Y2): Very difficult as I indicated that some can't even say a second langue word nor copy what you wrote on the board. So, you must push them to write correctly as it is on the board. So, I will say it negatively affects their performance.

- **Interviewer (Researcher):** Based on the experience that you have, is the use of second language as the language of learning and teaching effective, or not effective, for primary school learners? Explain.

  Interviewee (Teacher Y2): In Xitsonga we say 'Rigogo ri songiwa raha tsakama' (meaning, issues are easily solved immediately after they happened). So, for this I will say the root of the problem is in the Foundation Phase; here is where the solution must come from. It is not easy to resolve the language issue in the upper grades because already the learners have soaked the use of Xitsonga. So, I will say for the Grade 4 it is totally not effective, however we are bound to force these learners to develop English as it is the language throughout their studies. Since there is nothing we can do, as the department has taken the decision, we therefore are forced to work under pressure to correct what is wronged in the Foundation Phase.

- **Interviewer (Researcher):** When teaching in your classroom, do you in some circumstances use Xitsonga, English and mixed code in your teaching?

  Interviewee (Teacher Y2): Yes, to enforce understanding, yes, I do use Xitsonga.

- **Interviewer (Researcher):** Under what circumstances do you use Xitsonga, English and mixed code in your teaching, Sir?

  Interviewee (Teacher Y2): Only when you find that learners cannot hear nor understand what you are talking or teaching. To follow your teaching, you are sometimes bound to do so.

- **Interviewer (Researcher):** How is your learners' participation when English is used during teaching, compared to when their mother tongue (Xitsonga) is used?

  Interviewee (Teacher Y2): In a class for example like the one I am teaching, I have about 80 learners and when it comes to the participation almost 40% can understand second language while the remaining 60% find it difficult and therefore I am bound to repeat the lessons so that they are not left behind. As the lessons are repeated maybe for the third time then a lot of them now will be able to participate. The ability of these learners is not the same, some will just keep quiet and look at you.

- **Interviewer (Researcher):** How do you enforce understanding of the subject content in a situation where learners cannot understand what you are teaching as result of second language difficulty?

  Interviewee (Teacher Y2): Standing in front of them it becomes easy for me to identify those who are not performing well and sit on the front seats. In five underperforming learners I will put one outstanding learner to help them understand what we are learning about. I also prefer doing the rehearsals to repeat and repeat what I taught.

- **Interviewer (Researcher):** Lastly, what do you think are the benefits of using second language as the language of instruction in the science classroom?

  Interviewee (Teacher Y2): The aim of learning English as we were taught in our times was that you learn so that you can go and hunt for a job. Because mostly where black people work there were white people and English was compulsory for effective communication in a particular company. To follow the instructions of the whites, English was required. Even nowadays in different offices they use it as a communication tool. Even if you go to Johannesburg to hunt for a job English is used. So according to my understanding English is not only applicable in a classroom environment but in a working environment.

CONCLUDING REMARKS

Interviewer (Researcher): Okay, Sir, the interview is finished. Please allow me to say thank you for the input in this research study. I heard that you urgently rushed home but after receiving a call that I am here, you came back. Thank you, Sir, for all the effort you have made. I know it wasn't easy to rush back just for something that will not personally benefit you but you sacrificed. Thank you once more.

Interviewee (Teacher Y2): No problem, Ma'am its fine.

THE END

Appendix 3D: Interview transcript 4

Interviewer: Chauke Basambilu (Researcher)

Section A: Interviewee background

Name of school: **School D**

Name of teacher/Interviewee: **Teacher W1**

Gender: **Female**

Qualifications: **Bachelor of Education**

Area of specialisation: **Physical sciences and mathematics**

Position held: **Post Level 2 or PL2 (Natural Science Departmental Head)**

Home language: **Xitsonga**

Teaching experience: **33 years**

Grades teaching: **7**

Date: **25/04/2022**

Time: **10: 15**

Venue**: School D premises (Teacher W1's office)**

INTRODUCTIONS (before the interview starts)

Interviewer (Researcher): We have already done the introductions in the presence of Teacher W2 but, before we start with our interview, I would like to remind you that please do not be surprised to be called by a pseudonym - Teacher W1 - this is your name for confidentiality purposes, so is it fine?

Interviewee (Teacher W1): Yes, Ma'am it's fine confidentiality is what I also want and you explained everything and all is clear. We can start.

SECTION B: INTERVIEW PROCESS

- **Interviewer (Researcher):** Our question one, Ma'am, is what challenges do you experience when using second language with primary science learners?

Interviewee (Teacher W1): The challenge here is that learners cannot understand English, 80% of them cannot hear you. When you ask them questions, they will answer you in Xitsonga. Some can hear but cannot speak nor write.

- **Interviewer (Researcher):** The second question Ma'am … what perceived factors have an influence on learners' understanding of English as a language of Instruction?

Interviewee (Teacher W1): The cause of these challenges is that in our time we were introduced to English as language of instruction from Grade one. So, it was easy for us to cope and adapt to the use of second language. Nowadays things have changed; Xitsonga is used in almost every learning area. You will hear a learner saying this is 'yinhlanharhu' meaning triangle. The system of our education is the cause of all these challenges.

- **Interviewer (Researcher):** The next question Ma'am, have you been trained on second language practices for science teaching to primary learners? If yes, was it effective?

Interviewee (Teacher W1): We are mostly taught on how to get in teaching science to the learners, however, they used to combine the primary schools with the secondary schools. Nevertheless, the training was effective.

- **Interviewer (Researcher):** So, to resolve the challenges that you have mentioned Ma'am, what strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

Interviewee (Teacher W1): When I see that my learners do not understand how I teach them a particular topic, I use practical examples, as science is all about practical experiments. The experiments help them comprehend a topic I will be teaching.

- **Interviewer (Researcher):** Okay, the next question, what do you think can be done to resolve the challenges caused by the use of second language in the science classroom?

Interviewee (Teacher W1): If the government can change the education system in the Foundation Phase and try to come to observe the challenges our learners together with us are going through, as a result of the system they introduced. Only if the department can change the system, it can bare better fruits. Without that we will find

our education getting buried bit by bit. You know these learners differ year after year, this year you might find we have better learners and the coming year we have worse. So let them get to schools and see what is happening, rather than sending us circulars which does not have eyes to see nor ears to hear.

Interviewer (Researcher): So, you want the Departmental directors to come and see what you go through?

Interviewee (Teacher W1): Yes, Ma'am, they must sometimes come down and have eyewitness of what is going on in the classroom environment, instead of sending us circulars.

- **Interviewer (Researcher):** Does the use of second language affect Natural Science teaching? If yes, how?

Interviewee (Teacher W1): It does affect it because when you teach in English throughout, learners will not hear anything or sometimes some will be sleeping because they get bored of something they do not even hear. When you ask questions based on what you are teaching, they will not answer maybe one can answer. If not that they will just be seated and look at you amazed because it is English which is a strange language to them is. They got it in Grade 4,5 and 6, they are not well on it but if they got it from Grade R it may be something better.

- **Interviewer (researcher):** So, how does the use of second language affect your performance as a teacher in the classroom?

Interviewee (Teacher W1): It affects my performance in that what I usually get from my learners as a result of what I taught them is very poor and non-motivating. Whenever I code switch for their understanding's sake, they grab it and use their language to answer in assessments questions. It is also not easy to complete the curriculum or content required because I cannot move to the next lesson while about 80% of the class is left behind. Looking at the time allocated I think is not enough based on what we are going through.

- **Interviewer (Researcher):** The next question Ma'am, do learners find it easy or difficult to understand the subject content and the assessment questions in second language?

Interviewee (Teacher W1): Very difficult but only easy to those who their IQ is high. Those who their IQ is low you find them seated and if you ask what the problem is? He or she will say I do not understand the question. When you try to read the question in learner's home language, is then that a learner will start writing. So, can you read questions for a Grade 7 learner like a Grade 4? No, it is impossible. So, it is difficult to those who cannot read this second language with understanding. Some can't read in Grade 7, some can't even write their names. The system also allows a learner to pass by age cohort, this also contributes to the challenges we are going through. When learners can be allowed to repeat a grade as it was years back such learners develop better understanding. Some of the learners just developed this stereotype that they will be pushed even though they do not work hard.

- **Interviewer (Researcher):** In cases where learners find it difficult to interpret assessment questions, how do you go about helping them?

Interviewee (Teacher W1): Very difficult, due to this difficulty that most of the learners have they end up copying the questions as they are in from the question paper to their answer sheets. I interpret in their home language if they find it difficult, some also cannot write so they will use the same language you interpreted the assessment questions with due to the failure to translate the home language to English.

- **Interviewer (Researcher):** Learning and teaching process requires discussions mostly, in your classroom Ma'am, how does second language influence learners' interaction during classroom discussion?

Interviewee (Teacher W1): Only the gifted and the average will participate in such discussion. Even if you group them and put the one with high IQ to be a group leader, the group leader will end up doing the group work alone. They cannot even interact in English as it is a barrier. They discuss fully when Xitsonga is used. When you ask them to translate what they discuss about into English, they can't.

- **Interviewer (Researcher):** Science is full of terminologies Ma'am, or concepts; how do you help your learners learn scientific terms in second language?

Interviewee (Teacher W1): I usually use concrete examples than abstract ones to develop better understanding of the concept.

- **Interviewer (Researcher):** In terms of your Grade 7 learners' performance, how does second language (English) affect them? How does English affect their performance, so to say?

Interviewee (Teacher W1): Because many learners can't read, though some can read but cannot understand what they read, even in writing it becomes problematic. As a person you can only write what you understand so that what you write can make sense. Some just copy the questions as they are on their answer sheet. So obviously they cannot perform as they can't understand what is required of them. In so to say they poorly perform.

- **1Interviewer (Researcher):** Looking at all the challenges that you come across in the science classroom, do you think the use of second language as the language of learning and teaching is effective or not effective for primary school learners? Explain.

Interviewee (Teacher W1): It is not effective at all although there are some who perform, and you will enjoy teaching them. As such we end up not achieving the science learning outcomes because of learners' inability to understand the language.

- **Interviewer: (Researcher):** The next question, do you in some circumstances use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher W1): Yes

- **Interviewer (Researcher):** As you indicated to use Xitsonga, English and mixed code in your teaching Ma'am, under what circumstances do you do it?

Interviewee (Researcher): In a situation where learners are so quiet and not able to answer the questions based on what I would be teaching obviously I am bound to explain in their own language and go back to English. It is like using both the languages for better understanding of the lesson.

- **Interviewer (Researcher):** How are your learners' participating when English is used during teaching compared to when their mother tongue (Xitsonga) is used?

Interviewee (Teacher W1): They participate fully when Xitsonga is used than when English is used. They also enjoy answering questions in their home language but when English is used many of them withdraw and become quiet.

- **Interviewer (Researcher):** How do you enforce understanding of the subject content in a situation where learners cannot grasp what you are teaching as a result of second language?

Interviewee (Teacher W1): In order to enforce I usually use practical examples rather than abstract examples. For example, during the process of changing states, I explained evaporation by boiling water to show a state of changing water into gas/vapour. So, they ended up understanding it more as they usually see it happening at home.

- **Interviewee (Researcher):** What do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (TeacherW1): English is beneficial and has to be used as a language of instruction because these learners will grow and they won't be able to communicate with anyone of different tribe if is not English. They cannot go or work anywhere without the use of it. This is the language that is used all over the world.

Concluding Remarks

Interviewer (Researcher): Thank you, Ma'am, for all the effort you made for me to interview you. I know you are always busy as you indicated when we speak on the phone, but you squeezed me in your programme. I thank you. So, are we proceeding to the classroom immediately or later?

Interviewee (teacher W1): Yes, we are going to the class, my period is the next one coming. Thank you for allowing us also to pour out our challenges 'Hey, phela ta vuya. Va Department ava tshiki ku rhumela ti circular va pfa vat ava ta vona hi voxe'. Translation: Hey it is not easy; the Department must stop the issue of sending us circulars but, they need to come sometimes and have a look on their own.

THE END

Appendix 3E: Interview transcript 5

Interviewer: Chauke Basambilu (Researcher)

SECTION A: INTERVIEWEE BACKGROUND

Name of school: **School D**

Name of teacher/interviewee: **Teacher W2**

Gender**: Male**

Qualifications: **Bachelor of Education.**

Area of specialisation**: English & Life Orientation**

Position held: **Post level 1 educator (PL1)**

Home Language: **Xitsonga**

Teaching experience: **4 years**

Grades teaching: 4

Date: **25/04/2022**

Time**: 09: 10**

Venue**: School D premise (Teacher W1's office)**

INTRODUCTIONS (before the interview starts)

Interviewer (Researcher): My name is Chauke Basambilu, a researcher from the University of South Africa but occupationally I am a teacher, so do not think I am from a different organisation, we are colleagues work-wise. My research is about investigating Teachers' Experiences of Teaching Natural Sciences in a Second Language: a Case of Primary Schools In Mopani East District. I believe you have understood everything concerning the research, but in case you have something to ask before we start with the interviews you are warmly welcome to ask. What I would also like to remind you are your rights to participate or not participate in this research. Whenever you feel not comfortable, you are free to exclude yourself, Madam, without any penalties. Is there anything you would like to say before we start?

Teacher W1: Okay, the other day you introduced yourself, but we did not have enough time to introduce ourselves. I am Teacher W1, Science Departmental Head and sitting next to me is Teacher W2 and we are pleased to participate in this type of research that allows us to express our insight. Maybe our views can evoke the National level to do something. Do not ask yourself why Teacher W2 is also here, we know it's a one-on-one interview but we agreed to use the same office so immediately the interview starts one of us will be out. Teacher W2 will be interviewed first and I will come after him if its fine with you Ma'am.

Interviewer (Researcher): No problem, that choice lies between the two of you.

Teacher W1: Okay, let me be out for now.

Interviewer (Researcher): You are welcome. See you in less than an hour.

Interviewee (Teacher W2): Be excused so we can start Ma'am.

Interviewer (Researcher): Ok, Sir. Please keep in mind that you are Teacher W2 for now.

Interviewee (Teacher W2): Ok, its fine.

SECTION B: INTERVIEW PROCESS

- **Interviewer (Researcher):** Our question one is what challenges do you experience when using second language with primary science learners?

Interviewee (Teacher W2): The challenge here is that learners cannot hear what we usually teach them due to the language barrier which according to my experience is caused by our current education system. Yes, there are those who can hear me but since learners are different some can't understand anything. The use of home language in Grades R – 3 poses a problem in a sense that when science, life skills, maths and social science is introduced in English in the next grade, it becomes a challenge for the learners to understand what they are taught. To an extent where you use a lot of home language or their vernacular because when you can spend the whole period teaching in English, they may end up knowing nothing. To answer this question in terms of percentages I will say, only 20% of learners do not have a problem with English, but the remaining 80% struggle.

- **Interviewer (Researcher):** Question 2, what perceived factors have an influence on learners' understanding of English as a language of Instruction?

Interviewee (Teacher W2): I think the education system itself of learners using home language in the early grade is a main factor. I also think this challenge is not with us Xitsonga speaking people but may be applicable to all second language speaking learners in the public schools. The main cause is that we do not introduce them to English which is used as language of instruction but to their mother tongue in the lower grades. Learners are not introduced to English at an early stage and foundation is very important. English is introduced fully at Grade 4 and they are expected to continue with it throughout their educational journey so I think that is the most or main factor.

- **Interviewer (Researcher):** Sir, have you been trained on second language practices for science teaching for primary learners? If yes, was it effective?

Interviewee (Teacher W2): Yes, we are trained in workshops by the curriculum advisors, they do train us on how to teach learners to understand science terminologies as it is one of the aspects which seems to be difficult for most of the learners.

- **Interviewer (Researcher):** With regard to all the challenges that you have mentioned Sir, what strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

Interviewee (Teacher W2): What I normally do is that I breakdown that English. For example; when I see that the English used is too much for my learners, I make it simpler using simple English. I also do a lot of code switching wherein I use a lot of mother tongue although it is not always easy as science is full of terminologies that are not easily translated. I even sometimes go the extra mile by organising extra classes for my learners' sake because natural science is not allocated enough time based on what our learners are going through with regard to the second language barrier.

- **Interviewer (Researcher):** Based on your experience Sir, what do you think can be done to resolve the challenges caused by the use of second language in the science classroom?

Interviewee (Teacher W2): Since English is the language of learning and teaching, I think what can be done, if at least the department of education itself can change the

system in the public schools. Maybe there are factors that they have identified when English is used at an early age, but it has reached a situation where I have compared a learner from the public-school Foundation Phase and a learner coming from a private school Foundation Phase where they have their own system on the use of language of teaching. These two learners when they are in Grade 4 together you find that a learner from the private school understands English questions very well rather than a learner in from the public school. So, I think if the education system can introduce the use of English from Grade R all second language challenges will be resolved because at the end the day mother tongue will not be used except in the foundation level (Grade R-3), but 90% of the learning areas are in English. When English can be used learners can use to it and when they get into Grade 4 it will not be a surprise to them.

- **Interviewer (researcher)**: So, does the use of second language affect Natural Science teaching? If yes, how?

Interviewee (Teacher W2): It does affect, since they do not understand what the teacher tries to convey to them unlike when Xitsonga is used wherein they understand everything. The use of English does affect the content delivered or the lesson because some of the things you can't just take them to Xitsonga because science is in English and full of terminologies which are not easily translated. So, it does affect a lot.

- **Interviewer (researcher):** Looking at all the challenges that you experience in your classroom Sir, how does the use of second language affect your performance as a teacher in the classroom?

Interviewee (Teacher W2): Because of the education system as I indicated I end up teaching science in Xitsonga as a result of our learners' inability to hear us. You find that I end up "tsongalising" (to use Xitsonga almost in every English word) in my every science teaching. This is because our learners cannot hear us, they cannot read they cannot write. So here I am I want to teach science which must be done in English I will end up teaching languages (Xitsonga and English). The same applies with second language teachers they end up teaching it in Xitsonga. These instances, Interviewer, affect our communication skills as educators and how we should perform not in science only but in all English based subjects. There is also a huge delay on a term content coverage considering that science time was allocated based on its content and it was made with the translation to any home language, but allocated based on

one language use and that is very problematic as we always code switch in almost every information we give. By doing so you end up not reaching the lesson aims by trying to make learners understand you.

- **Interviewer (researcher):** Do your Grade 4 learners find it easy or difficult to understand the subject content and the assessment questions in second language?

Interviewee (Teacher W2): With the strategies that I normally use I will say my learners find it easy, because I spend a lot of time in one lesson while code switching. Sometimes I make a song with the content I will be teaching because these learners love singing a lot. So, when you make a song, it makes them develop better understanding and if they come across assessment, they will remember the song and be able to answer. I even make use of observations, practical experiments so that they can absorb every aspect we did and by doing so they will remember all important aspects and discover that these things are what we sang about. However, it still hard because our learners to be honest with you cannot read with understanding, even if you give them a paper, they will just read my name is so and so but, if you ask what that means she/he can't comprehend. The problem here is the education system. If they can put English as a language of instruction in the Foundation Phase things will change, I am telling you. If they can put it into practise, it will work because the private schools are doing it and they are performing. If you want to see that it is working, take your child to the private school grade R, 1, 2 and 3 and bring him/her here to Grade 4 she is going to be a star because she understands almost everything that you are trying to teach. It is not that we are not teaching we are, but because of the system, it is very difficult. They can answer the questions during assessments but in terms of percentages 70% they can understand but 30% do cannot understand. You find that learners wrong something that he/she knows, but when you do the corrections you hear a learner saying OO"H!" And you can see that the learner knew the answer but could not interpret what it meant.

- **Interviewer (Researcher):** In cases where learners find it difficult to interpret assessment questions, how do you go about helping them?

Interviewee (Teacher W2): When I am the one invigilating, I read the question and interpret it to make them understand what it means in the learners' home language.

For example, what is energy? And when I discover that they find it difficult then I will go like “I yini matimba?” that’s how I help them.

- **Interviewer (researcher):** We usually make use of discussions in the classroom Sir, so how does second language influence learners’ interactions during classroom discussion?

Interviewee (Teacher W2): English itself makes them look like they are very much disciplined, while they are not. Let’s say we have a group discussion as you are saying, they will be too quiet and so passive, but immediately I say you can use your home language to talk about these things then I can hear voices. English makes them as if they are behaving while they are not, it’s just that they cannot interact in English to each other.

- **Interviewer (researcher):** Science is full of terminologies Sir, I mean concepts; how do you help your learners to learn scientific terms in second language?

Interviewee (Teacher W2): I do practical experiments. Giving an example: let’s say I teach about evaporation; I will ask what is evaporation then explain to them what it is. To develop more understanding, I will bring the kettle with water, boil it and immediately the water starts to boil, vapour will go out and I will explain more that the process of liquid water changing into gas/vapour is called evaporation. So, in so to say I use practical experiments to explain terms/concepts.

- **Interviewer (Researcher):** Okay, how does second language (English) affect your learners’ performance?

Interviewee (Teacher W2): It affects them in a very bad way as even learners who seems to be better or good find them getting low marks, because of some of the questions she could not understand due to the language barrier.

- **Interviewer (Researcher):** So, do you find the use of second language as the language of learning and teaching effective or not effective for primary school learners? Explain.

Interviewee (Teacher W2): For that I will say it is 50% effective and 50% not effective because our learners are different. There are some learners who find it easy to understand English while some could not. It is effective to those who are gifted but to the underperformers it is not effective.

- **Interviewer (Researcher):** Sir, do you in some circumstances use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher W2): Yes, I do mostly.

- **Interviewer (Researcher):** In the previous question Sir you said: 'Yes mostly. Under what circumstances do you use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher W2): I do not just use Xitsonga but use it where I see that my learners do not comprehend what I am teaching them. I mostly use Xitsonga where the content is full of terminologies. Sometimes I even use the projector to project whatever that I will be teaching or play some videos to hook their interest and understanding to avoid use of Xitsonga more. When videos are played and discover their inability to understand then it's where I step in with their home language to interpret.

- **Interviewer (Researcher):** Okay and how are learners' participating when English is used during teaching, compared to when their mother tongue (Xitsonga) is used?

Interviewee (Teacher W2): The participation is totally different just like when you are teaching science in English and you told yourself that I want to teach in English, you will teach and teach but you will only be with few learners. Immediately you switch to learners' language, now you will see most of them starting to raise their hands, they will be now back into the class, you will see them living and active. But if you just only use English ''whaya-whaya'' you will find that only 4 or 5 learners are raising hands understanding what you are trying to say.

- **Interviewer (Researcher):** Mr. W2, how do you enforce understanding of the subject content in a situation where learners cannot grasp what you are teaching as result of second language?

Interviewee (Teacher W2): This is what I do since our learners learn by observing or by seeing things. As now we are in water cycle, I will teach whatever that is there in the water cycle. When I discover that there still a lack of some sort. I will use projector and power point slides. The use of technology also plays an important role as they will be interested in it, paying attention in seeing colourful pictures, pointing at it and say ooh look how the water evaporates, ooh now is changing, ooh, so that helps a lot.

- **Interviewer (Researcher):** The last question, … based on your experience Sir, what do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (Teacher W2: The benefit part of it is that when a learner proceeds with his/her studies she/he will be able to communicate with fellow students since English is used as a common language of communication. It is also useful for the answering of interview questions. It is very simple for the child to understand the language than an old person. If you can take a child to learn a language, he/she will develop faster than "magogo". Therefore, it is an advantage if these learners are introduced to the language of instruction as it is the one to be used anywhere professional. When English helps learners pass their school and university examinations as all assessments except home language are done in English. It is also useful in the working environment.

Concluding Remarks

Interviewer (researcher): I know you are in hurry as you indicated, Sir, but please allow me say, thank you very much for the input that you have made in participating and sharing your insight in the study. Thank you and be blessed.

Interviewee (Teacher W2): My pleasure Ma'am please do not throw away all the knowledge you are gaining in your studies so that you can also assist me. I am behind you; I will get registered soon.

Interviewer (Researcher): You are welcome. Sir, I can assist where I can. Thank you once more.

THE END.

Appendix 3F: Interview transcript 6

Researcher/Interviewer: Chauke Basambilu

SECTION A: INTERVIEWEE BACKGROUND

Name of school: **School C**

Name of teacher/Interviewee: **Teacher Z1**

Gender**: Male**

Qualifications: **Bachelor of Education**

Area of specialisation: **Physical sciences and Mathematics**

Position held: **Post level 2 Educator or PL2** (**Natural Science Departmental Head)**

Home Language**: Xitsonga**

Teaching experience: **11 Years**

Grades teaching: **Grade 7**

Date: **19/04/2022**

Time**: 12:50**

Venue: **School premises (teacher Z1's office)**

INTRODUCTIONS (Before the interview starts)

The Interviewer (Researcher): My name is Chauke Basambilu as I have introduced myself the other day. I am a teacher also, but today I came as a researcher from the University of South Africa. My research is about investigating TEACHERS' EXPERIENCES OF TEACHING NATURAL SCIENCES IN A SECOND LANGUAGE: A CASE OF PRIMARY SCHOOLS IN MOPANI EAST DISTRICT. Before we start with the interview process, I would also like to remind you of your rights to participate or not participate in this study, in so saying your participation is voluntary and remember there is no any kind of compensation that you will be given in return of the information that you will provide. So, are you willingly and ready to do this, Sir?

Interviewee (Teacher Z1): Yes, absolutely.

Interviewer (Researcher): Ok thank you. Let us start with our interview process, remember you have 18 questions to reply.

Interviewee (Teacher Z1): Yes, I know.

SECTION B: INTERVIEW PROCESS

- **Interviewer (researcher):** Question number one Sir is, what challenges do you experience when using second language with primary science learners? Based on the grade that you are teaching.

Interviewee (Teacher Z1): The second language is the language of instruction which is English so these learners have a challenge in understanding the language itself as a basic. They can't understand some questions when they are phrased and that causes them not to understand the science terminologies because already language to them is a barrier. Therefore, it causes a very big challenge in such a way that they don't even understand the language barrier even though they have scientific terms. Understanding scientific terms need a learner who has a background of the language in which they are taught or written. English to our learners is a problem as they cannot analyse questions nor give responses in English because the understanding of the language is a challenge.

- **Interviewer (Researcher):** Okay, so what perceived factors have an influence on learners understanding of English as a language of Instruction

Interviewee (Teacher Z1): One of the factors could be the social factor, the background of the families they are coming from because at home these learners normally use their home language which is Xitsonga. They don't practise to speak in English so the social factor that I am talking about is the main issue. Even when they communicate with their neighbours or friends they use Xitsonga which makes it difficult to understand or translate to English, when they come into the classroom situation the problem persists because at home they use a different language which is different from the one they use when they are in class. Another factor could be lack of commitment, I have come to realise that these learners do not have time to practise, they do have dictionaries but they cannot use them. They do have smartphones but they can't use them for their education; if they were using the dictionaries on their

smartphones they could be improving their language. What they do is that they keep focusing on the social media and in the social media they are able to read some of these things but to give responses if you can check there are lots of spelling errors because they are not used to the language.

- **Interviewer (Researcher):** Question three: Have you been trained in second language practices for science teaching for primary learners? If yes, was it effective?

Interviewee (Teacher Z1): Can you clarify that please?

Interviewer (Researcher): Ok Sir, have you been in a workshop or attended a training session that was aiming to train you with regard to the use of English language with your learners in the classroom?

Interviewee (Teacher Z1): Yes, all the terms we go for workshops. We are trained and also advised to teach science in second language as it is the language used to assess them. We are advised to teach and assess in English. We are trying our best and it seems to be effective in the sense that when you teach a terminology or a certain aspect today and you allow them to go and practise at home you find them to have mastered it although it takes a bit longer sometimes to do so, but after you have emphasised it, they go and practise and they master it.

- **Interviewer (Researcher):** What strategies do you use in managing the challenges caused by the use of second language (English) in your classroom?

Interviewee (Teacher Z1): We normally advise these learners to use dictionaries - if you can see there (bookshelves) we have sets of dictionaries. We also use dictionaries in class when we are teaching and learning. We know that they may find difficult words or terminologies that they won't understand as we are learning and we advise them to refer to the dictionaries. We also advise them to consult their elders at home to assist them whenever they are reading or have a particular task to help on how to translate or write in English so that when they come to the class it becomes a little bit easy to understand the content being taught in second language.

- **Interviewer (Researcher):** The next question, what do you think can be done to resolve the challenges caused by the use of second language in the science classroom?

Interviewee (Teacher Z 1): What I can say is that in our lower grades (the Foundation Phase), learners are being taught in their home languages so it delays them to develop further in the second language because they start the language in Grade 4. You find that when they get into Grade 4 where the use of second language starts as the language of instruction, they are still empty. I can suggest that if we can allow the learners to do all the subjects in English as the language of instruction as early as in Grade R, then that will help them to improve their language skills.

- **Interviewer (Researcher**): Question six, does the use of second language affect Natural Science teaching? If yes, how?

Interviewee (Teacher Z1): Yes, it does because if a learner can't understand the question written in second language already the learner has fallen off. Maybe if it was possible that these learners learn science in their home language it was going to be better. Taking an example of English-speaking people are doing the same science in their home language and it is advantageous to them, I think they understand it better that we do. So, I suggest that somewhere somehow we need to develop terminologies and dictionaries that are in our home language so that these learners can learn and understand better than second language.

- **Interviewer (Researcher):** Ok, the next question, how does the use of second language affect your performance as a teacher in the classroom?

Interviewee (Teacher Z1): This one is very challenging because of the language itself. When you are teaching you can easily observe whether learners are following you or not and you can't just rush as a means of completing a lesson when learners are behind. You need to conduct a lesson where you are aware and satisfied that learners are understanding. So sometimes I am even lagging behind the pacesetter because I must follow their pace, allowing them to learn the language. I have to follow their pace and make sure that my learners understand what I am teaching. Therefore, the performance is somehow affected in such a way that I cannot deliver as expected in time. There is always a time delay as a result of learners inability to understand the second language used, and that means I will have to consolidate and integrate between language and subject content.

- **Interviewer (researcher):** Do learners find it easy or difficult to understand the subject content and the assessment questions in second language?

Interviewee (TeacherZ1): Very difficult, as I indicated earlier on that language is a barrier on its own. It is already a problem to them, some of the questions they are not able to respond to, because they are not used to the questions even if the content has been taught. The way the questions are phrased becomes problematic; for instance, let's say you when you were doing classwork you phrased a question in this manner and then comes a test you change the way the question is phrased, they will fail to respond even if the response is the same because they find it difficult to understand the question because it is differently phrased from the one given in the classwork.

- **Interviewer (researcher):** In cases where learners find it difficult to interpret assessment questions Sir, how do you go about helping them? I mean what effort do you make trying to let them understand the questions in different assessments that you give in the classroom?

Interviewee (Teacher Z1): With this one is very easy to assist them when it is in a classwork situation, when it is a class activity because I can interpret for them. The same applies when it is homework, when they start to write in class, I can help, but it is difficult when it is a formal task because we cannot help them in such a way.

- **Interviewer (Researcher):** In cases where you have discussions in your classroom during learning and teaching, how does second language influence your learners' interaction?

Interviewee (Teacher Z1): These learners are aware that they are not good in second language so it makes them shy. When you pose a question, they are reserved to answer because they know they are sometimes struggling. There is also this tendency of some learners laughing at others, say for example some want to say something and they hear that he/she fails to pronounce it properly, they will laugh at that learner. Such instances affect those with lower self-esteem but to those who have high self-esteem they do not have a problem. There are few learners who can speak English fluently.

- **Interviewer (Researcher):** Science has concepts and terminologies. As a science educator how do you help your learners learn scientific terms in second language?

Interviewee (Teacher Z1): What we normally do here we know it is not easy but is to try to translate the terminologies into learners' language although in science not all the terminologies are easily translatable to other languages. What we also do is to use

daily normal life examples to enforce terms understanding. We also design a table or list of scientific definitions for learners to go and practice/ master at home.

- **Interviewer (Research):** Mr. Teacher Z1, whenever we teach and whatever we teach we must assess to determine what our learners understand and their understanding of a particular topic or content is determined by their pass rate. So, how does second language (English) affect your Grade 7 learners' performance?

Interviewee (Teacher Z1): It does affect learners' performance because if they do not understand the language itself, obviously they will not provide the right answer as expected. This literally means they are not going to do well if they do not understand the questions. They do not perform well in science because of the second language.

- **Interviewer (researcher):** Is the use of second language as the language of learning and teaching effective or not effective for primary school learners? Explain.

Interviewee (Teacher Z1): Yes, it is effective, as we know that English is a language of instruction and it is a globally a common language of communication. So, I will say it is good to use it as a language of instruction for it prepares our learners to communicate with other people in their professional places or different respective areas. It will also help them for their career development especially when they go to the higher institutions. To be able to prepare for an interview question and give responses if they are looking for a job.

- **Interviewer (Researcher):** Mr Teacher Z1, during your teaching process do you in some circumstances use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher Z1): Yes, normally when you realise that learners are not grasping what you are teaching about, we do try to use their language, English and mixed code.

- **Interviewer (Researcher):** As you indicated that you do use mixed code sometimes in your class, under what circumstances do you use Xitsonga, English and mixed code in your teaching?

Interviewee (Teacher Z1): We use Xitsonga when we realise that learners are having problems in understanding the content or terminologies we are teaching or a particular information that we are conveying.

- **Interviewer (researcher):** Okay Sir, how are your learners' participating when English is used during teaching, compared to when their mother tongue (Xitsonga) is used?

Interviewee (Teacher Z1): The participation is very poor when English is used. I can say that mostly when we pose a question or topic for discussion instead of them to respond in English, they will do it in Xitsonga. So, this gives an indication that they are able to respond or participate in their home language rather than in English.

- **Interviewer (Researcher):** Mr. teacher Z1, in cases where you are teaching a particular science content using second language and you realise that your learners does not understand what you are teaching, how do you enforce understanding of the subject content in a situation like that? How do you enforce understanding where learners cannot grasp what you are teaching as result of second language?

Interviewee (Teacher Z1): With this one is a very challenging situation; we do come across these situations but normally because this is science what we basically do is we have realised that learners can understand or do better when they do things. Therefore, when we realise that learners do not grasp a certain content, we prefer to take them through a practical task which will be conducting the very same lesson that they do not understand. If we allow them to do the practical and they come back being able to respond to questions based on the experiments they, then we can see that they understand better than before. Although we do not have laboratories where we can conduct science experiments but we sometimes improvise.

Interviewer (researcher): In so to say you normally use experiments and abstract or practical examples to enforce understanding in your classroom?

Interviewee (Teacher Z1): Yes,

- **Interviewer (Research):** What do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (Teacher Z1): Well, English prepares our learners for assessments so that they can be able to attempt or give answers in their formal assessments and even attempt other English based learning areas. So, if English is used in the science classroom, it helps them understand other English based subjects too as these

subjects integrate. One other thing is that it also prepares them to interact with the outside world where they can come across other tribes because when they come across other tribes the mode of communication must be English. It also prepares them for the working industry in order to communicate with the employers and colleagues. One other thing is that whenever they cross the border they will manage to interact as English is greatly used as the common language of interaction.

Concluding Remarks

Interviewer (Researcher): Ok Sir, our interview ends here. I would like to thank you for the opportunity you have afforded me to do this interview. As Departmental Head I know you are always loaded with the departmental work, but you sacrificed a lot to participate in this study. Thank you, Sir, once more.

Interviewee (Teacher Z1): You are welcome, Ma'am. We are looking forward to seeing the research results as the school.

Interviewer (Researcher): No problem, Sir, thank you

THE END

Appendix 3G: Interview transcript 7

Interviewer: Chauke Basambilu (Researcher)

SECTION A: INTERVIEWEE BACKGROUND

Name of school: **School C**

Name of teacher: **Teacher Z2**

Gender**: Female**

Qualifications: **Bachelor of Education**

Area of specialisation: **Natural sciences, Technology and Xitsonga**

Position held: **Post level 1 Educator (PL1**)

Home Language: **Xitsonga**

Teaching experience: **28 years**

Grades teaching: **Grade 4**

Date: **19/04/2022**

Time: **13: 40**

Venue: **School premises (Teacher Z1's office)**

INTRODUCTIONS (Before the interview starts)

The Interviewer (Researcher): My name is Chauke Basambilu a researcher from University of South Africa for Master's Studies in the Department of Science and Technology. The research explores TEACHERS' EXPERIENCES OF TEACHING NATURAL SCIENCES IN A SECOND LANGUAGE: A CASE OF PRIMARY SCHOOLS IN MOPANI EAST DISTRICT. You are reminded of your rights to participate or not participate in this study Ma'am, meaning that participation is voluntary. I also thank you before we start for giving me the opportunity to hear your insight about different aspects as in the research questions.

Interviewee (Teacher Z2): Okay.

Interviewer (Researcher): Are you okay that we can proceed to the interview questions?

Interviewee (Teacher Z2): 'ina', se ni hlamula hi xilungu kumbe hi xichangani' Translation: Yes, so do we answer in English or in Xitsonga?

Interviewer (researcher): No, you are free to use the language of your choice as long as we can hear each other, Ma'am. Questions are also in Xitsonga and English so you are also free to be asked in your language. So which language do you prefer?

Interviewee (Teacher Z2): You can use ask using both.

Interviewer (researcher): Okay, it's fine.

SECTION B: INTERVIEW PROCESS

- **Interviewer (Researcher):** Okay, Ma'am, let's start with question one, what challenges do you experience when using second language to primary science learners? 'Xana hi swihi swi phiqo/ku tikeriwa loku mi hlanganaka na kona loko mi tirhisa xinghezi ku dyondzisa vana lava nga vulavuriki ririmi ra xinghezi'?

Interviewee (Teacher Z2): The problem is that these learners, Ma'am, come from the lower grades where Xitsonga or home language was used as a language of instruction. They do not hear, write nor speak English - which is used as a language of instruction - at all, and it is their first time to hear science terms here in Grade 4.

- **Interviewer (researcher):** The next question, what perceived factors have an influence on learners' understanding of English as a language of Instruction? 'Xana hi swihi swi vangelo leswi kavanyetaka vana ku twisisa xinghezi tani hi ririmi ro dyondza no dyondzisa'?

Interviewee (Teacher Z2): The main factor to me is the use of Xitsonga in all the Foundation Phase grades. The transition and language used in the lower grades is problematic.

Interviewer (researcher): You think the main factor is that learners start to use English in Grade 4, only that?

Interviewee (Teacher Z2): Yes, that is the main causing factor to the Grade 4's.

- **Interviewer (Researcher**): Okay, have you been trained in second language practices for science teaching for primary learners? If yes, was it effective? ‘ Xana mi tshame mi nga leteriwa hi matirhisele ya xinghezi ku dyondzisa sayense eka vana va tidyondzo tale hansi ke, loko kuve I ina xana kuve na kupfuneka ke’? How did the training help you, if yes?

Interviewee (Teacher Z2): On language practice no, but we are trying to make the learners understand the language … some can hear us.

- **Interviewer (Researcher):** So, based on the challenges that you come across in your classroom with regard to the use of second language, what strategies do you use in managing the challenges caused by the use of second language (English)? ‘Xana hi tihi tindlela leti miti tirhisaka ku lwisana na swiphiqo leswi vangiwaka hiku tirhisa xinghezi e tlilasini ya n’wina?’

Interviewee (Teacher Z2): Hey ‘swa tika’ (it is very difficult) but, what I normally do is to explain and translate in their home language for understanding. For instance I will say when they talk about a leaf they mean ’rikamba’ in Xitsonga.

- **Interviewer (researcher):** This is our question 5, Ma’am; what do you think can be done to resolve the challenges caused by the use of second language in the science classroom? ‘Xana miehleketa leswaku kunga endliwa yini ku lwisana na mintlhotlho leyi vangiwaka hiku tirhisa ririmi ra xinghezi eka tidyondzo ta sayense etlilasini.’?

Interviewee (Teacher Z2): ‘Ni hleketa ku loko vanga suka na xinghezi lexi aka foundation phase swinga olova. Aka grade 4 hinga ha sunguli hansi.’ I think what will help is to use English from the Foundation Phase. Changing the language of instruction in the Foundation Phase can help. Although what they will learn will be based on their age, using English will help not to teach second language and content subjects at the same time in the Intermediate Phase. When you say ‘stone’ for instance, they will know what you mean by that.

- **Interviewer (Researcher):** Does the use of second language affect Natural Science teaching? If yes, how? Ku tirhisa ririmi ra xinghezi swa kavanyeta vudyondzisi bya sayense xana, loko kuri ina hindlela yihi? Mi kavanyeteka njhani ma’am aka matirhele ya n’wina tani hi mudyondzisi wa sayense loko xinghezi xi tirhisiwa.

Interviewee (teacher Z2): 'Nkavanyeto wu kulu lku vana ava yi tei langweji leyi' se swidya nkarhi ngopfu wa ha yisa aka Xitsonga. Translation: It affects a lot. This is because for every English work you will have to translate and such consumes a lot of time, considering the timeframe set for curriculum coverage.

- **Interviewer (Researcher):** Okay, so how does the use of second language affect your performance as a teacher in the classroom? Xana ku tirhisa ririmi ra vadyi va hlapfi swi kavanyeta njhani matirhele ya n'wina tani hi mudyondzisi etlilasini.

Interviewee (Teacher Z2): 'Swi endla ku inga fambi hi pace leyi lavekaku minkarhi hinkwayo' it affects my performance because there is no way I can teach a lesson once and for all, but instead I will have to repeat again and again. Secondly, I must follow their understanding pace which affects curriculum coverage as I indicated.

Interviewer (Researcher): It only affects your pace of moving along with the curriculum?

Interviewee (Teacher Z2): Yes, you do not work accordingly because of the repetitions of the lessons.

- **Interviewer (Researcher):** Do learners find it easy or difficult to understand the subject content and the assessment questions in second language? ' Xana vadyondzi va oloveriwa kumbe ku tikeriwa ku fika kwihi ku twisisa mongo wa tidyondzo ta sayense na swivutiso swa swikambelo hi ririmi ra xinghezi?'

Interviewee (Teacher Z2): They find it very difficult because many of them cannot even read a single English word, due to the language barrier.

- **Interviewer (researcher):** In cases where your learners find it difficult to interpret assessment questions, how do you go about helping them? 'Laha vana va fikaka va tikeriwa ku twisisa kumbe kuhundzuluxela swi vutiso swa swikambelo, xana miva pfunisa ku yini?'

Interviewee (Teacher Z2): I usually read the questions in English then explain what the question requires in Xitsonga, because learners usually cannot read in their own language.

- **Interviewer (Researcher):** We normally have discussions in science classrooms Ma'am, now, how does second language influence learners' interaction during classroom discussion? The interaction amongst your learners how does it get

affected by the use of second language? 'In Xitsonga ni vula ku Xana ririmi ra xinghezi ri olovisa kumbe ku nhonhohisa njhani mbulavurisano wa vadyondzi etlilasini?'

Interviewee (Teacher Z2): 'Haa! Kwalanu ku tika ku tika' Translation: That is very, very problematic. when it comes to discussion is very stressful because when you use English only, they will just look at you without doing what you advise them to do. The discussion to the Grade 4 becomes very unfruitful, until you switch to their own language.

Interviewer (Researcher): So, you mean that you render classroom discussions using Xitsonga for the learners to hear you?

Interviewee (Teacher Z2): Yes, that's what I usually do.

- **Interviewer (Researcher):** Okay, the next question, in science we have terminologies, concepts or definitions, for example, in Grade 4 there is matter, energy etc., so how do you help your learners to learn scientific terms in second language? 'Xana miva pfuna njhani vadyondzi ku dyondza marito ya sayense hi ririmi ra xinghezi?'

Interviewee (Teacher Z2): I write the term on the board, explain it in Xitsonga, give them notes which they must go and read and rehearse at home. However, the way the terms are phrased on the first day you teach them, it must not be changed in any way because a slight change may seem as if they have never learned about that term.

Interviewer (Researcher): Since you said English is not easy for your learners, when you give them notes of the terms are they able to understand the meanings of what you gave them?

Interviewee (Teacher Z2): No, I make sure the notes are well explained in their own language too and the phrasing does not change in the assessment tasks.

- **Interviewer (Researcher):** The next question Ma'am, how does second language (English) affect learners' performance? 'Xana ririmi ra vadya nhlampfi ri kavanyeta nhjani matirhele ya vana/vadyondzi?'

Interviewee (Teacher Z2): Negatively it affects their performance, they do not perform the way they should.

Interviewer (Researcher): What do you mean by “they do not perform the way they should?” ‘Mi vula yini loko miku ava tirhi hi Ndlela leyi a va fane va tirha hi yona?’

Interviewee (Teacher Z2): ‘Ni vula ku a va tirhi kahle, va tirhela hansi swinene’. (Translation: What I mean is that they do not perform well, their performance is very low.)

- **Interviewer (Researcher):** So, based on your experience Ma’am do you think the use of second language as the language of learning and teaching is effective or not effective for primary school learners? Explain. ‘Xana xinghezi xa tirhiseka kumbe axi tirhiseki ku dyondzisa naku dyondza eka vana va xikolo xale hansi ke? Hlamusela.’

Interviewee (Teacher Z2): I will say it is effective because some learners try it and there is no way we can change what is decided by the Department,

Interviewer (Researcher): Not forgetting that we are teaching for learners to pass, checking on your learners’ performance in Grade 4 is the use of language effective?

Interviewee (Teacher Z2): In that case no, for the Grade 4 learners, it is not effective at all because although we use English in the classroom, we are bound to use learners’ home language as well, and many learners are not performing well.

- **Interviewer (researcher):** The next question, do you in some circumstances use Xitsonga, English and mixed code in your teaching? ‘Xana kuna nkarhi lowu mi pfaka mi tirhisa Xitsonga, xinghezi kumbe nkatsakanyo wa tindzimi eku dyondziseni ka n’wina ke?’

Interviewee (Teacher Z2): Yes.

- **Interviewer (Researcher):** In the previous question Ma’am, you said yes you sometimes use Xitsonga, English and mixed code. Under what circumstances do you do it? ‘Hile hansi ka xuyimo xihi lexi endlaka leswaku mi tirhisa Xitsonga, xinghezi kumbe nkatsakanyo wa ti ndzimi xana?’

Interviewee (Teacher Z2): Whenever I get to the detailed content of the lesson and discover that they are lost, I then change to their mother tongue.

- **Interviewer (Researcher):** How are learners' participating when English is used during teaching, compared to when their mother tongue (Xitsonga) is used? 'Xana van ava nghenelela ngopfu loko mi tirhisa ririmi rihi eka Xitsonga na xinghezi?'

Interviewee (Teacher Z2): 'ku vulavula ntiyiso va nghenelela ngopfu loko hi tirhisa xitsonga because va kota ku twa swilo hinkwaswo.' Translation: They participate more when Xitsonga as their home language is used, rather than when English is used because they are able to hear everything.

- **Interviewer (Researcher):** There are situations where your learners do not understand the content of what you are teaching because of the second language difficulty. Ma'am how do you enforce understanding of the subject content in a situation where learners cannot grasp what you are teaching as result of second language? 'Xana mi tirhisa ndlela yihi ku endlela leswaku vana va twisisa mongo wa nhloko mhaka eka xiyimo lexi vatsandzekaka ku xi twisisa hikokwalaho ka ku tirhisiwa ka xinghezi?'

Interviewee (teacher Z2): To enforce understanding I repeat the lesson and make use of Xitsonga mostly to ensure that there is progress in my teaching.

- **Interviewer (Researcher**): Okay, Ma'am, the last question of our interview is what do you think are the benefits of using second language as the language of instruction in the science classroom?

Interviewee (Teacher Z2): The benefit of using second language is that as they continue into the next grades, they continue to develop understanding of the language which is very important as it is the common language in the outer world.

Concluding Remarks

Interviewer (Researcher): Thank you once more, Ma'am for your time. It was a pleasure interacting with you, I thank you.

Interviewee (Teacher Z2): Na mina ni nkhensile. Trans: I also thank you.

THE END

Appendix 4: Preliminary, Reviewed and sub themes from research interview of participating teachers

Category	Code	Themes	Reviewed Themes	Subthemes	Count	% Codes	Cases	% Cases
1.1. Challenges of using second language English	Challenges that are positive				2	0.60%	1	10.00%
1.1. Challenges of using second language English	Challenges that are negative				5	1.60%	3	30.00%
1.1. Challenges of using second language English	Learners find it difficult to express themselves	They cannot read, write and speak in second language	Inadequate second language proficiency		1	0.30%	1	10.00%
1.1. Challenges of using second language English	Learners cannot write English	They cannot read, write and speak in second language	Inadequate second language proficiency		3	0.90%	3	30.00%
1.1. Challenges of using second language English	Learners are shy to speak English	They cannot read, write and speak in second language	Inadequate second language proficiency		3	0.90%	3	30.00%
1.1. Challenges of using second language English	Learners cannot read English	They cannot read, write and speak in second language	Inadequate second language proficiency		1	0.30%	1	10.00%
1.1. Challenges of using second language English	Passed by age policy	Pass by age policy			1	0.30%	1	10.00%
1.1. Challenges of using second language English	Learners are too young	Learners are too young when they start going to school	School entry age		1	0.30%	1	10.00%
1.1. Challenges of using second language English	Learners do not understand concepts	Learners do not understand the second language	Inadequate second language proficiency		7	2.20%	6	60.00%
1.1. Challenges of using second language English	Learners cannot copy what is on the board	They cannot read, write and speak in second language	Inadequate second language proficiency		1	0.30%	1	10.00%
1.1. Challenges of using second language English	Learners Cannot complete tasks	Learners do not understand the second language	Inadequate second language proficiency		1	0.30%	1	10.00%
1.1. Challenges of using second language English	Learners do not understand English as a language	Learners do not understand the second language	Inadequate second language proficiency		5	1.60%	4	40.00%
1.1. Challenges of using second language English	Learners cannot analyse questions	Learners do not understand the second language	Inadequate second language proficiency		1	0.30%	1	10.00%

1.1. Challenges of using second language English	Learners cannot give responses in English	They cannot read, write and speak in the second language	Inadequate second language proficiency		3	0.90%	2	20.00%
1.1. Challenges of using second language English	Other language was used for instruction	The use of learners' home language in the Foundation Phase	The language of instruction in the Foundation Phase		4	1.20%	3	30.00%
1.1. Challenges of using second language English	Learners cannot hear English	They cannot read, write and speak in second language	Inadequate second language proficiency		3	0.90%	2	20.00%
1.1. Challenges of using second language English	Current education system	Caused by our current education system	Language of instruction in the Foundation Phase	school entry age	1	0.30%	1	10.00%
1.2. Perceived factors influencing learners understanding of second language English	South Africa Educational Policy	South Africa Educational Policy	Language of instruction in the Foundation Phase		5	1.60%	5	50.00%
1.2. Perceived factors influencing learners understanding of second language English	Learners are allowed to be taught using home languages until Grade 4	The use of learners' home language in the Foundation Phase	The language of instruction in the Foundation Phase		6	1.90%	5	50.00%
1.2. Perceived factors influencing learners understanding of second language English	Learners have to learn basics of second language English and simultaneously have to understand the science content	The use of learners' home language in the Foundation Phase	The language of instruction in the Foundation Phase		2	0.60%	1	10.00%
1.2. Perceived factors influencing learners understanding of second language English	English is only used at school	Learner's background	Societal factor		3	0.90%	2	20.00%
1.2. Perceived factors influencing learners understanding of second language English	Learners' environment	Learner's background	Societal factor		2	0.60%	2	20.00%
1.2. Perceived factors influencing learners understanding of second language English	Social factor	Learner's background	Societal factor		2	0.60%	1	10.00%

1.2. Perceived factors influencing learners understanding of second language English	Learner's lack of commitment	Learner's lack of commitment	Lack of commitment		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Teacher uses second language English and Xitsonga	Teacher use mixed code	Code Switching		5	1.60%	5	50.00%
1.3. Strategies for Managing Challenges	Teacher gives learners lots of extra activities	Teacher gives learners lots of extra activities	Teacher gives learners lots of extra activities		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Teacher asks learners if they understand	Learners are asked if they understand by teachers	Learners are asked if they understand by teachers		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Learners are advised to use a dictionary	Learners are advised to use a dictionary	Learners are advised to use a dictionary		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Learners are encouraged to consult Elders at home	Learners are encouraged to consult elders at home	Learners are encouraged to consult Elders at home		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Teacher uses practical examples and experiments	The use of practical experimental demonstration and examples	The use of practical examples and experiments		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Teacher uses simplified English	Use of simplified English	Use of simplified English		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Teacher arranges extra lessons	Teacher arranges extra lessons	Give extra lessons		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Learners allowed to be taught science in their home language	Switch to first language to help the learners	Code switching and translation		1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Let them use home language	Learners are allowed to use Xitshonga	Learners are allowed to use Xitsonga		1	0.30%	1	10.00%
1.4. Teachers Training on Second Language Practices	Teacher went for training but, not on language	Teachers receive pedagogical training not language training	Exclusion of language in science professional development		4	1.20%	4	40.00%
1.4. Teachers Training on Second Language Practices	Training effectiveness				4	1.20%	4	40.00%

1.4. Teachers Training on Second Language Practices	Teacher did not receive training	Teachers did not receive use of language training	Exclusion of language in science professional development		3	0.90%	3	30.00%
2.5. Suggested Strategies for Managing Challenges	Introduction of second language at early grade and at foundation level	Introduction of second language as soon as learners start with their schooling (grade R-3)	Second language use at the early age of schooling		7	2.20%	5	50.00%
2.5. Suggested Strategies for Managing Challenges	It is up to government department				4	1.20%	3	30.00%
2.5. Suggested Strategies for Managing Challenges	Change of pass by age policy	Change of pass by age policy	Change of pass by age policy		1	0.30%	1	10.00%
2.5. Suggested Strategies for Managing Challenges	Change of school entry age	Change of school entry age	Change of school entry age		1	0.30%	1	10.00%
2.6. Effect on Natural science teaching	Learners find it difficult to understand science	Learners fail to understand subject content	Learners' does not understand and comprehend subject content		5	1.60%	5	50.00%
2.6. Effect on Natural science teaching	Affect teaching time	Time used for translation consumes a lot of time for curriculum coverage	Teaching time and Curriculum coverage		3	0.90%	3	30.00%
2.6. Effect on Natural science teaching	It has positive impacts				1	0.30%	1	10.00%
2.6. Effect on Natural science teaching	Affect content delivered or lesson	Affect content delivered or lesson	Affect content delivery time		1	0.30%	1	10.00%
2.6. Effect on Natural science teaching	Yes, it affects Natural science teaching				6	1.90%	6	60.00%
2.6. Effect on Natural science teaching	No, it does not affect Natural science teaching				2	0.60%	2	20.00%
2.6. Effect on Natural science teaching	Translation is problematic	Teachers have problem with translation	Teachers have problem with translation		2	0.60%	1	10.00%
2.7. Effect on teachers' performance	Spend longer time than recommended	Time used for translation consumes a lot of time for curriculum coverage	Teaching time and Curriculum coverage		5	1.60%	5	50.00%

2.7. Effect on teachers' performance	Learners perform poorly during assessment	Learners perform poorly	Learners perform poorly		2	0.60%	2	20.00%
2.7. Effect on teachers' performance	Does not affect performance				1	0.30%	1	10.00%
2.7. Effect on teachers' performance	Fail to finish or perform to the expected level	Inability to perform to the expected level because I must follow their pace	Curriculum coverage		5	1.60%	5	50.00%
2.8. Learners subject content & assessment understanding	Learners find it difficult to understand subject content	Very difficult because of their inability to read and understand	Learners' does not understand and comprehend subject content		5	1.60%	5	50.00%
2.8. Learners subject content & assessment understanding	Learners find it easy to understand subject content	Learners find it easy to understand subject content	Learners find it easy to understand subject content		2	0.60%	2	20.00%
2.10. Learners' classroom interaction	Learners are not confident	Learners' lack of self confidence	Poor classroom discussion		1	0.30%	1	10.00%
2.10. Learners classroom interaction	Learners are shy to speak	Cannot interact with each other using second language but in their first language			4	1.20%	3	30.00%
2.10. Learners classroom interaction	learners lack self-confidence	Learners lack of self confidence	Poor classroom discussion		1	0.30%	1	10.00%
2.10. Learners classroom interaction	Learners have low self esteem	Learners lack of self confidence	Poor classroom discussion		1	0.30%	1	10.00%
2.10. Learners classroom interaction	Learners discussions are unfruitful	Cannot interact with each other using second language and do so only with first language	Poor classroom discussion		2	0.60%	2	20.00%
2.10. Learners classroom interaction	Not able to participate in class discussions	Cannot interact with each other using second language and do so only with first language	Poor classroom discussion		2	0.60%	2	20.00%
2.11. Learners assistance in learn scientific terms by teachers	Explain by breaking down scientific term using simple language	Use of simplified English	Use of simplified English		3	0.90%	3	30.00%
2.11. Learners assistance in learn scientific terms by teachers	Through practical experimental demonstration	Through use of practical experimental demonstration examples	The use of practical experimental demonstration and examples		3	0.90%	3	30.00%

2.11. Learners assistance in learn scientific terms by teachers	By saying it and asking learners questions	Through active participation of learners			1	0.30%	1	10.00%
2.11. Learners assistance in learn scientific terms by teachers	Translate terminology into home language	Explain the terms in learners' first language	Code switching and translation		2	0.60%	2	20.00%
2.11. Learners' assistance in learn scientific terms by teachers	Create table of terminology for learners to practice at home	By creating a table of terminology for learners to practice at home			2	0.60%	2	20.00%
2.12. Affect learners' performance	Learners are unable to understand assessment questions	Unable to correctly interpret assessment questions and thus affect their performance	Inability to understand assessment questions and poor performance		4	1.20%	4	40.00%
2.12. Affect learners' performance	Learners are not able to seek clarity or answer questions	They cannot read, write and speak in second language	Inadequate second language proficiency		1	0.30%	1	10.00%
2.12. Affect learners' performance	Learners' performance is affected negatively				3	0.90%	3	30.00%
2.12. Affect learners' performance	Not achieving science learning outcomes	Unable to correctly interpret assessment questions and thus affect their performance	Inability to understand assessment questions and poor performance		1	0.30%	1	10.00%
2.12. Affect learners' performance	Learners are getting lower marks	Unable to correctly interpret assessment questions and thus affect their performance	Inability to understand assessment questions and poor performance		1	0.30%	1	10.00%
2.17. Enforcement of subject content understanding for learners to grasp	Teacher use examples and practicals	Make use of practical experiments or practical examples	The use of practical experimental demonstration and examples		9	2.80%	6	60.00%
2.17. Enforcement of subject content understanding for learners to grasp	Teacher use learners study groups	Teachers use learners study groups			3	0.90%	3	30.00%
2.17. Enforcement of subject content understanding for learners to grasp	Teacher use first language	Switch to first language to help the learners	Code switching and translation		2	0.60%	2	20.00%

2.9. Solution to Learners finding it difficult to interpret assessment	Teacher explaining and interpret terminologies and meaning in home language	Interpret questions using learners' home language	Code switching and translation		7	2.20%	7	70.00%
2.9. Solution to Learners finding it difficult to interpret assessment	By being prepared and knowing what you are doing	Teachers' knowledge and preparedness of the subject			1	0.30%	1	10.00%
2.9. Solution to Learners finding it difficult to interpret assessment	Difficult to assist if it is homework	Teachers are unable to assist in case of homework			1	0.30%	1	10.00%
3.13. Effectiveness of using second language	It is not effective	Not effective because learners find it difficult to understand	Ineffective in science teaching		3	0.90%	3	30.00%
3.13. Effectiveness of using second language	It is effective	It is effective	It is effective		3	0.90%	3	30.00%
3.13. Effectiveness of using second language	It is neutral				2	0.60%	1	10.00%
3.14. Circumstance under which Xitsonga, English and mixed code is used	Yes, I use Xitsonga to enhance understanding	To enhance understanding	Code switch and translation, where learners are unable to comprehend the subject content, to explain terminologies, and in making emphasis		6	1.90%	6	60.00%
3.14. Circumstance under which Xitsonga, English and mixed code is used	Yes, I use mixed code if learners are not understanding	When learners are not understanding	Code switching and translation, where learners are unable to comprehend the subject content, to explain terminologies, and in making emphasis		1	0.30%	1	10.00%
3.15. Circumstances under which Xitsonga, English	When learners do not comprehend lesson	Where learners are unable to comprehend the subject content, to explain	Code switch, where learners are unable to comprehend the subject		4	1.20%	4	40.00%

and mixed code is used		terminologies, and in making emphasis	content, to explain terminologies, and in making emphasis					
3.15. Circumstances under which Xitsonga, English and mixed code is used	When content is full of terminology	When lesson is mostly terminology for learners to understand	Code switch and translate, where learners are unable to comprehend the subject content, to explain terminologies, and in making emphasis		1	0.30%	1	10.00%
3.15. Circumstances under which Xitsonga, English and mixed code is used	To hook learners' interest and understanding	To motivate learners' participation			1	0.30%	1	10.00%
3.16. Learners' participation when English vs Xitsonga is used	Learners are not able to clearly articulate themselves when English is used	There is poor participation when English is used than when home language is used	There is poor participation when English is used than when home language is used (ineffective)		1	0.30%	1	10.00%
3.16. Learners' participation when English vs Xitsonga is used	Learners shy away from participating when English is used	Most are shy to speak and even attempt questions in their home language	Poor understanding of assessment questions and poor performance		3	0.90%	3	30.00%
3.16. Learners' participation when English vs Xitsonga is used	Learners fully participate when Xitsonga is used	Learners fully participate when Xitsonga is used	Second language is ineffective		7	2.20%	4	40.00%
3.18. Benefits of using second language English	It empowers learners for real world	It prepares learners for the real world and it is used as a communication tool all over the world	Effective for learners' futuristic outlook		6	1.90%	6	60.00%
3.18. Benefits of using second language English	It builds learners confidence, self-esteem	It builds learners confidence, self-esteem			1	0.30%	1	10.00%
3.18. Benefits of using second language English	It prepares learners for assessments	It prepares learners for assessments			2	0.60%	2	20.00%
3.18. Benefits of using second language English	It assists learners to communicate with others	English is not only applicable in a classroom	Effective for learners'		3	0.90%	3	30.00%

		environment but also in a working environment	futuristic outlook					

Appendix 5: Initial data coding from research interviews of participating teachers

Category	Code	Count	% Codes	Cases	% Cases
1.1. Challenges in using second language	Positive	2	0.60%	1	10.00%
1.1. Challenges in using second language	Negative	5	1.50%	3	30.00%
1.1. Challenges in using second language	Difficult to express themselves	1	0.30%	1	10.00%
1.1. Challenges in using second language	Cannot write English	3	0.90%	3	30.00%
1.1. Challenges in using second language	Shy to speak English	3	0.90%	3	30.00%
1.1. Challenges in using second language	Cannot read English	1	0.30%	1	10.00%
1.1. Challenges in using second language	Passed by age	1	0.30%	1	10.00%
1.1. Challenges in using second language	Too young	1	0.30%	1	10.00%
1.1. Challenges in using second language	Do not understand concept	7	2.20%	6	60.00%
1.1. Challenges in using second language	Cannot copy what is on the board	1	0.30%	1	10.00%
1.1. Challenges in using second language	Cannot complete tasks	1	0.30%	1	10.00%
1.1. Challenges in using second language	Do not understand English as a language	5	1.50%	4	40.00%
1.1. Challenges in using second language	Cannot analyse the question	1	0.30%	1	10.00%
1.1. Challenges in using second language	Cannot give responses in English	3	0.90%	2	20.00%
1.1. Challenges in using second language	Other language was used for instruction	4	1.20%	3	30.00%
1.1. Challenges in using second language	Cannot hear English	3	0.90%	2	20.00%
1.1. Challenges in using second language	Current education system	1	0.30%	1	10.00%
1.2. Perceived factors influencing understanding of English	Policy of South Africa	5	1.50%	5	50.00%
1.2. Perceived factors influencing understanding of English	Allowed to be taught in home language until Grade 4	6	1.90%	5	50.00%
1.2. Perceived factors influencing understanding of English	Having to learn basics of English	1	0.30%	1	10.00%
1.2. Perceived factors influencing understanding of English	Simultaneous understanding of English and content of science	1	0.30%	1	10.00%
1.2. Perceived factors influencing understanding of English	English is only used at school	3	0.90%	2	20.00%
1.2. Perceived factors influencing understanding of English	Their environment	2	0.60%	2	20.00%
1.2. Perceived factors influencing understanding of English	Social factor	2	0.60%	1	10.00%

1.2. Perceived factors influencing understanding of English	Lack of commitment	1	0.30%	1	10.00%
1.2. Perceived factors influencing understanding of English	Lack of resources	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Use both languages	5	1.50%	5	50.00%
1.3. Strategies for Managing Challenges	Give lots of extra activities	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Find out from learners if they understand	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Learners advised to use Dictionary	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	To consult Elders at home	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Use practical examples and experiment	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Use simplified English	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Organise extra lessons	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Learn science in their home language	1	0.30%	1	10.00%
1.3. Strategies for Managing Challenges	Let them use home language	1	0.30%	1	10.00%
1.4. Teachers Training on Second Language Practices	Have you been trained Yes	4	1.20%	4	40.00%
1.4. Teachers Training on Second Language Practices	Training effectiveness	4	1.20%	4	40.00%
1.4. Teachers Training on Second Language Practices	Have you been trained No	3	0.90%	3	30.00%
2.5. Suggested Possible solutions for use of second language		5	2.20%		
2.5. Suggested Possible solutions for use of second language	Is up to the department	4	1.20%	3	30.00%
2.5. Suggested Possible solutions for use of second language	Change policy of pass by age	1	0.30%	1	10.00%
2.5. Suggested Possible solutions for use of second language	Change of age to start school	1	0.30%	1	10.00%
2.6. Effect of second language on Natural science teaching	Learners find it difficult to understand science	5	1.50%	5	50.00%
2.6. Effect of second language on Natural science teaching	Affects the teaching time	3	0.90%	3	30.00%
2.6. Effect of second language on Natural science teaching	It has positive impacts	1	0.30%	1	10.00%
2.6. Effect of second language on Natural science teaching	Effects content delivered or lesson	1	0.30%	1	10.00%
2.6. Effect of second language on Natural science teaching	Yes it affects Natural Science teaching	6	1.90%	6	60.00%
2.6. Effect of second language on Natural science teaching	No it does not affect Natural Science teaching	2	0.60%	2	20.00%
2.6. Effect of second language on Natural science teaching	Translation is problematic	2	0.60%	1	10.00%
2.7. Second language effect on teachers' performance	Spend longer time than recommended	5	1.50%	5	50.00%

2.7. Second language effect on teachers' performance	Learners perform poorly during assessment	2	0.60%	2	20.00%
2.7. Second language effect on teachers' performance	Does not affect performance	1	0.30%	1	10.00%
2.7. Second language effect on teachers' performance	Fail to finish or perform to the expected level	5	1.50%	5	50.00%
2.8. Second language influence interactions	Learners not confident	1	0.30%	1	10.00%
2.8. Second language influence interactions	Shy to speak	4	1.20%	3	30.00%
2.8. Second language influence interactions	Lack of self-confidence	1	0.30%	1	10.00%
2.8. Second language influence interactions	Lower self-esteem	1	0.30%	1	10.00%
2.8. Second language influence interactions	Discussions are unfruitful	2	0.60%	2	20.00%
2.8. Second language influence interactions	Not able to participate in class discussions	2	0.60%	2	20.00%
2.9. Learners ability to understand subject content	Find it difficult to understand subject content	5	1.50%	5	50.00%
2.9. Learners ability to understand subject content	Find it easy to understand subject content	2	0.60%	2	20.00%
2.10. How learners are helped to learn scientific terms	Explain and break them to simplest way possible	3	0.90%	3	30.00%
2.10. How learners are helped to learn scientific terms	Through practical experimental demonstration	3	0.90%	3	30.00%
2.10. How learners are helped to learn scientific terms	By saying it and asking learners questions	1	0.30%	1	10.00%
2.10. How learners are helped to learn scientific terms	Translate terminology into home language	2	0.60%	2	20.00%
2.10. How learners are helped to learn scientific terms	Create table of terminology for practise at home	2	0.60%	2	20.00%
2.11. Second language affects learners performance	Unable to understand assessment questions	4	1.20%	4	40.00%
2.11. Second language affects learners performance	Not able to seek clarity or answer questions	1	0.30%	1	10.00%
2.11. Second language affects learners performance	Negatively	3	0.90%	3	30.00%
2.11. Second language affects learners performance	Not achieving science learning outcomes	1	0.30%	1	10.00%
2.11. Second language affects learners performance	Getting lower marks	1	0.30%	1	10.00%
2.12. How do you enhance understanding of the subject content	Use of examples and practical activities	9	2.80%	6	60.00%
2.12. How do you enhance understanding of the subject content	Use of study groups	3	0.90%	3	30.00%
2.12. How do you enhance understanding of the subject content	Use of first language	2	0.60%	2	20.00%
2.13. Solution to learners finding it difficult	7	2.20%	7	70.00%	
2.13. Solution to learners finding it difficult	Being Prepared and knowing what you are doing	1	0.30%	1	10.00%
2.13. Solution to learners finding it difficult	Difficult to assist when homework is done at home	1	0.30%	1	10.00%

3.14. Effectiveness of using second language	Not effective	3	0.90%	3	30.00%
3.14. Effectiveness of using second language	Is effective	3	0.90%	3	30.00%
3.14. Effectiveness of using second language	Neutral	2	0.60%	1	10.00%
3.15. Some circumstances use Xitsonga	Yes I use Xitsonga to enhance understanding	6	1.90%	6	60.00%
3.15. Some circumstances use Xitsonga	Yes I use mixed code if learners are not understanding	1	0.30%	1	10.00%
3.16. Under what circumstances are Xitsonga, English and Mixed code used	Learners do not comprehend lesson	4	1.20%	4	40.00%
3.16. Under what circumstances are Xitsonga, English and Mixed code used	When content is full of terminology	1	0.30%	1	10.00%
3.16. Under what circumstances are Xitsonga, English and Mixed code used	To hook their interest and understanding	1	0.30%	1	10.00%
3.17. Learners participation when English is used vs Xitsonga	Not able to clearly articulate themselves when English is used	1	0.30%	1	10.00%
3.17. Learners participation when English is used vs Xitsonga	Shy away from participation when English is used	3	0.90%	3	30.00%
3.17. Learners participation when English is used vs Xitsonga	Fully participate when Xitsonga is used	7	2.20%	4	40.00%
3.17. Learners participation when English is used vs Xitsonga	They participate when English is used	2	0.60%	2	20.00%
3.18. Benefits of using second language as the language of instruction	Empowering learners for real world	6	1.90%	6	60.00%
3.18. Benefits of using second language as the language of instruction	Build learners confidence, self-esteem	1	0.30%	1	10.00%
3.18. Benefits of using second language as the language of instruction	Prepare learners for assessments	2	0.60%	2	20.00%
3.18. Benefits of using second language as the language of instruction	To communicate with others	3	0.90%	3	30.00%
How participants interact using second language?	Teacher-Learner interaction	5	1.50%	3	30.00%
How participants interact using second language?	Learners' interaction	6	1.90%	3	30.00%
How is the lesson delivered?	Practical examples	2	0.60%	1	10.00%
How is the lesson delivered?	Second language is used	4	1.20%	2	20.00%
Learners undertaking the lesson	Actively involved	3	0.90%	2	20.00%
Learners undertaking the lesson	Passive learners	3	0.90%	2	20.00%
learners undertaking the lesson	Overcrowded classroom	1	0.30%	1	10.00%
learners' participation/ how are they engaged?	Full participation	4	1.20%	2	20.00%
learners' participation/ how are they engaged?	Poorly engaged	2	0.60%	1	10.00%
Who is talking/listening	Interaction was important	2	0.60%	1	10.00%

Who is talking/listening	Teacher is talking while learners are quiet	3	0.90%	2	20.00%
Who is talking/listening	Learners were given a chance to ask questions	1	0.30%	1	10.00%
Non-verbal information	2	0.60%	1	10.00%	
Non-verbal information	classroom is clean but not conducive	1	0.30%	1	10.00%
Non-verbal information	No instructive posters inside the classroom	2	0.60%	1	10.00%
Non-verbal information	Overcrowded classroom	1	0.30%	1	10.00%
Non-verbal information	2	0.60%	1	10.00%	
Use of Xitsonga, English and mixed codes	Learners find it difficult	3	0.90%	2	20.00%
Use of Xitsonga, English and mixed codes	Very passive	1	0.30%	1	10.00%
Use of Xitsonga, English and mixed codes	Mixed code used to convey better understanding	2	0.60%	1	10.00%
Is there a classroom discussion?	Yes	2	0.60%	2	20.00%
Is there a classroom discussion?	Discussion is done in class	2	0.60%	2	20.00%
Is there a classroom discussion?	No discussion take place in class	2	0.60%	1	10.00%
Is the discussion effective and useful for learning?	Discussion not effective	3	0.90%	2	20.00%
Is the discussion effective and useful for learning?	Discussion effective	3	0.90%	2	20.00%
How are learners learning from the discussion?	Peer discussion	3	0.90%	2	20.00%
How are learners learning from the discussion?	Passively learning	1	0.30%	1	10.00%
How are assessments undertaken?	Understanding of the questions	6	1.90%	3	30.00%
How are assessments undertaken?	How is feedback being given to learners?	5	1.50%	3	30.00%
What is the evidence that shows that learners have achieved expected learning outcomes	Their ability to provide the correct answers to the asked questions.	2	0.60%	1	10.00%

Appendix 7: Letter of approval from the Limpopo Department of Education

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

CONFIDENTIAL

Ref: 2/2/2 Enq: Makola MC Tel No: 015 290 9448 E-mail:MaxnlaMC@edu.limpopo.gov.za

Chauke B
P O Box 392
unisa
003

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

1. The above bears reference.
2. The Department wishes to inform you that your request to conduct research has been approved. Topic of the research proposal: **"TEACHERS EXPERIENCE OF TEACHING NATURAL SCIENCES IN A SECOND LANGUAGE :A CASE OF PRIMARY SCHOOLS IN MOPANI EAST DIDSTRICT "**
3. The following conditions should be considered:

3.1 The research should not have any financial implications for Limpopo Department of Education.

3.2 Arrangements should be made with the Circuit Office and the School concerned.

3.3 The conduct of research should not in anyhow disrupt the academic programs at the schools.

3.4 The research should not be conducted during the time of Examinations especially the fourth term.

3.5 During the study, applicable research ethics should be adhered to; in particular the principle of voluntary participation (the people involved should be respected).

3.6 Upon completion of research study, the researcher shall share the final product of the research with the Department.

Cnr 113 Biccard & 24 Excelsior Street, POLOKWANE, 0700, Private Bag X 9489, Polokwane, 0700
Tel:015 290 7600/ 7702 Fax 086 218 0560

4 Furthermore, you are expected to produce this letter at Schools/ Offices where you intend conducting your research as an evidence that you are permitted to conduct the research.

5 The department appreciates the contribution that you wish to make and wishes you success in your investigation.

Best wishes.

Mashaba KM
DDG: CORPORATE SERVICES

07/12/2021
Date

Appendix 8: Permission letter to the circuit managers

Po Box 1981
Giyani
0826
20 January 2022

The Circuit Manager
Limpopo Department of Education
Mopani District
Private Bag X9489
Giyani
0826

Dear Sir/ Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH.

I, Basambilu Chauke, am currently conducting a research study entitled 'Teachers' Experiences of Teaching Natural Sciences in a Second Language: A Case of Primary Schools in Mopani East District' under supervision of Prof. Motlhabane A.T, a professor in the Department of Science and Technology Education towards a Master's Degree in Natural science Education at the University of South Africa. I have funding from UNISA Post-Graduate Bursaries for the Master's Dissertation. I humbly wish to request your permission to conduct the research study in one of your schools with the aim of exploring the experiences of primary school teachers on teaching natural science in the second language. This will help to identify the challenges of using second language, find out how these challenges affect the learning and teaching of the subject and determine some recommendations.

Your circuit is chosen because it is one of the Mopani East District circuits and the school selected falls within my residing area. The province, district and as well as the selected schools for data collection will benefit from this study as the research findings and recommendations are intended to improve the language practices in relation to the language of instruction appropriate for teaching of science at the primary level. All participants' names and schools selected will not be disclosed anywhere in the study to remain confidential and anonymous. The research study is free of any foreseeable

risks. However, it will entail lesson observation that will involve learners' and teachers' interviews. Participation is voluntary and participants can withdraw their participation at any stage of the study without any consequences. There will be no reimbursement or any incentives for participation in the research, the final research work will be made available to the province, district and selected schools at request.

Data collection processes of the study will start only when it is approved by the University of South Africa's Research Ethics Review, the district senior manager, and you.

For further information concerning the research study, kindly contact me or my supervisor through the contact details below:

1.Chauke Basambilu - 079 5481 789, 58246614@mylife.unisa.ac.za/basambiluchauke@gmail.com.

2. Prof. Motlhabane A.T - 012 4292 840, motlhat@unisa.ac.za.

Your kind consideration and approval is appreciated in advance.

Yours Sincerely

Basambilu Chauke (Master's Degree student)

Appendix 9: permission letter to the principals

Po Box

1981

Giyani
0826
04 February 2022

The School Principal

Dear Sir/ Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH.

I, Basambilu Chauke, I am currently conducting a research study titled 'Teachers' Experiences of Teaching Natural Sciences in a Second Language: a Case of Primary Schools in Mopani East District' under supervision of Prof. Motlhabane A.T, a professor in the Department of Science and Technology Education towards a Master's Degree in Natural science Education at the University of South Africa. I have funding from UNISA Post-Graduate Bursaries for the Master's Dissertation. I humbly wish to request your permission to conduct the research study in your school with the aim of exploring the experiences of primary school teachers on teaching natural science in the second language. This will help to identify the challenges of using second language, find out how these challenges affect the learning and teaching of the subject and determine some recommendations. The research findings and its recommendations are intended to improve the language practices in relation to the language of instruction appropriate for teaching of science at the primary level as the benefits of the study.

As per the criteria of selecting schools, your school is chosen because it is one of the public schools in the Mopani East District where second language is used as the language of instruction, and one that falls within my residing area. Participants' names and schools selected will not be disclosed anywhere in the study to remain confidential and anonymous. The research study is free of any foreseeable risks, however it will entail lesson observation that will involve learners' and teachers' interviews. Participation is voluntary and participants can withdraw their participation at any stage of the study without any consequences. There will be no reimbursement or any

incentives for participation in the research, the study report will be made available to you at your request.

Data collection processes of the study will start only when it is approved by the University of South Africa's Research Ethics Review, the district senior manager, the circuit manager and you.

For further information concerning the research study, kindly contact me or my supervisor through the contact details below:

1. Chauke Basambilu - 079 5481 789, 58246614@mylife.unisa.ac.za/basambiluchauke@gmail.com.

2. Prof. Motlhabane A.T - 012 4292 840, motlhat@unisa.ac.za.

Your kind consideration and approval is appreciated in advance.

Yours Sincerely

Basambilu Chauke (Master's Degree student)

Appendix 10A: Participants information Sheet in English.

UNISA college of education

Participant Information Sheet

My name is Basambilu Chauke and I am currently doing research titled **"Teachers' experiences of teaching natural sciences in a second language: a case of primary schools in Mopani East District"**, under supervision of Prof. Motlhabane A.T a professor in the Department of Science and Technology Education towards a Master's of Education Degree at the University of South Africa. We have funding from UNISA Postgraduate Bursaries for the Masters Dissertation. We are inviting you to participate in a research study which aims to explore the experiences of primary school teachers on teaching natural science in the second language so as to identify the challenges of using second language and find out how these challenges affect the teaching and learning of the subject.

You are invited because you are a Natural science teacher at your school. I obtained your contacts from the school's principal. The approximately 10 educators will be participating in this study however, only two educators in your school will be participating and the other 8 educators are from four other different schools.

The study involves an open-ended interview and lesson observations, during the interview an audio-recorder will be used to collect information. You will be asked 18 questions, aiming to get your relevant and reliable experiences with regard to the use of second (English) language in Natural science classroom. The duration for both interview and lesson observation will be 40-50 minutes but, the observation will be determined by the duration of the lesson as per your school time table.

Participating in this study is voluntary and you are under no obligation to consent to participation. If you decide to take part, you will be given this information sheet to keep and asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

The benefits of this study are to explore teachers' experiences and challenges of using second language, so as to improve the language practices in relation to the language of instruction appropriate for teaching of science at the primary level.

This study is a medium risk study, because the lesson observation will involve the learners below 18 which may be discomforting to them. However, the study will collect information that will be regarded as non-sensitive, such as opinion rather than personal information.

Your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your involvement in this research and no one will be able to connect you to the answers you give. Your answers will be given a code number or pseudonym and you will be referred to this way in the data, any publications, or other research reporting methods, such as conference proceedings.

The anonymous data may be used for other purposes, such as, research report, journal articles and/or other proceedings. The privacy of the data will maintain confidential and anonymous.

Hard copies of your answers will be stored by the researcher for a period of five years in a locked cupboard, at home in my study room for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. If necessary hard copies will be shredded and electronic copies will be permanently deleted from computer.

No payment or any incentive will be given for participating in this study.

This study has received written approval from the Research Ethics Review Committee of UNISA. A copy of the approval letter can be obtained from the researcher if you so wish.

If you would like to be informed of the research findings, please contact Basambilu Chauke @ 079 5481 789 or email basambiluchauke@gmail.com. The findings are accessible for one year. Should you require any information or want to contact the researcher about any aspect of this study,

Should you have concerns about the way in which the research is conducted, you may contact

Prof, Motlhabane A.T

Email: motlhat@unisa.ac.za

Internal Phone: 012 429 2840

Thank you for taking time to read this information sheet and participating in this study.

Basambilu Chauke (Master's degree student)

Appendix 10B: **Participant information sheet in Xitsonga**

Papila ra vuxoko-xoko bya vulavisisi

Vito ra mina hi mina Basambilu Chauke ni leku endleni ka vulavisisi ehansi ka nhloko mhaka leyi nge**: "Ntokoto wa vadyondzisi kaku dyondzisa dyondzo ya Sayense hi ririmi ra vadya hlampfi eka vana va xikolo xale hansi va xifundhza ntsongo xa Mopani".** Dyondzo leyi yi leteriwa hi Phorofesa Motlhabane A.T, phorofesa wa ndzawulo ya sayense na thekinoloji eka ti dyondzo ta masitasi e yunivhesiti ya Afrika Dzonga. Hina mpfuno wa swa timali ku suka ''UNISA Postgraduate Bursaries'' ku endla papila ra masitasi. Kutani hami rhamba kuva xiave xa vulavisisi eka dyondzo leyi kongomelo wa yona kunga ku kumisisa ntokoto lowu vadyondzisi vanga na wona hi thlelo raku tirhisa xinghezi eka vana lava vulavulaka ririmi rin'wana. Vulavisisi lebyi na kambe byi lava ku kumisisa nthlonthlo lowu vaka kona hikokwalaho kaku tirhisiwa ka xinghezi na hi laha nthlothlo lowu wu kavanyetaka ha kona ku dyondza naku dyondzisa sayense etlilasisi.

Hikokwalaho marhambiwa hikuva mi wun'wani wava dyondzisi va sayense exikolweni xa n'wina na swona ni kume vuxoko-xoko bya n'wina eka nhloko ya xikolo. Vadyondzisi vo ringana khume (10) vata nghenelela eka dyondzo leyi kambe exikolweni xa n'wina kuta nghenelela vambirhi (2) ntsena, kasi nhungu vata huma eka swikolo swi n'wana.

Dyondzo leyi yi katsa swivutiso swa nkambelo na vonisiso wa dyondzo etlilasini, kasi hi nkarhi wa nkambelo na swivutiso kuta tirhisiwa xi teka marito ku teka vuxoko-xoko. Mita vutisiwa swi vutiso swa khume nhungu (18) kuri nkongomelo wa ku kumisisa hi vuenti ntokoto wa n'wina wa ku tirhisa ririmi ra vadya nhlampfi etlilasisi ku dyondzisa sayense. Swivutiso swa ndzavisiso na vonisiso wa dyondzo etlilasisi swita teka ntsena timinetse ta makume mune (40) kuya fika ka makume nthlanu (50) kambe nkarhi lowu wuta lawuriwa hi nkarhi wa tidyondzo wa xikolo xin'wani na xin'wani leyi nghenelelaka.

Kuva xiave xa vulavisisi lebyi iku tsakela ka n'wina na swona I vutihlamuleri bya n'wina kuva mi pfumela ku nghenelela. Loko mi teka xiboho xaku va na xiave mita nyikiwa papila leri ra vuxoko-xoko leswaku miri hlayisa na swona mita komberiwa ku sayina

fomo yo pfumela kuva xiave xa vulavisisi lebyi. Mi ntshuxekile kuti humesa eka vulavisisi/dyondzo leyi nkarhi wihi kumbe wihi handle kaku nyika swi vangelo.

Mbuyelo wa dyondzo leyi iku kumisisa swiphiqo leswi vangiwaka hiku tirhisa xinghezi eka tidyondzo ta sayense hikokwalaho ka nkongomelo wo kuma ndlela yo antswisa matirhisele ya ririmi ra xinghezi ku dyondzisa vana vale hansi.

Vulavisisi lebyi byina swita ndhzaku swale xikarhi hikuva vonisiso wa dyondzo yale tlilasini yita katsa vana vale hansi ka malembe ya khume nhungu (18) leswi swinga endlaka leswaku vanga khomeki kahle/ va nga tshuxeki. Hambi swi ri tano dyondzo leyi yita teka vuxoko-xoko lebyi nga kule nas wi twi swa vumunhu.

Mavito ya n'wina aya nga kandziyisiwi kumbe ku tsariwa helo eka vulavisisi lebyi handle ka ku tiviwa ntsena hi mulavisisi na swona aku ngavi na loyi a nga ta tiva tinhlamulo ta swivutiso leswi minga ta swi hlamula. Tinhlamulo ta n'wina hinkwato tita nyikiwa tikhodi/tinambara kasi xikhomela ndhawu xa vito xita tirhisiwa ematshan'wini ya mavito ya n'wina ya ntiyiso. Swikhomela ndhawu swa mavito hi swona swinga ta tirha nale ka xiviko xa vulavisisi na swona vuxoko-xoko hinkwabyo lebyi ngata tekiwa eka vangheneleri byita va xihundla. Kasi ti notsi hinkwato leti ngata tsariwa ehansi kumbe ku tekiwa hi xiteka marito swita hlayisiwa ku ringana malembe ya nthlanu (5) eka vuhlayiselo (cardboard) nale ka khophuyuta leyi ngata vana xilotlelo lexi tiviwaka hi mulavisisi ntsena. Endhaku ka malembe lawa vuxoko-xoko hinkwabyo byita herisiwa.

Ku nghenelela kwihi kumbe kwihi eka vulavisisi lebyi ku hava hakelo yihi kumbe yihi leyi kumekaka. Dyondzo leyi yi amukele mfumelelo wo huma eka komiti ya milawu ya vulavisisi ya yunivhesiti ya Afrika- Dzonga, naswona papila leri mi nga ha ri kuma eka mulavisisi.

Loko mi tsakela ku kuma hungu ra xiviko kumbe swi n'wana mayelana na dyondzo leyi mi komberiwa ku ti hlanganisa na mulavisisi Basambilu Chauke eka 079 5481 789 kumbe eka imeyili basambiluchauke@gmail.com

Loko minga va na swivilelo swa hi laha vulavisisi byi endliweke ha kona minga ti hlanganisa na phurofesa hi byakwe. Motlhabane A.T

imeyili: motlhat@unisa.ac.za

foni: 012 429 2840

Ndza nkhensa swinene kuva mi ti nyike nkarhi waku hlaya papila leri ra vuxoko-xoko na ku nghenelela ka n’wina eka dyondzo leyi.

Basambilu Chauke (Muchudeni eka tidyondzo ta masitasi)

Appendix 11A: Participant's Consent form in English

CONSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the open-ended interview

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print) _____

_____ _____

Participant Signature Date

Researcher's Name & Surname (please print) Basambilu Chauke

____20/09/2021_____

Researcher's signature Date

Appendix 11 B: participant consent form in Xitsonga

Mpfumelelo wo nghenelela eka dyondyo leyi (xilipi lexi vuyaka)

Mina, _____ (mavito ya mungheneleri), ndza tiyisisa leswaku munhu loyi a kombelaka vungheneleri bya mina eka vulavisisi lebyi, u ndzi hlamuserile hi vuenti nongonoko, mbuyelo na swita ndhzaku swaku swaku va xiave.

Ndzi hlayile (kumbe ku hlamuseriwa) ku tani ndzi twisisa kahle vulavisisi lebyi, hi laha vuxoko-xoko byi nyikiweke hakona eka papila.
Ndzive na nkarhi waku ringana ku vutisa swi vutiso na swona ndzi ti yimiserile ku nghenelela eka dyondzo leyi.

Ndzi twisisa hi vuenti leswaku ndzi nghenelela hiku swi tsakela ka mina eka dyondzo leyi ku ngari hi xiboho na swona nina lunghelo ro ti humesa nkarhi wihi na wihi kuri hava nxupulo.

Ndza swi tiva leswaku dyondzo leyi yita humesa xiviko lexi nga ta hangalasiwa kambe kunghenelela ka mina ku ta va xuhundla xa mulavisisi handle ka loko kuri hiku lerisa/kupfumeleriwa ka/hi mina.

Ndza pfumelelana na nkandziyiso wa swivutiso nkambelo na swona ndzi amukerile nkandziyiso wa papila leri sayiniweke wa vuxoko-xoko bya pfumelelo.

Vito ra Mungheneleri na xivongo (tsala mavito hiku hetiseka) : _____

_____ _____
Nsayino wa mungheneleri Siku

Vito na xivongo xa mulavisisi (tsala mavito hiku hetiseka): Basambilu Chauke

____20/09/2021_____

Nsayino wa mulavisisi Siku

Appendix 12A: Parental consent and learner's Assent in English

UNISA | college of education

20 September 2021

Dear Parent

Your child is invited to participate in a study entitled 'Teachers' experiences of teaching natural sciences in a second language: a case of primary schools in Mopani East District'. I am undertaking this study as part of my master's research at the University of South Africa. The purpose of the study is to explore the experiences of primary school teachers on teaching natural science in the second language so as to identify the challenges of using second language and find out how these challenges affect the teaching and learning of the subject. The possible benefits of the study are the improvement of the language practices in relation to the language of instruction appropriate for the teaching of science at the primary level. I am asking permission to include your child in this study because is one of the grade 7 learners. I expect to have 174 other children participating in the study.

Your child is part of the study because the observations will be done in his/her presence. The observation will take 40-50 minutes depending on the lesson duration. I also request your permission to use the audio recorder as the instrument that will help to record how second language is used in the classroom during Natural science teaching and learning.

Any information that is obtained in connection with this study and can be identified with your child will remain confidential. His/her responses will not be linked to his/her name or your name or the school's name in any written or verbal report based on this study. Such a report will be used for research purposes only.

There are no foreseeable risks to your child by participating in the study. Your child will receive no direct benefit from participating in the study; however, the possible benefits to education are the improvement of the language practices in relation to the language of instruction appropriate for the teaching of science at the primary level. Neither your child nor you will receive any type of payment for participating in this study.

Your child's participation in this study is voluntary. Your child may decline to participate or to withdraw from participation at any time. Withdrawal or refusal to participate will not affect him/her in any way. Similarly, you can agree to allow your child to be in the study now and change your mind later without any penalty.

The study will take place during regular classroom activities with the prior approval of the school and your child's teacher. However, if you do not want your child to participate, an alternative activity will be available where he/she will be given science books to read and some exercises to write.

In addition to your permission, your child must agree to participate in the study and will also be asked to sign the assent form which accompanies this letter. If your child does not wish to participate in the study, he or she will not be included and there will be no penalty. The information gathered from the study and your child's participation in the

UNISA | college of education

20 September 2021

Dear learner.

My name is Teacher Basambilu Chauke and would like to ask you if I can come and watch you do some activities. I am trying to learn more about how children do science activities with their teachers as well as when they play with friends. If you say YES to do this, I will come and watch you when you are with your teacher doing science activities as well as when you play on the playground. We will do a fun game where you have to answer some questions for me. I will also ask you to do some activities with me. I will not ask to you to do anything that may hurt you or that you don't want to do.

I will also ask your parents if you can take part. If you do not want to take part, it will also be fine with me. Remember, you can say yes or you can say no and no one will be upset if you don't want to take part or even if you change your mind later and want to stop. You can ask any questions that you have now. If you have a question later that you didn't think of now, ask me next time I visit your school.

Please speak to mommy or daddy about taking part before you sign this letter. Signing your name at the bottom means that you agree to be in this study. A copy of this letter will be given to your parents.

Regards

Teacher Basambilu Chauke

Your Name	Yes I will take part 	No I don't want to take part 
Name of the researcher Chauke B		
Date		

Appendix 12B: Parental consent and learner's Assent in Xitsonga

Eka Vatswari

N'wana wa n'wina wa rhambiwa ku nghenelela eka dyondzo ya vulavisisi ya nhloko mhaka leyi : **"Ntokoto wa vadyondzisi kaku dyondzisa dyondzo ya Sayense hi ririmi ra vadya hlampfi eka vana va xikolo xale hansi va xifundhza ntsongo xa Mopani".** Dyondzo leyi i xiave xa vulavisisi xa tidyondzo ta mina ta masitasi leti ndzi tiendlaka na yunivhesiti ya Afrika - Dzonga. kongomelo wa dyondzo leyi iku kumisisa ntokoto lowu vadyondzisi vanga na wona hi thlelo ra ku tirhisa xinghezi eka vana lava vulavulaka ririmi rin'wana. Vulavisisi lebyi na kambe byi lava ku kumisisa nthlonthlo lowu vaka kona hikokwalaho kaku tirhisiwa ka xinghezi na hi laha nthlothlo lowu wu kavanyetaka ha kona ku dyondza naku dyondzisa sayense etlilasini. Hikokwalaho ndzi kombela mpfumelelo wa n'wina ku katsa n'wana wa n'wina hikuva hi wun'wani wa vana vaka ntangha nkombo. Ni langutele kuva na vana va 174 lava nga ta nghenelela eka dyondzo leyi.

N'wana wa n'wina I nghenelela ntsena hikokwalaho ka leswi vonisiso wa dyondzo wunga ta endliwa etlisini leyi a nghenaka eka yona. Vonisiso wama dyondzele ya vana etlilasini wuta teka timinetse ta makume mune ku fika ka makume nthlanu kambe, hi kuya hi timinetse leti vekiweke hi xikolo. Ndzi thlela ndzi kombela mpfumelelo wa n'wina ku tirhisa xiteka marito lexi nga ta pfuna ku teka marito kuri ndlela yaku kumisisa matirhiselo ya xinghezi hi mudyondzisi na mudyondzi eka tidyondzo ta sayense etlilasini.

Vuxoko-xoko byihi kumbe byihi lebyi ngata kumeka eka vulavisisi, lebyi nga khumbhaka n'wana wa n'wina byi tava xihundla. Swihi na swihi leswi anga ta swi hlamula, mavito ya yena, hambi yari mavito ya xikolo a swinge vuriwi kumbe ku tsariwa helo eka vulavisisi lebyi.

Akuna nghozi leyi languateriweke ku humelela eka n'wana wa n'wina kuva ava xiave xa vulavisisi lebyi na swona akuna ku hakeriwa loku n'wina kumbe n'wana wa n'wina angata ku kuma. Hambi swiri tano mbuyelo wa kona iku antswisa matirhiselo ya ririmi ra vadya hlampfi eka vana va xikolo xale hansi eka ti dyondzo ta sayense.

Ku nghenelela ka n'wana wa n'wina iku ti twela ka yena, na swona anga ha ti humesa nkarhi wihi na wihi. Ku ala ku nghenelela kumbe ku pfumela a swi nge n'wi onheli nchumu na swona minga ha pfumela ku a nghenelela kumbe mi ncica miehleketo handle ka nxupulo/nandzu.

Ku langutisisa hi laha mudyondzisi a dyondzisaka hakona na hilaha vana va dyondzaka ha kona swita endliwa hi mulavisisi hi nkarhi wa tidyondzo ntsena hiku pfumeleriwa hi nhloko ya xikolo na mudyondzisi wa n'wana wa n'wina. Himbiswiritano, loko minga tsakeli leswaku n'wana wa n'wina ava xiave xa vonisiso lowu ngata endliwa ku tava na migingiriko leyi nga ta endliwa ku nga kuhlaya naku tsala.

Ehenhla ka ku pfumela ka n'wina, n'wana na yena u ta fanela ku pfumela ku nghenelela kutani a sayina fomo yo pfumela leyi fambaka na papila leri. Loko n'wana wa n'wina anga lavi ku nghenelela ange katsiwi na swona aku nga vi na nxupulo wo karhi. Kasi vuxoko-xoko hinkwabyo byita hlayisiwa ku ringana malembe ya nthlanu (5) eka vuhlayiselo (cardboard) nale ka khophuyuta leyi ngata va na xilotlelo (password) lexi tiviwaka hi mulavisisi ntsena. Endhaku ka malembe lawa vuxoko-xoko hinkwabyo byita herisiwa.

Ku hava swita ndhaku leswi ehleteleriwaka kuva kona eka ndzavisiso lowu kambe hambi swiritano, vana vata lemukisiwa vonisiso etlilasini wunga si endliwa kuva lulamisela naku susa nchavo lowu nga tshikaka wu va kona. Aku nga vi na ku hakeriwa kumbe tinyiko leti nga ta nyikiwa vangheneleri.

Loko miri na swivutiso mayelana na ndzavisiso/dyondzo leyi mi komberiwa ku vutisa mulavisisi kumbe supavhayisara phurofesa Motlhabane A.T eka ndzawulo ya sayense na thekinoloji ya kholeji ya dyondzo ya univhesiti ya Afrika dzonga. Mulavisisi minga n'u kuma eka nambara leyi 0795481789 kumbe eka imayili basambiluchauke@gmail.com. Kasi supavhayisara anga kumeka eka imayili motlhat@unisa.ac.za.

Mpfumelelo wa dyondzo leyi wu nyikiwile hi ndzawulo ya dyondzo ya xifundhza xa Limpopo, nhloko ya xikolo na komiti ya vulavisisi ya kholeji ya dyondzo ya univhesiti ya Afrika dzonga.

Hi n'wina mi endlaka kungu ra ku pfumelela n'wana wa n'wina ku nghenelela eka dyondzo/ndzvisiso leyi/lowu na swona nsayino wa n'wina laha hansi wu tiyisisa

leswaku mi hlayile vuxoko-xoko hinkwabyo lebyi nyikiweke, mi thlele mi teka xiboho xaku pfumelela n'wana kuva xiave xa dyondzo leyi. Minga hlayisa nkandziyiso wa papila leri.

Vito ra n'wana: _____

_____ _____

Mavito ya Muntswari/Muhlayisi wa n'wana Nsayini wa muntswari/ Muhlayisi Siku _____

Basambilu Chauke 20/09/2021

Mavito ya Mulavisisi Nsayino wa Mulavisisi Siku:

20 September 2021

Eka Mudyondzi.

Hi mina mudyondzisi Basambilu Chauke na swona ndzi na xikombelo xa ku ta ku ta vona loko mi endla migingiriko ya tidyondzo exikolweni xa n'wina. Ndzi leku ringeteni kaku dyondza hi laha vana va endlaka ha kona migingiriko ya sayense na vadyondzisi va vona, na hi laha va huhaka ha kona na vanghana va vona. Loko u pfumela ndzi tata, na swona hitava na nkarhi wo tsakisa swinene wa ku tlanga mintlangu laha unga ta ndzi hlamula na swivutiso swi n'wani. Ndzi ta thlela ndzi ku kombela ku endla migingiriko yin'wani na mina na swona a ndzi nga ku kombeli ku endla leswi swi nga taku vavisa kumbe leswi unga swi laviki.

Ndzi ta thlela ndzi kombela vatswari va wena loko kuve va swi tsakela kuva u nghenelela eka dyondzo leyi. Loko unga swi tsakeli kunghenelela swi tava swi lulamile eka mina. Tsundzuka leswaku unga pfumela kumbe u ala ku hava loyi anga ta kwata hikokwalaho ka ku va unga lavi ku nghenelela kumbe kuva u ncinca miehleketo endhzaku u ti humesa.

U nga ha vutisa swivutiso leswi u nga na swona sweswi kumbe loko u tava na swivutiso u nga ndzi vutisa nkarhi wihi na wihi lowu ndzinga ta endzela xikolo xa wena.

Ndzi kombela u vulavula na vatswari kumbe muhlayisi wa wena hi mhaka leyi u nga si sayina papila leri. Kuva u sayina vito ra wena laha hansi swi vula leswaku wa pfumela kuva xiave xa dyondzo leyi. Nkandziyiso wa dyondzo leyi wuta nyikiwa vatswari va wena.

Wa wena la rhandzekaka

Mudyondzisi Basambilu Chauke

Vito ra wena	Ina, ndza pfumela ku nghenelela 	E- e andzi pfumeli ku nghenelela 
Vito ra Mulavisisi Chauke B		
Siku 20/09/2021		
Mbhoni		

Appendix 13: Editor's Declaration

Mirna Lawrence
Language editor & proofreader

DATE: 27 December 2022

I, Mirna Lawrence, hereby declare that I edited the Master's in Education document of Ms Basambilu Chauke, Student Number 58246614, titled *Teachers' Experiences of Teaching Natural Sciences in a Second Language: A Case of Primary schools in Mopani East District*.

The document has been edited within ethical and professional limits for syntax, grammar, spelling, punctuation, word usage, sentence structure and flow, consistency of argument, stylistic consistency, tense, consistency of voice (passive voice to active voice), sequencing of figures and tables, and referencing.

The editor's revisions, comments and suggestions and overall quality of the final product do not detract from the content being the author's sole responsibility and work in its entirety.

The language editor does not accept responsibility for any changes made to this documents after the issuing of this declaration.

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