Term creation strategies used in the development of the Northern Sotho mathematics dictionaries for grade R-6

By

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DEDICATION

I dedicate this dissertation to my parents: Chikane Levy Maredi , and Ranku Rebecca Maredi (nee Makeketlane) and my four kids, Moyagabo, Maredi, Morongwa and Moneelwa, my two brothers, Morwangoako and Masebe Maredi.

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ABSTRACT

This study analysed the term creation strategies that were used to develop Mathematics dictionaries from Grade R-6, which is the foundation phase and intermediate phase in South African education. Furthermore, the study sought to determine whether the strategies employed yielded term equivalents that are unambiguous, comprehensible and effective. Furthermore, the study also analysed spelling and orthography rules to ascertain whether they were not violated when the terms were created. The study is content analysis which makes it a qualitative study.

This study discussed term creation strategies such as borrowing (direct or indirect), paraphrasing, loan translation, compounding and coinage as appropriate for the term creation process. It further revealed that when strategies such as borrowing are used, there are spelling and orthographic inconsistencies, especially when translating borrowed words from English into Northern Sotho. Furthermore, the study found that there are types of paraphrasing used to create terms, namely paraphrasing using related words, paraphrasing using unrelated words, explicative paraphrasing, distributive paraphrasing, and paraphrasing characterised by borrowing. The study further revealed that in all the types of paraphrasing, the most used is the explicative paraphrase followed by paraphrasing using related words, and the least used is paraphrasing characterised by borrowing and paraphrasing using unrelated words. The study revealed that the distributive strategy creates lengthy terms that might not be understood by learners. The study found that there was a lack of harmonisation of translated equivalents, where one concept is translated differently and thus creates inconsistencies in the orthography of the borrowed concepts. The study further found that, translators and terminologists work in silos and do not consult previous work done in the same field. Lastly, the study recommends that, the National Language Body for Terminology Technical Committee should produce standardised spelling and orthography guidelines for technical domains. The guidelines should address the spelling and orthography of technical terminology in specific fields. This will ensure a harmonised standardised terminology in specific domains. It will further avoid the use ambiguous, confusing and multiple terms in one domain.

KEY TERMS: paraphrasing, distributive paraphrasing, explicative paraphrasing, borrowing, transliteration, loan translation, partial loan translation, total or integral translation, compounding, coinage, term creation, term formation communicative Theory of terminology, International Standard Organization, Terminology work principles, transparency, appropriateness,

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LIST OF ABBREVIATIONS AND ACRONYMS

CTT	: Communicative Theory of Terminology
DSAC	: Department of Sport, Arts and Culture
DTS	: Descriptive Translation Studies
PanSALB	: Pan South African Language Board
NLB	: National Language Body
NLBs	: National Language Bodies
NLU	: National Lexicographic Unit
NLUs	: National Lexicography Units
NLS	: National Language Service
ISO	: International Standard Organization
PLSs	: Provincial Language Councils
SL	: Source Language
TL	: Target Language
TCS	: Terminology Coordination Section

CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The current study analysed the term creation strategies that were used to develop Mathematics dictionaries from Grade R-6, which is the foundation phase and intermediate phase in South African education. Furthermore, the study sought to determine whether the strategies employed yield term equivalents that are unambiguous, comprehensible, and effective. Furthermore, the study also analysed the rules of spelling and orthography to ascertain whether they were not violated when the terms were created.

Term creation is the process of coining new words into technical vocabularies to facilitate mother-tongue education. The process entails creating words and assigning them new meanings and new forms. According to International Standard Organization (ISO) 704 (2000), term formation patterns are guided by the morphosyntactic, phonological, lexical structures of individual languages. It is aimed at collecting, developing, analysing, and recording terminology in one or more subject fields for a specific purpose. According to Sager (1990), it occurs according to the subject field area, the nature of the people for whom it is intended, and the purpose of term creation. Wright and Budin (1997) state that term creation is a process of naming concepts to develop cognitive and communication that is needed by a particular speech community. It involves the transference of knowledge from one language to another. Sager (1990:80) concurs that term creation is a result of knowledge transfer to another linguistic community. According to Gumbo (2016), term creation strategies are linguistic instruments used to develop languages for use in all domains of life. In this study, term creation strategies, which were analysed included borrowing, paraphrasing, compounding, loan translation and coinage. The terms that were analysed were sourced from online dictionaries, glossaries and mathematical sources such as texts books.

The main source of the data was the Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R- 6 (2013). The dictionary comprises a multilingual and unidirectional term list containing approximately 1000 entries. A unidirectional dictionary, according to Alberts (2017:13), is a dictionary in which the translation is

only in one direction, namely, from a source language (SL) to a target language (TL). She further gives an example that, in a unidirectional dictionary, it is assumed that the target user knows the TL; for example, the user of an isiXhosa-Afrikaans dictionary must therefore know Afrikaans (Alberts, 2017:13).

The Multilingual Mathematics Dictionary for Grade R-6 is a unidirectional dictionary, which is also called a term list, contains a list of terms in English as the SL and equivalents in Afrikaans, IsiZulu, IsiXhosa, SiSwati, IsiNdebele, Setswana, Sepedi, Sesotho, Tshivenḓa, and Xitsonga as the Target Languages (TLs). The dictionary was published in 2003 by the Terminology Coordination Section (TCS) within the National Language Service in the Department of Sports, Arts and Culture (now Department of Sport, Arts and Culture). The aim of the multilingual dictionary was to facilitate and develop terminology in African languages for new concepts that appear in various learning areas. The term list has explanatory notes on the structure of the term list, which were presented as follows; lemma, which are head words in an alphabetical order with their equivalents below in official languages, contextual information is given in curly brackets, headwords are recorded in a singular form throughout, except where the term is used mainly in the plural form, where identical headwords indicate different parts of speech. In cases where there are synonyms, they are entered under one another, and abbreviations, acronyms and short forms of the terms are treated as synonyms but may appear as main entry terms where the full form is less familiar.

Another dictionary that was analysed in this study is the Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3, developed by Funda Wande, which is not for a profit organisation that develops high quality learning and teaching materials which are aligned with the CAPS (Curriculum Policy Statement) in South African indigenous languages. The bilingual dictionary includes English and Northern Sotho terms in an alphabetical order. It has explanations and diagrams for lesson plans; teachers' notes and includes a daily list of lesson vocabulary.

The third document that was analysed in this study is Sesotho sa Leboa Terminology No 4 1988, which was prepared by the Northern Sotho Language Committee. It is a term list and a unidirectional dictionary and contains a term list in two source languages (SLs), namely, English and Afrikaans, and the TL, Northern Sotho, as the equivalent language. It terms that were intended in the first place to be used in primary

schools and were taken from the syllabuses for the various subjects of primary school, including arithmetic and general science. The terms in the list are useful for training in schools and for use by translators and writers of schoolbooks. The document was considered in the study because it forms the basis of terminology development in Northern Sotho. It was developed in 1988 as the first point of reference regarding standardised terminology and spelling in Northern Sotho.

The fourth document that was analysed in this study was Pukutlhahlo ya Mareo Mphato wa R, which is a Grade R Mathematics improvement programme developed by the Gauteng Education Development Trust together with the Gauteng Department of Education. The concept guide has Mathematics terms as a glossary in both English and Northern Sotho term equivalents. The programme develops Mathematics concepts that are CAPS aligned. It was included in the study because it provided insights into how mathematical concepts were created in Northern Sotho.

The researcher also considered the document named CAPS/Setatamente sa Pholisi ya Lenaneothuto Mphato wa 1 -3, which is developed by the Department of Basic Education. It has mathematical English terms and equivalent terms in Northern Sotho. Although this document is not a dictionary, it was used in this study to supplement the selected dictionaries because it contains similar content with them. Furthermore, the CAPS document deals with curriculum and including it the study aided the researcher in ascertaining whether dictionaries develop terms that align with the CAPS curriculum.

The last document that was analysed in this study was the Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition, a textbook of Mathematics which was translated from English into Northern Sotho. Although this document is not a dictionary, it supplements and aligns with the selected Mathematics dictionaries in terms of content. Furthermore, this text was developed in 1980 and as such, it formed a base for creating Mathematics terms in Northern Sotho.

1.2 BACKGROUND OF THE STUDY

Section 6 Chapter 2.29 (2) of the Constitution of the Republic of South Africa states that every child has a right to be taught in their mother tongue. On chapter 1.6.1. It emphasises on multilingualism, and the elevation of indigenous languages and academic freedom of scientific research. It further states in Chapter 2.29 (2) that it is

a right to receive education in the official language or languages of choice in public educational institutions. Lastly, the Constitution (1996:4), declares that “All languages must enjoy parity of esteem and must be treated equitably”. However, prior to the Constitution of the Republic of South Africa (1996), African languages were not developed in technical, academic and scientific fields, and were not seen to be appropriate languages for use as Learning of Learning and Teaching (LoLT) (Ntshangase-Mtolo, 2009). Ntshangase - Mtolo (2009) further says that this resulted in little time spent in the learning and acquisition of Cognitive Academic Language Proficiency in African languages in schools. According to Alexandra (2003), there is a paradox in the current educational system, which creates an imbalance where the only children who enjoy all the advantages of mother-tongue education are L1-speakers of English and Afrikaans.

These problems of language imbalances, which were caused by the apartheid regime, create poor academic performance for learners who find English as a barrier to understanding technical terms in their curriculum (Ntshangase-Mtolo, 2009). Mathematics is one of the specialised subjects which involves high technical vocabulary. Technical vocabulary is a specialised language, with codes, symbols formulas and high vocabularies. Due to its high technicality of register, concepts should be transferred from one language into another largely for cognisance. This technical language can be a barrier for learners, i.e. Northern Sotho speakers.

Northern Sotho is one of the languages that lack technical vocabulary and has a low technical vocabulary (Mojapelo, 2018). Letsoalo, Mabaso and Gouws (2022) opine that there is a lack of terminology in specialised fields. Hence, there was a need for term creation to enhance the medium of instruction and terminology development on specific terms since everything must be commercialised (Mojapelo, 2018). Letsoalo, Mabaso and Gouws (2022) proffer that there is an urgent and important task of research in the field of translating specialised terminology in indigenous languages to achieve adequate translations, accelerate information exchange and ensure easy accessibility in fields of the latest achievements in economic science.

The Language Policy Framework for Public Higher Education Institutions, of 30 October (2020) in Paragraph 39, states that institutions must develop strategies, policies and implementation plans for promoting multilingualism. Creating technical

vocabulary in technical domains necessitates developing multilingualism through term creation. Mother-tongue-based education can be possible through corpus building, that is created through terminology development in technical vocabularies.

1.3 STATEMENT OF THE RESEARCH PROBLEM

Term creation is the process of developing terminology in technical fields through various terms creation strategies. It has been observed that during term creation for fields such as Mathematics, there are prevalent spelling and orthographic inconsistencies, which are notable largely in Mathematics dictionaries and term lists for grade R-6. Moreover, a lack of standardised mathematical terms contributes immensely to the inconsistencies when creating mathematical terms for one concept in Northern Sotho.

1.3.1 Research Aim

The aim of the study was to analyse term creation strategies used in the development of Mathematics dictionaries for Grade R to 6 in Northern Sotho.

1.3.2 Research Questions

- Which term creation strategies were followed when developing mathematical dictionaries for Grade R-6 in Northern Sotho?
- Did the term creation strategies used yield better, comprehensible, unambiguous and effective terms?
- Did the term creation strategies adhere to the correct linguistic principles of Northern Sotho spelling and orthography?

1.3.3 Objectives of the Study

- To identify the term creation strategies used when developing Mathematics dictionaries for grade R-6 in Northern Sotho.
- To investigate whether the term creation strategies employed by terminologists resulted in unambiguous and comprehensible equivalents.
- To explore and analyse if spelling and orthography rules were followed when developing terms for Mathematics dictionaries in Northern Sotho.

1.4 SIGNIFICANCE OF THE STUDY

Minimum research has been conducted on term creation strategies for grade R-6 Mathematics dictionaries in Northern Sotho. This study sheds light on the term creation strategies that were used to develop Mathematics dictionaries in Northern

Sotho by analysing whether the development of Mathematics terms for Northern Sotho dictionaries has been effective, unambiguous and comprehensible.

Although several studies that have been conducted on related topics, they focused on other subject fields. For instance, Maleka (2005) focused on *Chemistry in Sepedi: Translation strategies for success?* She discussed translation strategies used in developing Chemistry-related concepts from English into Sepedi. On the other hand, Mabule (2009) explored the taboos attached to the translation of biological terms from English into Northern Sotho. Mabule (2016) also explored issues involved in translating technical texts from English into Northern Sotho. It is envisaged that the study will fill the knowledge gap on the development in Mathematics terminology in Northern Sotho. Therefore, the study will contribute to the body of literature on term creation studies.

1.5 THEORETICAL FRAMEWORK

The study employed a dual theoretical framework, namely, Communicative Theory of Terminology (CTT) by Cabre (2003) and Descriptive Translation Studies (DTS) by Toury (1995). CTT describes terminology as activities carried out under different conditions. According to Cabre (2003:183), terminology presupposes a need for all the activities related to the representation and transfer of specialised knowledge such as technical translation, the teaching of languages for specific purposes, etc. This study explored the linguistic aspects of term creation strategies, which included the process of formulating new terms by borrowing, loaning words, paraphrasing, and transliteration. CTT aided the current study in exploring the term creation strategies used to develop mathematical dictionaries for grade R-6 in Northern Sotho because it firstly describes terminological activities and secondly provides insights on how to analyse terminological activities such as term creation strategies. Furthermore, Cabre (2003) says the circumstance of each situation determines the type of application (for example, glossary, lexicon, software, text, poster in one or several languages). In this study, the circumstance that led to the development of Mathematics dictionaries was that new mathematical concepts appeared in the teaching materials for Grade R-6 learners, and this required development of new terms in indigenous languages to facilitate teaching and learning in the mother tongue. Furthermore, the researcher selected and analysed Mathematics dictionaries, term lists and textbooks that were produced in Northern Sotho through term creation.

Gumbo (2016) applied CTT to analyse terminology activities comprising term creation strategies in Zimbabwe such as paraphrasing, borrowing and compounding used in a Shona specialised dictionary. Gumbo (2016) focused on selected specialised terms dictionaries: *Duramazwi Reurapi Neutano* (Dictionary of Biomedical Terms), *Duramazwi Remimnanzi* (Dictionary of Musical Terms), and *Duramazwi Redudziramutauro Ne Uvaromnwe* (Dictionary of Shona Linguistic and Literature Terms). However, although the current study employed the CTT, it differed from Gumbo's (2016) study because it focused on Mathematics dictionaries from grade R-6, a foundation to intermediate phase in Northern Sotho.

DTS by Toury (1995) was also employed in this study because it is process-oriented and describes what occurs in the mind of a translator during the translation process. The process involves a translator's decision-making and the psychology of translation, which includes the translator's choice and use of translation strategies during translation process. This process applies to terminology development and involves linguistic research in the SL and supplying term equivalents in the TL using, for instance, borrowing and paraphrasing, through verification and authentication by National Language Bodies (NLBs) in the Pan South African Language Board.

Function-oriented DTS describes the context rather than text; it elucidates the functions of translations and focuses on the value of the translated text in the intended target context and the sociocultural situation of the target reader. In terminology development, before embarking on a terminology development project, the purpose for developing the terminology must be stated, including the function of the terminology lists or dictionaries. For example, the development of Mathematics dictionaries is to facilitate mother-tongue learning in all thirteen 13 official languages in South Africa. Such dictionaries help Grade R-6 learners to understand Mathematics concepts and in so doing, they are best equipped to demonstrate excellence in the subject. DTS aided the current study because it analyses the term creation process regarding the choice and use of translation strategies by a translator during translation process.

Maleka (2005) employed DTS to investigate the translation strategies used to translate Chemistry-related concepts in Grade 12 Physical Sciences question papers from English into Sepedi. This study focused on term creation strategies for Grade R-6 Mathematics dictionaries in Northern Sotho. Overall, CTT highlighted the

communicative aspect of terminology and that terminological activities occur under different conditions. The researcher sought to elucidate the communicative aspect of the terminologies developed for Grade R-6 Mathematics in Northern Sotho and the conditions under which such a development occurred (Gumbo, 2016). DTT, on the other hand, DTT aided the researcher in how to describe the phenomena that characterise translation and terminology development (Munday, 2012). Therefore, both theories being descriptive in nature enabled the researcher to provide a comprehensive discussion of the activities related to the transfer of specialised and technical knowledge into Northern Sotho through term creation strategies.

1.6 LITERATURE REVIEW

The researcher reviewed previous studies on term creation, word formation, translation strategies and terminology development to identify what has been found on the topic and the gaps therein. The literature review presented in this study used a funnel approach and was divided into three categories: literature review from global researchers, literature by African scholars and literature by South African scholars on the topic. This enabled the researcher to gain a comprehensive overview of term creation formation strategies in technical fields. For instance, the researcher considered Cluver's (1980:53) who focused on term creation in English and observations by Gumbo (2016) who cited Sterhlov and Wright (1993) whose lament then was that linguists in Western countries remained far less committed to terminology activities than their counterparts in other countries and hence were very few. The researcher also probed studies from China, Serbia and Arab languages focusing on term creation strategies and found that, in the Serbian language, paraphrasing is often used as a term creation strategy for translating metaphorical economics terms, although the strategy creates long and complex terms. The same applies to Northern Sotho.

The literature review also highlighted the terminological issues creating confusion and inconsistencies caused by borrowing as a term creation strategy in the Arabic language. Similarly, in Northern Sotho, inconsistencies in the spelling and orthography of borrowed words remained a challenge. Furthermore, it was noted that in the Arabic language there was a dualism and multiplicity of terms, which created confusi, 2015). Furthermore, in the Chinese language, there were inconsistencies and mistranslations when translating food terminology from English into Chinese language (Li, 2021).

Thus, such observations from previous studies aided the researcher in articulating the challenges related to term creation strategies in Northern Sotho, especially to highlight similarities and dissimilarities on the topic.

African scholars have notably engaged in research on term creation and the development of terminology in African languages. Notable contributions include those of Mtintsilana and Morris (1988), Madiba (2000), Mheta and Muhwati (2009), Mojapelo (2018), Mabena (2020), and Gelagay (2021), who concentrated on term creation strategies such as borrowing, loanwords, and compounding in African languages. King ei (2000), Nchabeleng (2011) and Ramuedzisi (2016) focused on inconsistencies in the spelling and orthography of loanwords, which were caused by a lack of standardised rules on the development of technical terminology. These scholars found that there were inconsistencies of spelling borrowed words during term creation process. They found that inconsistencies were caused by a lack of standardised coordinated terminology processes.

Furthermore, Ngobeni (2013), Taljaard (2007), Maleka (2005) and Mabule (2016) focused on term creation in the scientific context. These scholars found that transliteration is one of the strategies that can be used to develop a particular language. However, it should not be first resort as it can dilute a language. On the other hand, Alberts (2013) focused on developing terminology in the context of law in South Africa. Alberts (2013) found that transliteration can be used as an effective strategy especially with words that are internationally recognisable as they can be easily comprehended and understandable by experts of a particular field.

Letsoalo (2018) focused on political terminology in South African indigenous languages. He found out that there is no specific strategy that can be used when developing terminology. It depends on the type of the word developed and usually the word will guide on how to approach the task depending on the context.

Mabasa (2007), Mabule (2009), Madzimbamato (2012), Ndhlovu (2014) as well as Igboanusi, Odoje and Ibrahim (2016) focused on health and anatomy terminology in indigenous languages. Mabule (2009) found that the use of euphemism in translating reproductive organs can sometimes be misleading and not deliver the intended message. She further says that it can limit the communication and the correctness of the intended message. Ndlovhu (2014) found that in Ndebele, due to the lack of

terminology there is an overlap of terms and meaning, where several source terms are translated using one word in Ndebele.

These scholars contributed knowledge on term creation in indigenous languages. They also contributed valuable ideas on how to overcome challenges faced during term creation in various technical fields. However, one notable scholar that has contributed valuable and useful information to this current study was Gumbo (2016), who analysed term creation strategies used in the development of Shona specialised dictionaries. Gumbo's (2016) emphasis was on borrowing, paraphrasing, compounding and coinage. Similarly, this study analysed the effectiveness and comprehensiveness of term creation strategies in Mathematics dictionaries in Northern Sotho. Another important study that provided valuable insights into this research was Mukoya's (2023) research. Mukoya conducted a critical analysis of terminological creation strategies within the multilingual context of Namibia and foregrounded term creation strategies such as borrowing, paraphrasing, compounding, and loan translation.

Regarding the creation of Mathematics terms in indigenous languages such as Northern Sotho, Setati (1998), Webb and Webb (2008) as well as Voster (2008) propagate code-switching as an effective means for promoting teaching and learning in a multilingual context. Although the authors did not emphasise term creation strategies, they nevertheless discussed mechanisms such as code-switching that could be used to teach Mathematics in indigenous languages. Ntshangase -Mtolo (2009) investigated the translatability of English Academic Discourse into isiZulu with specific reference to the mathematics discourse. This study contributed valuable ideas to this current study, as it analysing strategies that are used in translating mathematics discourse in IsiZulu, the information is useful to this current study as it talks about how mathematics is translated in indigenous languages. Kazima (2008) discussed two strategies that deal with mathematical terminology in the use of the mother tongue in teaching and learning in Nigeria, Tanzania and Malawi. Kazima (2008) reiterated that Mathematics terminology can be created by using the existing vocabulary of local languages and borrowing from mathematical English.

1.7 RESEARCH DESIGN AND METHODOLOGY

1.7.1 Research Design

Research design is a strategic framework of conducting research by determining a hypothesis, analysing and interpreting data. Rajasekar and Verma (2013) define research design as diverse practices to be used in solving research problems and the information period related to the problem. In other words, the research design is guided by the purpose and problem of the study.

1.7.2 Research Methodology

Research methodology reveals the purpose for conducting research, defines the research problem, and articulates the formulation of a hypothesis. Rajasekar and Verma (2013) define research methodology as systematic procedures that researchers use to describe, explain and predict a phenomenon. This study analysed the term creation strategies used to develop Mathematics dictionaries in Northern Sotho. The terms were sourced from online dictionaries and other documents in hardcopies. The following section explains the methodology used in this study.

1.7.2.1 Qualitative method

The qualitative method was suitable for the study as it analysed term creation as a phenomenon or an experience from a subjective or human-centred perspective. Qualitative research is descriptive in nature, this study described term creation strategies for Grade R-6 Mathematics in Northern Sotho. Researchers use a qualitative research method to understand the meaning people have constructed, how people make sense of their experience and world they live in. Therefore, this study used the qualitative method to analyse term creation strategies that were used to create Mathematics terms in Northern Sotho, to establish if they were effective and comprehendible, and if they followed the rules of spelling and orthography of Northern Sotho. According to Cresswell (2018), qualitative research is an approach that is used to understand and explore the meaning associated to individuals or groups in a social human problem. On the other hand, Leavy (2014) says qualitative research is a way of understanding, describing, explaining, unravelling, illuminating, chronicling and documenting social life.

1.7.2.2 Content analysis

Content analysis is a method of communication research that is largely used in media and culture studies. According to Krippendorff (2013), a research procedure for

making replicable and valid inferences from texts or other meaning matter to their context of their use. Elo and Kyngas (2008) regard content analysis is a systematic and objective means to describe phenomena and analyse documents. Content analysis was used as a tool to analyse all the data that were gathered from written documents, which are mathematical dictionaries compiled by different institutions. The terms were gathered from Mathematics dictionaries and critiqued to see whether they conformed to the strategies of term formation and of translation, i.e., if they followed or abode by the linguistic rules, principles and structure of the Northern Sotho language.

1.8 ETHICAL ISSUES

The study was desktop research; therefore, it relied on documents for data collection. No human participants were involved in the study; therefore, the data that were collected had no relevance to them, and this was in no way be harmful to them.

1.9 SCOPE AND LIMITATIONS

The study aimed to analyse terms creation strategies in the development of Mathematics dictionaries in Mathematics for Grade R-6. Furthermore, it also analysed if the strategies yield to terms that are effective and unambiguous and if they followed the spelling and orthography of Northern Sotho. Since the study dealt with terms from various sources, only a portion of the terms chosen and analysed. Terms were selected from online dictionaries, glossaries, and other printed materials. The limitation is that the study only focuses on the field of Mathematics only in Northern Sotho.

1.10 ORGANISATION OF THE STUDY

Chapter 1: Introduction and Background of the Study

This chapter provides an overview of the study, including the problem statement, historical background, aims and objectives, research questions, a concise literature review, research methodologies, scope of the study, and definitions of key term. It highlights the issues the research seeks to address and establishes the theoretical framework guiding the study.

Chapter 2: Literature Review

This chapter reviews the literature that forms the basis for analysing and evaluating term creation in Northern Sotho Mathematics dictionaries. It draws on existing

literature concerning term creation and terminology development in Northen Sotho, providing the study's foundational context. Relevant literature was sourced from South African, African and international publications.

Chapter 3: Theoretical Framework

This chapter examines the theoretical frameworks relevant to term creation and translation strategies, specifically the Descriptive Translation Theory (DTS) and the Communicative Theory of Terminology (CTT). These theories offer a comprehensive methodological foundation for analysing the term creation strategies employed by compilers of Northern Sotho mathematical dictionaries. Both theories are fundamental to term creation and translation, as they guide terminologists in addressing and incorporating linguistic aspects of a language. The researcher also assesses the applicability of these theories to the study of term creation strategies.

Chapter 4: Research Methodology

This chapter presents the research methods that were used for gathering research materials for this study. Thus, the researcher gave an outline of methodologies, research paradigms, research procedures, research instruments and the methods of analysis that were used that were used to collect, analyse and interpret the collected data.

Chapter 5: Data Presentation and Analysis

This chapter present, analyse and discuss term creation strategies used in the development of Mathematics dictionaries in Northern Sotho from Grade R-6. To ascertain whether the compilers of these dictionaries used term creation strategies that are unambiguous, effective and understandable and if the rules and orthography were followed during term creation. Furthermore, this chapter provided a discussion of term creation strategies and an exploration of some of the basic processes by which new terms are created. Specifically, the strategies which were discussed are borrowing, paraphrasing, compounding, loan translation and coinage.

Chapter 6: Summary, Findings and Recommendations

This chapter provided the findings and recommendations, of what has been investigated in the study and draw a conclusion. Furthermore, it sums up the main results obtained from entire research study, the conclusion that contains remarks, observation and recommendations drawn from the entire study.

1.11 CHAPTER SUMMARY

This chapter introduced study on the creation of new terms is an integral aspect of language development and can be utilised to advance indigenous languages in technical domains. This point has been emphasised in the introduction and background sections, as well as in the research problems, questions, aims, and objectives of the study. A literature review and theoretical framework are presented to provide an overview of the research area, highlighting how existing perspectives align with or differ from this study. Additionally, the research methodology is outlined to ensure that the data collected were both valid and reliable.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

A literature review focuses on arguments, ideas and knowledge that are appropriate to the study. It is the information extracted from different authors, linguists and other specialists that helps the readers to understand the argument presented in a broader sense. Mouton (2001) opines that literature review is not just a collection of texts, but rather an accumulation of scholarship from other scholars. He further states that, it is having a perspective of how other scholars have conceptualised on issues, what are their empirical findings. In essence, it is investigating what other scholars have analysed, their findings, the instruments they have used, and to what effect.

Kanyane (2018) explains a literature review as articles, journals, newspapers, and books about the specific topic or the issue discussed. Oliver (2012) states that literature review is a vital part for student projects, dissertations, and research studies. Oliver (2012) further explains that a literature review is a tool to evaluate how recent studies and research they operate as building blocks laid upon the ideas built by others. In other words, literature review is a way of assessing what other scholars have researched on a specific topic and building upon ideas on the topic of research. However, it is noted that a literature review is not a survey of one author or researcher after another (Oliver, 2012).

Gumbo (2016) explains literature review as a summarisation, assessment, description, and explanation of the literature relevant to a particular field or topic. Gumbo (2016) says that a literature review uses a funnel approach, which starts out broad and become more specific. It begins with focusing on broad issues as the analysis continues until the research focus established. The researcher looked at scholars who conducted studies on term creation, word formation, translation strategies and terminology development. The literature review presented on this study used a funnel approach and divided into three categories: literature review from global researchers, then literature by African scholars and literature by South African scholars. Reviewing literature on terminology development enabled the researcher to investigate a knowledge of term creation formation strategies in technical fields to

contribute to other people's research in term creation strategies in Northern Sotho in the field of Mathematics.

2.2. Research on Term Creation Strategies by International Scholars

Silaški (2010) conducted a study entitled, *Translating metaphorical economic terms from English into Serbian - some strategies and challenges*. The research focused on the Conceptual Metaphor Theory by Lakoff and Johnson (1980), Chaffner (2004) and Deignan (1999). The study foregrounded the cognitive approach to translating English economics science metaphorical terms into Serbian. The study explained and described various translation explanations, especially dealing with those metaphorical terms in English, whose translation in Serbian renders a non-metaphorical expression. According to Silaški (2010), the commencing proposition of the analysis is that term creators consider the metaphor strategy as a substandard strategy for creating scientific terminology and considered too flowery to be used in rendering the meaning of economic terms to the audience. Furthermore, term creators unwillingly preserve metaphors in translating metaphorical terms from English into Serbian. Therefore, the scholar presented an explanation for an unfavourable perspective toward employing metaphors in the Serbian economic terminology.

Silaški (2010) discusses different mechanisms among which translators may choose to translate metaphors, such as using the original metaphor as an equivalent; for example, creeping inflation – *pazajuca inflacija*, (the behaviour of inflation is the behaviour of a person), malleable capital – *savitljivi kapital* (money is a solid), spillover effect- *efekat prelivanja* (market is a container). The second way, according to the scholar, is expressing a similar sense by using another metaphorical phrase; for example, flight from cash - *bekstvo od gotovine,* internal drain- *unutrašnje usisavanje,* labour turnover – *fluktuacija radne snage.* According to Silaški (2010), paraphrasing is another strategy in which an English metaphorical term is replaced by a rather long and cumbersome literal phrase in Serbian, leading to more complex or explanation renderings, thus violating the main characteristics of a term. Brevity is preferrable, for example, *feartherbedding-zapošljavanje većeg broja radnika od potrebnog*, bears- *špekulanti koji očekuju pad cena.* This challenge of long, complex and cumbersome equivalents is also identified when translating economic metaphors from English metaphors into Northern Sotho through paraphrasing. For example, in the Multilingual

Human Science Economic and Management Sciences Terminology, bubble (in finance context), appears thus, *tlhahlošo ya ditheko ntle le mabaka,* open market – *mmaraka wa go gwebišana le dinaga tša ka ntle*, open economy- *ikonomi ya go gwebišana le dinaga dišele.* The foregoing example shows that, in Northern Sotho, metaphors can be translated through paraphrasing; however, the equivalent term in Northern Sotho looks like a long sentence rather than a term. The researcher is of the view that, a lengthy term violates the principle of conciseness, meaning the lengthier the term, the harder it is for it to be used. In contrast, the shorter the term, the easier it will be to facilitate communication effectively. Gumbo (2016:68) says that concise or shorter terms facilitate efficient communication. The absence of conciseness is also seen in the Northern Sotho Mathematics term list, which is also full of metaphors; for example, **vulgar fraction - *palophatloditlwaelwa*.** The example shows that in Northern Sotho, compounding as a term creation strategy is used for translating metaphors in Mathematics. This strategy, however, makes the term too long, complex and even hard to read and understand. The issue of articulation also plays a role in term creation, where terms that are created should be easier to read and articulate. Gumbo (2016:68) notes longer terms are less likely to be used.

Silaški's (2010) findings revealed that metaphors in Serbian economic terminology are still marginalised and regarded as unscientific. Furthermore, metaphors have not gained their place in Serbian economic terminology because literal translations remain the most frequently used term creating strategy. Silaški (2010) focused on the use of metaphors in economic terminology and their translation while the current study only focused on strategies employed in the translation of Mathematics terms from English into Northern Sotho. The researcher identified and analysed strategies such as borrowing (direct and indirect), paraphrasing, semantic transfer, compounding, transliteration and the challenges of spelling and orthography of borrowed or transliterated terms, which creates inconsistencies in the Northern Sotho language. The current study further showed how these inconsistencies of spelling and orthography created confusion and a lack of standardised equivalents that can be used by translators or terminologists. Silaški (2010) did not comment on how the spelling and orthography of Serbian economic terms created the kind of confusion observed in Northern Sotho term creation.

Hafiz (2015) considered *Lexical Borrowing (Ta`rib) in Arabic computing Terminology: Issues and strategies* and investigated the degree to which neologisation in Arabic is used as a strategy of lexical borrowing in computing term creation compared to the mechanisms of semantic extension, derivation and compounding. According to Hafiz (2015), the evolution of computing technology requires immediate term creation in the Arabic language. Therefore, the study assessed the significance and effect of lexical borrowing as a computing term creation mechanism in Arabic. The research was based on a corpus of specialised dictionaries and literature. The findings of the study showed that lexical borrowing was by far the most used Arabic term creation strategy in computing term creation, followed by compounding, derivation and semantic extensions.

Hafiz (2015) discussed strategies such as derivation (*ishtiqāq*) as a mechanism in technical and computing terminology commonly used in Arabic, providing examples such as:

mail barīd derived ***from [b-r-d]***
application taṭbīq derived ***from [ṭ-b-q]***
computer ḥāsūb derived from ***[ḥ-s-b]***

According to Hafiz (2015:94), compounding is another mechanism commonly used in technical and computing terminology creation in Arabic language, as seen in the following examples:

login	***tasjīl dukhūl***
firewall	***ḥājiz ḥimāya,***
laptop	***ḥāsūb maḥmūl***
hard disk	***qurṣ ṣulb,***
touchpad	***lawḥat lams.***

In Northern Sotho, compounding is also used in computing terminology as a ter creation strategy. For example, **application- *lenaneotirišo (lenaneo + tirišo)*** **browser- *lenaneonyako (lenaneo + nyaka/nyako)***. These terms were extracted from the Multilingual Terminology for Information Communication Technology.

Although compounding seems to be a very effective term creation strategy, for technical terms, however, the strategy often creates ambiguity, lacks specificity and results in overly long terms that are hard to read and understand. Considering the above example, **lenaneo + tirišo** has two nouns that are joined together, which are too general and not specific. Furthermore, ***lenaneo*** can be a programme for television, radio, party; as such, it lacks specifity and might not be related to the subject field when used. **Tirišo** is also too general, as anything can be used. In Mathematics, terms or names for shapes such as polygon - **sebopegohlakorentšhithwii** (noun+noun+adjective+adverb), are too long, and hard to read and complex. In fact, the Northern Sotho equivalent is a description and not a term. Mojela (2010) says that compound terms are ambiguous, unfriendly, descriptive and will unlikely be used in any translation text. Hafiz (2015) discussed loanwords as another strategy that is used to create computing terms in the Arabic language. According to Hafiz (2015), Arabic tends to borrow more from English, and this is due to the import of technologies, which are often in English. Hence, lexical borrowing becomes a convenient mechanism to coin Arabic equivalents for the Arabic terms (Hafiz, 2015:177). For example,

modem -	***mūdim***
computer	***kumbiyūtir***
electronic-	***iliktrūnī***

The examples below appear in Northern Sotho computing terminology, which also shows that Northern Sotho has borrowed technical terms from English. These examples were extracted from the Multilingual Terminology for Information Communication and Technology (2013) Department of Arts and Culture:

internet	***inthanete***
byte	***paetana***
mouse	***maose***
computer	***khomphutha/khomphyutha/khomphiyutha***
network	***neteweke/netweke***
software	***sofotewere***
keyboard	***khiiboto***

Hafiz (2015) discussed the terminological confusion and inconsistencies caused by spelling, especially when using lexical borrowing as a strategy for term creation. Hafiz

(2015) found that loanword spellings were a result of using a short vowel instead of a long vowel or vice versa or adding or omitting a consonant, which could be related to the colloquial variety of Arabic using loanwords. For example, the term **computer** is spelt differently, where one is with a short vowel [u] as in ***kumbiyūtir***, while the other is spelt with a long vowel [ū], as in ***kūmbiyūtir***. In another example, the term 'cable' is used in three ways in the study: one with a short vowel [a] as ***kabl***, one with a long vowel [ā] as in ***kābl***, and one with an additional consonant [y] and a short vowel [a], as in ***kaybal*** (Hafiz, 2015:197). This problem is also evident in Northern Sotho, where inconsistencies in the spelling of borrowed words appear in the Multilingual Terminology for Information Communication and Technology (2013) by the Department of Arts and Culture. For example, the term 'computer' is spelt in three different ways:

khomphyutha/ *khomphiutha/khomphutha*

Other similar inconsistencies are **cable - *kheibole or kheipole*** and **website - websaete or wepsaete**. There are no standardised rules for spelling technical words or terminology (Nchabeleng, 2011). A term has one or more spellings, which creates challenges for a terminologist to choose the correct and standardised term. This challenge of spelling inconsistencies during term creation was also discussed by Nchabeleng (2011), who states that Northern Sotho has serious problems of spelling rules, which creates inconsistencies and confusion during term creation. This is also seen in Kiswahili language where adapting technical terms from foreign languages becomes a challenge. King `ei (2000) explains that the problem is caused by a lack of an agreed procedure for standardising and harmonising the loaned or borrowed words. According to Nchabeleng (2011) and King `ei (2000), a lack of standardised and harmonised procedure for standardising technical terms creates spelling inconsistencies. The researcher agrees with both scholars that National Language Bodies (NLBs) and Terminology Technical Committees of Northern Sotho should come up with a specialised and standardised procedure of spelling technical terms. This standardised procedure should be followed to prevent confusion regarding technical words. Having one concept with more than one spelling violates the principle of "form of correctness" which states that loan words should be written in a correct form according to the morphological structure of the recipient language. The National

Language Body (NLB) of Northern Sotho language should agree on one form of writing loan words to avoid confusion and having one concept with different spellings.

Hafiz (2015) looked at lexical borrowing in Arabic computing terminology. This study looked at different strategies such as transliteration, compounding, paraphrasing, coinage and semantic transfer in the creation of Northern Sotho Mathematics terminology. Both studies looked at the challenges of borrowing technical terms, which is caused by a lack of harmonised or standardised procedure of spelling borrowed technical terms. Elmgrab's (2016) *The Creation of Terminology in Arabic* investigated the applicability of approaches employed by early Arab grammarians to create and present new Arabic terminology to cope with the flow of modern terminologies. The research compared term creation methods to investigate their workability in managing the problem of finding equivalence in the Arabic language. The scholar further discussed the different methods used by Arab scholars and grammarians to customise new terms to suit the properties of Arabic. For example, **derivation** was considered as a process of creating new terms. There are two main categories of derivation in morphology: derivational morphology and inflectional morphology. in Arabic, the derivational process of term creation could entail the combination of **nation (noun)** and **national (adj.**) whereas the inflectional process results in a different form of the same word; for example: **nation (noun) and nations (noun)**. The scholar further indicates that **simple derivation** is another strategy used to create new vocabulary in philosophy, science and technology in the Arabic language. For example, from the radicals, **d-r-b (ض ر ب) (we can derive the following forms: *darb* (beat) (noun), *madrib* (place**; **noun), *midrab* (bat), *dārib* (hitter)** and ***madrūb* (beaten)** (Elmgrab,2016:77)

Another method of introducing new terms into Arabic is circumlocution. According to Elmgrab (2016), this method involves giving new words meaning by conveying the same message but in words that are different from the words in the standard or original translation. For example, **microphone** becomes ***mukabbir al-ṣawt/laqit al-ṣawt***, **and conditioned reflex** is sometimes translated into Arabic as ***al-inCikās al-Šartī*** and as ***al-inCikās aldharfī***. This method, according to Elmgrab (2016:79), leads to the problem of the dualism of terminology in Arabic language where a term has variants which are not sufficiently current in their literary usage. This problem of the multiplicity of terms is also observed in Northern Sotho where a term will have two meanings that

describe the action or the object in English. For example, in the Multilingual Glossary of Agricultural, Commercial, Disabled Persons and Health/Medical Terms of the Department of Sport, Arts and Culture, the term antibody has three variants, **antibody-*twantšhatwatši*\ *mašole a mmele*\ *twantšhabolwetši***. The same term in the Multilingual HIV/AIDS Terminology also has two variants: for example, **antibody-*selwantšhatwatši sa mmele* *selwantšhatwatši***. Another example relates to the term **arrears** in the context of finance, where several variants are used redundantly. For example, in the Multilingual Human, Social Economic and Management Sciences Terminology List, the term **arrears** is ***tšhalelo ka tefo*** in Northern Sotho whereas in the Multilingual Glossary of Agricultural, Commercial, Disabled Persons and Health/Medical Terms, it is ***tefotšhalelomorago/tšhalelamorago ya tefo***. All these equivalents in Northern Sotho mean the same thing but written differently, resulting in a redundancy of terms and dualism of terminology, which creates confusion and a lack of harmonisation.

In the above example, ***tšhalelomorago*** is a compound term, ***tšhalelomorago ya tefo*** is a statement describing the English term, and ***tšhalelo ka tefelo*** is also describing or explaining the idea or concept in Northern Sotho. Circumlocution is a good strategy for describing the idea or the concept; however, there should be rules among linguists and term creators that provide guidance on how to avoid creating terms that yield dualism and a multiplicity of terms. Another example in Mathematics terminology involves a term with multiple variants, which also leads to a dualism of terms. For example, the term **abacus** has four variants describing it differently, namely, **abacus-*sebalapalo*** (that which counts a number or sum), ***motheopalo*** (the base of a number), ***mmadiphetana*** (a person who is having beads) and ***abakhase*** (which is a direct translation). Here, a term is described differently and has more than one variant, which is confusing. Even if the other equivalents were regarded as synonyms, they would still be misleading because synonyms should explain the same thing and not describe different things. These examples in Arabic and Northern Sotho reveal problems of duality in term creation, which causes confusion and a multiplicity of terms. Circumlocution as a term creation strategy is less adequate in both Arabic and Northern Sotho, as it leads to the multiplicity of terms. Nevertheless, the study revealed that, derivation has played its role in dealing with Arabic term creation. However, it might be regarded as less attractive option owing to the lack of

coordinating among Arab neologisers and academics. In the study, scientific and technical terms were more effective through Arabicisation than derivation and blending. This is because there are rules that are used to a mono-morphemic word, whereas in a compound morpheme, it is difficult to apply the same rules. Blending is regarded as less productive and had not been described by Arabic grammarians as a customary method of forming new terminology.

Li's (2021) *Translating food terminology as a cultural and communicative process: a corpus based-approach* focused on analysing food-related terminology and their translation between English and Chinese. The research featured three case studies that focused on environment-related terms, food safety, nutrition-related terms, and seafood products. Food term creation was described as a cultural process and not only a linguistic and social process. The study further showed that there were prevalent inconsistencies, inappropriateness, and mistranslations of food terminology between English and Chinese. A significant problem affecting food terminology was finding precise terms or the best ways of classifying food in a term creation process. The study further showed that there are inconsistencies, mistranslations of names and labels, which hindered communication in the global trade. Similarly, in the Northern Sotho-English terminology for food, foreign food translation concepts were misleading and inconsistent. The term ***meat pie*** is translated ***kukunama*** in the Sesotho sa Leboa Terminology No 4 1988, which is misleading because ***kuku*** is used as a general term for cake and scones. These inconsistencies emerge because one term cannot be used as an equivalent for two or more concepts.

The food term **pumpkin broth** was translated as ***kgodu*** in the Northern Sotho /English Dictionary. However, ***kgodu*** and **pumpkin broth** are two different concepts and mean different things. ***Kgodu*** is porridge made with pumpkin and **pumpkin broth** is a soup made from pumpkin. So, there is a mistranslation of these food concepts. The problem of spelling food names was another challenge observed in Northern Sotho terminology. For example, in the Sesotho sa Leboa Terminology No 4, 1988, the term **flour** was designated as ***folouru*** whereas in the Oxford First Bilingual Dictionary, it is spelled **flouru**. It seems that the Consonant-Vowel (CV) structure was not followed correctly or perhaps it was unknown when or how it must be followed. Another example was the term **ice cream**. In the Oxford First Bilingual Dictionary Sesotho sa Leboa and English, the Northern Sotho equivalent was ***aesekhirimi***. However, the same word

was spelled differently in the Sesotho sa Leboa Terminology No 4 1988, that is, as ***aesekherimi***. Therefore, there were inconsistencies in translating high raised vowels from English into Northern Sotho. Another example is the term **cheese**, where in the Sesotho sa Leboa Terminology No 4 1988, it was spelt as ***tšhese***. However, in the Oxford First Bilingual Dictionary, it was spelled ***tšhisi***, which creates confusion in terms of which one is correct.

2.3 Research on Term Creation Strategies by African Scholars

King 'ei (2000) explored *Swahili technical terminology: problems of development and usage in Kenya.* The study focused on the deficiency of Swahili technical terminology in technical fields. According to King `ei (2000), this lack of terminologies was felt by other professional language users, such as lecturers, teachers, and broadcasters. The opined that, Swahili languages needed to be developed and modernised in scientific domains so that they could be used in teaching and learning at tertiary institutions. The study outlines the methods used by Swahili experts to develop technical vocabulary such as calquing, compounding, loan translation and acronyms. King `ei (2000) observed that term creation was attained through the Swahilisation of the loan/transliteration, and loan words were adopted and structurally written morphologically to bear the likeness of the Bantu word; for example, **cable-*kebo,* peddle-*pedeli,* aerial-*erio*** (King `2000,151). However, King `el (2000) adds that although this technique is productive, it creates problems such as the use of the vocabulary solely consumed by the experts and not for any ordinary Swahili speaker. The scholar further argues that there appears to be no morphological framework or system of Swahilising the loans. Similarly, in Northern Sotho, although there is standardised system of spelling technical vocabulary, as discussed by Nchabeleng (2011), inconsistencies persist in the spelling of technical terms. For example, **electronic-*elekhetheroniki or elekthroniki, kheibole/kheipole***. This aspect was discussed further in this study on Mathematics vocabulary.

The scholar pinpointed the challenges of term creation in Swahili, which are, lack of harmonisation of technical vocabulary due to regional differences in usage and in some cases, differences among universities, departments and individual lecturers. For example, text – ***makala/matini/kifungu habari/maandish***i (King`ei, 2000:155). King`ei (2000:156) further states that there is nothing wrong with the existence of synonyms, as in the above example. However, if not harmonised and standardised,

such random usage may impede wide communication among experts and professionals. This is supported by Ramuedzisi (2016) in the South African context, that if terminology is not coordinated and managed, there will be inconsistencies, which create a duplication of work among terminology developers. For example, the term **fever** was treated differently by different terminology developers in Northern Sotho, as seen in the following examples: in the Sesotho sa Leboa Terminology No 4, 1988, it is translated as **fever- *phišo***, ***letadi*** and in the COVID-19 Multilingual Terminology (2021), the translation of the term is ***phišommele***. The same term was given a different equivalent by the Department of Sports, Arts and Culture Multilingual Glossary of Agriculture, Disabled Persons and Health/Medical Terms, thus: ***matšhona/mokomane/go fiša***. The synonym ***mokomane*** in this case is confusing because ***mokomane*** is the equivalent of the term **flu** in the Mulitilingual HIV/AIDS Terminology by the then Department of Arts and Culture. This problem violates the principle of "mononymy" where, one concept is expressed by one system throughout the terminology system. In other words, the term **fever *-phišo*** or ***letadi***, depending on the context, should be used as an equivalent in Northern Sotho. The equivalents ***phišo*** or ***letadi***, should not be used to designate any concept but ***fever***. The researcher thinks that, when term equivalents are already existing in the terminology system of a particular language, there is no need to create a new term designating that concept, as it creates polysemous terms in one domain.

It also seems the term **fever** in Northern Sotho has the same equivalent with the term **flu**, which is ***mokomane***, and the term **common cold** is also ***mokomane***, which creates redundancy in the use of one term with the same equivalent in different contexts. This also creates ambiguity because the indigenous term ***mokomane*** can refer to three different concepts in English. Mojela (1991:26) affirms that ambiguity is created when a loan word is used synonymously with an indigenous word. Furthermore, King `ei (2000) pinpoints the challenge where Swahili equivalents lack specificity, which means the equivalents are too general and do no satisfy the specialised meaning of the register. Similarly, in Northern Sotho terminology, there are too many general terms coined that lack specificity. Mojela (2010) and King `ei (2000) concur that too many general terms cause ambiguity and do not add to the vocabulary development of Northern Sotho and Swahili. In fact, too many general terms for one concept violate the principles of one-concept-one term. For example, in Mathematics,

some terms are presented thus: **addendum - *setlaleletši, assignment – mošomo***. ***Setlaleletši*** can be anything, as it does not specify and satisfy the specialised meaning of the register. Another example is ***calculator -sebaledi***, where the equivalent term in Northern Sotho appears too general, as anything can be ***sebaledi***; as such, it does not specify the specialised register. This is also identified in the Multilingual Pharmaceutical Terminology where the term ***embrocation – setlolo*** lacks specificity. This is because ***setlolo*** can mean anything, including ***vaseline, dawn, cream***. Moreover, in an example such as ***elixir – seelanatefišahlare***, the equivalent is too general and does not satisfy the specialised register. This is because ***seelanatifišahlare*** can be any liquid and not specifically **elixir**. To avoid terms that lack specificity, a puristic approach should be avoided, especially in specialised fields. Terminologists should employ strategies that create terms that are more specific instead of using general and ambiguous terms. King `ei (2000) concludes that for Swahili to develop, it will have to continue borrowing from other African languages and foreign languages as well as coining new terminology, especially in science and technology fields.

King`ei's (2000) study focused on problems faced when developing Swahili technical terminology while the current study investigated term creation in Mathematics, which is also a technical field. However, the focus was on identifying and analysing term creation strategies used when developing mathematical terminology in Northern Sotho. Both King `ei (2000) and this study considered inconsistencies in spelling borrowed technical terms and observed this was caused by a lack of harmonised and standardised procedures.

Mheta (2005) conducted a study entitled*, The impact of translation activities on the development of African languages in a multilingual society: Duramazwi reMimhanzi as a case study*. He analysed Shona musical terms created through translation processes and strategies such as borrowing, coining, compounding, and derivation. In his analysis of these terms, he established that in most specialised fields taught in English, there is a lack of equivalence in Shona, especially in musical terms. According to Mheta (2005), this trend of a lack of equivalence in Shona in specialised fields can be managed through a translation process that uses borrowing. In his discussion, he shows that borrowing has resulted in the creation of musical terms such as the examples below:

alto	***aruto***
bass	***bhesi***
beat	***bhiti***
chorus	***korasi***

Mheta (2005:288) explained that examples shown above are English terms adopted and then adapted to the Shona phonological and morphological structure. However, there are inconsistencies in the Shona alphabet, where the English term **alto** is retained even though the current Shona alphabet does not include /l/. Mheta (2005:290) explains that in other instances, the term **alto** is written ***aruto***, the lateral /l/ is replaced by the trill sound /r/. Mheta (2005:290) suggests that in these cases, term creators must come up with clear-cut policies to deal with terms such as **alto**. Similarly, in Northern Sotho, musical terms were created through a borrowing strategy in the Multilingual Arts and Culture Intermediate Phase Terminology List (2015) by the Department of the then Arts and Culture, spelled different from the Sesotho sa Leboa Terminology No 4 1988. For example:

alto	***aletho from English***
alto	***alto from Afrikaans***
metronome	***metheronomi from English***
metronome	***meteronome from Afrikaans.***

It seems that there are inconsistencies around the issue of the CV structure, prompting the question: Is the CV structure used in all borrowed words from English excluding borrowed words from Afrikaans? If words are borrowed from both Afrikaans and English, are they both acceptable and the one borrowed from Afrikaans takes precedent over the English borrowed term? In chapter 8, rule 108 (paragraph 8.2), Mongwalelo le Mopeleto wa Sesotho sa Leboa 2019, there are sounds that are not allowed because they do not follow the correct spelling of Northern Sotho. Rule number 108 (paragraph 8.2) states that, when translating terms from English that have consonants that follow each other, such as **kr, sf, pr, tr, ft, sk, rk**, a vowel should be added between the consonants. The structure of the Northern Sotho syllable structure follows the consonant and vowel; for example, **credit > kherediti** and not **khrediti** because there is no **khr** sound. The rule is applicable when translating lexical items

from Afrikaans; for example, **sypker > sepikiri**, **skool > sekolo**. However, the rule seems to be limiting because there are other consonants in English that are not included such as, bl**, lt, ct, ay, fr, dr, pt**, which therefore becomes challenging for terminologists during the term creation process. It seems as if the rule applies only to consonants mentioned in the spelling and orthography rules. It is unclear whether these consonants are regarded as the only ones in English or they represent a larger class of consonants.

Mheta (2005) adds that term creation does not only end with borrowing, but coinage is also another term development process. He opined that coinage can be used as an effective strategy to create musical terms, especially if term creators understand the context of the Shona language. Mheta (2005) says that coinage is also a way of expanding and enriching the Shona language with new terminology. However, on this note, Mheta (2005) found that there are challenges of inconsistency in the creation of Shona musical terms, with too many different terms referring to the same musical concept. Mheta (2005) pinpoints the problem of inaccessibility of some Shona musical terms already created, where the terms are easily accessible to Ndau speakers and not to users of the Shona dialects such as Korekore, Manyika, Zezuru and Karanga. This is caused by a lack of uniformity and largely unplanned and uncoordinated terminology development process. He recommends that there should be committees responsible for terminological work, to facilitate well-coordinated terminology work in Shona.

Mheta and Muhwati (2009) conducted a study entitled*, The use of loan translation as a term creation strategy in Duramazw reMimhanzi a musical dictionary in Shona*. The article presented loan translation as one of the key strategies that was employed by lexicographers during the compilation of a music dictionary. The music dictionary developed by lexicographers at the African Languages Research Institute (ALRI). The article discussed the advantages and disadvantages of using loan translation during the terminology development of musical dictionary. The article further discusses loan translation based on Chimhundu's (1996) scan and balance theory used for translation and terminology development.

Both Mheta and Muhwati (2009) are of the view that loan translation is a productive term creation strategy, especially where there is zero equivalence, as in the case of

Shona. They demonstrated that a term creator can use the six stages of scan and balance theory. In their discussion, they illustrate the stages of the scan and balance theory used by the term creator or translator to find direct and accurate translation equivalents. According to the authors, a term creator should understand their role fully, including understanding the SL text before transferring it into the TL and making sure that a created term equivalent has a balanced form and meaning. They both suggest the following six stages by Chimhundu (1996):

Scan and balance theory by Mheta and Muhwati (2006)

They proffer that the scan and balance theory is a better method of dealing with the lack of equivalents; however, it should be noted that it can only be used to assist the term creator or translator if she/he has full information about the referent. In their discussion, Mheta and Muhwati (2009:151) discuss the following musical terms:

genre	***mhando yemumhanzi*** (literally: type of music)
composer	***munyori werwiyo*** (literally: writer of a song)
minor scale	***neramhazi diki*** (literally: small music ladder)
lyrics	***mazwi erwiyo(literally: words of a song).***

According to these scholars, the above examples should ensure that there is a retainment of the sense in the TL terms as in SL terms as much as possible. Although there might be slight adjustments as the level of form to ensure effective rendition of the SL meaning in the TL. They conclude that loan translation can be used as a productive term creation strategy. Madzimbamuto (2012) conducted a study entitled, *Developing anatomical terms in an African language.* The article focused on word compounding to demonstrate the language's ability to form new technical terms using anatomical terms as a model. He adds that, from a medical perspective, patients prefer

information in their own language. This can happen through acquiring new terms using various strategies. Madzimbamuto (2012:133) says there are various methods such as word borrowing, loan translation and semantic extensions that can be used in terminology development in anatomical terms; for example, borrowing words from English and Africanising them. In Shona, such examples include:

operation	***opareishene***	
loan translation	***family planning***	***rhonga mhuri***
semantic transfer	***kucheka***	***to operate or to cut***
compounding	***mhetamakumbo***	***polio***

The scholar found out that word compounding is used by Chishona dictionary developers in technical fields. The study relates to the current study in that the term creation strategies used in developing anatomy terminology are also used in developing anatomy terms in Northern Sotho. For example, borrowing is used to as a strategy to create terms in the medical/anatomy field. In the Multilingual HIV/AIDS Terminology (2013) by the Department of Arts and Culture, the following examples appear:

operation	***ophareišene,***
loan translation: family planning	***peakanyo ya lapa***

Semantic transfer is used where the meaning of the word is modified or extended to accommodate the new meaning or use. For example, in Northern Sotho, the term **injection** is a new concept, however, ***tšhwana***, a term that already exists, has its meaning modified to accommodate injection. Based on these examples, it can be said that both studies relate to each other, as they have shown that terms can be created by using borrowing, semantic transfer, and loan transfer. Both studies show that Northern Sotho and Shona can develop through term creation process. Therefore, in this current study, these strategies were analysed in the development of mathematical terminology in Northern Sotho.

Adika and Kevongo (2014) published an article entitled, *Swahili military terminology: a case of an evolving non-institutionalized language standard*. They scrutinised the non-institutionalised advancement of Kiswahili over the years to elaborate new military concepts such as terrorism, bomb, sniper etc. They stated that due to scientific,

technological, political and socio-economic developments, Kiswahili absorbs strategies such loan words. For example,

radio -	***redio***
radar -	***rada***
bomb -	***bomu***
drone	***(droni)***

According to Adika and Kevongo (2014:184), some of the military terminologies created used internal sources based on existing words from the Kiswahili vocabulary. For example, ***mzinga***, ***sungusungu***, ***kifaru*** and ***ndenge*** are expanded to elaborate novel military concepts or hardware. However, the scholars argue that using existing vocabulary to create military terms is not satisfactory as some words are recognisable in the common speech of Kiswahili and do not bear the restricted meaning put upon them in military spheres. Both scholars argued that conservative language purists are more inclined to internal sources when creating terms, while avant-garde linguists advocate external sources and modernising the Kiswahili language. In their discussion, they pinpointed that several Kiswahili military terminologies are embedded in oral literary genres. However, these terms are preserved by oral artists in their heads and not documented anywhere. This, according to the scholars, portends a risk of the language's vital source of technical language. Some of the military terminologies were created by soldiers' colloquial speech, pidgin varieties of Kiswahili and the underworld slang.

The challenges outlined by the scholars are that, even though attempts were made to use Kiswahili words as technical military terminology, a number of these terms were not satisfactory. They concluded that the Kiswahili register of military terminology has been growing steadily and informally, as there is a continued use of these terminologies in general purpose dictionaries. However, they recommend that specialised dictionaries should be compiled for harmonisation and standardisation. Igboanusi, Odoje and Ibrahim (2016) conducted a study entitled, *Ebola-associated terms in Hausa, Igbo and Yoruba*. The study focused on translating Ebola associated terms into Nigeria's three major languages, with the aim of making information available and accessible about Ebola to the grassroots population. The study was part of an ongoing project on "A metalanguage for HIV/AIDS and Ebola discourses in

Hausa, Igbo and Yoruba." The scholars firstly developed a source text from various sources such as publications (UNESCO 2016, newspapers articles, NGO, hospitals, media houses) as the primary source text production. The second phase was the secondary term creation phase, which involved translating Ebola terms from English into Igbo, Hausa, Yoruba. The scholars used online existing documents to provide equivalents and workshops held to verify or consider and agree about the translated terms. In their discussion, the translated equivalents created from English into target languages through the process of terminology formations such as borrowing and adapting a term in the SL with its form Hausaised, Igboised and Yorubaised. Loan translation was used where the term was translated using words from the in the TL while keeping the meaning and the form on the word in the SL. Semantic extension was used to modify or extend the meaning of an existing word to accommodate a new meaning or use of acronyms and calquing. The scholars concluded that Ebola terms were crucial, and people should use them in their languages appropriately.

Gumbo's (2016) doctoral study entitled, *Term creation: an analysis of the strategies used in some selected Shona specialised terms dictionaries*, focused on analysing term used in the selected specialised terms dictionaries: *Duramazwi eurapi Neutano* (Dictionary of Biomedical Terms), *Duramazwi Remimnanzi* (Dictionary of Musical Terms), and *Duramazwi Redudziramutauro Ne Uvaromnwe* (Dictionary of Shona Linguistic and Literature Terms). The study analysed and explored how terminographers, language practitioners and specialists in the field of music, health, language and literature use different strategies to create terminology in these specialised fields. Gumbo (2016:42) revealed some term creation strategies such as loan words:

laboratory	***rhaboritari***
cartoon	***katuni***
director	***dharekita***
amplifier	***amburifaya***

Gumbo (2016) proffers that loan translation is a good term creation strategy but is not suitable for the promotion and development of the Shona language because the created terms are heavily lexical loaded, making them hard to master and understand for Shona speakers. Compounding is also one of the strategies used to create terms in Shona specialised dictionaries; however, due to its complex packaged structure, it

tends to largely complicated (Gumbo, 2016:4). The scholar showed that compounding has a potential of rejection by the people, mainly because of the lengths of the words. The longer the words, the less likely they are to be used. Such words include:

rhythm	***chirongamhazi***
clef	***chiratidzachidenhamhanzi***

The current study shares the same view that, in Northern Sotho, compounding creates long, complex and complicated words that are hard to read. For example,

pentagon	***sebopegohlakorekhutlohlano***
tetrahendron	***sebopegohlakorenne***
aneurism	***kokomogotšhikamadi***
antidepressant	***seimollakgatelelomonagano***
appendicitis	***tšhatšhamelothurogoaphentikisi***

Terms should be concise, short and easily understandable. The conciseness of a terms should be considered while also bearing in mind the orthographic length of a term. If a term is too long and hard to read, it will be also hard to understand. Gumbo (2016) asserts that lexical terms should be concise to facilitate communication in the specific situations in which they should. The study further revealed that, term creation strategies, such as semantic expansion and loan translation, are unproductive, and often do not add value to the Shona vocabulary. Gumbo (2016) analysed term creation strategies used in some selected Shona specialised terms dictionaries while the current study analysed term creation strategies used in developing Mathematics terminology in Northern Sotho. Both studies analysed how term creators use different strategies during term creation process such as borrowing, semantic transfer, paraphrasing, compounding. However, the difference was that the current study focused on Mathematics dictionaries while Gumbo (2016) focused on music, health dictionaries in Shona. Gumbo (2016) is silent on the inconsistencies caused by an incorrect spelling of borrowed words in Shona.

Gelagay (2021) conducted research entitled, *Term-formation methods in the Gamo language*, in which a description of techniques was employed to form terms in the Gamo language, where an Omotic language of Afro-Asiatic family in South- Western Ethiopia was outlined. The Gamo language was introduced as a medium of instruction in primary education for all subjects in all grades. The study showed that the creation

of new terms for concepts that do not exist in the Gamo language needed to be developed. It is shown in the study that new terms in science and Mathematics were formed to facilitate teaching and learning. A linguistic and communicative approach was followed to describe techniques of term formation and the linguistic feature in line with linguistic properties of the Gamo language.

Gelagay (2021) discussed methods used to facilitate teaching and learning in Gamo, which included borrowing, compounding, semantic extension, blending, initialism and paraphrasing. According to Gelegay (2021:21), the Gamo language borrowed many words from Amharic, and the borrowed words were adapted to Gamo through phonological and morphological processes. For example,

Amharic	**Gamo**
muuz -	***mmuze (banana)***
loomi -	***loome (lemon)***
kihilot -	***kilot (skill)***

Gelagay (2021:25) also mentioned that compounding is used to form terms for languages and science education in Gamo. For example,

sinta guye	***sequence***
zari beyo	***revision***
guta hasaaya	***colloquial speech/dialect***

Paraphrasing is also another way used for term formation, by forming concept through illustrating an object or idea in Gamo language (Gelegay, 2021:30). For example,

bila doona awa	***philosopher***
mole oyk`etsan ak`iza asa	***fisher***

The findings showed that compounding, borrowing, blending, initialism, paraphrasing and semantic extension were applied to form terms in the Gamo language. The most common mechanisms were borrowing, followed by compounding but a few terms were formed by blending and paraphrasing. Although Gelagay (2021) focused on term formation in education, and sciences, the issue of inconsistencies caused by the spelling of borrowed terms was not discussed. However, the current study and Gelagay's (2021) study resonate in that they discussed term formation process by discussing term creation strategies. Mukoya's (2022) doctoral study entitled, *A critical*

analysis of the strategies of terminology creation in the context of a multilingual Namibia: the case on ruManyo, examined the strategies employed to develop terms in the language ruManyo. The focus of the study was on existing strategies used by language practitioners to create analogous key-concept terms in ruManyo for applications in various fields.

The theoretical framework explored was traditional onomasiological theory and sociolinguistics as "new theoretical approaches" to terminology. The samples were taken from various fields such as radio, education, agriculture, law, hospital, and bank. The study found that ruManyo language practitioners lacked the skills and information required to build appropriate terminology solutions for specific fields. It further indicated that there was no linguistic competence that guided word generating efforts in certain disciplines. The scholar discussed term creation strategies for analysing existing mathematical terms as such as paraphrasing as one of the strategies used in creating mathematical terms (Mukoya, 2022:122). For example,

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algebraic	***likushongo lyavishwi vyavivarero***
decimal places	**shitwa *shakugaunwita ruha Rwanomora nayintje naruha rwanomora*** (Literally: a point that is used to divide the whole numbers from the other part of the numbers).
quadrilaterals	***likugwanekero lyandjirane***

The current researcher shared the same view, in Northern Sotho, where paraphrasing was also a strategy for creating Mathematics terms. For example,

polyhendron - *sebogohlakorentšhi sa tšeomethri*

The study further revealed that there should be an evolution of multilingual word generating techniques. Finally, the study discovered that specific fields necessitate specific tactics based on the context in which the terms are used.

2.4 Research on Term Creation Strategies in South African Languages

In his thesis, *Strategies in the modernization of Venḓa,* Madiba (2000) proposed a systematic approach based on the canonical model for language planning for the development of modern terminology in indigenous languages, especially Tshivenḓa.

The scholar further discussed that in this model, there are steps that should be taken for terminology development, namely, (1) needs analysis of the terminological situation, (2) planning and strategies for research, (3) implementation of practice according to policies and lastly (4) evaluation and updating of terminology. He further argued that a pragmatic approach should be adopted for the creation and modernisation of indigenous languages. The scholar divided the pragmatic approach into two phases: the borrowing phase and indigenisation phase.

Madiba (2000:104) further provided examples of borrowing taken from the Tshivenḓa bible and further stated that most of the loanwords were borrowed because of a lack of equivalents in indigenous terms in the Tshivenḓa language. For example, ***thembele* - temple*, veine* - vine*,* silver- *silivhere***. However, there are words that were also borrowed from the Sesotho language. for example, **Murena** was borrowed from a Sesotho word ***Morena***, which in English is ***Lord,*** and ***phutheo*** borrowed from a Sesotho word ***phuthego*** meaning a ***congregation*** in English.

Compounding was also discussed by Madiba (2000:107) as a way of combining two or more words or stems; for instance, reduplication in Tshivenḓa is to repeat the stem without the prefix; for example, ***mudzimumudzimu*** which is translated as ***"the true god"***. Madiba (2000:107) also discussed another form of compound formed by noun and a noun or nominal stems; for example, ***mafhungongoho***, ***mafhungo*** (news) + ***ngoho*** (truth). Madiba (2000) asserts that in the borrowing phase, the borrowed terms are immediately incorporated into the language whereas in the indigenisation phase, strategies such as compounding, semantic transfer, paraphrasing and derivation are used to create terminology. Lastly, Madiba (2000) recommends a sociolinguistic approach rather than a pure linguistic approach. The researcher thinks that a pure linguistic approach is more rigid than a pragmatic approach, as it inhibits the growth of a language from adding new vocabulary through borrowing. Furthermore, scientific domains are more specialised; therefore, using a more pragmatic approach to terminology development enhances the growth of a language.

The similarity between Madiba's (2000) study and the current one is that, both studies looked at term creation strategies such as borrowing, paraphrasing, compounding and semantic transfer to modernise and develop terminology in indigenous languages. The major difference is that Madiba (2000) is silent on the inconsistencies in the spelling

of borrowed words, which formed the crux of the current study. Mbananga, Mniki, and Oelofese (2004) conducted a study entitled, *A model of developing medical terms in indigenous languages: a step towards consumer health informatics in South Africa.* The paper aimed at developing medical terms in indigenous languages in South Africa, to improve health information and science communication and compile a medical dictionary. The study further aimed at improving Provider Consumer Interaction and developing Consumer Health Informatics Systems such as websites and health kiosks for individual use. The study used Creative Systems Theory as a theoretical foundation as a user perspective for consumers. In their discussion, the scholars explained the phases of terminology development for developing medical terms. The preparatory stage was compiling a medical term list by searching or harvesting terms in health journals and textbooks. The second phase was to validate and verify source lists by consulting with health specialists (nurses). The third phase was defining terms and looking at issues of copyright and layout of the dictionary. The implementation phase was done in 2 phases: Phase 1 was where a qualitative research method was used to develop medical terms by using 3 focus groups of 12 members from three provinces, Eastern Cape, North-West and Free State. The second phase was the focus group facilitation where guidelines, systems, and methods were developed by a group facilitator (nurse).

In their discussion, the scholars found that the process of creating a method for term development in indigenous knowledge had a few challenges. The use of textbooks and journals as source texts appeared to be authentic and only referenced. The provision of definitions in English for the source text seemed difficult even with the use of medical dictionaries at hand. The scholars also found that the team of specialists, health professionals, and researchers played a crucial role in the development of terms. The scholars concluded that developing medical terms in indigenous languages is not an easy task, especially without knowing the methodology and system of how to go about it. The scholars further recommended that the methodology created in this project could be tested by others doing similar projects.

Mabasa (2007) explored *Translation equivalents for health/medical terms in Xitsonga*, as a comparative study of translation equivalents in Xitsonga for medical/health terminology. The scholar discussed problems in word formation strategies applied in certain translation equivalents of DSAC/Multilingual Glossary of Medical Health. A

selection of terms was from a glossary of DSAC Multilingual Glossary of Medical Health Terminology compiled by experts. Purposive sampling was used, which resulted in identifying 33 problematic source language English terms. The study discussed term formation strategies such as paraphrasing, compounding, borrowing and transliteration. Paraphrasing emerged as another productive manner of creating vocabulary in indigenous languages. For example, gynaecologist was translated as ***dokodela wa vasati***, which in English "***a doctor of women***". Mabasa (2007:14) says in paraphrasing, explanations are given when there is a lack of an equivalent term.

Another strategy was compounding where two or more morphemes are combined to form a new term. For example, ***antibody*** was translated as ***xilwa -ni- vuvabyi*** which in English is *"**disease fighter**".* In her discussion, the scholar argued that in 40% of the cases, transliteration was mostly frequently used while paraphrasing was the second frequently used strategy at 32,5%. The use of a more general word was the second most frequently applied term formation strategy at 28,1%. The scholar also found that several source language (English) terms were provided with incorrect TL equivalents. Mabasa (2007) found out that the study showed that there was a need for collaborative effort in terminology development. Taljard (2007) conducted research on *Issues in scientific terminology in African/Bantu languages*. Her article focused on the issue of the translation of technical terminology in Sepedi papers. The paper was based at data collected for a research project aimed at evaluating the impact of learners' performance done under the auspices of CentRepoL. In her discussion, she mentioned several term creation strategies which African language terminologists can use. She divided them into language internal term formation processes and borrowing from other languages. Taljard (2007) pinpointed language internal term formation strategies, such as **semantic transfer**, which entails attaching new meanings to existing words by modifying their semantic content. There is also a **paraphrase**, which is a brief description or explanation and **compounding**, which is a process of coining new terms by using or combining existing words or lexical item. Furthermore, **loan words** are words that have been borrowed as their whole meanings while **transliterations and adoptive** are words that have been completely adapted to their target language. The scholar found that the use of transliteration was a topic of much heated debate. While other scholars such as Mabela and Ditsele (2024) say that transliteration is a pragmatic strategy for terminology adaptation, and it is relatable to

the speakers of the language because of their convenience. It would be easier for a speaker of a language to say ***netweke ga e sware*** instead of ***mafarahlahla ga a sware***. Transliteration is more of a pragmatic strategy as it is closer to the already known concept in English.

Mphahlele (2004), on the other hand, thought that transliteration should be used as the last resort and not the first solution after all measures for supplying term equivalents have failed. He states that if transliteration is used excessively, it will not help to develop the technical vocabulary of the TL. However, Taljard (2007) says transliteration has disadvantages and advantages since they are readily available and nothing more is needed than the necessary morphological and phonological adaptation of the term in the SL. Mojela (2010) agrees with Taljard that, the use of direct borrowing (transliteration) is important as it is accurate, and it is a method of creating and developing new lexical items in Sesotho sa Leboa. However, the researcher argues that Northern Sotho has adopted concepts which are foreign to the language and now the concepts are part of the language. For example, **economy-*ekonomi***, **inflation - *infleišene***, **policy-*pholisi***, **insurance - *inšorentshe***, **website-*webosaete*, workshop-*wekešopo***, **conference-*khonferentshe***, **symposium-*simphosiamo***, **emer-*emere***, **beker-*lebekere***, **sussie-*sesi***, **boetie-*buti***, and **rook-*roko***. These words provided are adopted and assimilated into Northern Sotho and are preferred by the speakers. Transliteration bridges a gap where terms are not available but familiar to the speaker of the language. In other words, a concept might be known and internalised to the speaker because of its everyday use. For example, the term **computer - *khomputha*** is a well-known term that has been adopted in the Northern Sotho and is widely accepted. The equivalent is direct and accurate than a newly the coined ***sebaledi***, which means (that which counts).

On the other hand, transliteration also helps as the term is closer to the source term, and it is familiar to the user, especially if the user has already internalised and knows the concept. For example, the term **wi-fi – *waefa*** is a familiar term for people who use phones and technology, even though the user might not explain it in detail, but the user knows it that **wi-fi** relates to technology. However, though transliteration in other sectors of linguistic communities is frowned upon as it is regarded as spoiling the purity of the language, it can also be used to add new vocabulary into Northern Sotho, especially on a technical specialised field. Mabela and Ditsele (2024) proffer that

transliteration is a strategy to improve intellectual integration into scientific discourse, it can also cause reliance on imported lexicons. Taljard (2008) focused on the strategies used to create scientific terminology, but she was silent on how borrowing causes inconsistencies regarding the spelling of borrowed words.

Alberts (2013) focused on *Developing legal terminology in African languages as aid to the court interpreter: a South African perspective*. The idea was to look at how to bridge communication gaps in a legal setting faced by legal court interpreters in a multilingual South Africa. The study further discussed word forming principles in the legal profession, principles of standardisation, harmonisation and various matters relating to terminology usage in a multilingual society. Alberts (2013) says that terms are not created in a haphazard manner; therefore, term equivalents are supplied in specific ways through borrowing, transliteration, total embedding and neologisms. For example, Alberts (2013:40) argues that loan words may be from English, Afrikaans, Dutch, Flemish, German, French Spanish and Italian. For example, English - ***affidavit*** and Northern Sotho ***afidavite****.* The addition of the vowel {e} at the end of the loan word ***afidavite*** follows the morphological and phonological rules of Northern Sotho.

Another strategy is transliteration, which may be seen in the example*,* ***addendum***, which in Northern Sotho is *adentamo, tlalletšo.* Alberts (2013:41) says that transliterated words that are internationally recognisable and were borrowed from French, German and Spanish, have an advantage of experts in the field to recognise the word and comprehend it. For instance, the transliterated term equivalent ***adentamo*** is more specific and understandable, as it is a language for a specific purpose, in this case the law context, rather than the coined term equivalent, ***tlalletšo*** (literally: supplementing), which is too general and not specific.

Alberts (2013:44) argues that culture plays a vital role in the translation of terms. She further says that translators, interpreters and linguists face difficulties because of cultural background that are different. In other words, the SLs' background will differ from the TLs. For instance, in a certain case, the Northern Sotho exclamation ***sebatakgomo*** (English: a cry for help), was misinterpreted in a court case where a plaintiff (a woman who was raped) was misinterpreted by a Sesotho interpreter as "*Ke batla kgomo*" (English: "I want an ox"), and as a result the perpetrator (rapist) was set free. Clearly, culture plays a role in translation, including in translating private parts in

Northen Sotho, where a translator will find it difficult as they are not named directly as they are perceived as sensitive and vulgar language.

Lastly, Alberts (2013) on the issue of harmonisation suggests that where terms in African languages are comparatively similar, terms should be harmonised. She further argues that terminology harmonisation means that an existing term is maintained, and by extending its meaning to match the new concept and adjusting it to the orthographic rules of a particular language. Nteso (2013) focused on *A critical analysis of online Sesotho ICT terminology* and explored the online Sesotho Information and Communication Technology (ICT) terminology and further aimed at analysing its development. The determined how Sesotho ICT and the linguistic aspect of ICT and Sesotho correlate and how it played a role in the ICT online terminology. The terms were extracted or sourced from then Department of Arts and Culture terminology list and other online sources. The study further aimed at assessing the quality of terms whether the Sesotho equivalents adhere to the linguistic rules and principles of the language.

Nteso (2013) proffered the three processes of developing terms, namely, cognitive process, which is the accuracy of meaning and describes the correctness of a language and the communicative process, which is the standardisation, and acceptability of the terms by speech communities. The scholar describes the terminology strategies used in the Sesotho ICT terminology such as borrowing from English into Sesotho. Other examples from Nteso (2013:121) are **file-*faele*, internet-*inthanete***, and **cable-*kheibole***. Coinage was used to creating words according to their descriptions, functions and cultural usages. For example, Nteso (2013: 122) submits an example such as **wireless protocol application - *metlaetutswe e se nang thapo***. Paraphrasing was used as a brief description or explanation that represents a productive manner. for example, Nteso (2013:122) provides **laptop-*khomphuta e o tsamayang hotle ka yona*** as an example.

Nteso (2013) found out that standardisation can only be used successfully if technical terms are evaluated in terms of acceptability into speakers since partially acceptable terms cannot be afforded recognition in any language. Ndhlovu (2014) considered *Term creation strategies used by Ndebele translators in the health sector: a corpus-based approach*. The study used English and Ndebele Parallel Corpus (ENPC)

created by Ndhlovu (2014) to identify specialised terms. The study revealed that borrowing in the form of pure language, acronyms, abbreviation preceded by an explanation identified as the most used strategies in medical translations, followed by semantic shift using synonyms and paraphrasing. These were the least used term creation strategies used by Ndebele translators in Zimbabwe's health sector.

Ndhlovu revealed that the translators applied borrowing or loaning in the ENPC when translating from English into Ndebele, where the indigenised loan words changed the structure, spelling and pronunciation of those terms to suit the language without changing the meaning and sound. Such examples from Ndhlovu (2014:332) include **condom-*ikhondomu***, **pills- *amaphilisi***, and **gloves-*amagilavu***. This is evident in Northern Sotho HI/AIDS Terminology where for the term **condom-*khontomo***, transliteration strategy was used to create a new concept in Northern Sotho, and the spelling and orthography of Northern Sotho was adopted; hence, ***khontomo*** the **c > kh** and the **d> t**. On **adrenaline-*aderenaline*/*aterenaline***, **acrylate-*akhrileiti*/*akhirileiti***, it can be observed from these examples that the terms are not spelled the same, where one followed the CV structure and the other did not follow the CV structure. However, ***akhrileiti*** retained the root of the borrowed word to show that the word is not an original word in Northern Sotho. This example creates confusion regarding when to follow the CV structure and when to retain the root when borrowing, or in technical terms where there should be an exception in Northern Sotho orthography for words which are not spelled according to the CV structure.

The scholar further showed that the translators used a pure loan strategy by retaining the words from the SL in the TL. However, the words gained prefixal elements to fit with the Ndebele style of writing. For example, Ndhlovu (2014:333) proffers **glands - *ama glands,* antibodies - *ama antibodies,* hormones - *ama hormones***. She further showed that translators used acronyms and abbreviations to create terms in Ndebele for example, Ndhlovu (2014:334) **PEP- *lwe PEP and* ART *-ye ART***. Ndhlovu (2014) found that under borrowing, pure loaning of acronyms and abbreviations followed by pure loaning of words were used to a larger extent. Coinage, compounding, and paraphrasing were the least used strategies. She also found out that due to a lack of terminology, there is an overlap of terms and meaning in the Ndebele language, where several source terms are translated using one word in Ndebele. Her study showed that different strategies can be used for term creation in IsiNdebele in the health sector.

However, she did not say anything about inconsistencies in IsiNdebele caused by borrowing.

Letsoalo's (2018) *Towards the development of political terminology for South Africa's indigenous languages,* proposed a different terminological procedure that terminologists can use to supply appropriate and accurate terms without making excessive use of transliteration. He argued against the adoption of transliteration as a first strategy to terminology development in favour of a more pragmatic approach. Letsoalo (2018) used the scan and balance theory to analyse the translation and terminology development. Letsoalo 2018:65) pinpointed different term creation strategies such as transliteration; for example, **cabinet-*kabinete***, and **democracy-*temokerasi***. However, Letsoalo (2018) argued that transliteration is often used because it quickly solves the problems of zero equivalence. He further argued that if transliteration is used, the rules of the language should be followed, and the root is retained to make it sound such as the TL words. The scholar highlighted compounding as another term creation strategy used extensively as a way of using the language's resources rather than transliterating. For example, Letsoalo (2018:66) provides this example: **democracy-*pušobontši***. Compounding is effective when the equivalent term comprises two lexical elements that are descriptive, as in the example given by Letsoalo (2018:66) for the term equivalent **democracy-*pušobontši*** is more effective and understandable.

The scholar found out that there is no specific strategy that can used when developing terminology. It depends on the type of the word developed and usually the word will guide on how to approach the task depending on the context. Letsoalo (2018) found that the most important thing is that the speaker of the TL and the context plays a crucial role. Letsoalo (2018) emphasised following the rules of spelling and orthography but did not mention the inconsistencies related to spelling borrowed words from English into Northern Sotho. Ramuedzisi, Huyststeen and Mandende (2019) conducted research on *An enhanced terminology development and management approach for South African languages* and proposed an effective model and principles for terminology development and management to avoid duplications of terminology. A mechanism for terminology, project flow, which would ensure verification, authentication and standardisation was recommended. The findings proposed two models for terminology development: first, a National Terminology Policy and

secondly, encouraging National Term Bank to manage terminology efficiently in all official South African languages.

Mabena (2020) focused on *Terminology development in isiNdebele: challenges and solutions* and gave a critical overview of terminology development with specific reference to terminology development as part of language development and term formation strategies available for the creation of isiNdebele terminology. The scholar focused on legislation regarding terminology development, an evaluation of term formation techniques and strategies such as derivations/affixations, semantic expression, compounding, loan translation and borrowing. The study also established whether there are disadvantages and advantages to each strategy. The finding of the study was that paraphrasing is one of the strategies that has been existing and long used in isiNdebele.

Mlambo, Matfunywa and Skosana (2022) provided a *Contrastive analysis of word-formation strategies in the translated South African constitution* by investigating different mechanisms to the translation, when there are no direct translation equivalents in the target languages. The study undertook a comparative analysis of the strategies used in the translation of South African Constitution from English into Xitsonga, Siswati, isiNdebele. A multilingual concordance (ParaConc) was used to extract translation equivalence.

The study revealed that translators used various strategies to translate the Constitution in their target languages. The scholars found that were no equivalents, the translators used word formation strategies recognised in other Indigenous languages. In the study, some strategies were more reproductive than others which closes the lexical gap between a source and TL where no equivalence is relevant. The study observed that borrowing, paraphrasing, derivation, and compounding were productive strategies because equivalents created using already existing words in the languages which natural speakers distinctly understand. It further showed that borrowing revealed a critical need for terminology development work in these languages to avoid transliterating terms from foreign languages in which the native speaker understands.

Letsoalo, Mabaso and Gouws (2022) focused on *Access to information through translation: a case of multilingual OER robotics project at a South African university*

and examined the methodology of translation used in translating Inspired towards Science Engineering and Technology (I-SET) terminology for robotics from English into Indigenous languages for the purpose of creating a multilingual OER. The study investigated translations of robotics terms from English into indigenous languages, namely, Sepedi, Xitsonga, and isiXhosa. The study was undertaken to identify the translation strategies used in the context of robotics and to show how learning and teaching transformed in robotics in indigenous languages. It further indicated and evaluated the appropriateness of the translation equivalents if used in developing open educational information in their respective languages. The scholars revealed that borrowing is used as a mechanism for term development but often as an option because it is a quick method to solve the problem of lack of terminology. Moreover, according to the scholars, borrowing should not infringe the morphological and phonological rules of the TL, and it should be the last resort as it will encroach the vocabulary of the language if used excessively. It further noted that the same translation strategies used to translate the same terms. It also revealed that two indigenous languages could use the same strategy to develop equivalents for one TL while another language employs its own strategy for the same TL term. It recommended that strategies such as semantic transfer, derivation and borrowing should be considered and that in the development of robotics in indigenous languages, there is no universal way to develop terms. Letsoalo, Mabaso and Gouws (2022) suggest that to facilitate and access scientific knowledge in the field of robotics in indigenous knowledge, a need to develop terms in this field is eminent.

Maleka (2005) conducted research entitled, *Chemistry in Sepedi: translation strategies for success?* She discussed translation strategies used for success in translating Chemistry-related concepts from English into Sepedi. In her thesis, the aim was to investigate the translation strategies used to translate Matric Physical Science Question and Answers into Sepedi. The study drew the corpus from questions and Answers Matric Physical Science and its translations. The study further investigated if the translation strategies used had an effect and if they were functional on the target text. The study also established the perception and attitudes that learners and educators had concerning the use of Chemistry examination papers produced in Sepedi. The project also focused on mother-tongue education within the South Africa context as a language that can be used as a language for specific purposes (LSP).

Maleka (2005:53) outlines the strategies used to create term in Sepedi through translation by a loan word or direct borrowing where the English spelling has been retained and not transliterating it. For example, ***alkaline-alkaline*** and ***alkane-alkane***. Possessive construction was used as a translation strategy were the English multiword terms comprising two morphemes are translated by circumlocutions containing Sepedi elements as well as transliterations. However, the translated phrases comprise two nouns combined by a possessive conjunction such as ya, tša and la. For example, Maleka (2005:54) proffers **ammonium carbonate - *khabonate ya amoniamo,* chemical name - *leina la khemikhale*** as examples.

Transliteration by adapting the phonological structure of the loan word to the sound system of the borrowing language (Sepedi). For example, regarding **electron- *elektrone*** and ***electrolytes-dielekrolite***, Maleka (2005:51) says they are spelled differently from the term equivalents from the Multilingual Pharmaceutical Terminology developed by Sports, Arts and Culture. For example, **electrolyte- *eleketherolaete*** or ***elekthrolaete*** reveal inconsistencies and lack of harmonisation in spelling and orthography. The same term equivalent was spelled differently where in Maleka's (2005) example, the CV structure was not followed and the plosive ***t-th*** in Northern Sotho was not adhered to.

She found that, a foreign loan word was Africanised using transliteration by changing their phonological and morphological structure to accord with African language structures. The study further showed that a higher number of transliteration and loan words were ascribed as an attempt for secondary term formation to make Sepedi a language for knowledge transfer. Maleka (2005) found that transliteration should not be regarded as wrong to coin terms but as a mechanism to develop the Sepedi vocabulary. She further states that borrowing, and transliteration add to the Sepedi scientific terminology; however, too many of these strategies will dilute the language if used excessively. Indeed, transliteration should not be regarded as wrong, especially in technical domains, as it helps to enrich a language with new vocabulary.

Maleka's position on the lack of inconsistencies regarding spelling and orthography rules in Sepedi is unclear. This study discusses how Physics can be translated into Northern Sotho. Similarly, the current study analysed term creation strategies in Mathematics into Northern Sotho. In her article entitled, *The taboos attached to the*

translation of biological terms from English into Northern Sotho, Mabule (2009) explored the taboos ascribed to the translation of biological terms from English into Northern Sotho. The scholar indicated that due to the inequality of the developed scientific register between English and Northern Sotho, a translator is a mediator between these two cultures. It is the duty of the translator or interpreter to understand cultural taboos pertaining to physiological terms between these two cultures. She states that a translator is expected to translate biological terms in a way that the target reader would not be offended by the terms used. In Northern Sotho culture, biological terms are not named using euphemisms. Therefore, a translator as a mediator must ensure that the end user's beliefs and cultural norms are respected and not violated.

Mabule (2009) discussed the problems encountered when translating biological terms, i.e. body parts, from English into Northern Sotho. The use of euphemisms as a strategy is employed because of the taboos attached to literally and specifically naming body parts and their functions. For example, Mabule (2009:49) refers to terms such as **arbotion - *go senya mpa*** or ***phološo*** as examples, where both these terms use euphemism. This was done to be culturally sensitive because abortion is not a culturally permissible thing to do and is regarded as a taboo. However, both these terms do not mean the exact thing because ***go senya mpa***, can mean something else other than the literal meaning of ***go ntšha mpa***, which is more direct and accurate.

Another example is seen in the term anal sex intercourse, which has several equivalents in Northern Sotho. For example, Mabule (2009:49) says anal sex intercourse can be translated as ***matanyola/thobalano ya ka mogweteng/thobalano ya ka maragong/thobalano ya ka mafuri***. In these examples, ***thobalano ya ka mafuri*** is inaccurate and ambiguous because ***mafuri*** can be anywhere behind anything. The term ***thobalano ya ka maragong*** is also ambiguous because ***marago*** is different from ***mogwete*****,** which are two body parts with different functions. The equivalent for **sex**, ***thobalano*** is also indirect and inaccurate because ***thobalano*** means the act of people sleeping with each other. Although an act of penetration is implied, however, people can sleep together without penetration, and it can still be regarded as ***thobalano***. The use of euphemism can sometimes be misleading and not deliver the intended message. Although euphemism can be seen to solve the issue of lack of equivalence in translating reproductive organs in Northern Sotho, it also limits the communication and the correctness of the intended message.

Mabule (2009) reiterates that euphemism hinders the intended message, especially in specialised domains. Figures of speech are concerned with the richness of linguistic devices; hence, they are inadequate in scientific texts. Scientific texts are more specialised and technical. According to Mabule (2009:50), in medical texts, facts are important and should be presented in ordinary language to communicate the intended message. In other words, the meaning of the message will not be as accurate as the intended meaning of the source text, if euphemism is used. For example, the translation of **vagina** as ***setho sa bosadi*** (a woman's body part) is inaccurate because ***setho*** can be any body part, such as breasts or hands. As such, this euphemism is inaccurate and can distort the intended meaning. Mabule concludes that new terms should be developed for reproductive terms. Mabule focused on the use of euphemism to translate health and reproductive terms in Northern Sotho while the current study analysed term creation strategies such as borrowing, paraphrasing and transliteration in Mathematics terminology. However, Mabule's position on dealing with inconsistencies caused by borrowing is silent.

Magagane (2011:106) explored *The development and technologizing of selected Sepedi ICT terminology*. The scholar discussed term creation that can help speakers of the language to access information in the technological world. She found that term creation mechanisms such as derivation were used to develop new terms coined from roots by adding affixes only. For example, Magagane (2011:107) proffers examples such as **lock up *- notlela***, **client-*modiriši,* manufacturer- *motšweletši***. On this note, Magagane does not regard coining new words as effective and argues on **client - *modiriši*,** the term equivalent is more general, and can be confused with ***user***, which is also ***modiriši****.* In other words, coining words from words that exist in a language creates more words, which creates more confusion.

Compounding was used as another productive method in Sepedi ICT terminology development, where one word or term is formed from two or more words or terms. Magagane (2011:108) provides examples such as **bookmark manager-*taolapukuntšu,* media-*kgašoditaba***, **protocol-*tatelomolao***. A productive method for Sepedi ICT terminology development was loan translation and paraphrasing, where new terms are created by translating the meaning of a foreign term into the TL. Magagane(2011:110) considers examples such as **offline support-*thekgo ya ntle le go kgomagantšha megala*, access key- *senotlelo sa phihlelo*, saved passwords-**

mantšuphetišo ao a bolokilwego. Magagane (2011) recommended that National Language Bodies (NLBs) should develop guidelines for the standardisation process and coordination with other terminology structures to assist Sepedi terminologists to use real languages as a point of departure. She further recommended the use of Sepedi language in ICT and ensuring the development of new ICT terminology, grammar, dictionaries, and other publications.

Nchabeleng (2011) probed *Terminological issues in the translation of Chemistry terms from English to Northen Sotho.* The scholar gave an account of the terminological issues experienced by translators when translating technical texts from English into a limited language of diffusion such as Northern Sotho. According to Nchabeleng, in Northern Sotho as a language of diffusion, before any translation work, a translator often experiences challenges of finding equivalents. The research sought to contribute to the terminological development of Northern Sotho in the field of Chemistry and add to the vocabulary of Northern Sotho, especially in the technical domain. Nchabeleng (2011) further discussed the inconsistencies caused by the spelling and orthography of the term equivalents in Northern Sotho, the central argument in the current research. This creates disharmony and a lack of lexical standardisation. A translator often becomes confused about what spelling to choose between one equivalent that has two or more spellings. For example, **electron - *elektrone*** or ***eleketerone*** or ***eleketrone***, may require a translator to use borrowing, semantic transfer and compounding for an effective translation.

The current study sought to ascertain whether spelling and orthographic rules were adhered to when creating Mathematics dictionaries for Grade R-6, considering aspects such as the structure of CV structure in examples such as ***crayon-khrayone*** and ***trapezium-trapesiamo*** where the clusters **cr** and **tr** in Northern Sotho were followed by a consonant according to *Mongwalelo le Mopeleto wa Sesotho sa Leboa* (2019). However, there are no rules for words with **dr clusters** in terms such as ***quadrillion-khwaterilione***,. In the current *Mongwalelo le Mopeleto wa Sesotho sa Leboa* (2019), it is stated that the CV structure should be adhered to, but in the mentioned examples, it becomes a challenge for the terminologist to know when to follow the CV structure and when not to follow it when dealing with transliterations. Letsoalo (2018) submits that transliterated words usually retain the root of the original term but are made to sound like TL words. However, this is not always the case for

Northern Sotho, as term equivalents often have different spellings. In Northern Sotho, for example, **democracy** is translated as either ***temokerasi* or *temokrasi***. Mojela (1999) explained that lexical items created by the borrowing language are either totally unadopted or with partial adaption. For example, there are consonant clusters, which are foreign to Northern Sotho, namely, **president-*mopresidente***, **draw-*drowa*** and priest**-*moprista***. The mentioned examples pose a challenge for a terminologist, as there are no clear guidelines in the spelling and orthography rules on when and which words should be totally unadopted or partially adapted. Nchabeleng (2011) affirms that inconsistencies of spelling in Northern Sotho are caused by borrowing words.

In a study entitled, *An analysis of zero equivalence in translation of scientific terms from English into Northern Sotho*, Ngobeni (2013) examined difficulties that translators face when translating scientific terms. It was found that translators did not find the correct equivalents, especially when translating scientific terms, which led to using transliteration and borrowing as the last resort. Ngobeni (2013:39) argued that zero equivalence, a process where a word or a particular term in the SL does not have a translation in the TL, occurred in examples such as **microscope-*maekroskopo*** and **lantern-*lanterene***. These examples show a linguistic gap where both speakers know the concept, but Northern Sotho does not have an equivalent term. Ngobeni (2013) further argued that transliteration, if used in the first procedure, technical terms will not be found for a language and such a language will not be developed. The current study argues to the contrary that, transliteration may help where terms are already known and widely used by a lay person even though such a person may not be necessarily familiar with the full conceptual content in the given subject area. For example, terms such as **data-*datha***, **wi-fi-*waefa***, **computer-*khomphutha***, **loadshedding-*loudešeding*, laptop-*lepothopo***, **airtime- *ethaeme***, **funeral cover- *feneralekhava***, **insurance - *inšorentshe***, **affidavit-*afidaviti*** and **address-*aterese***. These terms are widely used by laypeople and so, coining new words for these concepts may sometimes create reluctance in using the newly coined words. For example, **computer-*khomphutha*** is widely known than ***sebaledi*** or ***lengwalokeno*** for ***afidaviti*.** In other words, transliteration should not always be regarded as the last resort or inadequate for language development, it is helpful where there is no knowledge gap of the concept and in situations where the layperson knows the word even though they are not familiar with the full content in the subject area. In support of

this, Polcz et al. (2023:243) discuss the taxonomy of term transparency resulting from the translation process. Plocz et al. (2023) argue that linguistically transparent terms are textual units which are widely known by a lay person although unfamiliar with the full conceptual content of the subject area. In other words, a lay person may know certain terms in a particular subject area but lack the concept meaning of the subject area. Therefore, transliteration is effective where a lay person is familiar with a term but does not understand the full conceptual content in the subject area.

Mabela and Ditsele (2024) say speakers are dependent on the borrowed word and prefer to use terms that are convenient to them regardless of whether there are coined terms. Indeed, the user may opt to use ***sebaledi*** and not **khomphutha**, or **radio** for ***seyalemoya***, or ***feneralekhava*** for ***tšhireletšo ya lehu***. Mabela and Ditsele (2024) add that the user's preference clearly indicates that speakers use words that are transliterated and borrowed simply because of their convenience and widely used. Thus, speakers usually use words that they prefer.

In her article, *Issues involved in translating technical texts from English into Northern Sotho,* Mabule (2016) examined the challenges encountered during the translation of technical texts from English into Northern Sotho. She further outlined strategies such as paraphrasing, compounding, transliteration and semantic transfer to overcome these challenges. Mabule (2016) says term creation strategies are used to coin terms to overcome the lack of equivalent terms in Northern Sotho, especially in technical texts. Mabule (2016:223) pinpoints that strategies such as paraphrasing are necessary for constructing equivalents to transfer information from the SL to the TL. However, the disadvantage is that there is no one word equivalent term in the translated term. For example, the term ***commissary*** is translated as ***motho yo a kgethilwego ke ba bagolo go yena go dira mošomo wo o rilego wa bona*** (someone who has been chosen by his senior to represent them). Indeed, paraphrasing creates terms that are too long, as seen in Mathematics, where the term ***positive*** {symbol +} is translated as ***leswaoboleng la godimo ga 0*** {a quantity sign above 0}. Therefore, in specialised fields such as Mathematics, which involve mathematical signs, it is better to borrow words directly to avoid lengthy equivalents.

Mabule (2016:223) proposed compounding as a strategy, where a term is coined by combining existing words in the TL. For example, the word ***beneficiary*** translated as

a compound ***monewabohwa***, which is a combination of words ***monewa*** and ***bohwa***, which in English mean ***recipient*** and ***inheritance****.* The scholar further argues that an increasing demand for technical texts must be translated in Northern Sotho. Therefore, technical texts must be translated. According to Mabule (2016), technical texts must be translated with accuracy, clarity and intelligibility. In other words, the translator should translate in such a way that the target readers understand the message conveyed. In technical texts, the translator does not translate language but the text. Therefore, the accuracy of the content is important to the client.

In her thesis entitled, *A critical analysis of the translation strategies used by SM Serudu in his translation of Mandela's Long Walk to Freedom into Sesotho sa Leboa*, Kanyane (2018) investigated how the transference of linguistic and cultural-specific concepts was translated in Mandela's autobiography. Kanyane investigated if Serudu used domestication or foreignisation. The findings revealed that Serudu used domestication by using euphemisms, hyperbole, idioms, proverbs, personification metaphors and idioms. It was found that while the translator addressed foreignisation when borrowing and loaning words by transferring culture-specific concepts. The two main strategies used by the translator were domestication and foreignisation. Kanyane (2018) states that the translator used domestication on concepts that were foreign in the source culture by replacing them with the concepts from the target culture to bring the readers closer to understanding. Foreignisation can be used to preserve the foreignness of the original language and keep something that is foreign in the original text. However, Kanyane did not discuss the inconsistencies of spelling borrowed words from English into Northern Sotho.

Mojapelo (2018) conducted research entitled, *An investigation of term creation in Northern Sotho vocabulary* and probed various strategies used in term creation. It was clear that, transliteration, semantic transfer, borrowing and paraphrasing are used during term creation. Mojapelo (2018) adds that to alleviate problems of term creation in Northern Sotho, the government must prioritise language development. She further states that the dissemination of terminology that has been developed must be accessible to the speakers of the language to avoid duplication. She recommends that for languages to grow, terminology should be accessed at Terminology Division

Section of DAC and the LLUs offices. Lastly, individuals should harvest specialised terms to perform term creation, and strategies applied for terminology development should be outlined for users. Although Mojapelo (2018) explained different strategies of term creation, her position on challenges caused by the spelling of borrowed words in Northern Sotho was not discussed.

In their paper entitled*, Loanword nativisation in Tshivenḓa: A descriptive analysis*, Sebola and Chokoe (2021) described the process of loanword adaptation in Tshivenda. The study adopted a descriptive approach by looking at factors that play a role in the alterations that adopted and adapted words in Tshivenḓa undergo. The study discussed that in Tshivenḓa a) loanwords undergo neither segmental nor analogical alterations, b) loanwords which do not undergo analogical alterations but undergo segmental alterations, c) loanwords which undergo both analogical and segmental alterations to correspond to Tshivenḓa patterns. The study used the Clements and Keyser's (1983) CV -Phonology and Chomsky and Halle's (1968) Generative Phonology Model by describing how loan words are adapted in Tshivenḓa.

The paper further discussed phases that a loan word is adapted in Tshivenḓa, namely, phonetic adaptation, phonological adaptation, morphological adaptation and semantic adaptation. In phonological adaptation, is the phase whereby the native speaker searches for sounds in her language to relate them to the speech sound present in the loanword, for example, ***coke is khoukhu*** in Tshivenḓa, meaning that, the sound "c" in the word "coke", which is represented by an aspirated velar speech sound {kh} and the sound. The sound "o" when it is articulated sounds like "ou" in Tshivenḓa. The sound "k" is like the first, "c", and is thus represented as {kh} while the last speech sound "e" in "coke" is articulated as "u". In morphological adaptation is the process of whether the loanword permits prefixation or suffixation for example, in plural form, dzi- noun class 10, meaning that the word has two morphemes, class noun prefix (N(i)/ Dzi-) and the noun stem (*khoukhu*). Both scholars showed that when words are adopted in Tshivenda, they exhibit phonological changes but no morphological alterations. Sebola and Chokoe (2021) found that there are also orthographic inconsistencies that tend to characterise undergirding the spelling of loanwords in Tshivenḓa. Furthermore, these scholars found that orthographic inconsistencies regarding partially adopted loanwords certainly permeate the Tshivenḓa lexicon.

These similarities are also seen in adapting loanwords in Northern Sotho, that there are orthographic inconsistencies regarding the issue of CV syllable pattern.

Hlungwani (2022) conducted research entitled, *The development of Northern Sotho linguistic terminology for Higher Education in South Africa* to create new special terms and increase the Northern Sotho vocabulary in higher education for mother-tongue speakers. The study followed the theory of onomasiology to coin neologisms in Northern Sotho. The Flex program was used to enter the coined terms and a glossary was produced. The English terms were collected from the course material for undergraduate materials, from Wits University linguistic dictionaries. Northern Sotho equivalents were searched from the Spelling and Orthography no 4, 1988, and only 63 equivalents of 163 were found in Northern Sotho.

Mabela and Ditsele (2024) investigated and proposed a pragmatic approach in the adaptation of English terminologies for scientific purposes into Northern Sotho. The study argued that scientific phenomena in Northern Sotho cannot be described or defined due to lack of scientific terminologies. The research thus focused on overcoming the challenges of scientific terminology development for Northern Sotho by analysing existing data and using corpus linguistics as a method. Compounding, transliterations, and coinage are adaptation strategies used to create terms in indigenous languages. Borrowing was used where no direct equivalents were available in Northern Sotho. The borrowed words changed the morphological and phonological structure of the term (Mabela and Ditsele, 2024). For example, ***internet-intanete***. Coinage was also used as a strategy to create scientific words in English by using pre-existing words in Northern Sotho; for example, ***camouflage - boiphihlakalefelo*** (which is loosely translated to hide within an environment) (Mabela & Ditsele, 2024:7). According to Mabela and Ditsele (2024), coinage creates ambiguity and confusion, which may leave the reader confused. Both scholars argue that coinage is a more puristic approach of term creation strategy, which often creates complicated and unusual lexicons. Similarly, in Mathematics, **axis-*mothalogare, mothalo in isolation*** is ***line*** and ***gare*** is **centre**. This is ambiguous and creates confusion because it implies that any line on the centre is axis. Finally, the study found that strategies such as coinage and compounding create ambiguous and inaccurate terms because these strategies are more puristic than pragmatic.

2.5 Research on Term Creation Strategies on Mathematics

Scholars such as Setati (1998) and Webb and Webb (2008) and Voster (2008) propagate that code-switching is used as a means for promoting teaching and learning in a multilingual context. Webb and Webb (2008) investigated whether exploratory talk in Mathematics could be achieved through code-switching in the multilingual teaching and learning of Mathematics. The study discovered that there were successes in terms of teachers initiating exploratory talk, especially where code-switching was used between English and isiXhosa. In addition, Voster (2008) investigated how code-switching process can be aided through using multilingual materials such as glossaries and notes in English and Setswana for teaching and learning Mathematics. According to Voster (2008), code-switching is a strategy to help learners cope with the subject matter, especially Mathematics in Setswana. The study revealed that learners and teachers had a positive attitude towards the use of both English and Setswana. However, the teachers had mixed feelings about the use of mathematical terminology in Setswana. In other instances, the Setswana learners preferred English terminologies to answer the questions while other teachers found the Setswana terminology difficult to explain. However, even though other teachers found the Setswana terminology more difficult than expected, they used the Setswana terminology to explain the concepts; for example: ***Dikuthlo-tsaemalano*** *…* ***Dia tsamalana***. That means they are the same, they are in the same position. Setati (1998) investigated different ways in which a multilingual senior primary Mathematics teacher used code-switching when teaching Mathematics to second language learners. The data was collected in one grade 5 (11-15) class where the pupils were first language Setswana speakers and all second language speakers of English. It was discovered that the teacher used code-switching to facilitate the understanding of concepts by learners and encourage participation and familiarise learners with the English language. It was also found that, the teacher used three types of switching: (1) for reformulation for content of activity and for translation, (2) switching for content of activity and (3) direct translation.

The discussion showed that the reformulation of content happened in two ways: the teacher paraphrased what had been said and did not add new information or new instruction. Code-switching occurred in three different functions: explanatory, informing and regulatory. The last switch is direct translation where everything said by

the teacher in English was said in Setswana. According the Setati (1998), direct translation switching is not always possible in Mathematics because some terms are either unavailable in Setswana or are not readily used. The study further showed that these three types switching served different purposes: they were used for explanatory, pedagogical and communicative demands in the classroom.

Kazima (2008) discussed two strategies that deal with mathematical terminology when teaching in the mother tongue. The two strategies discussed entailed developing a Mathematics register by using existing vocabulary of local languages and borrowing from mathematical English focusing on Nigeria, Tanzania and Malawi. Focusing on Nigeria, Kazima (2008:58) said the strategy that was used to create terms in Efik and Yoruba was borrowing; for example, *"**besi**"* **(base in Efik),** ***'facto' (factor in Igbo)*** and ***'angu'*** **(angle in Yoruba)** seem to have been borrowed from mathematical English. The scholar found that borrowing was effective in teaching Mathematics in Yoruba. In Northern Sotho, there are mathematical terms that are borrowed from English, such as **cylinder- *silintara,* rhombus-*rompase*, trapezium- *trapesiamo*.** The borrowing strategy is more effective only if the target readers are familiar with the concept. In accord, Ntshangase-Mtolo, (2009) says borrowing is an effective strategy in Mathematics because users will understand it easily. For instance, in Mathematics, names of shapes, when directly borrowed, are easier and simpler to understand. This becomes easy for the learner to understand, as they can relate them to the English concepts which they already know. Furthermore, in the case of Tanzania, the scholar found that the Swahili method of creating Mathematics terminology for teaching largely entailed transferring the concept rather than mere translation. In other words, Swahili translators used coinage to create terms using the already existing vocabulary in their language. Similarly, in Northern Sotho, mathematical terms were created using available vocabulary in the language, for example, **area - *sekgoba***, the translators used a general word in Northern Sotho and attached it to the mathematics context. However, this strategy is not always effective, as it can cause confusion and ambiguity because ***sekgoba*** is **space** in Northern Sotho, it is not related to an amount of space measured in square metres in Mathematics. In support of this, Kazima (2008) says that the disadvantage of using vocabulary that is available can create problems of literal meanings that might cause confusion for the target readers. However, Kazima (2008) says an advantage of using available vocabulary is that in some cases, a

descriptive coinage can be used to further explain the mathematical concept to be fully understood. In Northern Sotho, internal resources were used to creatively develop mathematical concepts; for example, **cardioid- *sebopego sa pelo***. The equivalent term describes the source term so that the target reader can understand the concept in their language. According to Kazima (2008), exploiting internal resources to create new terminology is an effective way to convey the meaning of concepts instead of borrowing. Lastly, in the case of Malawi, Kazima (2008) found that, borrowing was a strategy used to take English mathematical terms as they are and spell them in Chichewa language. According to Kazima (2008), borrowing words will not create confusion as they are written in Chichewa, so learners will relate the borrowed concept with the English since their orthographies are not far from each other. Furthermore, Kazima (2008) says borrowed words are hardly lost in interpretation since they are taken as they are. On this note, the researcher agrees with Kazima (2008) that, when words are borrowed directly, they will not confuse the learners or users as they are close to the already known concept in English.

Kazima's (2008) study related to the current study as they both discussed the strategies used to create mathematical terminology in indigenous languages. Both studies concur that, strategies such as coinage, which use existing words to create terms, are effective as they use internal resources to creatively develop mathematical terminology. Additionally, borrowing can be used as another effective strategy to create terms in the mathematics field. Furthermore, both studies argue that other strategies are more effective in creating terms that are understandable in the TL. Kazima (2008) did not comment on the inconsistencies caused by borrowing words from English into indigenous languages. Ntshangase-Mtolo (2009) investigated the *translatability of English academic discourse into isiZulu with specific reference to the discourse of Mathematics*. The research was undertaken because of a lack of understanding among African learners on critical academic concepts in English and the language that contextualises them. The research focused on translation strategies used to retain the core meaning of the concepts.

The translated concepts and Mathematics learning areas were selected from a *Multilingual Teachers Resource Book* written for learners at the GET level (Grade 7-9). The study further analysed the quality of the translated texts and the translation strategies that was used by the translators to check if the concepts retained their

original meaning in their original text. It also checked whether the learners would understand the mathematics concepts in their African languages since languages are non-cognate. The study revealed that translators found it difficult to reach an equivalence level between English and isiZulu because of the technicality of the mathematics terminology. Borrowing was used to overcome the challenge, and terms were adopted as they were into the TL because the translators did not want to confuse the readers by coining new concepts. For example, the term **angle – *iegili,*** was borrowed directly from English into isiZulu, because it is familiar in the field of Mathematics and users would understand it because it is a familiar concept (Ntshangase-Mtolo, 2009:54).

Coinage was not preferred by translators as it caused confusion in the target audience because, coining new concepts does not make it easier for the target audience to understand newly coined words, as they might be unfamiliar to the target audience. The coined terms were not explained or defined, which led to more confusion for the back-translators. For example, the coined ***imbobo*** for ***bearing*** in English, creates confusion as the readers are unfamiliar with it in isiZulu. Ntshangase-Mtolo, (2009:49) further argues that although coinage is an acceptable strategy for developing a language, the terms should be standardised and popularised so that the speakers can be familiar with them. Similarly, in Northern Sotho, there are coined terms that bring confusion and lack specificity and do not retain the core meaning of the original text; for example, the term ***abacus – mmadiphetana***, ***mmadifegana*** (which means a woman with beads). In other words, the translated equivalent did not retain the core meaning of the original source deviating from the context of Mathematics.

The study discovered that paraphrasing led to lexical items that are more diluted in meaning by translators. Paraphrasing led to deviation of meaning from the original meaning in the source text. Ntshangase-Mtolo, (2009:73) found that paraphrased terms lacked specificity of the original text; for example, **grid - *ngokwensimbi enezikhala***, applies to an agricultural context and is not mathematical, which means the equivalent term is a mistranslation. Similarly, in Northern Sotho, the term area {context of amount of space measured}, which is translated ***sekgoba*** (space), the equivalent terms are not specific but too general and does not relate to the context of Mathematics. The study recommended a revision and republication of bilingual dictionaries because the translators indicated that they were unhelpful, as they only

provided the roots of the terms and multiple prefixes and suffixes. Monolingual technical contexts are vital to consider, as they provide clear explanatory and syntactic structures of the terms.

Ntshangase-Mtolo,`s study related to the current study because they both investigated translating mathematical language into Northern Sotho. However, the researcher analysed the strategies used by terminologists to create Mathematics terminology in Northern Sotho. Although Mathematics can be translatable, there are strategies that are ineffective, and terminologists or translators prefer other strategies over others. Strategies such as borrowing, transliteration, paraphrasing, compounding, coinage, derivatives, and loan translation recurred as effective in term creation. However, other researchers considered code-switching as a strategy to create Mathematics terms in multilingual learning.

From the presented literature review, term creation strategies are accompanied by challenges such as lack of brevity in terms, inconsistencies caused by spelling, dualism, and multiplicity of terms. Lack of brevity is caused by terms that are too long, cumbersome to read and understand. For example, in Mathematics, ***sebopegohlakorentšhithwii*** or ***sebopegohlakorenne***, both these terms are descriptive and too long to understand. Terminological confusion and inconsistencies caused by spelling include ***khomphyutha*/*khomphiutha*/*khomphutha***, a term spelled in three diverse ways, which creates confusion. Dualism and the multiplicity of terms caused by one term having several variants which are not synonyms, such as **abacus-*sebalapalo*/*motheoplao*/*abakhase*/*mmadiphetana***, feature in the challenges observed. Polysemous terms, which create confusion and ambiguity also cause problems in term creation where one English term will have the same equivalent translation in Northern Sotho: for example, **calculator- *sebaledi***, **counter-*sebaledi,* activity- *mošomo***, **assignment *-mošomo.*** However, the literature showed that, other strategies can be used to create terms by using an existing vocabulary of the language, which is effective because it describes the term to be understood by the speaker rather than transferring the term as raw as it is in the TL; for example, **cardioid- *sebopego sa pelo.*** Using existing vocabularies to creatively develop terms is effective as it focuses on the concept rather than literal translation.

2.6 CHAPTER SUMMARY

The literature reviewed in this chapter focused on global and local studies on term creation strategies in technical domains. The review revealed that little was done locally in analysing term creation in a technical field such as Mathematics in Northern Sotho, with current research on the topic being only in IsiZulu. This legitimised the need and urgency for a similar study in Northern Sotho. The next chapter elucidates the research methodology of the study.

CHAPTER 3: THEORETICAL FRAMEWORK

3.1 INTRODUCTION

This chapter discusses the theories associated with terminology development and strategies used in creating new terms, namely, Communicative Theory of Terminology (CTT) by Cabre (2003) and Descriptive Translation Studies (DTS) by (Toury, 1995). CTT describes terminology as activities carried out under different conditions whereas DTS focuses on a function-oriented translation and on a translator's decision-making during the translation process. Both these theories are descriptive in nature. CTT underpins research on various aspects of terminology such as terminological variations, term creation and different linguistic models to terminology (Gumbo, 2016). On the other hand, DTS is a systematic, non-prescriptive means of understanding the norms of and the laws of the translation process (Munday, 2012). These theories aided the study in describing the term creation strategies used during the development of Mathematics dictionaries in Northern Sotho. However, the chapter commences with a discussion of terminology and translation as disciplines, considering their origins and further reflects on terminology development in South Africa.

3.2 History and the Theory of Terminology

Sager (1990) defines terminology as the study of, and the field of activity concerned with the collection, description, processing, and presentation of terms, i.e. lexical items belonging to specialised areas of usage of one or more languages. Cabre (2003) regards terminology as an interdisciplinary study that is determined by characteristics of terminological units, which are linguistic cognitive elements (logic and ontology) and vehicles of communication (communication theory). ISO 704 (2009) defines terminology as dealing with specialised language in a particular field of knowledge (i.e. a subject field), the concept should be viewed not only as a unit of thought but also as a unit of knowledge.

Alberts (2017:64) defines terminology as the collection of systematic coherent concepts of a specific subject field, discipline, professional field, domain or theme. She further explains that terminology forms part of the Language for Specific Purpose (LSP) of a particular subject field with special-field concepts with their definitions and designations. For example, in this study, Mathematics is a language for specific purposes, which has terminology for a specific domain. Alberts (2017:65) says terminology encapsulates three meanings:

- The field of study used for collection, description and presentation of terms.
- A theory which is a set of premises, arguments and conclusions required for explaining the relationship between concepts and terms which are pertinent to a coherent activity of terminology, and
- A vocabulary or collection of a domain, field or special subject field.

Clearly, terminology is the study of technical specialised field guided by terminographic principles and methods. It is the processing of scientific technical languages represented by concepts with their definitions. The following section investigated the origin of terminology, how it started, and why.

3.3 The Origin of Terminology

The need for terminology started in the Middle Ages with the famous work of Toledo translation school where literature of classical antiquity where translated (Packeiser, 2009). In the 18th Century, a few scientists started to coordinate terminology systematically within their special fields and later terminology development took place. Carl von Linne (1707-1778) cited in Packeiser(2009),was one of the scientists whose work was based on fundamental botanica (1736) and the first coordinated systematised terminology of botany (Packeiser, 2009). In the 19th Century, due to the internationalisation of science, the need for scientists to have at their disposal a set of rules for formulating terms for their respective disciplines became apparent. The 1867 Botanists, 1889 zoologists, and 1892 chemists expressed this need at their respective international meetings. In the 20th Century, engineers and technicians became involved (Cabre, 2003). The swift progress and development of technology required not only the naming of new concepts but also agreement on the terms to be used (Cabre, 2003). The next section explicates the theory of terminology and its exponents.

3.4 Theory of Terminology

The prominent name associated with the study of terminology is Eugene Wuster, who was born in Vienna in 1930. He is an Austrian linguist considered to be the father of terminology who developed a theoretically oriented approach towards terminology, and he brought a new perception that was twofold: a systematised list of concepts of a subject area and other attendant designations. Eugene Wüster developed a theory in 1930 and the main objective was to avoid the ambiguity of communication among

professionals of the same field (Cabre, 2003). According to Protopopescu (2014), he had a strong interest in information science and was a fierce proponent of unambiguous professional communication. In his doctoral thesis (1930), he presented arguments for systematising working methods in terminology, established several principles for working with terms and outlined the main points of a methodology for processing

3.5 Traditional Theory of Terminology

Gumbo (2016) says the Wusterian theology was descriptive and did not include aspects such as communicative, social, and cognitive linguistics of terminology. Campo (2012) adds that the Wusterian theory was insufficient because it disregarded the social dimension of terms as naming elements, which was limiting. These restrictions birthed a new perspective from other theorists who saw terminology as a phenomenon that involves different activities carried out under different circumstances. The following section briefly looks into the theories of terminology and the scholars who developed them.

3.6 Theories of Terminology

The following are theories of terminology as cited in Campo (2012):

- Sociocognitive Terminology explains that terminology should include aspects of cognitive semantics and functional linguistics (Temmerman, 2000). The theory asserts that polysemy is functional as it helps us to understand specialised discourse (Campo,2012).
- Textual Terminology by Bourigault and Slodzian (1999) states that specialised language is unique when managing ambiguity and polysemy. It suggests that textual terminology has a role of corpora in analysing terminology (Campo, 2012).
- The cultural approach to terminology theory by Kidiri (2008), an African linguist, suggests that terminology is inspired by the specific situation of African languages and societies. It looks at how a group or community understands terminology (Campo, 2012).
- CTT by Cabre (2000) describes terminology as activities carried out under different conditions. According to Cabre (2003:183), terminology presupposes a need for all the activities related to the representation and transfer of

specialised knowledge such as technical translation and the teaching of languages for specific purposes.

The study analysed translation strategies used for term creation processes. The following segment discusses translation theories.

3.6.1 Translation Theory before the Twentieth Century

Translation emerged before the Twentieth Century from the pre-linguists' period of word-for-word (literal) and sense for sense translation. It was until the second half of the Twentieth Century that translation theory was focused on word for word or sense translation. The trailblazers for this era, Cicero (first century BCE), Horace, St Jerome (late fourth century CE), propagated literal and free translation. Cicero's approach to translation was advanced in *De optimo oratorum* (46BCE/1960 CE) by introducing his own translations of speeches by the Attic orators. Translators focused on the replacement of each individual word in the ST (Greek) with its closest grammatical equivalent Latin. To Cicero, the goal of translation was to produce an aesthetically pleasing and creative text in the TL to please receivers of the target text (Munday, 2012). However, on that note, St Jerome disparaged the word for word approach and propagated the sense for sense, stating that the meaning of the SL words is translated within their context and TL requirements.

3.6.1.2 Faithfulness, spirit and truth

By the seventeenth century, linguistic elements were not regarded in a text, the only thing that was regarded was fidelity, which was truth and spirit in a text. Citing Amos (1920/1973) in Munday (2012), early translators gave meaning to terms such as faithfulness, accuracy, and the word translation itself. According to Munday (2012), during this era, the concept of fidelity meant that the translator was supposed to be *fidus interpres* i.e. the faithful interpreter. It was only until the 17th Century that fidelity had come to mean faithfulness to the meaning rather than to the words of the writer (Munday, 2012). Citing Kelly (ibid 206) in Munday (2012) describes spirit having two meanings, which are creative energy or inspiration, however, ST Augustine (354-430 CE) used it to mean the Holy Spirit of God. However, later, spirit lost the original religious sense it possessed and was henceforth used in the sense of creative energy of a text or a language (Munday, 2012).

3.6.1.3 Equivalence-Based Theories

The notion of equivalence was dominant in translation throughout the 1970s and beyond (Munday, 2012). Approaches to the concept of equivalence caused heated controversy according to different theorists. Theorists such as Catford (1965), Nida and Taber (1969) and Koller (1995), define translation in terms of equivalence relations while others such as Snell-Hornby (1988) reject the idea of equivalence in translation as irrelevant or damaging to the study of translation (Munday, 2012). Citing Snell-Hornby (1998), Munday (2012) introduces an integrated approach of translation by integrating a variety of different linguistic and literary concepts based on text types. Shuttleworth and Cowie (1997) define equivalence as the relationship that exists between the linguistic elements of the SL and TL texts (Munday, 2012). Palumbo (2009) concur with Cowie and Shuttleworth (1997) who define equivalence as the relationship that exists between the original and the translated text (Munday, 2012). Kenny (1998), who also held the same perspective as the latter scholars, defines equivalence as the relationship between the source text (ST) and the target text (TT) and the TT takes preference over the ST (Munday, 2012).

Other scholars such as Jakobson (1959/2000) cited in Munday (2012) tried to categorise translation equivalence as follows:

- Intralingual translation - rewording or interpreting verbal signs by some means of some other languages.
- Interlingual translation or translation proper - interpretation of verbal signs by means of some other language.
- Intersemiotic translation - interpretation of verbal signs by means of non-verbal system.

Nida (1964a:159) cited in Munday (2012) describes two types of equivalence as Formal equivalence and Dynamic equivalence. Nida (1964a:159) says formal equivalence focuses on the message itself, in both form and content. One is concerned that the message in the receptor language should match as closely as possible the different elements in the source language (Nida, 1964:159). In other words, formal equivalence is oriented towards the ST structure, which influence accuracy and correctness. According to Munday (2012), formal equivalence is a translation that is closely approximate to the ST structure to gain close access to the language and customs of the source culture.

3.6.1.4 Dynamic Equivalence

Nida's principle of equivalent effect is based on the relationship between the primary receiver of the message, and the message should be the same as that which existed between the original receptor and the message (Munday, 2012). According to Nida (1964) cited in Munday (2012), the success of equivalence in translation depends on the 'four basic requirements of a translation' which is achieving the equivalence effect or response, which are:

- Making sense.
- Conveying the spirit and manner of the original.
- Producing a similar response.

Koller (1979b/1989:99-104) cited in Munday (2012) describes five different types of equivalence thus:

- Denotative equivalence - this focuses on equivalence of extralinguistic content of a text.
- Connotative equivalence - equivalence based on the lexical choices and sometimes called stylistic equivalence.
- Text normative equivalence- this is related to text types in diverse ways.
- Pragmatic equivalence - it is oriented towards the receiver of the message; it is also called communicative equivalence.

In the above section, a discussion around translation theories was investigated, it is evident that the scholars around the 16th and 17th centuries focused more on linguistic elements of translation. Over 2,000 years, beginning with Cicero in the first century BCE, translation was about literal, free, fidelity, truth and spirit. However, around 1970 and 1980 things started to move away from linguistic typologies to another shift which is functionalism communicative approach of translation. It was during this time in Germany where an era of functionalist communicative approach of translation began. The works of Kathrina Reiss (1970) on text type, Justa Holz-Manttari's (1984) theory of translatoral action, Hans J Vermeer's (1970) skopos theory focused on the purpose of TT, and Christiane Nord's (1997) text analysis model, which continued the functionalist tradition in the 1990 (Munday, 2012).

Kathrina Reiss (1970) cited in Munday (2012) focused on the concept of equivalence on a textual level rather than word for word. Her functional approach borrows from

linguist Karl Buhler (1879-1963) on the three functions of a language, which are informative, expressive and appellative. Reiss (1977/1989:108-9) summarised characteristics of text type as follows:

- Informative text type - communication of facts or information, knowledge and opinions.
- Expressive text type- aesthetic dimension of language or creative composition
- Operative text-appellative function to appeal to a reader or receiver.
- Audio-medial - texts such as films and audio visuals and spoken advertisements.

3.6.1.5 Translatoral action

The translatoral action model was proposed by Justa Holz- Manttari (Trsanslotariches *Handeln: Theorie und Methode*) and focuses on concepts from communication and action theory. The theory was developed with the aim of providing a model and producing guidelines to be applied during a translation situation (Munday, 2012). According to Munday (2012), translatorial action sees translation as a purpose-driven action with outcomes through human interaction. Translatorial action from a source text and as a communicative process involving a series of a series of roles and players, which are:

- the initiator - the company or person who needs the translation.
- the commissioner – the individual or agency who contacts the contacts translator.
- the ST producer – the individual or agency within the company who write the ST, and who are not necessarily involved in the TT production.
- the TT producer-the translator and the translation agency or department.
- the TT user- the person who uses the TT.
- the TT receiver – the final recipient of the TT.

From the above theory, it is evident that translation is an action that involves the initiator who needs the translation for a specific purpose. In the action, there are other aspects that are involved as well, such as the commissioner, ST producer who compile the ST, TT producer who is the translator, TT user who will use the translated product, TT receiver who is the end-user or the final recipient of the TT. This translational action

is similar with terminology workflow, where a request can be made by client, requesting the terminology office for a terminology list in a subject field or domain, the clients can either be an institution, or other users of language.

3.7 Skopos Theory

The Skopos theory was introduced in 1970 and was pioneered by Hans J Vermeer. The word Skopos is originally Greek, and it means aim or purpose or target of a translation and the action of translating (Munday, 2012). The aim of Skopos theory focuses on the purpose of translation which determines the strategies and the translation methods that are going to be used by a translator to produce a functional adequate translation proffered by Vermeer (1989/2000) cited in Munday (2012). Trailblazers such as Amman (1990), Kupsch-Losereit (1986) and Nord (1988) approached translation as purposeful, functional and text reader oriented, their view on translation was that translation happens at a scientific level not from a linguistic perspective. In other words, translation takes place at a functional approach, not a structural approach (Munday, 2012).

Vermeer (2004) explains that Skopos is not primarily focused on an exact equivalence of the source text. However, to produce a new text according to a certain aim or purpose (Munday, 2012). Vermeer (1996) divides the concept of skopos into three aspects, namely, the translator's intention, the aim of the original text and the function of translation. Vermeer adapts Reiss (1984:119) cited in Munday (2012), functional text type model, and they are as follows:

- A transluatum (TT) is determined by its skopos.
- A TT offering information in in a target culture and TL concerning an offer of information in a source culture and SL.
- A TT must be internally coherent.
- A TT must be coherent with the ST.

Nord (1997) cited in Munday (2012), presents a more detailed model incorporating elements of texts analysis which organises text. Nord (1997) proposes a functionalist approach highlighting the following elements:

- the importance of the translation commission or translation brief (who the translation is intended for, the intended function of the text, the medium in which the text will be delivered, and the motive for why the text is being translated).

- the role of the ST analysis (analysing the subject matter of the SL, content of the SL).
- the functional hierarchy of translation problems.

This model is also seen in the terminology flow, where Alberts (2017) says, before a terminology projects is embarked on, a needs assessment should be done, to identify the needs in a specific domain or subject area, which includes determining the needs of a language community requiring the list i.e., tertiary institutions, health institutions, etc. The similarities between a translation brief and the needs assessment are that both steps identify needs, who and why the process is done.

3.8 CTT

This study employed CTT (Cabre, 2003), a theory that describes terminology as activities carried out under different conditions. According to Cabre (2003:183), terminology presupposes a need for all the activities related to the representation and transfer of specialised knowledge such as technical translation, the teaching of languages for specific purposes, etc. This study explored linguistic aspects of term creation strategies, which included the formulation of new terms by borrowing, loanwords, paraphrasing, and transliteration. Cabre (2003:183) started by explaining that CTT has two major assumptions assigned to terminology.

3.8.1 The First Assumption

Firstly, terminology presupposes a need for all the activities related to the representation and transfer of specialised knowledge such as technical translation, the teaching of languages for specific purposes, technical writing, the teaching of special subjects, documentation, special language engineering, language planning, technical standardisation, etc. All professions dealing with special knowledge need terminology (Cabre, 2003:183)

As science and technology are rapidly growing, the need to develop specialised terminology in indigenous languages is eminent. The rapid growth in scientific and technological domains is caused by the naming of new concepts in different domains; therefore, these new concepts should be named in Northern Sotho. Mathematics is a specialised field of knowledge, with concepts that are scientific, making it difficult to understand. Therefore, creating mathematical terminology in Northern Sotho is a way of transferring information and communicating knowledge in a specific domain or

subject's field. Furthermore, according to Packeiser (2009:44), terminology development work is to construct information that can be communicated to improve the knowledge of specific domain of subject field. In other words, when terms are created for teaching languages for specific purposes, it makes it easier for learners to learn specialised subjects such as Mathematics in their own languages. According to Cabre (2003:183), "terms in their widest sense, are the units which most efficiently manipulate the knowledge of a subject field". This can be seen as a manipulation of a particular subject through term creation within a subject field. It is against this notion that the current study, analyses how specialised knowledge is transferred from English into Northern Sotho through term creation strategies. These strategies are helpful in transferring knowledge so that specialised vocabulary can be used for teaching languages of specific purposes such as Mathematics, therefore, CTT was relevant for this study.

The strategies discussed in this study were used to transfer specialised knowledge of Mathematics into Northern Sotho, and they are paraphrasing, borrowing, compounding, loan translation and coinage. According to Cabre (2003), CTT, these is a set of practices to resolve these needs. In other words, the strategies are used to facilitate a need to learn specialised field in the learners' mother tongue so that they can understand mathematical concepts easier. For example, the then Department of Sport, Arts and Culture developed a Multilingual Mathematics Dictionary for Grade R-6 to facilitate and develop terminology in African languages for new concepts that appear in the learning areas. The compilers of the Multilingual Mathematics Dictionary used different strategies to create terms in Northern Sotho; for example, the term ***cardiod*** translated as ***sebopego sa pelo***, was paraphrased for Northern Sotho learners to understand the concept easier and effectively. Cabre (2003:183) describes CTT as a theory that talks about terminology as a discipline that describes an object and provides sufficiently a methodological framework, which includes the practices intended for the satisfaction of diverse needs.

Gumbo (2016) says that term creation adheres to systematic working methods and principles. In terminology development, ISO 704 2000 (E), is a standard that deals with Terminology Work- Principles and methods and establishes and harmonises the basic principles and methods for preparing and compiling terminologies both inside and outside the framework of standardisation. As terminological activities involve

terminology projects, terminology projects have the same characteristics as a general project as it has the start and the end. According to Fahndrich (2005:227) and Nykänen (1999:62) cited in Perälä (2014) these include a defined start and end, allocated resources, division of responsibilities and a specific goal to achieve. In other words, a terminology project can indeed without exception be treated as a "real project" (Fahndrich, 2005: 227).

A terminology "project is aimed at collecting, developing, analysing and recording the terminology of one or more subject fields" (ISO 15188, 2001:2). Dobrina (2013) cited in Perälä (2014), classifies types of terminology projects based on five variants (objective, target group, scope, language and project steps) and distinguishes six types of terminology projects thus:

- **Monolingual Terminology** - a terminology project in one language for the purpose of collating and documenting information for the purpose of preserving Indigenous knowledge.
- **Multilingual Terminology** - a terminology project in at least two or more official languages, the Terminology Coordination Section (TCS) is currently developing and have developed multilingual terminology lists in all 11 official African languages in different technical fields; for example, the Multilingual Mathematics, Pharmaceutical, Construction and Engineering. In this study, the dictionaries that were analysed included the Department of Sport, Arts and Culture's Multilingual Mathematics Dictionary for Grade R-6, *Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3* bilingual dictionary and Sesotho sa Leboa Terminology No 4 1988, which is a unidirectional dictionary or term list.
- **Completion of an existing terminology** - a type of terminology project is a type of information about how the terms or new languages are added to an existing terminology. The TCS has developed the Pharmaceutical and Indigenous Plants and Animals term list that existed before and completed it.
- **Improving the quality of an existing terminology** - a revised or restructuring of a terminology; for example, the TCS Multilingual Information Communication Terminology ICT terminology (2005) and second edition (2013).

- **Comprehensive terminology** combination of existing terminologies into a single, large terminology, which covers several domains.
- **Terminology projects on request** - this refers to the terminology which customers or members of the public may request the TCS to develop in a particular or specific field or domain. For example, the then Financial Service Board requested TCS to embark on a Multilingual Finance terminology project in all the twelve official languages to help translators translate financial texts.

Terminological activities involve planning of terminology process. Nykänen (1999:63) cited in Perälä (2014) divides terminology projects into five phases:

- **The planning phase** - which includes the analysis of the need behind the project, serves as a basis for defining the objectives of the project. The project must meet the needs of an identifiable user group. The needs analysis should define a target group (can include learners, lecturers, technicians). The purpose for which the term list is created can be useful (training, technical communication), and typology (monolingual, bilingual). According to Fänhdrich (2005) cited in Perälä (2014), a terminology project is about purpose, target audience, content and
- scope, complexity of entries, and delivery or hosting. A terminology project should not take place without a proper needs analysis because it will be fruitless exercise, as it will not be used by the intended users.

The planning phase includes drawing up a project plan, finding financial resources and drawing up a financial budget. The project plan should clearly show the objectives of the project, schedule, a description of the result and the benefits the project will bring. According to Nykänen (1999) cited in Perälä (2014), the actual project begins once the planning is completed, and the funding is secured. The planning phase, according to Nykänen (1999) cited in Perälä (2014), is where the project group is selected, and assigned different responsibilities. The project managers assign and train project members on the subject matter and tools and methods are agreed upon in this stage on how the project is going to be led and overseen.

- **The implementation phase** is the phase where terminology is compiled through gathering the source material. This phase is the source text production

phase, which means collecting information from which terms are harvested Nykänen (1999) cited in Perälä (2014). Terms can be harvested from textbooks, periodicals, existing dictionaries, and technical articles. After collecting terms, then comes the concept analysis and definition writing, which according to Nykänen (1999) cited in Perälä (2014), is the most time-consuming part of the project. During this phase, in the South African context, is where meetings are scheduled for consultation with specialists, linguists, and provision of equivalents in the official languages.

- **The review phase** - this is the phase where the terminology can be validated and published. The review is done by relevant language bodies to ensure that terminology is correct and fulfils the objectives laid down in the project plan. In the South African context, this entails the verification and authentication phase by PanSALB. Statements and comments should be gathered from subject-matter experts, target group representatives, and in some instances, the user group of terminology as well, to ensure that the terminology meets their needs.

- **The finalisation phase** - this is the last phase where the terminology project is finalised based on the comments gathered and published in a suitable form. The target group concerned should be made aware of the publishing of the terminology. The terminology can be published online in a term bank or published in a printed hardcopy.

Furthermore, according to Cabre (2003:183), CTT states that, “terminology is a set of applications in as far as it allows the development of products specifically intended to satisfy needs.” In other words, the terminology products and applications that are developed should be target oriented and satisfy the needs of the users of the products. In South Africa, various institutions develop terminology products to meet the needs of their users; for example, the Terminology Coordination Section (TCS) develops term lists, which are unidirectional dictionaries, in all official languages in various domains, to meet the needs of their users. In this study, an example of one the products analysed was the Multilingual Mathematics Dictionary for Grade R- 6, which was developed to contribute to mother-tongue education for all speech communities in South Africa. Furthermore, Cabre (2003:183) says that the application must have a solution towards a specific need and consider its recipients and the planned activities according to the specific application. In other words, the terminology application or

product that is being developed must meet the specific need of its recipient and must be a solution to their needs and not confuse them in any way. For example, in this study, one of the products analysed was the Pukuntšu/Dictionary, *Mmetse*/ Mathematics for Grade R-3. The dictionary is bilingual, with English terms and their Northen Sotho equivalents. Furthermore, the dictionary has definitions in both English and Northern Sotho, illustrations of the term defined and an exemplary sentence. In other words, this dictionary is oriented towards the specific needs of its recipient according to CTT.

On this note, Cabre (2003:183) CTT emphasises that terminological applications must be appropriate and be oriented towards the solution of the specific needs, and the circumstances of each situation will determine the type of applications. ISO 15188 (2001:13) states that a specific user's needs should be met, target group should be determined, and the end -product should reach the end user. Dobrina (2013) cited in Perälä (2014) says that a terminology project has a purpose and a result. The purpose is to fulfil a particular people's needs (target group) and the result of a terminological project is a collection of structured terminological information, which can be compiled in a term list or a term bank. In this study, the terminology products that were analysed included term lists and dictionaries, which are end-products that meet the needs of grade R-6 learners learning Mathematics in their mother tongue. The Department of Basic Education multilingualism policy advocates that children be taught in their mother tongue. Therefore, the curriculum must be translated into Northern Sotho to facilitate teaching and learning in the language. Therefore, term creation can enable the translation of Mathematics concepts to meet the needs of learners in the foundation and intermediate phases of education in Northern Sotho. Furthermore, Cabre (2003:183), says other things that should be considered in the terminology application included terminology, phraseology, definitions, variants, context, phonological representation, foreign language equivalents, illustrations, and their means of dissemination. In this study, a unidirectional term list that was analysed, the DAC Multilingual Dictionary for grade R-6, has the following information, the head words or lemmas in alphabetical order, the term in the SL, an English term as the headword, and equivalents are entered below as the headword as the main entry term. For example:

common fraction	
English	*simple fraction*
Afrikaans	*gewonde breuk*
Sepedi	*palophahloditlwaela*

Figure 2 DAC Multilingual Dictionary for grade R-6,

In the above example, the information in the application is not user-friendly as it does not have example sentences, it does not consider the end user by stating how the term can be used in a sentence. CTT states that the application must be solution-oriented and meet the needs of a specific user. Therefore, unidirectional term lists are not always user friendly as they do not show how the term can be used appropriately.

Another dictionary is the *Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3*, which is bilingual, and includes the English terms and Northern Sotho terms in an alphabetical order. The dictionary has explanations and diagrams for the lesson plans and the teacher's notes and includes a daily list of lesson vocabulary. For example, in the *Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3*:

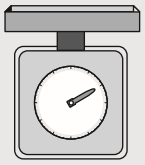
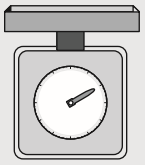
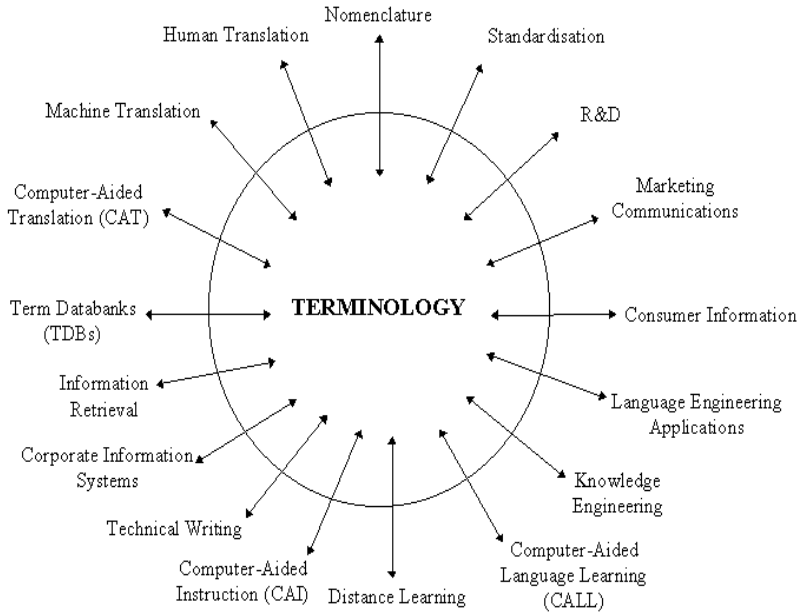
A scale that is used to measure mass. You put it on a counter and some goods in the scale, and then you can read the mass of the goods. E.g. You can find the mass of butter when you are cooking.		*sekala sa khitšhing/ moraleng*	*Sekala seo se šomišwago go ela boima. O se bea godimo ga khaonthara gomme wa bea dilo godimo ga sona gore o kgone go bala boima bja dilo.* *Mohlala: O ka kgona go hwetša boima bja potoro ge o apea.*	

Figure 3 the *Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3*:

In the above example, the application has definitions in both English and Northern Sotho. It has illustrations that explain the term so that it can be fully understood by the end-user. It also has example sentences to show how the term equivalent can be used in a sentence in Northern Sotho. Therefore, according to CTT, this application is appropriate, and it is oriented towards a solution that is specific as it takes account needs of the end user, the end user will understand. On that note, Gumbo (2016)

states that terminological activities result in several products such as dictionaries, glossaries, term lists, data banks and terminology management systems. The figure below shows the terminology applications and products.



Source: Ahmand (1994) Figure 4

Considering the above diagram, Cabre (2003) states that terminology products should have a means of dissemination, which could be through term banks. In South Africa, TCS within the DSAC engages in terminology activities to resolve terminological needs of the country at a national level. Its function is to; develop and manage a National Termbank. In this study, the dictionaries that were analysed were disseminated online, so that the public could access them. However, it should also be noted that other forms of dissemination are through printing, in the form of hard copy; for example, the DAC Multilingual Mathematics Dictionary for Grade R-6. Noteworthy, the dissemination process should also reach the end user, so that the product can be used. If the dissemination process is not done thoroughly, the targeted end users will not have access to the application.

Cabre (2003:183) says: “This leads us to think that despite of what is usually said about standardized terminological glossaries, it is the situation which determines the type of application.” Considering the above diagram, the issue of standardising terminological glossaries is a part of terminology activities. In this study, the

dictionaries that were analysed went through a standardisation process by the National Language Bodies in PanSALB. The process involves verification and authentication to ensure consistency in the usage of dictionaries. For example, the DAC Multilingual Mathematics Dictionary for Grade R-6 has been verified by PanSALB. However, it should be noted that, for other dictionaries such as the Pukuntsu/Mmetse grade R-3, it is not clear whether authentication was done. This causes inconsistencies in Mathematics, as different compilers always see the need to always create new terms without using the already existing standardised terms by NLBs. Gumbo (2016) adds that terminological applications in specialised subject fields should be adequate and accurate in indigenous languages.

3.8.2 The Second Assumption

The second assumption is that the central object of terminology is terminological units, which enable specialised communication. According to Cabre (2003:182), "terminology operates with terminological units which are multi-dimensional, and which are simultaneously units of knowledge, units of language, working methods and units of communication." The second assumption emphasises the communicative nature of terminology (Gumbo, 2016). Campo (2012) further states that the approach highlights the pragmatic, cognitive nature and linguistic functions in specialised communication that play a role in terminology. Mukoya (2023) states that the communicative approach has specialised jargon that form part of the lexicon of a particular language that is used, such as the specialised jargon of Mathematics that the study focused on. Thus, developing mathematical terms in Northen Sotho was a communicative approach or nature of terminology which aligned with CTT (Cabre, 2003).

Cabre (2003) also introduced the theory of doors to CTT to justify this communicative nature of terminology. Cabre (2003) further explains that the theory of doors denotes the plural but not simultaneous access to the object in a way that directly addresses the central object – the terminological unit whether starting from the concept term or unit. Cabre (2003) refers to these terminological units as "units of special meaning" because it covers communication among specialists, semi-specialists, technicians, learners and popularisation of science and technology. In this study, Mathematics terms were "units of special meaning" as they were concepts within the domain of Mathematics. In other words, these "units of special meaning" were Language for

Specific Purposes, which have specialised meanings. Therefore, developing terms in Northern Sotho could aid the learners to understand these units of specialised meaning in their mother tongue. Furthermore, by creating Mathematics terms in Northern Sotho, communication between learners and educators will be easier.

Gumbo (2016) says that the theory of doors, as proposed by Cabre, involves various term creation strategies such as borrowing, compounding, coining language, elaboration, derivation, inflection and semantic transfer can be used depending on the communicative situation. Against this background, this study analysed term creation strategies in developing mathematical dictionaries in Northern Sotho. According to Gumbo (2016), the theory of doors stipulates that using the terms in a specialised dictionary is a way of communicating between the terminographers and dictionary users. In other words, dictionary compilers must use term creation strategies in such a way that grade R-6 learners will understand without any difficulty in Northern Sotho.

3.9 Descriptive Translation Studies

In Holmes' map of translation studies, there is "pure" and "applied" translation studies. Pure translation studies are further subdivided into two branches: Descriptive Translation Studies (DTS) to describe the phenomena of translation and Translation theory to establish general principles to predict, explain translation phenomena (Munday, 2012). The descriptive branch of "pure" research as suggested by Holmes map encompasses three areas of research, namely:

- Product-oriented, DTS examines existing translations by describing and analysing a single ST -TT pair or a comparative analysis of several translations of the same text (either in the same or different language). In this study, ST and TT pair of Mathematics dictionaries were analysed to check if the term creation strategies that were used to develop the TT text in Northern Sotho were effective. DTS analyses the ST text and TT text by describing the translation process through term creation from English into Northern Sotho in Mathematics. For example, ST dictionaries are DAC Multilingual Mathematics Dictionary for Grade R-6, Mmetse /Pukuntšu Grade R-3, and were analysed with the ST pair in English.
- Function-oriented DTS describes the context rather than texts focusing on the functions of translations. It focuses on the value of the translated text in the

intended target context and the sociocultural situation of the target reader. In terminology development, before embarking on a terminology list, a purpose must be identified, and the terminology list must have a function. The value of Mathematics dictionaries lies in their potential to help Grade R-6 learners in understanding Mathematics.

- Process-oriented DTS focuses on describing a system of what is going on in the mind of a translator during the translation process. This involves the decision-making of the translator and the psychology of translation, which includes the choice of translation strategies that the translator decides to use during translation process. This process occurs in terminology development and involves linguistic research in TL and supplying term equivalents in TL using term creation strategies such as borrowing, paraphrasing, compounding and coinage. In this study, term creation strategies were analysed to see if they were effective in developing mathematical terminology in Northern Sotho.

The concept of norms is within the framework of DTS. Toury (1995) sees various kinds of norms operating at different stages of the translation process: initial norm, preliminary norm and operational norm.

- Initial norm refers to the general choice made the translator; thus, translators can subject themselves to the norms of ST or the norms of the target culture or language.
- Preliminary norms, according to Munday (2012), are sets of considerations in terms of translation policy, i.e., factors that govern the choice of text-types or even of individual texts that are transferred through translation into a particular language at a time. Thus, translation policy was influenced by mother tongue-based education in foundation phase according to the CAPS curriculum. Therefore, dictionaries were developed to aid teaching specialised concepts such as Mathematics in Northern Sotho.
- Operational norms are the decisions made during the act of translation. They indirectly or directly govern the relationships obtained between the target and source texts. In other words, operational norms serve as a model according to how translation comes into being between the ST and TT texts. Toury (1995) says that these norms have certain modifications that make the translation to be an adequate translation. In this study, the term creation strategies entailed

the norm or decisions that dictionary compilers chose during term creation. Term creation strategies determine how the translation comes into being in the TT in Northern Sotho. The choice of strategies used by dictionary compilers affect the understanding of the end users in Northern Sotho.

- Textual-linguistic norms govern the selection of linguistic elements such as lexical, phrases, and stylistic features. In this study, the nature of the field was Mathematics; therefore, the form of the dictionaries contains linguistic elements such as phrases and complex long phrases.

From the above presentations of DTS and CTT, it can be deduced that both theories describe the translation process by using translation strategies such as borrowing, paraphrasing, transliteration, semantic transfer. It is also can be seen that both theories propagate that before an action can be embarked on, a needs analysis or translation brief should be the first point of departure. Both theories emphasise that a target group should be first identified so that the product will reach the intended audience. Furthermore, these theories address the issue of the structure of linguistic elements that should be considered in the final products, and how they affect the final product. Against the background, both theories were employed in the study. The following section reflects on terminology development in South Africa.

3.10 Terminology in South Africa

African language terminology started in 1928 with the formation of language committees such as language boards (Alberts, 2000). However, in 1948, language boards took a fundamental position of associating language boards with independent homelands, such as political formation, (Alberts, 2000). Bantustan homelands were areas designated for Black people only during apartheid in South Africa. Black people were grouped according to their tribes and languages (Ramuedzisi, 2016). These homelands were the Transkei (isiXhosa), Bophuthatswana (Setswana), Ciskei (IsiXhosa), Venḓa (Tshivenḓa), Gazankulu (Xitsonga), KaNgwane (Siswati), KwaNdebele (IsiNdebele), KwaZulu (IsiZulu), Lebowa (Sepedi) and QwaQwa (Sesotho). Each homeland had a language board, which supported, promoted and developed these languages. In addition, the languages were used officially in schools and government departments of all homelands. The orthography and the spelling rules of the respective languages were documented by the language boards. These rules

gave clear guidelines on how to write official documents in those languages (Ramuedzisi, 2016).

During this era, translators were documenting English and Afrikaans terms on cards the Language Bureau of the Department of Culture, which later became Department of National Education. At a later stage, the division of terminology within the bureau was developed, terminologists were appointed to excerpt and systematise terminology in various subjects' fields (Ramuedzisi, 2016). Since 1994, after the dawn of democracy, African language terminologists have been employed to document the terminology of different subject fields in African languages. Multilingual terminology lists such as Weather Terms, Basic Health Terms, HIV/AIDS Terms, Building Terms, Election Terminology, Banking Terminology, were compiled (Alberts, 2000).

When the Constitution of the Republic of South Africa, Act 108 of 1996, Section 6(2) was adopted, it recognised and confirmed twelve official languages in South Africa. This called for the status of African languages to be elevated. Terminology development was a point of departure, because for any language to be used in political, scientific and economic purposes, terminology should be elaborated. Two structures were formed for language planning and development, including terminology management. Two structures were stated in the 1996 Constitution as tools to utilise official languages for official purposes. These structures are the National Language Services (NLS) established in 1998, and the Pan South African Language Board (PanSALB) formed in 1996. The National Language Services is a directorate located in DSAC. The mandate of the NLS is to administer corpus planning through terminology development. The mission of the Terminology Coordination Section (TCS) is to develop technical vocabularies in all the official languages. The TCS is a division developed to assist in the development and modernisation of the technical vocabularies of the official languages (Alberts, 2000). The purpose of terminology coordination is to coordinate terminology development in all the official languages in the technical domains. One of its main functions is to develop, document and coordinate terminology in all the official languages in the technical domains. There were policies that were developed after passing the new South African Constitution in 1996. The following national language policies were developed, and Acts passed by Parliament:

- Pan South African Language Board Act (No. 59 of 1995);
- The Use of Official Languages Act (No. 12 of 2012); and
- South African Language Practitioners ` Council Act (No 8 of 2014).

Two structures were formed for language planning and development, terminology development and management, and this was stated in the 1996 Constitution. The NLS, established in 1998, and PanSALB, formed in 1996, are the said structures and their historical backgrounds are provided below.

3.10.1 National Language Service (NLS)

The NLS is a directorate located in the DSAC, which was previously known as the Department of Arts, Culture, Science and Technology (DACST). The mandate of the NLS is to administer corpus planning, i.e., to develop and promote official languages and other languages used in South Africa. This was promulgated in the Constitution and the National Language Policy Framework (NLPF) in 2003. The purpose of the NLS and its responsibility to develop, promote, and protect all official languages through policy formulation and implementation is clearly defined in the NLPF. The mandate provided by the Implementation Plan: National Language Policy Framework, is to make sure the NLS accomplishes its function (2003:12), i.e. to:

- Provide a translation and editing service to governments departments.
- Promote and protect the language professions.
- Facilitate the establishment of language units in government departments
- Provide skills development in the language profession.
- Facilitate the development of provincial language policies.
- Develop literature in compliance with the NLPF.
- Develop specialised terminologies in official languages.
- Establish a National Centre for Human Language Technologies (HLT).
- Facilitate the production of Human Language Technologies.

3.10.2 The Pan South African Language Board (PANSALB)

PanSALB was established in terms of the Pan South African Language Board Act 59 of 1995, amended as the PanSALB Amendment Act of 1999. The Board was established according to the Constitution of Republic of South Africa (Act 106 0f 1996:4) to:

- “Promote and create conditions for the development and usage of official languages, the Khoe, and San languages and South African Sign Language
- promote and ensure respect for all languages commonly used by communities in South Africa, including German, Greek, Gujarati, Hindi, Portuguese, Tamil,Telegu, and Urdu and Arabic, Hebrew, Sanskrit, and other languages used for religious purposes in South Africa”.

PanSALB has affiliate structures such as NLBs, National Lexicography Units (NLUs) and Provincial Language Councils (PLCs). The NLBs, which are established for all official languages, have a function to verify and authenticate terminology lists and all publications in their languages. The following section focuses on term creation and translation strategies.

3.10.3 Term Creation and Translation Strategies

Term creation is the process of giving words, new meanings, and new forms. According to ISO 704 (2000), term formation patterns are guided by the morphosyntactic, phonological, lexical structures of individual languages. It is aimed at collecting, developing, analysing, and recording terminology in one or more subjects’ fields for a specific purpose. According to Sager (1990), it occurs according to the subject field area, nature of the people intended for and the purpose of term formation. Wright and Budin (1997) states that term formation is the process of naming concepts to develop cognitive and communication that is needed by a particular speech community. Term creation involves the transference of knowledge from one language to the other. Sager (1990:80) agrees that term creation is a result of knowledge transfer to another linguistic community. Sager (1990:80) describes two types of term creation process, namely: primary term formation and secondary term formation. Primary term formation is a process where a concept is identified, named, and characterised by the creator in their native language. According to Sager, (1990:80), this process accompanies concept formation and is therefore monolingual. This approach is also named an onomasiology approach of naming things. According to Nchabeleng (2011), all languages have an onomasiological origin. In Northern Sotho, there are concepts that were named and characterised by the forebears, and those concepts belonged to different lexical or semantic fields. In Northern Sotho, the concept ***selemela***, which is a name of a star, was identified and given characteristics

in a specialised field of astronomy. For instance, *Selemela - ke dinaledi, tša go sepela ka sekgomothwana, tša go tšwa bohlabela di lebile bodikela. Tšona di balama ge mabele a thoma go butšwa, ge mabele a budule ka moka, di sobelela sa ruri go fihla ngwaga o tlago* (Segagešo Mphato wa 9:400). There are many concepts that were identified and characterised, revealing that terminology development has been happening since time immemorial.

Secondary term formation is a process where a term exists in language A, in a specific domain, for a specific purpose. The concept from language A must be transferred into another language through term creation. According to Sager (1990:80), secondary term formation occurs when a new term is created for a known concept. This process happens in developing countries where English is dominant in scientific and technical research. In such contexts, English terms are transposed into other language communities. According to Nchabeleng (2011), in this process, knowledge is transferred from one language into the other. Secondary term formation is usually designed and engineered to follow specific guidelines.

ISO 704 2000 (E), Terminology Work-Principles and methods is one of the standards that establishes and harmonises the basic principles and methods for preparing and compiling terminologies both inside and outside the framework of standardisation. ISO 704 2000 (E) states that there are principles that are applicable to creating new terms or systematising existing terminologies, and they are as follows:

- Transparency
- Consistency
- Appropriateness
- Linguistic economy
- Linguistic correctness

Furthermore, there are term evaluating criteria by Gilreath (1993:81) namely, accuracy, precision, descriptiveness, unequivocalness, pronounceability, appropriate simplicity, form correctness and conciseness. These term evaluating criteria are used for better terminology and thus better communication (Gilreath, 1993).

3.10.3.1 Accuracy

According to Gilreath (1993:81), accuracy means that, “the term quality is determined by the absence or presence of misleading or incorrect elements”. In other words, terms

that are created should be error free and transparent. If terms that are created are accurate, they simply contribute to the credibility and usability of terms by target users (Gumbo, 2016).

3.10.3.2 Precision

According to Gilreath (1993:83), precision "is the degree to which a term clearly delineates its concept". In other words, precision is when a name refers to the concept intended for. A term should reflect the concept it designates to avoid ambiguity and confusion. Gumbo (2016) asserts that all created terms should be precise in form and meaning, however, she further says that this guideline of precision has a problem in that language is dynamic and is constantly evolving. The researcher is not of the same opinion as Gumbo (2016) because in specialised fields such as medical, engineering and mathematics, precision is inevitable to avoid confusion and ambiguity. According to Gutierezz (1988:88, cited in Pavel & Nolet 2001), a term is precise if the communicative dimension is unchanging and its meaning does not depend on the context, discourse in which is inserted to achieve communication. In other words, term should be able to communicate the intended message precisely without any confusion. For example, in this study the term equivalent from the Department of Arts and Culture Multilingual Mathematics Dictionary for Grades R–6 (2013), ***addendum*** is translated ***setlaleletši,*** another term ***accessory is t***ranslated ***setlaleletši*** as well, both these term equivalents are not precise and if they are used without providing the context, the user might not understand as they might think ***setlaleletši*** is anything that is added as according to the translation of the term equivalent in Northern Sotho. In other words, for a learner these two concepts in their language have the same meaning, even though they are different in its original meaning. The researcher is of the view that, to avoid ambiguity, precision should be considered as the concept is designated is intended. However, the researcher is not of the opinion that, in other instances in our indigenous languages it might be difficult to create term equivalents that follow the principle of precision.

3.10.3.4 Descriptiveness

Gilreath (1993:83) asserts that descriptiveness "is the degree to which the term's elements signify its intended meaning". In other words, descriptiveness means that a term`s literal whole words or word parts can have a meaning matching its intended meaning in the target language. Descriptiveness also means that terms can have the

quality of self-descriptiveness as they describe the nature of the concept. For example, ***clock – sešupanako, calender- tšhupamabaka,*** these term equivalents are both descriptive in nature as they are describing the function of the concept. The user will not have a problem of understanding the words in a dictionary as they are self-descriptive.

3.10.3.5 Unequivocalness

Gilreath (1993: 85) asserts that unequivocalness is "the quality of a term which has only one meaning within a particular field of knowledge or within a particular nomenclature". In other words, one-concept-one-designation principle, meaning that each concept is designated should have one meaning not several meanings. However, Gilreath (1993: 85) further says that this criterion is the most widely violated, as "there are far more concepts to be named than there are lexical terms." He further says that the equivocal clash in thus unavoidable, this can be seen in this study, in which the term equivalent ***palo*** can be ***number, sum, figure and digit in*** Northern Sotho in mathematics. This brings confusion and polysemous terms creating concepts that is designated in several meanings. Although this is unavoidable, the researcher is of the view that, this principle is not effective in our indigenous languages as we lack certain vocabulary especially in mathematics. Furthermore, terminographers should also use a more pragmatic approach to terminology development rather than a puristic approach.

3.10.3.6 Conciseness

Gilreath (1993:88) asserts that conciseness is the "orthographic length of a term". He further says that for efficiency of communication it is important for the term to be concise. Gumbo (2016) says that the lengthier the term the harder it is to understand. However, this principle is questionable in that there are various factors that are determined during terminology development. In other specialised fields, there particular and peculiar practices whereby for example in mathematics there are lengthier terms, meaning that, in Northern Sotho, long and complex term equivalents will be created. For example, ***binary operation- mongwalopalo wa nomoropedi.*** In other words, the principle of conciseness is not always applicable especially in certain specialised fields such as the given example.

3.10.3.7 Appropriate simplicity

Gilreath (1993:89) states that “the number of words in a term is appropriate for the level of importance of the designated concept.” He further states that, the term should be simple if it is more important so that it can convey the message in an appropriate manner without confusion. The researcher is of the view that difficult terms maybe disregarded by target readers therefore, terminographers should coin simple terms that are simple explanatory. For example, the term ***pentagon*** translated as ***sebopegohlakorekhutlohlano*** is not simple and easier for a learner to use. Gumbo (2016) states that target users stress that indigenous terms are not easy and simple as English terms.

3.10.3.8 Form correctness

Gilreath (1993:90) asserts that form correctness “is the extent to which a term has no grammatical errors, such as misspellings, wrong hyphenation, wrong part of speech.” In other words, the term has been free from linguistic and grammatical error. In essence, it is upon a terminologist to create terms that are free from error in terms of spellings and grammatical elements. The products that are produced, such as dictionaries or term lists, should contain term equivalents that are free from mistakes or errors regarding the grammatical elements of a particular language. In this study, the researcher also analyses if the term equivalent created are accurate according to Gilreath (1993) term evaluating criteria. Are the term created follow the spelling and orthography of Northern Sotho, for example, the mathematics term ***rhombus translated as rompus*** extracted from **Pukuhlahlo ya Mareo a Mmetse Grade R,** is not accurately spelled according to the orthography of Northern Sotho. Another example, the term ***trapezoid*** translated as ***trapesoit*** is also not accurate and incorrectly spelled, as they end with both consonants. The researcher is of the view that when term equivalents are not correctly spelled, the credibility and usability and acceptability of terms by target users is compromised.

3.10.3.9 Pronounceability

Gilreath (1993:92) states that pronounceability “is the ease of the pronunciation of the term”. This principle means that the terms that are created through the strategy of borrowing should be easily pronounced. The terms should follow the correct spelling and orthography of the language that is borrowing. The following examples further

validate this fact: *quintillion- khwinthilione, million-milione.* Furthermore, through phonological adaptation the borrowed word becomes adopted in Northern Sotho and becomes part of the vocabulary.

3.11 Borrowing

Borrowing is the process of transferring linguistic elements from one language to the other. Cluver (1989:266) says that borrowing refers to the process by which linguistic elements are exchanged from one language or dialect to another. Mojapelo (2014) states that "*Kadimo ke lereo leo le šomišwago mo polelong e le ge e šupa mantšu goba go ba gona ga mantšu a dipolelodišele ka gare ga polelo ye nngwe" [Borrowing is a term used in the field of language referring to foreign words that exists in another language*]. Nteso (2013) agrees that borrowing is a process of including words that do not exist in the TL. For Gumbo (2016), borrowing is bringing foreign lexical units into the lexicon of any given speech community. This happens especially where there is a deficiency of technical terms in the receiving language. Mojela (2010) explains that borrowing occurs directly or indirectly. Mojela (2010:702) explains direct borrowing as words borrowed by one language from another which in the process are subjected to phonological rules of the language that borrows; for example, ***lekkers – malekere***. On the other hand, indirect borrowing is when the sense or meaning of a foreign word is taken; as such, coinage focuses only on the word itself (Mojela, 2010:702). For example, **radio - *seyalemoya*** (meaning literally "that which goes with the wind"), **bed *-bolao*** (place to sleep) are such examples (Mojela, 2010:702).

Although borrowing is a common term used for explaining the process of exchanging words from one language to another, different scholars still differ on whether it is borrowing, loan words or adoptives while other scholars seem to suggest that these terms mean the same thing. foreign languages and incorporated into linguistic system of the borrowing language. Chokoe (2022) proffers that loan words are also called adoptives, which are taken over without any change of meaning. Mojela (2010) concurs that adoptives are taken over without any linguistic change and these words can also be referred as foreign words. Mojapelo (2014) affirms that *"Taba yeo e lego gona ke gore ka nako ye nngwe bangwadi ba fela ba kgakgana ka baka la leina. Ditsebi tša polelo di tle di ngangišane gore gabotse lereo la maleba leo le ka šomišwago e ka ba lefe [What should be noted is that different scholars have different opinions with about what is the proper name for it].* Calteaux (1996) also says that the

terms “loan words”, “borrowings” and “adoptive” can be used interchangeably. On this view, Mojapelo (2014) says that “*Bangwadi ba bangwe ge ba šupa mantšu a a dipolelodišele ba re ke ‘loan words’bangwe ba re ‘borrowing’ mola ba bangwe ba re ke ‘adoptives’. Ba bangwe ba bolela gore mantšu a a ka šomišwa go šupa selo se tee mola ba bangwe ba ganana le se* [*Other scholars refer to foreign words as loan words while others say borrowing, others say adoptives. Other researchers are saying that these words can be used to mean the same thing while others are not in agreement*]. According to Chokoe (2022), loan shifts are adoptives that change the semantic meaning from their original meaning after they have been introduced into Northern Sotho, for example,

aloga	***to graduate***
mphato	***grade/standard***
lepatlelo	***stadium***
mogala	***phone***

Kemmer (2011) says borrowing is synonymous with loanwords. She argues that loanwords are words that are adopted by the speaker of one language from another language, which is the SL. The SL, which borrows the TL, has power, prestige, and wealth, which creates asymmetry. This asymmetry gives the source community an advantage, as it is the one with more words, ideas and concepts to the borrowing language. Mojela (2010) defines loan words as words that have been borrowed from one language into the other. The meaning of these words remains intact although they adapt to the syntactic and morphological structure of the language they are borrowed into. He further says that loan words occur because of direct borrowing. Mtintsilana and Morris (1988) state that loan translation can also happen when another African language belonging to same family borrow from each other without affecting the linguistic elements of the language receiving, this is seen in Northern Sotho with words borrowed from IsiZulu, for example,

makoti	**makoti (IsiZulu)**
korobela	**korobela (IsiZulu)**
tšhaiša	**shayisa (IsiZulu)**
papalase	**papalase(IsiZulu)**

Transliteration is another form of direct borrowing. Letsoalo (2018) regards transliteration as a term creation strategy under the tree of borrowing where a word follows the syllable structure of the TL. Mtintsilana and Morris (1988) define transliteration as a process of Africanising loan words by changing their phonological and morphological structure to agree with the African language structures. Taljard (2008) agrees that transliteration is the process of adapting words completely morphologically and phonologically into the TL. In addition, Maleka (2005) asserts that transliteration involves adapting the phonological structure of the loan word to the sound system of the borrowing language. According to Mojela (2010), transliteration can also be regarded as a form of direct borrowing.

When words are borrowed into a language, the vocabulary of a borrowing language increases as new words are added. Fromkin and Rodman (2003) and Mojela (2010) agree that borrowing words from another language is an important source of new words by adding volume to the vocabulary of a language. As science and technology are developing quickly, the need to borrow new emerging technical terms is inevitable. Madiba (2000) says borrowing is the norm rather than the exception in the science and technology domains. These new emerging concepts are technical and foreign, especially to most developing countries and societies. Thus, these new concepts from developed countries are borrowed from developing countries. Cluver (1989) says that when technical words are borrowed, they increase and expand the vocabulary of the borrowing language, which makes technical communication across language boundaries easy. Gumbo (2016) adds that borrowing increases the vocabulary of the receiving language, especially in the field of Science and Technology. Borrowing new technical terms is a way of expanding technical vocabulary in a language. Sager (1990) says that through borrowing, there is a transfer of knowledge from one linguistic community to the other. Gelagay (2021) agrees that scientific and technological developments create a way for the transfer of certain concepts from one language to another. In addition, Nokaneng and Louwrens (1988:261) assert that, *Polelo ga e eme felo go tee. Polelo e fetoga ka mehla le mabaka. Go bjalo le Segagešo. Ka tlwaelo taba ye e tšwelela molaleng ka tlotlontšu eo e tšwelelago ka didirišwa tše dimpsha, ditšweletšwa, dikgopolo, le ditlhamo tšeo Segagešo se tšamago se gahlana natšo gomme di swanetšego go fiwa maina* [*Language is not stagnant and develops through*

time. It is the same with Indigenous languages. This is seen usually where new vocabulary is emerging through new ideas and concepts caused by language contact meaning that these concepts should be named in Indigenous languages.]

Usually, borrowing takes place when there is a gap or absence of a certain concept in each language. This lexical gap then creates a need to borrow lexical concepts to fill the gap in their language. Hafiz (2015) posits that lexical borrowing refers to the process of adapting loanwords into the linguistic system of language borrowing. In addition, Crystal (2010) defines borrowing as a natural process that people use to meet their communication needs by borrowing lexical items to fill the gap in their languages. In addition, Gelagay (2021) asserts that borrowing is a process that happens when there is an absence of a term denoting a concept or an object in each language. For example, in Northern Sotho, there are new concepts which were foreign but were assimilated and accepted into the linguistic system. Such terms are ***knoop-konupi, koek-kuku,*** **plate-*poleiti*** ***beker-lebikiri*** and ***tjalie-tšajana***. Suffice to say, borrowing happens due to language contact, where when two cultures come together, they influence each other. The influence causes a transfer of lexical elements between the two languages. During this lexical exchange, the other language that is borrowing adapts the loan word into its morphological and phonological structure. However, the donor language should not violate the structure of the receiving language during the adaptation process. Borrowing is an effective strategy for term creation because it adds new words to the vocabulary of the recipient language. It bridges the lexical gap between two languages caused by the absence of certain concepts in specialised domains. Therefore, borrowing increases the vocabulary of a language that is lacking certain concepts in specialised domains. Although it is effective, some scholars suggest that it is better to adopt a puristic approach rather than borrowing words, as it threatens the growth of indigenous languages.

3.12 Paraphrasing

Paraphrasing is another strategy that is used by translators when they were creating Mathematics terminology. In simple terms, paraphrasing entails explaining or describing a term so that it can be understood clearly by the target group. Taljard (2008) explains paraphrasing as a short way of describing or explaining, which is a very productive way of creating terms in African languages. Mojapelo (2018) says paraphrasing is a method that provides translation equivalents in the form of phrases.

Moropa (2007) says it is a process of involving more than one word or sentence to explain a concept. Ndhlovu (2014) agrees with Moropa (2007) that paraphrasing involves explaining the concept of the source language in the target language while Madiba (2000) says that it takes the form of a definition of the original concept. This is true because in paraphrasing, the translation equivalent of the headword is in a short definition form. This happens due to a lack of equivalents in the TL. Mojapelo (2018) asserts that, where there are no equivalents, the headword of the translation equivalence is defined in a short form or sentences. For example, in The Mulitilingual Mathematics Dictionary for Grade R-6, the term **distributive property-*molawana wa go tlhopholla palelontši***, the term is a lengthy sentence that could bring confusion, as it is unclear whether it is a term or a definition.

In paraphrasing, the short form of the target equivalence explains the meaning of the source text in a phrase format or what is called 'paraphrasing phrase' (Mojapelo, 2018). Therefore, making the head term of the target equivalence to be "equivalents phrases" is not term creation. Mojapelo (2018) says, linguistically, equivalents phrases are not recognised as terms due to their short phrasal structure. Therefore, linguists usually do not consider paraphrasing as an effective strategy because of lengthy terms. However, Mojapelo (2018) says, to fill the lexical gaps and to avoid non-equivalence, paraphrasing uses sentences to convey the idea in the ST but with a different wording. In addition, Mabasa (2006) asserts that explanations are given where there is non-equivalence in the TL.

Mabule (2016) postulates that, for the purpose of information transfer from the ST to the TL, paraphrasing is necessary to construct paraphrased terms. For example, in The Multilingual Mathematics Dictionary for Grade R-6, the term **ascending order** is translated as ***mokgwa wa go namelela***, which literally means **the way of going up**. This term is a sentence used to show what is happening, so that the target reader can have a full understanding of what the term is about. The head term **ascending order** is made clearer and simpler in Northern Sotho. Ordinary words were used to create an equivalent so that the end user can understand, which, according to Madiba (2000), is why this strategy is extensively used.

When explaining the term, unrelated words are used to describe the term clearly and comprehensibly. This kind of paraphrase of using unrelated words is one of the

strategies, which, according to Baker (2018), can be used to explain a complex concept by making it simpler in the TL. Baker (2018) says that paraphrasing using unrelated words is used when the lexical item is not available in TT. In other words, Baker (2018) says that when the concept is complex in the TT, simpler words should be used to explain the concept in the TT. In the above example, ***mokgwa wa go namelela*** simply means the manner of increasing or going up, which makes it clearer that the numbers are going up in a certain manner.

Another paraphrase strategy, according to Baker (2018), is paraphrasing using related words. This paraphrase works when the concept in the SL is lexicalised in a different form in the TT. For example, in the Multilingual Mathematics Dictionary for Grade R-6, the term **ordinal numbers** is translated as ***tatelano ya dinomoro*** (sequence of numbers). There are lexical items in the TT that are found in the ST; however, they are written in a different way. On the other hand, Harmon (2013) explains that paraphrasing is a translation strategy that can be classified into four kinds: simple paraphrase, distributive paraphrase, explicative paraphrase and omissive paraphrase. A simple paraphrase focuses on the modifications and shifts of information in the ST. In other words, all the information included in the original ST such as prepositions, can be found in the translated TT. All the information in the original text is preserved in the translated text; for example, in the Mmetse/Mathematics Pukuntšu/Dictionary Sepedi/English R-3, the term **addition facts** is translated as ***dintlha tša tlhakantšho*** and the information in the SL is preserved in the TL.

A distributive paraphrase deals with the distribution of information that is different from the information in the ST. This kind of paraphrase alters the word order that affects the information structure or word order in the TT. This can happen if it is a form of split or fused sentences. For example, in The Multilingual Mathematics Dictionary for Grade R-6, the term **automatic teller machine** is translated as ***motšhene wa tšhelete wa go itiriša*** and the information in the ST term is different from the TT equivalent. The message in the TT equivalent has altered words in the form of a sentence making it clear for the user to fully understand. It can be noticed that due to a lack of a lexical word **teller**, the translator distributed information by expanding it to ***motšhene wa tšhelete wa go itiriša***.

An explicative paraphrase involves the selection and addition of words in the TL text. In other words, the words in the TT seem longer than those in the original ST, as there is more clarification in the TT. For example, the mathematics term **baseline assessment** is translated as ***pušeletšo le kelo ya motheo***. The term is explained by adding other information to make it easier for the reader to understand. **Assessment** is translated as ***pušeletšo le kelo*** and the equivalent term is paraphrased by explaining and adding information because there is no lexical item for **assessment.**

An omissive paraphrase refers to omitting some information that was included in the original ST. In other words, the TT then becomes smaller than the ST. In omissive paraphrases, certain information can be selected and skipped in the TT; for example, in **Pukutlhahlo ya Mareo Mphato wa R**, the term **matching counters and number cards** is translated as ***go swantšha dikarata tša dinomoro***. The translator chose to omit information to make it more understandable and shorter to the target group. However, sometimes, omitting certain information may yield a translation equivalent that is not understood. For example, the translation in Northern Sotho ***go swantšha dikarata tša dinomoro*** **(to match number cards)** conveys a different message from the ST term. This may cause confusion and misunderstanding as the original meaning is not fully conveyed.

From the above discussions, paraphrasing is the process of explaining or describing a concept in a short definition. Paraphrasing also describes a concept in detail by using an existing word of a language. Usually, paraphrased term equivalents are not single terms, but rather short definitions of the source concept called paraphrased phrases (Mojapelo, 2018). The advantage of paraphrasing is that it explains the concept descriptively so that the end user will understand clearly. The disadvantage is that it uses phrases or sentences that might create confusion and deviate from the original source.

3.13 Compounding

Compounding is a term creation strategy that is used to create terms by combining two lexical elements together to form a new lexeme. Mabasa (2007) defines compounding as a process of combining two or more free morphemes to form a new term. In addition, Sager (1999) states that compounding forms a new lexeme by combining two or more lexical bases. On the other hand, Moropa (2007) proffers that

compounding is a process of combining one or more lexical elements to form one unit. Furthermore, Gumbo (2016) and Letsoalo (2018) concur with Moropa (2007) that compounding is a term creation strategy that combines existing words or lexical items to form a new word. Moreover, Mojapelo (2018) also asserts that compounds can have two heads on the right and on the left. She further says that compounding comprises a noun to a noun, noun to a verb, adjective to noun, and adverb to noun. In line with Mojapelo (2018), the following examples are compounds and were extracted from the Multilingual Mathematics Dictionary for Grade R-6.

acute angle > *khutlontlha* = *khutlo* + *ntlha* = {**Noun + Noun}**
tangent > *mothalokgoma*= *mothalo*+*kgoma* = {Noun + Verb}
axis > *mothalogare*= mothalo+gare = {Noun + Adverb}

Mabule (2016) and Nteso (2013) state that compounding is a process of coining new terms by combing existing lexical items in the TL. This is an example of words that are coined by combining lexical items in the language: ***account* > *tšhupa* + *letlotlo* = *tšhupa*** meaning that which shows *letlotlo* (money) (that which shows finance). The example was extracted from Multilingual Mathematics Dictionary for Grade R-6. Magagane (2011) and Mojapelo (2018) assert that most compounds in Northern Sotho are derived from coining words using internal resources of the language. For example, a mathematical term, from the Multilingual Mathematics Dictionary for Grade R-6***,*** **tangent - *mothalokgoma* (noun + verb)**. ***Mothalo*** (line) already exists in Northern Sotho vocabulary and *kgoma* (touch) already exists in Northern Sotho. Thus, compounding uses existing words to form new words in the TL. The SL is used to come up with new lexical items in the TL. In addition, Gumbo (2016) remarks that the advantage of compounding is its maximisation of existing words, to derive to new words. She further says that compounding is a term creation strategy that can produce numerous new specialised terms for a language.

Hlugwane (2022) defines compounding as a term creation strategy that involves compound lexemes such as complex terms, phrases or blends. Complex terms are terms with more than one noun. For example, in Mathematics, there are numerous complex terms or multiword terms. These examples were extracted from different mathematical sources; for example, **common fraction - *palophatloditlwaelwa*** or **problem-solving skill - *bokgoni bja tharollo ya marara***. Phrases are terms which start with a verb followed by a preposition or adverb; for example, **perform a**

calculation - *šoma palelo*. Some phrasal verbs are in the form of a sentence; for example, **pen and paper method - *mokgwa wa pene le lephephe***. Another aspect of compounding is that compound words are compositional. According to Mlambo, Matfunywa and Skosana (2022), compositional compounds are two or more words used to create new items that relate the meaning to their compound. Indeed, the Multilingual Mathematics Dictionary for Grade R-3 is an of compositional compound had such an example: **adjacent angle - *khutlobapi***, where the meaning of the two words in Northern Sotho could be derived from the original English term. Mlambo et al. (2022) further say that there are non-compositional compounds in which the meaning of a new item in the compound differs from the traditional meaning in the ST. For example, in **baker's dozen- *lesometharo***, the meaning of the translated term is different from the original ST.

One notable property of compounds is their form of descriptiveness and transparency, as they explain a term using the internal resources of a language. According to Gumbo (2016), compounding is transparent to the native speaker even when the term is unfamiliar. The speaker can deduce the meaning of the term because the term is being described such as in the example, **acute angle- *khutlontlha*** meaning ***khutlo ya go ba le nthla*** (the angle that has a point)**.** Letsoalo (2018) says compounding should be used excessively as a way of using the languages' internal resources to create terms. In addition, Madzimbamuto (2012) asserts that through compound noun formation, new terminologies are created in a language. However, in technical terms, the strategy creates ambiguity, and terms lack specificity. For example, the mathematical term, **base - *motheopalo***, is too general, as any number can be a base. Moreover, the synonym for **abacus** which is translated ***motheopalo*** in *The Multilingual Mathematics Dictionary for Grade R-6* creates confusion and redundancy. Although compounding is efficient for term creation, the structure of the terms becomes too long and uneconomical in their usage. Mojapelo (2018) states that the disadvantage of using compounding is that their translation equivalents are too complex.

Gumbo (2016) asserts that the complex packaged structure of compound terms creates complications, especially in transferring specialised knowledge. For example, in the *Multilingual Mathematics Dictionary for Grade R-6*, the structure of **bisector- *mothaloseripagare*** or ***mothalosephatlogare*** is complex because it comprises several words. It becomes difficult to use this word in a translation text because of its

long and complex structure. Hence, the user will prefer the borrowed word ***paesektha***. Furthermore, Gumbo (2016) argues that long terms might face rejection by the target users because of their uneconomical usage. Madiba (2000) emphasises the power of economic use versus the purism approach. Target users might prefer short, borrowed terms which are precise and quick to communicate an intended message. In addition, Allen and Guy (1974) postulate that, if the word is longer, the less likely it is to be used by speakers. For example, in Mathematics, the translation of the term **cube - *palokatišwatharong*** will not even be used by a student because of its length. Instead, the speaker prefers the borrowed word ***khupu because*** it is closer to the English word. Long and complex terms should be simplified or paraphrased to communicate the intended message depending on the target group. If the intended group has no prior knowledge of the concept, then explaining it descriptively will help with the comprehension of the term. In the translation of the mathematical term **equation - *papišotekantšho***, the user will prefer the borrowed word ***ikhweišene*** than ***papišotekantšho*.** Speakers usually use short and precise words that are quick to understand rather than using a compound word that is long. Katamba (1993) postulates that language users often produce cognitive, trackable and comprehensive linguistic utterances, which explains why speakers refrain from verbalising too long nominal compounds. According to ISO 704 2000 (E), a term is transparent when the concept it designates can be inferred partially without a definition or an explanation. In other words, a term should be concise to effectively communicate the intended message. Citing Gilreath (1993), Gumbo (2016:69) asserts that conciseness or brevity of shortness of the term is according to its orthographic length.

Gumbo (2016) says that the longer the lexical item, the more difficult it is to facilitate communication, especially in a specialised context. In addition, Mojela (2010) submits that compound terms are ambiguous, unfriendly and descriptive and will unlikely be used in any translation text. Target users may prefer to use short words than long difficult words, especially in technical fields. Therefore, compounding is a process of combining two lexical elements to form a new lexeme or word. Two lexical elements are in the form of combining two nouns, a noun and adjectives etc. Compounding can also be used to coin new words by combining two lexical units that already exist in a particular language to form one new lexical word. This strategy seems effective as it uses existing words in a language to create new words in specialised domains.

However, although it may seem effective, its disadvantage is that it creates long and complex terms. Long and complex packaged terms are hard to pronounce and might even face rejection by users. If a term is too complex and long to read, it becomes more difficult to understand, and users resort to simple short words.

3.14 Loan Translation

Loan translation is another strategy that was used to create mathematical concepts into Northern Sotho. Gumbo (2016) states that loan translation is a term creation strategy where the morphological elements of a term are translated word for word to create a new term in the indigenous language. Mukoya (2023:119) says loan translation is a process of translating in a word for word method; for example, ***nkedi dakuterekita*** **(methods of cooking)**, ***nkedi*** **(method) +** ***kutereka*** **(cooking) (literally meaning ways of cooking)**.

Cluver (1989:269) says that loan translation is a process of translating the foreign word morpheme by morpheme into the receiving language. Cluver (1989:269) further says the foreign word pattern is also borrowed in words that have the same internal structure as English; for example, **summit conference** in German is ***Gipfelkonferenz*** **and in French, it is** ***conference au summit***. In Northern Sotho, there are terms which are created that have the same internal structure as English. The mathematical terms from the *Multilingual Mathematics Dictionary for Grade R-6*, **square net -** ***nnete ya sekwere*** and **square brackets -** ***mašakana a sekwere*** are such examples. The translators translated the equivalents by replacing the lexical elements in Northern Sotho word for word. In the term equivalent, ***nnete ya sekwere***, the lexical items were replaced literally through directly borrowed words ***nnete*** **(net)** and ***sekwere*** **(square**) as they are from English. However, the equivalent term ***nnete ya sekwere*** is ambiguous and not understandable. It is not clear whether the net is for fishing or not. It leaves the end user wondering what exactly is meant by ***nnete ya sekwere***. This challenge of artificial terms that are confusing created through loan translation is discussed by Madiba (2000:196) who indicates that in Tshivenḓa, ***tshikalamaina*** **(minor scale)**, ***tshikalo*** **(scale) +** ***maina*** **(minor) (cf. tshikalo tshiJuku)**, where he says that loan translations are sometimes confusing and artificial as they are not clear. On the term equivalent, ***mašakana a sekwere***, it can be noted that that one component of the term equivalent is foreign, and the other component has indigenous

lexical unit, this type of loan translation is partially translated. The term equivalent is clearer and more understandable in the target language.

According to Madiba (2000), there are two types of loan translations, namely, partial loan translation and total or integral loan translation. Madiba (2000:193) explains total or integral loan translation as a process of translating the components of the source word with the indigenous forms in the TL. For example, the word cold war is translated in Swahili as ***vita baridi***. In this example, the components of the source have been replaced by Swahili forms; hence, it is classified as an integrated loan translation. In Northern Sotho, an example of total or integrated loan translation in Mathematics is a term extracted from Multilingual Mathematics Dictionary for Grade R-6, **whole number - *palotlalo***, it is noted that the components of source have been replaced by Northern Sotho forms. Another type of loan translation, according to Madiba (2000:193), is partial loan translation where the foreign concept is used, and it is foreign to the target user. In other words, in partial loan translation, one component of the term is borrowed, and the other is not. For example, the mathematical term, **square root sign - *leswao la skwerute***. In this case, ***skwerute*** is borrowed directly from **square root** whereas **sign** is translated as ***leswao* (sign)** in Northern Sotho. However, the translated equivalent will not confuse the learner because there are some parts that borrowing was used. This will not confuse the learner as they already know the term in English. The translated equivalent will serve as a reference of what they know already and will facilitate learning easily. However, in other instances loan translation occurs in a form of paraphrased terms where to render a meaning in the TL, the term is paraphrased through loan translation. For example, the mathematical term in the *Multilingual Mathematics Dictionary for Grade R-6*, **properties of numbers - *ditšhupetšo tša dinomoro***. Gumbo (2016) also supports this thought by saying that loan translation is a process of borrowing a word from the SL by paraphrasing it to render the meaning in the recipient language.

From the above discussions, loan translation is a process where morphological units of a term are translated word for word to form a new lexical item in an indigenous language. Two types of loan translation are discussed, namely, total or integral loan translation, which is the process of translating two components of the source word with the indigenous forms in the TL. Partial loan translation is the process where one

component of foreign concept is borrowed, and the other component is in the indigenous language.

3.15 Coinage/Neologisms

Besides compounding strategy, new mathematical terms can be created by inventing new words through coinage or neologism. Coinage or neologism is a process of creating or inventing new words that do not exist in a particular language. These new words are therefore accepted permanently and used by the speech communities that did not have the invented concept or word. Maleka (2005) says although some features of coinages or neologisms are accepted permanently, some will become permanent whereas for others, it is impossible to predict whether they will survive or die. In Northern Sotho, coined words are dying out. For example, the coined words extracted from the Sesotho sa Leboa Terminology No 4 1988, such as ***kgotlaomone*** as a translation equivalent of ***jam***, ***kukunama*** as a translation of ***meatpie*** and ***foofo*** as a translation equivalent for **tea** are either no longer used or are dying out. This is because the speakers choose short, borrowed words instead of the coinages.

Different scholars use the words neologisms and coinage interchangeably, as they regard them as the same thing. This study used coinage. Gumbo (2016) defines coinages as new lexical entries that did not exist before in a language. She further says that coinages are original terms and are also referred to as neologisms. In addition, Magagane (2011) defines coinage as a term formation strategy that is used to coin new terms for new inventions in technology. Moreover, Hlungwane (2022) asserts that neologism is a new concept that is introduced into a particular language. For Maleka (2005), coinage is described as the creation of new lexical items responding to a change in the external world. She further says that the speech community achieves currency, meaning that a new concept would have been added in the knowledge system of a speech community that will be lacking a particular concept.

Mabela and Ditsele (2024) as well as Mojela (2010) define coinage is in two folds, that is, firstly, in coinage, the meaning of the word is adopted and secondly, the meaning of the foreign lexical is associated with a native existing word. For Mojela (2010:702), coinage is a form of indirect borrowing, where the meaning or sense of the foreign lexical is taken and not the lexical itself. He further says that such a concept is

associated with the indigenous word. Mojela (2010) further asserts that, a word which previously referred to a known concept in Northern Sotho, has its meaning extended to refer to a new concept with a closer affinity with the known concept. For example, the term ***khutlo* – corner**, according to the *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete* defines the term as "***lefelo leo le lego makopanong a dilo tše pedi, go swana le magahlanong a meboto, maboto, maswika bjalobjalo, leo le sa bonagalego ka ge le bontšha go khutha***." ***Khutlo*** here refers to ***full stop*** in the context of grammar while in Mathematics, it refers to ***angle***. In other words, ***khutlo*** has three equivalents in different contexts, thus creating polysemous words which further create ambiguity and confusion. Mojela (2010) adds that coined lexical items are ambiguous, polysemous and difficult to lemmatise. In the researchers' opinion, in a technical context such as Mathematics, ***angle*** should have been borrowed as ***enkele*** in Northern Sotho. This is because ***enkele*** would be a new word added to the Northern Sotho vocabulary. The translation is direct, specific and can be used in a scientific context, unlike ***khutlo*** which has other meanings.

Mabela and Ditsele (2024) say coinage is a form of borrowing linguistics in which the meaning of a word is adopted. They further say that the meaning of the foreign lexical item (scientific or mathematical) is associated with a native word. For example, in **abacus-*mmadiphetana***, the association is that ***abacus*** comprises beads; hence, in Northern Sotho, the equivalence is ***mmadiphetana***. ***Mmadiphetana*** has two compound words ***mma*** + ***diphetana*** (literally the mother of beads), which creates confusion because an **abacus** is not always made with beads and is not a person as the Northern Sotho word implies.

Another example is seen in the term **axis-*mothalogare***, the Northern Sotho coined word has two words ***mothalo*** + ***gare***, which literally means a line on the centre. Does this mean that any line on the centre is axis? This creates ambiguity because it can mean anything besides axis. The word should have been transliterated as ***eksisi*** and then described as a synonym for the reader to fully understand; for example, ***eksisi/ mothalo wa gare***. In this way, the reader will understand that ***eksisi*** is synonymous with ***mothalogare***. Usually, in coinage, English scientific words are connected to pre-existing Northern Sotho words to produce new scientific concepts to communicate the message (Mabela and Ditsele, 2024). In other words, a terminologist uses existing words to describe the function of a lexical item to generate a new lexical item. In

accord, Nteso (2013) says coinage includes creating terms according to their respective functions. For example, the mathematical term extracted from the *Multilingual Mathematics Dictionary for Grade R-6*, **calculator-*sebaledi***, the equivalence was generated by explaining the function of the calculator, which is to count. However, ***sebaledi*** is ***selo sa go balela***, which can also be **counter** in Mathematics. As such, the equivalent ***sebaledi*** relates to both **calculator** and **counter**, thus creating polysemous, general and inaccurate terms. This creates terms that are not accurate and specific and will not communicate the intended message. Mabule (2016) says that terms should be accurate and convenient to serve the intended purpose. New coinages can be complex or multiword terms (Gumbo, 2016; Hlungwane, 2022); for example, **cuboid - *sebopegotaese* = *sebopego* + *taese* = noun+ noun** or **decimal notation** and ***mongwalopalotesimale* = *mongwalo* + *palo* + *tesimale* = noun + noun + noun**.

Although coinage is an effective strategy for developing terms in indigenous languages, it creates ambiguous and synonymous terms, thus creating redundancy in a language. Mojela (2010) asserts that coinage leads to widespread ambiguity in a language. He adds that coinage creates many lexical items in Sesotho sa Leboa that have the same lexical name referring to different things; for example, ***sebaledi*-calculator**, and ***sebaledi*-counter**. Overall, coinage is the process of inventing new words that do not exist in a language. New words can be invented by attaching the existing words to the new domain by assigning their meaning to fit the new context in the new scientific domain.

3.16 Deideophonisation

This is the process of forming terms through sounds that resemble the object or action named. In Northern Sotho, there are terms that were created looking at the sound or action of the word (Mtintsilana and Morris,1988), for example,

sethuthuthu	***motor bike***
sethunya	***gun***
phaphapha	***windmill***
diphathaphata	***sandals***

3.17 Adoption from Other African Languages (Internal Borrowing)

African languages tend to borrow from each other often within the same group and at times outside of the language group. In Northern Sotho, Mtintsilana and Morris (1988) proffer these examples:

tšhaiša	***shayisa* (IsiZulu) (knock off time)**
makoti	***makoti***
sekhambelele	***sekhambeleni***
pokolo	***imbhongolo***

3.18 CHAPTER SUMMARY

This chapter discussed the theoretical framework that underpinned the study, namely CTT and DTS, and further elucidated the research design and methodology. It also expounded on the term creation strategies used to develop mathematics terminology. It also expounded on the population and sampling techniques of the study, data collection and analysis methods, quality criteria and ethical considerations. The next chapter presents, analyses and discusses the data.

CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter discusses research design and of this study. Before highlighting what, a research methodology and research design involve, it is fitting to define the concept research. According to Patel and Patel (2019), research is a scientific systematic search for valid information on a specific topic. Hurst (2023) defines research as a specific approach of investigation based on evidence where conclusions can be drawn from observable data, and this observable data can be evaluated. According to Goundar (2012), research is an examination that strives to find explanations to scientific and social problems through systematic and impartial analysis. Goundar (2012) further explains research as a search for knowledge that can be collected from various sources such as books, journals, human beings, experience and nature.

4.1 Research Design

Rajasekar and Verma (2013) define research design as diverse practices to be used in solving research problems and the information, period related to the problem. According to Leavy (2014), research design is a building plan for research. Bloomfield and Fisher (2019) say research design is a plan or blueprint that is used to conduct a study by researchers, and this plan also helps researchers to answer a specific research question. Kanyane (2018) describes it as a plan that guides the implementation of the study and informs the purpose and the problem of the study. Burns, Grove and Gray (2015) mention three distinct elements in a research design, which are a plan, a structure and a strategy. In other words, a research design is a strategic framework of conducting research by determining a hypothesis, analysing and interpreting the data. Furthermore, the research design is guided by the purpose and problem of the study.

4.2 Research Methodology

Rajasekar and Verma (2013) define research methodology as a systematic procedure that researchers use to describe, explain and predict a phenomenon. Patel and Patel (2019) explains it as a scientific systematic way to solve research problems. For Goundar (2012), research methodology is a structured systematic way of solving the research problem. Goundar (2012) further explains that research methodology seeks to answer the why, how and what of a study. In other words, the research methodology

clarifies why a study should be undertaken, defines the research problem and the way the hypothesis has been formulated. Goundar (2012) also explains that research methodology explains the method(s) used to collect data and the kind of data collected.

4.3 Types of Research Methods

This section discusses types of research methods, namely, qualitative research method, quantitative research method and mixed methods.

4.3.1 Qualitative research method

This study employed a qualitative research method. According to Hennik, Hutter and Bailey (2020) , qualitative research is a method of allowing a researcher to investigate people's experience in detail by using research methods such as in-depth interviews, focus groups and life histories or biographies (Tisdell et al ,2025) .

affirm that in qualitative research, the interesting thing that researchers investigate is the understanding of how people interpret their experiences and how they shape their views of the world, and how they relate meaning with their experience.

Leavy (2014) adds that qualitative research is a way of understanding, describing, explaining, unravelling, illuminating, chronicling and documenting social life. Leavy (2014) further states that it involves the study of others and self, and the relationships between people and their own entanglements. Creswell (2018) says qualitative research is an approach that is used to understand and explore the meaning associated to individuals or groups in a social or human problem. For Hurst (2023), qualitative research is about the social world that does not use numbers in its analysis. Goundar (2012) agrees that qualitative research is non-numerical, uses words and involves phenomenon involving quality. Overall, this method of research focuses on interpreting social phenomena to understand the world through human experiences. In this way, it analyses complex relationships among people and how they view the world around them. It is non-numerical. This research method was suitable to study which analysed term creation as a phenomenon or an experience from a subjective or human-centred perspective. The method is descriptive in nature and as such, this study described the term creation strategies. Goundar (2012) affirms that qualitative research aims to describe the meaning of phenomena.

4.3.2 Quantitative research method

Watson (2015) says the quantitative research method entails various systematic methods concerned with investigating social phenomena using numerical and statical data. Watson (2015) further says that it encompasses measurement and suggests that the phenomenon under study can be measured. Goundar (2012) that quantitative research views phenomena based on measurement expressed in quantity or amount. Ahmed et al. (2019) say quantitative research relies on numerical, computational and statistical data methods. They further explain that its objective is to establish a cause-and-effect relationship between two variables. Goertzen (2017) adds that this research involves collecting and analysing structured data that can be numerically represented. On the other hand, Creswell (2018) defines quantitative research as an approach of testing objective theories by examining the relationship between among variables These variables in turn can be measured typically on instruments, so that numbered data can be analysed using statistical procedures.

4.4 POPULATION AND SAMPLING

Sampling is “the process of choosing a sample of a population from an individual`s or a large group for a certain type of research objective” (Makwana et al., 2023: 763). In other words, sampling is done to obtain precise data (Makwana et al., 2023). Bhardwaj (2019) adds that sampling is a method of selecting a sample from an individual or a large group of population for a certain kind of research purpose. In other words, in research, a sample is a group of people, items or objects that are extracted from a large population for measurement (Bhardwaj, 2019). Furthermore, sampling helps in research when the population size is large. In addition, one of the advantages of sampling is that it saves time and money, enables us to assess the sampling error and when resources are limited sampling is the best (Bhardwaj, 2019).

From these discussions, sampling is the process of choosing a sample from individual or a large group of population to achieve the purpose of a kind of research. In this study the sample, is the mathematics dictionaries and other additional documents that supplement the dictionaries. The mathematics dictionaries were from Grade R-6, which is the foundation and intermediate phase. Other additional documents are also from foundation and intermediate phase. Furthermore, the researcher selected a sample from a large population of mathematics documents in Northern Sotho. The

researcher selected only mathematics dictionaries from grade R-6 which covers the foundation phase to intermediate phase. According to Bhardwaj (2019) there are two types of sampling which are namely, probability and non-probability sampling. Probability sampling is a type of sampling that focuses on the known probability of each member of the population being in the selected sample (Bhardwaj, 2019). Non-probability sampling is a type of sampling in which the likelihood of each member of the selected population for the sample is unknown (Makwana et al., 2023). Furthermore, purposive sampling is a type of non-probability sampling in which individuals are selected for inclusion in a sample based on their importance to the objectives to the research (Makwana et al., 2023). In other words, in this type of sampling, the members for a sample are selected according to the purpose of the study (Bhardwaj, 2019).

In this study, purposive sampling was used as a method of selecting the documents that were used to obtain research aim, which was to analyse term creation strategies used in the development of mathematics dictionaries. The mathematics dictionaries were deliberately selected for mathematics grade R-6 and other related mathematics documents with the same context related to mathematics dictionaries. These dictionaries were deliberately selected to achieve the purpose of what the research needs to achieve. The sample helped the researcher to achieve the objectives of the study. By choosing this sample purposively, the study also revealed whether the strategies used in the sampled documents followed the correct spelling of Northern Sotho during term creation process.

The corpus of this study encompassed a comprehensive collection of written documents, including dictionaries, term lists, Curriculum and Assessment Policy Statement (CAPS) documents, and textbooks. The specific sources analysed in this research were as follows:

- Department of Arts and Culture Multilingual Mathematics Dictionary for Grades R–6 (2013), which comprises 65 mathematical terms presented in a tabular format.
- Mmetse/Mathematics Pukuntšu/Dictionary for Grades R–3, containing 50 terms, also organised in a tabular format.

- Pukutlhahlo ya Mareo Mphato wa R, which includes 48 terms presented in a tabular form.
- CAPS/Setatamente sa Pholisi ya Lenaneothuto le Kelo Mphato wa 1-3, which provides translations of Mathematics concepts from English into Northern Sotho, consisting of 41 terms in a tabular form.
- Sesotho sa Leboa Terminology No. 4 (1988), which contains 44 terms in a tabular format.
- Mathematiki wa Mahlahla Mphato wa 1, a Mathematics textbook that includes 27 mathematical terms, also presented in a table.

The number of sampled terms varied across different strategies; some strategies had more examples than others. Certain documents also contained a greater number of examples for some strategies compared to others. For example, in the Department of Arts and Culture Multilingual Mathematics Dictionary for Grades R–6 (2013), only 12 examples related to the borrowing strategy were extracted, as this was sufficient for analysis. Regarding the paraphrasing strategy, a maximum of 5 examples per document were included due to the limited availability of such instances. Specifically, the same dictionary provided only 5 examples for paraphrasing, reflecting the scarcity of this strategy in the sources. For the compounding strategy, only 4 examples were drawn from the dictionary because of the small number of occurrences. The loan translation strategy was represented by 10 examples from the same document. Finally, the coinage strategy had a relatively higher representation, with 34 examples extracted. Overall, a total of 65 examples from the Department of Arts and Culture Multilingual Mathematics Dictionary for Grades R–6 (2013) was analysed.

In the Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3, 12 examples related to the borrowing strategy were extracted, deemed sufficient for analysis. For the paraphrasing strategy, only 5 examples were obtained from the document due to limited availability. The compounding strategy was represented by 4 examples from the same source. Regarding the loan translation strategy, 10 examples were sourced from the dictionary. The coinage strategy included 19 terms extracted from the document. In total, 50 examples from the Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3 were analysed.

In the Pukutlhahlo ya Mareo Mphato wa R, 12 examples pertaining to the borrowing strategy were extracted from the document for analysis. The paraphrasing strategy was represented by 5 examples sourced from the same document. For the compounding strategy, 4 examples were drawn from the source. The loan translation strategy included 10 examples from the document, while the coinage strategy accounted for 19 examples. Overall, a total of 50 examples from the Pukutlhahlo ya Mareo Mphato wa R were analysed.

In the CAPS/Setatamente sa Pholisi ya Lenaneothuto le Kelo Mphato wa 1-3, 12 examples related to the borrowing strategy were sourced from the document. For the paraphrasing strategy, only 5 examples were extracted due to the limited number available. The compounding strategy was represented by 4 examples from the same source. Regarding the loan translation strategy, 10 examples were obtained, while the coinage strategy included 16 examples. In total, 47 examples from the CAPS/Setatamente sa Pholisi ya Lenaneothuto le Kelo Mphato wa 1-3 were analysed.

In the Sesotho sa Leboa Terminology No. 4 (1988), 12 examples related to the borrowing strategy were selected from the source. No examples of the paraphrasing strategy were found in this document for analysis. The compounding strategy included 8 examples extracted from the source. For the loan translation strategy, 10 examples were obtained, and the coinage strategy had 13 examples sourced from the document. In total, 43 examples from the Sesotho sa Leboa Terminology No. 4 (1988) were analysed.

In the Mathematiki wa Mahlahla Mphato wa 1, 12 examples related to the borrowing strategy were selected from the document for analysis. No examples of the paraphrasing strategy were found in this document for analysis. Similarly, no examples of the compounding strategy were identified. The loan translation strategy included 6 examples extracted from the document, while the coinage strategy comprised 9 examples. Overall, 27 examples from the Mathematiki wa Mahlahla Mphato wa 1 were analysed. In this study, 288 examples were extracted from six different sources.

4.5 DATA COLLECTION

The study employed content analysis as a data collection method. Krippendorff (2013) defines content analysis as a research procedure for making replicable and valid inferences from texts or other meaning matter to the contexts of their use. According to Kleinheksel et al. (2020), content analysis is a method designed to identify and interpret meaning in recorded forms of communication by isolating small pieces of data. For Elo and Kyngas (2008), content analysis is a is a systematic and objective means to describe phenomena and analyse documents. Hence, the study identified and collected pertinent documents such as mathematical dictionaries in printed and electronic forms to analyse the strategies used by translators to create mathematical terms in Northern Sotho.

According to Renz, Carrington and Badger (2018), content analysis focuses on written or spoken language as communication emphasising on the context of a text or actual content. In this study, content analysis was used to gather data from mathematical dictionaries compiled by different institutions to see whether they conformed to the strategies of term formation and translation, interrogating whether they followed linguistic rules, principles and structure of the Northern Sotho language. On the other hand, other scholars such as Elo et al (2014) explain qualitative content analysis as a research method that is commonly used for analysing and interpreting qualitative data and its meaning. Forman and Damnschoroder (2007) define content as a “generic form of data analysis in that it is comprised of an atheoretical set of techniques which can be used in any qualitative inquiry in which the informational content of the data is relevant”. Therefore, content analysis focuses on analysing written documents, texts or forms of human communication.

4.6 DATA ANALYSIS

The current study analysed documents based on a set of themes; therefore, thematic analysis techniques by (Braun & Clarke 2006) were employed to show how data was organised. Thematic analysis is a method of identifying, analysing and reporting patterns(themes) within data. This method organises and describes data in detail and further interpreting different aspects of the research topic. According to Braun and Clarke (2006), thematic analysis is a qualitative theoretical approach used to analyse qualitative data. In other words, thematic analysis is an analytic method that search for patterns and themes. One of the advantages of this approach is its flexibility and a useful tool in research (Braun & Clarke, 2006).

According to Braun and Clarke (2006), thematic analysis has phases of qualitative research which involves six steps namely familiarising oneself with data. According to Braun and Clarke (2006), this is when a researcher engages themselves in analysing the data they would have collected. Braun and Clarke (2006) further state that the collected data can be done through interactive means that are known before. Analysing data also means that a researcher immerses himself or herself in the data to the extent that they are familiar with the content in depth. In this study, the researcher familiarised herself with the data, by analysing strategies in the data by identifying terms that were developed through different term creation strategies. The researcher identified and wrote down different strategies that were used. The researcher transcribed the data in a tabular format and described the strategy used and the equivalent that was provided in Northern Sotho. Furthermore, Braun and Clarke (2006) talk about the transcription of verbal data, where the data must be transcribed into a form or order during the process of thematic analysis.

In this study, the data that was transcribed was in a form of text or written form. The data was sourced from the mathematics dictionaries and then transcribed in a written form in a tabular form. By transcribing the data in a written form, the researcher familiarised herself with the data so that it could be interpreted in a qualitative manner. Braun and Clarke (2006) say that when the data is transcribed, it retains the information that is needed in its true original nature. In this research, the data that was transcribed in a tabular format, was written in its original nature, without altering it.

Braun and Clarke (2006) state that second phase of thematic analysis is generating initial codes. Here, initial codes are produced from the data by identifying a feature of the data that appears interesting in the process of analysis (Braun & Clarke, 2006). According to Miles and Huberman (1994), coding involves the process of analysis. Furthermore, it involves organising data into groups that are meaningful (Tuckett, 2005). In this current study, the data was organised according to the types of term creation strategies, such as borrowing, compounding, paraphrasing, loan translation and coinage.

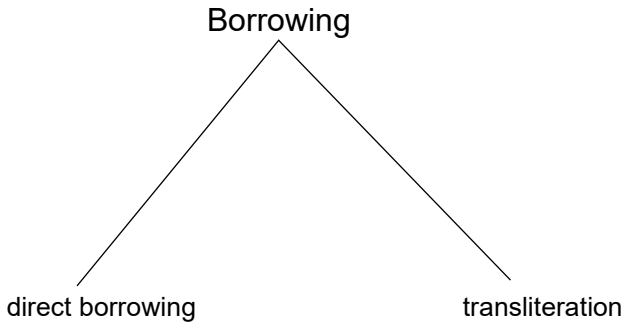
Furthermore, coding depends on whether the themes are data or theory driven. In other words, data that is theory driven when the themes depend on data and is theory driven when the data is approached by asking specific questions that are used to code. In this study, the data was theory driven as specific questions were used to code. In this study, the specific questions that the researcher wished to code around, were 'what term creation strategies were used to develop mathematics dictionaries for grade R-6?' Furthermore, the study questioned if the strategies used followed the correct spelling and orthography of Northern Sotho. In this study, coding was done manually, there was no software that was used to code; in other words, the data was extracted manually. The researcher identified different strategies on each dictionary and wrote them according to each strategy. The researcher grouped the strategies by writing them in a tabular format.

The third phase entails searching for themes. In this phase, after all the data has been collated and collected, the data is listed in codes and is identified across the data set (Braun & Clarke 2006). This phase involves sorting the different codes into potential themes at the broader level of themes. It involves collating all relevant coded data extracts within the identified themes. In this study, the collated coded data were refocused into themes; for example, borrowing, compounding, paraphrasing, loan translation and coinage.

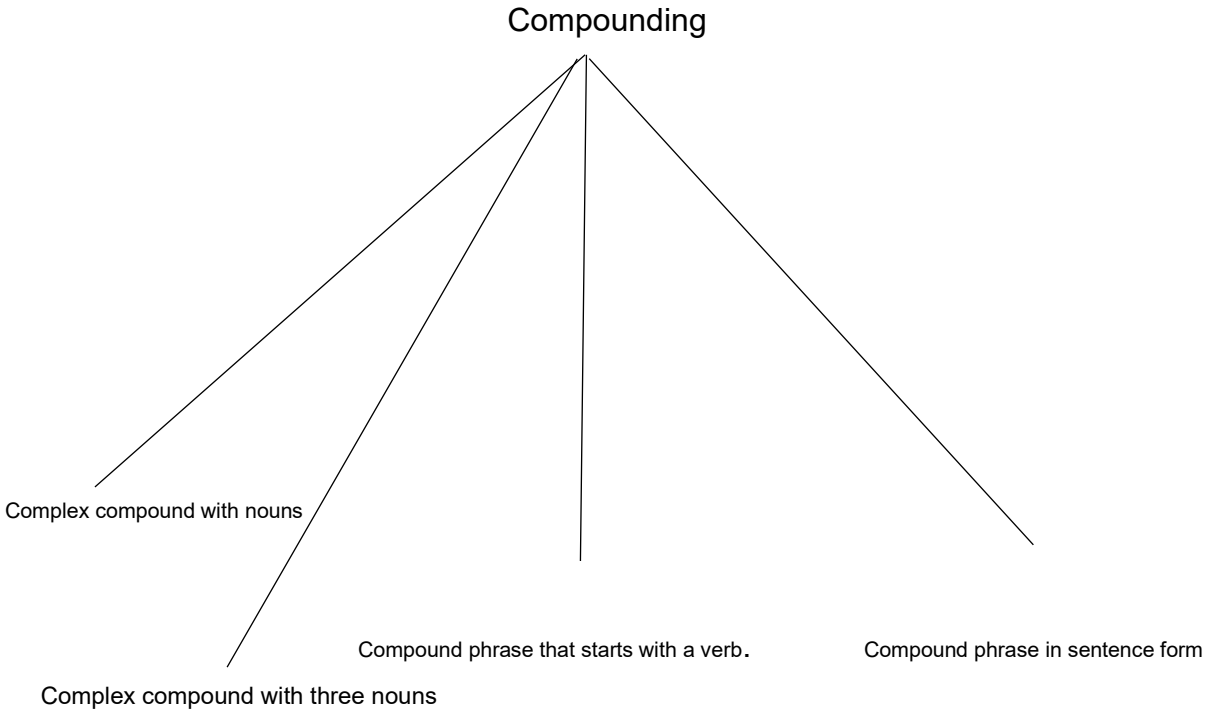
Phase 4 is the reviewing phase, where the researcher checked if the strategies that were used aligned with the collected data. This included re-reading the entire data set to ascertain whether the themes worked in relation to the data set. The second

purpose was to code additional data within themes that may have been missed in the coding stage.

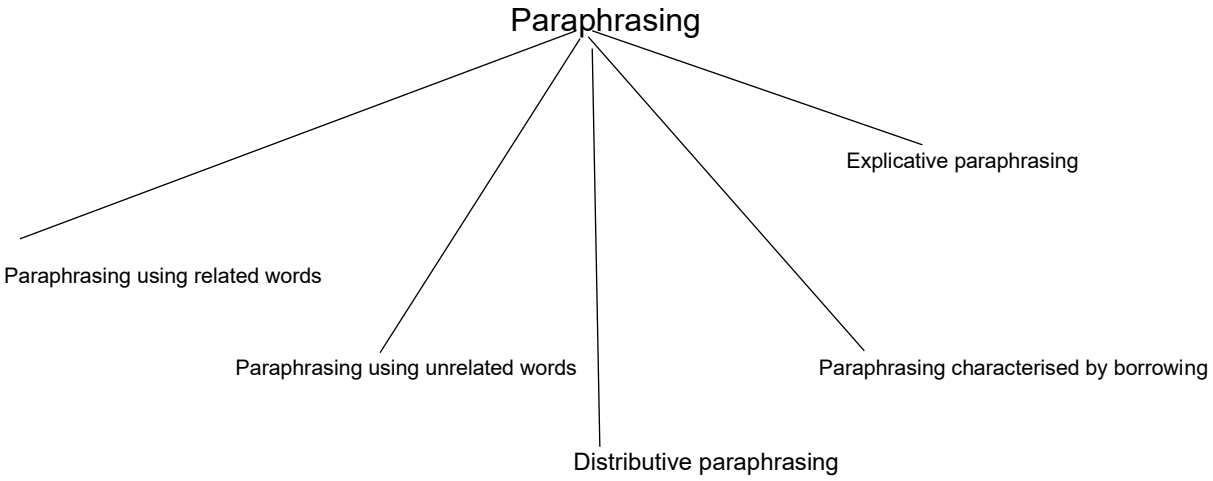
Phase 5 entailed defining and naming themes. In this phase, themes were defined according to how they represented the data with them. According to Braun and Clarke (2006), in this phase, the researcher defines and redefines each theme and determines what aspects of each data the theme captures. In this study, each theme had an aspect of what it captured.



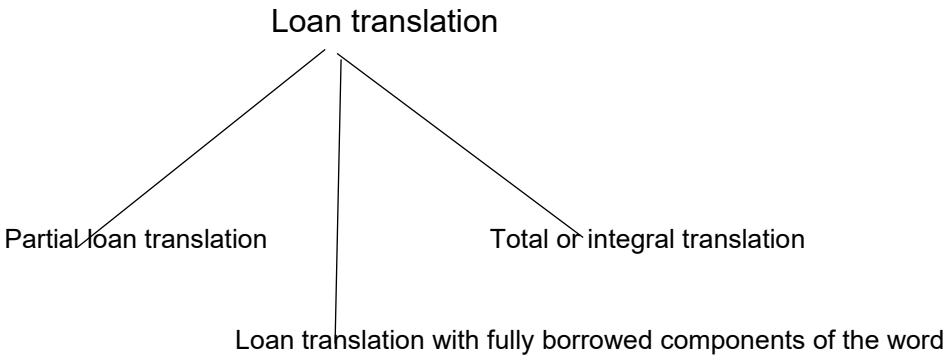
For borrowing with the subtheme of direct borrowing and transliteration.



Compounding which had the subtheme of compounding with two nouns, complex compound that starts with a verb, complex compound with a sentence form.



In paraphrasing, the themes were identified as follows: paraphrasing using unrelated words, paraphrasing using related words, paraphrasing characterised by borrowing, explicative paraphrasing and lastly distributive paraphrasing.



In loan translation, the themes were identified thus: partial loan translation and total or integral loan translation. In this research, each strategy has a sub theme, that was identified that was analysed that formed part of the main strategy.

The last phase of thematic analysis is producing the report. According to Braun and Clarke (2006), this a process of writing a report on the analysis. In this study, term

creation strategies such as borrowing, paraphrasing, compounding, loan translation and coinage were identified as themes for analysis. Furthermore, these themes were defined and given names. These themes that were identified were used in analysis of the data to reach an objective of thin research.

4.7 QUALITY CRITERIA

Qualitative content analysis is commonly used in analysing qualitative data. In qualitative content analysis, the trustworthiness is presented by looking at terms such as credibility, dependability, conformability and transferability.

4.7.1 Credibility

Credibility in qualitative research entails ascertaining whether the research findings are believable. There has been research on term creation strategies, however, none has been done on mathematics. Other studies showed that, term creation strategies such as borrowing, compounding, loan translation and paraphrasing are used for term creation to develop indigenous languages. This study is credible as it shows that, other studies have been done, and findings will also be same as the current study.

4.7.2 Dependability

Dependability refers to when the data is stable over time and under different conditions (Kyngäs et al., 2020). In this study, the dependability is that the data that was sourced from different documents, is stable as it was sourced from different documents which will never change at any circumstance. The documents are dictionaries that were compiled by different institutions meaning that the data extracted is stable as it cannot be changed or affect in any other way. If the same research were to be conducted by another researcher in a different language such as Setswana, the findings could reveal the same as this study.

4.7.3 Confirmability

Confirmability refers to the objectivity that is the potential for congruence between two or more independent people about the data`s accuracy, relevance or meaning (Kyngäs et al., 2020). In other words, the insights of the findings collected are not subjective and don’t have any biased views. In this study, the researcher, analysed six documents from different institutions to arrive at the findings that are not biased and prejudice.

4.7.4 Transferability

Transferability refers to that the findings can be generalised or transferred to other settings or groups. In other words, transferability means that, there is a potential of extrapolation. In this study, the findings can be transferred to another study that can be done in any other language such as Setswana, Xitsonga or IsiNdebele.

4.8 ETHICAL CONSIDERATIONS

The study went through the ethics committee which was given an ethical clearance certificate. The clearance number is attached in the list of appendices. The study maintained academic integrity as it has been submitted to Turnitin to detect plagiarism.

4.9 CHAPTER SUMMARY

This chapter discussed the theoretical framework that underpinned the study, namely CTT and DTS, and further elucidated the research design and methodology. It also expounded on the population and sampling techniques of the study, data collection and analysis methods, quality criteria and ethical considerations. The next chapter presents, analyses and discusses the data.

CHAPTER 5: DATA PRESENTATION AND DATA ANALYSIS

5.1 INTRODUCTION

This chapter presents and analyses the data collected from the DAC Multilingual Mathematics Dictionary for Grade R-6, Mathematiki wa mahlahla Mophato wa 1, Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3, Pukutlhahlo ya MareoMphato wa R, CAPS/Setatamente sa Pholisi ya Lenaneothuto le Kelo Mphato wa 1-3, Sesotho sa Leboa Terminology No 4 1988. The data were presented in a tabular form and thereafter analysed. Each document was analysed at considering various strategies used in the creation of Northern Sotho Mathematics terminology for Foundation and Intermediate phases. The researcher also compared the Mathematics terms in the DAC multilingual Mathematics dictionary with those in other resources.

The main source of Mathematics terminology in Northern Sotho was the Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R- 6 published in 2013 but published in 2003 by the Terminology Coordination Section (TCS) within National Language Service in the Department of Sports Arts and Culture. The aim of the multilingual dictionary was to facilitate and develop terminology in African languages for new concepts that appear in learning areas. The dictionary consists of approximately 1000 entries in all official languages, has different collaborators, linguists, subject specialists and language speakers of the target groups who added term equivalents.

Another dictionary was Mmetse/Mathematics Pukuntšu Dictionary for Grades R–3, developed by Funda Wande, a non-profit organisation that develops high quality learning and teaching materials that are CAPS aligned in indigenous languages. The dictionary is bilingual and includes English and Northern Sotho terms in an alphabetical order. The dictionary has explanations and diagrams for lesson plans and teachers' notes and includes a daily list of lesson vocabulary. The third document was Sesotho sa Leboa Terminology No 4 1988 by the Northern Sotho Language Committee. The Sesotho sa Leboa Terminology No 4 is a term list which is also a unidirectional dictionary but contains a list of terms in two source languages (SLs), English and Afrikaans, and the target language (TL), which is the equivalent language, Northern Sotho. The Sesotho sa Leboa Terminology No 4 has terms to be used in primary schools and were taken from syllabuses for various subjects of primary school

education, including arithmetic and general science. The terms in the list are useful for training in schools and for translators and writers of schoolbooks. The document forms the basis of terminology development in Northern Sotho. It was developed in 1988, meaning that it is the first point of reference regarding standardised terminology and spelling in Northern Sotho.

The fourth document was the Pukutlhahlo ya Mareo Mphato wa R, which is a Grade R Mathematics improvement programme developed by Gauteng Education Development Trust together with Gauteng Department of Education. The concept guide has Mathematics terms as a glossary in both English and Northern Sotho term equivalents. The programme develops Mathematics concepts which are aligned with CAPS. It contains mathematical terms that were beneficial to the study. In addition, the researcher analysed CAPS/Setatamente sa Pholisi ya Lenaneothuto Mphato wa 1-3, developed by the Department of Basic Education. The CAPS document has mathematical English terms and equivalent terms in Northern Sotho. Although CAPS /Setatamente sa Pholisi ya Lenaneothuto Mphato wa 1 -3 is not a dictionary, it was used in this study to supplement the other dictionaries because it contains similar content.

The last document was the Mathematiki wa Mahlahla Mphato wa 1, a textbook of Mathematics, which has been translated from English into Northern Sotho. Although this document is not a dictionary, it was included as a supplement to other dictionaries because its content aligned with the content of the selected dictionaries. It was developed in 1980, meaning it is a first point of reference for mathematical terms in Northern Sotho. The analysis was based on the following questions:

- What are the term creation strategies used by terminologists / translators used to create mathematical terminology in Northern Sotho?
- Are the term creation strategies used easier, clearer and unambiguous?
- Did the term creation strategies adhere to spelling and orthography rules?

5.2 Term Creation Strategies in Northern Sotho Mathematics Terminology

The section discusses term creation strategies such as borrowing, loan translation, paraphrasing, compounding and coinage, which are used to overcome the issue of non-equivalence in Northern Sotho, especially in the mathematical domain. These

strategies are also used to come up with new words in Northern Sotho. Through these strategies, information is transferred from English to Northern Sotho.

The theoretical frameworks that were employed in this research state that term creation is descriptive and not prescriptive (Cabre, 2003; Toury, 1995). Cabre (2003) states that terminology is a set of needs, practices to resolve needs, and a unified field of knowledge. In other words, a need to develop terminology must be there to be met. In this study, the need to develop mathematical terminology in all official languages of South Africa was met through term creation. Furthermore, CTT talks about applications or dictionaries that are products of terminological activities. The tables presented have data collected from different applications or dictionaries for Mathematics in Northern Sotho. In addition, DTS, a product-oriented theory, examines and describes existing translations, namely; ST and TT pairs, such as Mathematics dictionaries and other Mathematics documents. Furthermore, DTS is process-oriented and focuses on what is on the mind of a translator during translation. In this process, a translator decides on translation strategies, such as borrowing, paraphrasing, compounding and loan translation. These strategies are considered next.

5.1 Borrowing

The following table below presents the borrowed terms from English into Northern Sotho. The terms were sourced from Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R-6.

5.1. **Terms from Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R-6. - Borrowing**

Department of Arts and Culture (DAC) Multilingual Mathematics Dictionary for Grade R-6 – Borrowing	**Northern Sotho Equivalent**	**Strategy**
alfabet	alfabete	direct borrowing
block	ploko	direct borrowing
centimetre	sentimetara	direct borrowing
chart	tšhate	direct borrowing
cone	khoune	direct borrowing
trapezium	trapesiamo	direct borrowing

gram	kramo	direct borrowing
kilogram	khilokramo	direct borrowing
rhombus	rompas	direct borrowing
cylinder	silintara	direct borrowing
square	sekwere	direct borrowing
prism	prisima	direct borrowing

Table 1: Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R-6 – Borrowing.

The terms shown in the table above illustrate how mathematical terminology is developed in Northern Sotho. The table consists of three columns: the first lists the English source terms, the second provides their Northern Sotho equivalents, and the third identifies the strategy used to create the terms, which is direct borrowing. The data reveals that some Northern Sotho term equivalents derived from English do not fully conform to Northern Sotho spelling and orthographic rules; for example, ***ploko*** for **block** and ***prisima*** for **prism**. The table also shows that some terms are fully borrowed, while others are only partially borrowed. The researcher believes that for partially translated terms, the dictionary compilers retained the original English form to help learners connect the new term with the familiar English concept. At the same time, the compilers fully borrowed certain terms, adapting their spelling and orthography to make them sound more natural in Northern Sotho. The data revealed that the Communicative Theory of Terminology (CTT) was relevant in this study because direct borrowing emerged as a term creation strategy to develop Mathematics terms in Northern Sotho. Furthermore, the data revealed that Descriptive Translation Studies (DTS) was also relevant as it showed direct borrowing as a decision that the dictionary compilers made during the translation process.

5.2. Terms from the Mmetse/Mathematics Dictionary Grade R-3 - Borrowing

Mmetse/ Mathematics Pukuntšu /Dictionary R-3	**Northern Sotho equivalent**	**Strategy used**
algorithm	alegoritheme	direct borrowing

square	sekwere/khutlonne	direct borrowing
centimeter	sentimatara	direct borrowing
cylinder	silintere	direct borrowing
cents and rands	disente le diranta	direct borrowing
cone	khoune	direct borrowing
currency	kharentshi	direct borrowing
dozen	tosene	direct borrowing
gram	kramo	direct borrowing
kilogram	khilokramo	direct borrowing
pattern	patrone	direct borrowing
prism	prisimo	direct borrowing

Table (2): Mmetse/ Mathematics Pukuntšu /Dictionary R-3 Borrowing

The data in the table was sourced from Mmetse /Mathematics Pukuntšu/Dictionary R-3. The table was organised into three columns: the first column listed the English terms (source terms), the second column provides their Northern Sotho equivalents (target terms) and the third column indicates the strategy used to create these terms, which is direct borrowing. This shows that direct borrowing is a common method for forming mathematical terminology in Northern Sotho. The table reveals that certain mathematical concepts, particularly those related to shapes have been directly borrowed; for example, **prism** was translated as ***prisimo***, ***cone*** as ***khoune*** and ***cylinder*** **as** ***silintere***. Similarly, measurement terms such as **gram** for ***kramo*** and ***kilogram*** for ***khilokramo*** were also directly borrowed. However, for a borrowed term such as ***alegorithime*** for **algorithm** for, the compilers should have provided a descriptive explanation or adapted this term into Northern Sotho to enhance learners' comprehension.

5.3. Terms from Pukuhlahlo ya Mareo Mphato wa R - Borrowing

Pukutlhahlo ya Mareo Mphato wa R	**Northern Sotho equivalent**	**Strategy used**
algebra	altšebra	direct borrowing
blocks	dipoloko	direct borrowing

cone	khouno	direct borrowing
centimetre	sentimetara	direct borrowing
cylinder	silintara	direct borrowing
geometry	tšeometri	direct borrowing
gram	gramo	direct borrowing
kilogram	kilogramo	direct borrowing
pattern	paterone	direct borrowing
rhombus	rompus	direct borrowing
square	sekwere	direct borrowing
trapezoid	trapesoit	direct borrowing

Table 3: Pukutlhahlo ya Mareo Mphato wa R- Borrowing

The data in the table above is taken from **Pukutlhahlo ya Mareo Mphato wa R** and focuses on borrowing as a strategy. The table lists terms in three columns: the first contains the English source terms, the second shows their Northern Sotho equivalents, and the third identifies the strategy used to create the terms, which is direct borrowing. Some English concepts are partially translated, such as **trapezoid** translated as ***trapesoit*** and **rhombus** as ***rompus.*** These terms do not fully adhere to Northern Sotho spelling and orthography, but target readers are unlikely to be confused since the terms closely resemble their English originals. However, learners who are unfamiliar with these concepts may struggle to understand them. Additionally, the table reveals that some directly borrowed terms, such as ***altšebra*** **for algebra**, could still cause confusion among learners.

The data presented in the table above was extracted from **Pukutlhahlo ya Mareo Mphato wa R Borrowing**. The table has a list of terms presented in three columns. The first column comprises English terms as the source text, the middle column has the target term equivalents in Northen Sotho and the third column is the strategy that was used to create the term, which was direct borrowing. From the table above, other English concepts were partially translated; for example, **trapezoid - *trapesoit*** and **rhombus- *rompus***, both term equivalents did not follow the spelling and orthography of Northern Sotho. However, the target readers will not be confused as they will relate to the original orthography of English. However, if the target reader is not familiar with

the concept, they will not understand it. The table also shows that there are other terms that are directly borrowed that could create confusion for learners; for example, **algebra - *altšebra.***

5.4. Terms from CAPS/Setatamente sa Pholisi ya Lenaneothuto le Kelo Mphato wa 1-3 Mmetse – Borrowing

CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1 -3 Mmetse	**Northern Sotho equivalent**	**Strategy used**
algebra	altšebra	direct borrowing
blocks	diploko	direct borrowing
centimetre	sentimetara	direct borrowing
cube	khupu	direct borrowing
cylinder	silintere/selintara	direct borrowing
cone	khounu	direct borrowing
gram	kramo	direct borrowing
geometry	tšeometri	direct borrowing
kilogram	kilogramo	direct borrowing
prism	prisima	direct borrowing
set	sete	direct borrowing
square	sekwere	direct borrowing

Table 4: CAPS / Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1-3 Mmetse- Borrowing

The data shown in the table above was sourced from CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1-3 Mmetse. Presented in a tabular format, the information was organised into three columns. The first column lists the English source terms, the second column provides their Northern Sotho equivalents, and the third column indicates the strategy used by the compilers to develop the Northern Sotho Mathematics terminology. It is noticeable in the table that some term equivalents include aspirated consonants, while others do not; for example, **cone-*khoune* and**

kilogram-*kilokramo*. The reason for this inconsistency in the use of aspirated sounds is unclear. Nevertheless, the directly borrowed terms appear to be more effective, as they closely correspond to the English concepts and thus can facilitate easier learning for students.

5.5. Terms from Sesotho sa Leboa Terminology No 4 1988 - Borrowing

Sesotho sa Leboa Terminology No 4 1988	**Northern Sotho equivalent**	**Strategy used**
cone	khouni	direct borrowing
cylinder	selintere	direct borrowing
centimetre	sentimetara	direct borrowing
gram	kramo	direct borrowing
hectoliter	hektolitara	direct borrowing
kilogram	kilokramo	direct borrowing
parallelogram	paralelokramo	direct borrowing
pyramid	phiramiti	direct borrowing
quarter	kwarata	direct borrowing
rhombus	rompase	direct borrowing
square	sekwere	direct borrowing
trapezium	trapesiamo	direct borrowing

Table 5: Sesotho sa Leboa Terminology, No 4. 1988 - Borrowing

The data on the table above was taken from Sesotho sa Leboa Terminology. No 4. 1988. This terminology was designed for use in primary schools and served as the initial foundation for developing Northern Sotho terminology. The creators of Terminology No. 4 employed direct borrowing to form mathematical terms in Northern Sotho, as shown in the table; for example, **trapezium** is translated as ***trapesiamo***. The compilers preserved the root of the English word to indicate that the term was not originally from Northern Sotho. Partial borrowing is effective because it minimises confusion, given that learners are already familiar with the concept in English. Additionally, direct borrowing facilitates language learning by helping learners easily connect the borrowed term with its English counterpart.

5.6. **Terms from Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition -Borrowing**

Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition	**Northern Sotho equivalent**	**Strategy used**
centimetre	sentimetara	direct borrowing
change	tšhentšhi	direct borrowing
graph	kerafo	direct borrowing
gram	kramo	direct borrowing
half centimetre	hafosentimitara	direct borrowing
kilogram	kilokramo	direct borrowing
pattern	paterone	direct borrowing
square	sekwere	direct borrowing
mass	masa	direct borrowing
litre	litara	direct borrowing
set	sete	direct borrowing
number	nomoro	direct borrwoing

Table 6: Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition- Borrowing

The data shown in the table above was taken from **Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition, a** Mathematics textbook written in Northern Sotho. The table was organised into three columns: the first column lists the original English mathematical concepts, the second column provides their corresponding Northern Sotho terms, which were developed by the textbook's authors, and the third column explains the method used to create these Northern Sotho terms. The authors primarily employed direct borrowing as the strategy to formulate Mathematics terminology in Northern Sotho; for example, **set-*sete.***

5.2. Paraphrasing

The following examples in the tables are from different Mathematics documents, and they show how terms were created using paraphrasing.

5.7. Terms from Department of Arts and Culture (DAC) Multilingual Mathematics Dictionary for Grade R-6 - Paraphrasing

DAC Multilingual Mathematics Dictionary	Northern Sotho Equivalent	Strategy
ascending order	maemo a go namelela mokgwa wa go namelela	paraphrasing by using unrelated words
automatic teller machine	motšhene wa go ntša tšhelete	distributive paraphrasing
cardioid	sebopego sa pelo	paraphrasing by using related words
constant function	khii ya sebaledi ya go fa karabo	explicative paraphrasing
Kite shape	sebopego sa khaete	paraphrasing characterized by borrowing

Table 7: Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R-6- Paraphrasing

The data in the table above was sourced from the Department of Arts and Culture's Multilingual Mathematics Dictionary for Grades R-6. The table consists of three columns: the first lists the English terms as the original ST; the second provides their corresponding equivalents in Northern Sotho; and the third describes the strategy used to develop these terms, specifically paraphrasing. This table illustrates various paraphrasing methods applied to formulate mathematical terminology in Northern Sotho. The data indicates that new terms can be created by using words related to the original concept in the SL to form equivalent expressions in Northern Sotho. For example, the term **cardioid** is translated as ***sebopego sa pelo***, which will be clearly and easily understood by learners.

5.8. Terms from Mmetse/Mathematics Dictionary R-3 - Paraphrasing

Mmetse/ Mathematics Pukuntšu /Dictionary R-3	Northern Sotho equivalent	Strategy used
analogue clock	sešupanako sa manaka	paraphrasing by using unrelated words
ball shapes	dibopego tša kgwele	paraphrasing by using related words
bathroom scale	sekala sa ka ntlwaneng ya bohlapelo	explicative paraprasing
calibaration lines	methalo ya go swaiwa	distributive paraphrasing
compass direction	ditaetšo tša khamphase	paraphrasing charecterised by borrowing

Table 8: Mmetse/Mathematics Pukuntšu / Dictionary R-3 – Paraphrasing

The data in the table above was sourced from **Mmetse/Mathematics Pukuntšu/ Dictionary R-3**. The table consists of three columns: the first lists the English terms as the original ST; the second provides their corresponding equivalents in Northern Sotho; and the third describes the strategy used to develop these terms, specifically paraphrasing. This table illustrates various paraphrasing methods applied to formulate mathematical terminology in Northern Sotho. The data shows that terms can be formulated by using words that are not related to the original source concept to create a term equivalent in Northern Sotho. For example, **analogue clock-** ***sešupanako sa manaka.*** This type of strategy helps create terminology that is simple and easy to understand.

5.9. Terms from Pukuthlahlo ya Mareo Mphato wa R - Paraphrasing

Pukutlhahlo ya Mareo Mphato wa R	Northern Sotho equivalent	Strategy used
different orientations	dikhutlo tša go fapana	paraphrasing by using

		unrelated words
geometric shapes	dibopego tša tšeometri	paraphrasing charecterised by borrowing
repeating patterns	dibopego tša go boeletša	paraphrasing by using related words
Square based pyramid	Phiramiti ya botlase bja sekwere	explicative paraphrasing
Triangular based pyramid	Phiramiti ya botlase bja khutlotharo	distributive paraphrasing

Table 9 : Pukutlhahlo ya Mareo Mphato wa R - Paraphrasing

The data in the table above was sourced from **Pukutlhahlo ya Mareo Mphato wa R**. This table outlines the strategies and term equivalences used for Mathematics terminology in Northern Sotho at the foundation phase. It consists of three columns: the first lists the English source terms, the second provides their Northern Sotho equivalents, and the third indicates the strategy used to create the terms, which is paraphrasing. The table highlights various forms of paraphrasing applied in developing Northern Sotho mathematical terminology. Notably, explicative paraphrasing is one such strategy, as seen in the term for **square based pyramid**, which has been translated as ***phiramiti ya botlase bja sekwere*** This approach effectively creates terms by clarifying and making concepts easier to understand for Northern Sotho learners.

5.10. Terms from CAPS/ Setatamente sa Pholisi sa Lenaneothuto la Kelo Mphato wa 1-3 Mmetse – Paraphrasing

CAPS/ Setatamente sa Pholisi sa Lenaneothuto	Northern Sotho equivalent	Strategy used

la Kelo Mphato wa 1-3 Mmetse		
assymetry	**go ripagare ka go swana**	explicative paraphras**ing**
concrete objects	**dilo tša go swarega**	paraphrasing using unrelated words
calculation skills	mabokgoni a palelo	paraphrasing using related words
two-digit number	palotee ya dinomoro tša go tša 2	distributive paraphrasing
mental maths	metse wa hlogo	Paraphrasing characterised by borrowing

Table 10: Caps/Setatamente Sa Pholisi Sa Lenaneothuto Le Kelo Mphato Wa 1-3 Mmetse - Paraphrasing

The information in the table above was sourced from the *Caps/Setatamente Sa Pholisi Sa Lenaneothuto Le Kelo Mphato Wa 1-3 Mmetse*. This table outlines the strategies and term equivalence for Mathematics vocabulary in Northern Sotho at the foundation phase level. It contains three columns: the first lists the English terms (ST), the second provides their Northern Sotho equivalents, and the third specifies the strategy used to develop each term which is paraphrasing. The data indicates that paraphrasing, often involving borrowing, is a key method employed in forming mathematical terminology in Northern Sotho; for example, **mental maths-*mmetse wa hlogo***.

5.3. Compounding

The following are examples of compounding from different Mathematics dictionaries.

5.11. **Terms from Department of Arts and Culture Multilingual Mathematics Dictionary - for Grade R-6 -Compounding**

DAC Multilingual Mathematics Dictionary	**Northern Sotho Equivalent**	**Strategy**

base	motheopalo	complex compounding with two nouns
bisector	mothaloseripagare	complex compound with three nouns
pen and paper method	mokgwa wa pene le lephephe	phrasal compounding
perform a calculation	šoma palelo	compounding phrase that starts with a verb

Table 11: DAC Multilingual Mathematics Dictionary Grade R-6- Compounding

The data on the table above was sourced from the *DAC Multilingual Mathematics Dictionary Grade R-6.* This table outlines the strategies and term equivalents for Mathematics vocabulary in Northern Sotho at the foundation phase level. It contains three columns: the first lists the English terms (ST), the second provides their Northern Sotho equivalents, and the third specifies the strategy used to develop each term, which is paraphrasing. The data indicates that different types of compounding are used to create terminology in Northern Sotho. The data shows that complex compounding can be used by combing two nouns to create a term equivalent in Northern Sotho: for example, **base - *motheopalo***.

5.12. Terms from Mmetse/Mathematics Pukuntšu / Dictionary R-3 - Compounding

Mmetse/Mathematics Pukuntšu / Dictionary R-3	**Northern Sotho equivalent**	**Strategy used**
add hundreds	hlakanya makgolo	compound phrase that starts with a verb
odd number	palotlhokatatelano	complex compound with three nouns
even numbers	dinomorotatelano	compound with two nouns

long and shorthand on clock	lenaka le le telele le le lekopana mo tšhupanakong.	phrasal compound in a sentence form

Table 12 : Mmetse/Mathematics Pukuntšu / Dictionary R-3- Compounding

The data on the table above was sourced from **Mmetse/Mathematics Pukuntšu / Dictionary R-3**. This table outlines the strategies and term equivalence for Mathematics vocabulary in Northern Sotho at the foundation phase level. It contains three columns: the first lists the English terms (ST), the second provides their Northern Sotho equivalents, and the third specifies the strategy used to develop each term, which was paraphrasing. The data indicates that different types of compounding are used to create terminology in Northern Sotho. The data shoes that complex compounding can be used by combing three lexical items (noun + verb + noun) to create a term equivalent in Northern Sotho; for example, **odd number - *palotlhokatatelano.***

5.13. Terms from Pukutlhahlo ya Mareo Mphato wa R - Compounding

Pukutlhahlo ya Mareo Mphato wa R	**Northern Sotho equivalent**	**Strategy used**
build 3D object	aga dilo tša 3D	compound phrase that starts with a verb
Copy and complete patterns	Go kopolla le go feleletša dipatrone	compound phrase in a sentence form
Position, orientation and views	maemo, peakanyo le pono	complex compound with three nouns
3 dimensional	mahlakoretharo	compound with two nouns

Table 13: Pukutlhahlo ya Mareo Mphato wa R- Compounding

The information presented in the table above came from *Pukutlhahlo ya Mareo Mphato wa R*. This table presents the strategies and term equivalence for Mathematics vocabulary in Northern Sotho at the foundation phase. It is organised into three columns: the first shows the English terms (ST), the second lists their Northern Sotho translations, and the third explains the strategy used to form each term, which is paraphrasing. The data reveals that various forms of compounding are employed in developing Northern Sotho mathematical terminology. The above data shows that terms are created through compounding using phrases in a form of sentence; for example, **copy and complete patterns - *go kopolla le go feleletša dipatrone.***

5.14. Terms from CAPS/ Setatamente sa Pholisi sa Lenaneothuto le Kelo Mphato wa 1-3 Mmetse – Compounding

caps/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1-3 Mmetse	Northern Sotho Equivalent	Strategy
subtract from 999	ntšha go thoma ka 999	compounding phrase that starts with a verb
digit	palotee	complex compounding with two nouns
position orientation and views	Boemo, tsebišo le dipono	complex compound with three nouns
building up and breaking down	Go agantšha le go hlahlamolla dinomoro	compound phrase in a sentence form

Table 14: CAPS/ Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1 -3 Mmetse -Compounding

The data on the table above is sourced from the **CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1-3 Mmetse**. This table outlines the strategies and

term equivalence for Mathematics vocabulary in Northern Sotho at the foundation phase level. It contains three columns: the first lists the English terms (ST), the second provides their Northern Sotho equivalents, and the third specifies the strategy used to develop each term, which is compounding. The data indicates that different types of compounding are used to create terminology in Northern Sotho; for example, compound phrase that starts with a verb, ***subtract from 999 - ntšha go thoma ka 999***

5.15. Terms from Sesotho sa Leboa Terminology No 4 1988 - Compounding

Sesotho sa Leboa Terminology No 4 1988	**Northern Sotho Equivalent**	**Strategy**
three dimensional	mahlakoremararo	compound with two nouns
right angled triangle	khututlotharothwii	complex compound with three nouns
semicircle	sedikohalofo	compound with two nouns
numeral	tlhakapalo	compound with two nouns
multiplication sign	leswaokatišo	compound with two nouns
multilplication table	lenaneokatišo	compound with two nouns
semicircular	sedikohalofo	compound with two nouns
straightline	mothalothwii	compound with two nouns

Table 15: Sesotho sa Leboa Terminology No 4 1988- Compounding

The information on the table above was sourced from Sesotho sa Leboa Terminology No 4 1988. The table outlines the strategies and term equivalence used for Mathematics terminology in Northern Sotho at the foundation phase level. It contains three columns: the first lists the English terms as the ST, the second provides the corresponding Northern Sotho terms, and the third describes the strategy used to form the term, which is compounding. The table highlights various forms of compounding

applied to develop mathematical terms in Northern Sotho. Notably, it shows that there were only compounds consisting of two nouns which were used to create these terms: for example, ***numeral-tlhakapalo****.*

5.4 Loan translation

The following tables has examples of loan translation from different documents.

5.16. **Terms from Department of Arts and Cultural Multilingual Mathematics Dictionary for Grade R- 6 – Loan translation**

DAC Multilingual Mathematics Dictionary	**Northern Sotho Equivalent**	**Strategy**
number symbols	sekapalo	loan translation
number line	mothalopalo	loan translation
number phrase	sekafokopalo	loan translation
number name	leinapalo	loan translation
number skill	bokgonipalo	loan translation
number system	tselapalo/mokgwapalo	loan translation
pair of compass	phere ya khamphase	loan translation
percentage sign	leswao la phesente	loan translation
whole number	palotlalo	loan translation
square net	nnete ya sekwere	loan translation

Table 16: DAC Multilingual Mathematics Dictionary Grade R-6 – Loan translation

The information presented in the table above came from the *DAC Multilingual Mathematics Dictionary for Grades R-6*. This table details the approaches and equivalence of mathematical terms in Northern Sotho. It is organised into three columns: the first displays the English ST, the second shows their Northern Sotho equivalents, and the third explains the method used to create the term, which is loan translation. The data illustrates various types of loan translations used for Northern Sotho mathematical terms. For instance, some translated terms consist entirely of indigenous language elements, such as ***palotlalo*****, -whole number** while in other cases, both parts of the term are borrowed, as seen in ***nete ya sekwere*** **- square net**.

5.17. **Mmetse/Mathematics Pukuntšu / Dictionary R-3 – Loan translation**

Mmetse/Mathematics Pukuntšu / Dictionary R-3	Northern Sotho Equivalent	Strategy
box shapes	dibopego tša lepokisi	loan translation
even numbers	dinomorotekano	loan translation
fraction squares	dikwere tša palophatlo	loan translation
formal unit	yuniti ya semmušo	loan translation
graph tittle	hlogo ya kerafo	loan translation
geometric solid	soliti ya tšeometriki	loan translation
number line	mothalopalo	loan translation
number phrase	sekafokopalo	loan translation
number name	leinapalo	loan translation s
whole numbers	palotlalo	loan translation

Table 17: Mmetse/Mathematics Pukuntšu / Dictionary R-3- Loan translation

The data in the table above is extracted from the **Mmetse/Mathematics Pukuntšu / Dictionary R-3 .** This table outlines the strategies and term equivalence used for Mathematics terminology in Northern Sotho. It contains three columns: the first lists the English terms as the ST, the second provides the corresponding Northern Sotho terms, and the third describes the strategy used to form the term, which is loan translation. The data highlights different forms of loan translations applied mathematical terms in Northern Sotho. For example, there are loan translations where the translation equivalent terms have both components in indigenous language, **number line - *mothalopalo*** and in other instances, the term equivalent have borrowed both the components; for example, **geometric solid for *soliti ya tšeometriki*.**

5.18. **Pukutlhahlo ya Mareo Mphato wa R - Loan translation**

Pukutlhahlo ya Mareo Mphato wa R	Northern Sotho Equivalent	Strategy
height chart	tšhate ya bogodimo/botelele	loan translation
number cards	dikarata tša dinomoro	loan translation
number line	mothalopalo	loan translation
number symbols	dikapalo	loan translation
number name	leinapalo	loan translation
der number	dinomorotatelano	loan translation
place value	maemo a nomoro	Loan translation
tape measure	theipi ya go lekanetša	loan translation
whole numbers	palotlalo	loan translation
weather chart	tšhate ya boso	loan translation

Table 18: Pukutlhahlo ya Mareo Mphato wa R – Loan translation

The information shown in the table above was taken from the **Pukutlhahlo ya Mareo Mphato wa R**. It is structured in three columns: the first column lists the English ST, the second gives their Northern Sotho equivalents, and the third indicates the strategy used to create the term, which is loan translation. The data demonstrates various types of loan translations used for Northern Sotho mathematical terms. For example, some translated terms comprised entirely of indigenous language components, such as **number line** - ***mothalopalo*** while in other cases, both components of the term are borrowed, as seen in number **cards - *dikarata tša dinomoro***.

5.19. Terms from CAPS/Setatamente sa Pholisi sa Lenaneothuto le Kelo Mphato wa 1-3 Mmetse - Loan translation

CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1 -3 mmetse	Northern Sotho Equivalent	Strategy

geometric pattern	dipatrone tša tšeometri	loan translation
height chart	tšhate ya bogodimo	loan translation
mental maths	Mmetse wa hlogo	Loan translation.
number cards	dikarata tša dinomoro	loan translation
number line	mothalopalo	loan translation
number symbols	dikapalo	loan translation
number name	leinapalo	loan translation s
number cards	dikarata tša dinomoro	loan translation
place value	maemo a nomoro	loan translation
whole numbers	dipalotlalo	loan translation

Table 19: CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1- 3 Mmetse- Loan translation

The data presented in the table above is sourced from the CAPS / Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1 -3 Mmetse. This table illustrates the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It consists of three columns: the first shows the English ST, the second provides their Northern Sotho equivalents, and the third explains the strategy used to create the terms, which is loan translation. The data reveals various types of loan translations applied to mathematical terms in Northern Sotho. For instance, some translated terms combine one indigenous language component with one borrowed element, such as **height chart - *tšhate ya bogodimo***.

5.20. Terms from Sesotho sa Leboa Terminology No 4 1988– Loan translation

Sesotho sa Leboa Terminology No 4 1988	**Northern Sotho Equivalent**	**Strategy**
number line	mothalopalo	loan translation s

number sentence	lefokopalo	loan translation
number symbols	dikapalo	loan translation
number name	leinapalo	loan translation
number cards	dikarata tša dinomoro	loan translation.
place value	maemo a nomoro	loan translation
square root	modusekwere	loan translation
whole numbers	dipalotlalo	loan translation
word sums	palontšu	loan translation
word book	puku ya modiro	loan translation

Table 20: Sesotho sa Leboa Terminology No 4 1988-Loan translation

The data on the table above was extracted from Sesotho sa Leboa Terminology No 4 1988. This table outlines the strategies and term equivalence used for Mathematics terminology in Northern Sotho It contains three columns: the first lists the English terms as the ST, the second provides the corresponding Northern Sotho terms, and the third describes the strategy used to form the term, which is loan translation. The data highlights different forms of loan translations applied mathematical terms in Northern Sotho; for example, there are loan translations where the translation equivalent terms have one component in indigenous language, and one has a borrowed component; for example, **workbook *- puku ya modiro*** and ***modusekwere*- square root**.

5.21. Terms from Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition – Loan translation

Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition	**Northern Sotho Equivalent**	**Strategy**
division sum	palo ya karolo	loan translation
number line	mothalopalo	loan translation
number sentence	lefokopalo	loan translation

number name	leinapalo	loan translation
number cards	dikarata tša dipalo	loan translation
word sums	dipalontšu	loan translation

Table 21: Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition-Loan translation

The information on the table above was taken from **Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition**. This table presents the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is organised into three columns: the first lists the English ST, the second shows their Northern Sotho equivalents, and the third explains the strategy employed to form the terms, which is loan translation. The data highlights various types of loan translations used in Northern Sotho mathematical terms. For example, some translated terms combine one indigenous language component with one borrowed element, such as ***dikarata tša dipalo*** for **number cards**.

5.5 Coinage/Neologism

5.22. **Terms from Department of Arts and Culture Multilingual Mathematics Dictionary for Grade R-3– Coinage/Neologism**

DAC Multilingual Mathematics Dictionary	**Northern Sotho Equivalent**	**Strategy**
abacus	sebalapalo motheopalo mmadiphetana	coinage
abstract	senaganwa segopolwa	coinage
activity	mošomo modiro	coinage
accessory	setlaleletši seoketši	coinage
account	tšhupaletlotlo	coinage
addendum	setlaleletši	coinage

angle	khutlo	coinage
arithmetic	thutapalo dipalo	coinage
assignment	mošomo modiro	coinage
asterisk	naletšana	coinage
bill	tšhupamolato	coinage
brackets	mašakana	coinage
calculator	sebaledi	coinage
calendar	tšhupamabaka	coinage
circumference	sedikadikwe	coinage
clock	sešupanako	coinage
compass	tšhupakhutlo khamphase	coinage
copy	sengwalollwa	coinage
counter	sebaledi	coinage
cube	palokatišwatharong	coinage
cursor	sešupi	coinage
denominator	selekanyo searodi seripaganyi sekgaoganyi	coinage
divisor	palokarodi	coinage
dot	khutlo	coinage
hexagon	sebopego sa tekanyopedi goba tharo sa hlakorekhutlotshela	coinage
hand{clock}	lenaka	coinage
multiplier	palokatiši	coinage
multiples	palokatišanetšwa	coinage
nonagon	sebopego sa hlakorekhutlosenyane	coinage

octagon	sebopego sa hlakorekhutloseswai	coinage
pentagon	sebopegohlakorekhutlohlano	coinage
polygon	sebopegohlakorentšhithwii	coinage
total	palomoka	coinage
total amount	palomoka	coinage

Table 22: DAC Multilingual Mathematics Dictionary for Grades R-6 – Coinage/Neologism

The information on the table above was taken from *DAC Multilingual Mathematics Dictionary for Grades R-6*. This table presents the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is organised into three columns: the first lists the English ST, the second shows their Northern Sotho equivalents, and the third explains the strategy employed to form the terms equivalents, which is coinage. The data highlights that coinage is a strategy that can be used in various ways to create Northern Sotho mathematical terms by taking existing vocabulary and extending its meaning to a mathematical context; for example, **brackets - *mašakana*** and **hand [clock] *-lenakana*.**

5.23. Terms from Mmetse/Mathematics Pukuntšu/Dictionary R-3-Coinage/Neologism

Mmetse/ Mathematics Pukuntšu /Dictionary R-3	**Northern Sotho equivalent**	**Strategy used**
area	sekgoba	coinage
axis/axes	mothalogare	coinage
denominator	selekanyo	coinage
distance	sekgoba	coinage
even numbers	dinomorotatelano	coinage
fractions	dipalophatlo	coinage
frequency	boipoeletšo	coinage
interval	sekgala	coinage

label	pharoina/taetšina	coinage
measuring tape	thapotekanyo	coinage
multiple	katišanetšwa	coinage
number problem	palorara	coinage
numerator	lebadi	coinage
perimeter	modiko	coinage
rectangle	khutlonnethwii	coinage
tally	palomoka	coinage
triangle	khutlotharo	coinage
total	palomoka	coinage
word problems	mararantšu	coinage

Table 23: Mmetse/ Mathematics Pukuntšu /Dictionary R-3 -Coinage/Neologism

The data in the table above was drawn from *Mmetse/Mathematics Pukuntšu/Dictionary R -3*. This table outlines the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is structured into three columns: the first lists the English ST, the second provides their Northern Sotho equivalents, and the third describes the strategy used to form the terms, which is coinage. The data illustrates that coinage is an effective approach for creating Northern Sotho mathematical terms by using existing vocabulary to create new words, such as ***sekgala*** for **interval**.

5.24. Terms from Pukutlhahlo ya Mareo Mphato wa R – Coinage/Neologism

Pukutlhahlo ya Mareo Mphato wa R	**Northern Sotho equivalent**	**Strategy used**
activity	mošongwana	coinage
activity guide	pukutlhahlo	coinage
assessment	kelo	coinage
counters	dibaledi	coinage

decagon	khutlolesome	coinage
data	tshedimošo	coinage
heptagon	khutlošupa	coinage
hexagon	khutlotshelela	coinage
nonagon	khutlosenyane	coinage
octagon	khutloseswai	coinage
pentagon	khutlohlano	coinage
resource kit	dithušathuto	coinage
order	beakanya	coinage
rectangle	khutlonnethwii	coinage
square	khutlonne	coinage
triangle	khutlotharo	coinage

Table 24: Pukutlhahlo ya Mareo Mphato wa R-Coinage/Neologism

The information on the table above was taken from *Pukutlhahlo ya Mareo Mphato wa R.* This table presents the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is organised into three columns: the first lists the English ST, the second shows their Northern Sotho equivalents, and the third explains the strategy employed to form the terms, which coinage. The data highlights that coinage is a strategy that can be used in various ways to create Northern Sotho mathematical terms by using existing vocabulary to come up with a new term; for example, the names of shapes in Mathematics, such as **triangle-*khutlotharo*** and **pentagon-*khutlolano***.

5.25. Terms from CAPS/Setatamente sa Pholisi sa Lenaneothuto le Kelo Mphato wa 1 -3 Mmetse – Coinage/Neologism

CAPS/ Setatamente sa pholisi sa lenaneothuto le	**Northern Sotho equivalent**	**Strategy used**

kelo mphato wa 1 -3 Mmetse		
bean bag	mokotlanawa	coinage
counters	dibaledi	coinage
flashcards	papetlakgadima	coinage
fraction	palophatlo	coinage
pictograph	diswantšhothalwa	coinage
multiples	dipalokatišanetšwa	coinage
triangle	khutlotharo	coinage
rectangle	khutlonnethwii	coinage
ordinal numbers	dipalosešupatatelano	coinage
perimeter	modikologo	coinage

Table 25: CAPS/Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1 -3 Mmetse- Coinage/Neologism

The information on the table above was extracted from *CAPS / Setatamente sa pholisi sa lenaneothuto le kelo mphato wa 1-3 Mmetse.* This table presents the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is organised into three columns: the first lists the English source terms, the second shows their Northern Sotho equivalents, and the third explains the strategy employed to form the terms, which is coinage. The data highlights that coinage is a strategy that can be used in various ways to create Northern Sotho mathematical terms by using existing vocabulary to come up with a new term; for example, **pictograph-** ***diswantšhothalwa*** and **flashcards-** ***papetlakgadima****.*

5.26. Terms from Sesotho sa Leboa Terminology No 4 1988 – Coinage/Neologism

Sesotho sa Leboa Terminology No 4 1988	**Northern Sotho equivalent**	**Strategy used**
abacus	mmadiphetana, mmadifegana	coinage
fraction	palophatlo	coinage
multiplier	katiši	coinage
multiples	katišanetšwa	coinage
tangent	mothalokgoma	coinage
right angle	khutlotsepa	coinage
quadrangle	sekhutlonne	coinage
quadrilateral	khutlonne	coinage
polygon	khutlontši	coinage
place holder	sethibakgala	coinage
pentagon	khutlohlano	coinage
obtuse angle	khutloahlama	coinage
octagon	khutloseswai	coinage
total	palomoka	coinage

Table 26: Sesotho sa Leboa Terminology No. 4 1988 – Coinage/Neologism

The data in the table above was sourced from **Sesotho sa Leboa Terminology No 4 1988.** This table outlines the strategies and term equivalences applied to Mathematics terminology in Northern Sotho. It is arranged into three columns: the first lists the English ST, the second provides their Northern Sotho equivalents, and the third describes the strategy used to create the terms, which is coinage. The data demonstrates that coinage is an effective strategy for developing Northern Sotho

mathematical terms by utilising existing vocabulary to generate new words, such as the term for an **obtuse angle- *khutloahlama***.

5.27. Terms from Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition – Coinage/Neologism

Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition	**Northern Sotho equivalent**	**Strategy used**
counters	dipadišo	coinage
fractions	palophatlo	coinage
face clock	phatlatšhupanako	coinage
lesson	thutišo	coinage
multiplier	seatišo	coinage
multiples	katišanetšwa	coinage
rectangle	khutlonnethwii	coinage
triangle	khutlotharo	coinage
place holder	sethibakgala	coinage

Table 27: Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition- Coinage/Neologism

The data in the table above is sourced from *Mathematiki wa Mahlahla Mphato 1 Northern Sotho Edition*. This table outlines the strategies and term equivalences used for Mathematics terminology in Northern Sotho. It is divided into three columns: the first lists the English ST, the second provides their Northern Sotho equivalents, and

the third describes the strategy used to create the terms, which is coinage. The data shows that coinage can be applied in different ways to develop Northern Sotho mathematical terms by using existing vocabulary to form new words, such as ***phatlatšhupanako*** for **face clock**.

5.3 DISCUSSION

This section discusses the data presented on the tables above on the following term creation strategies: borrowing, paraphrasing, compounding, loan translation and coinage. Special attention is given to whether the terms created are unambiguous, user-friendly and easily understandable. Furthermore, the discussion considers whether the terms created adhered to the spelling and orthography of Northern Sotho.

5.3.1 Borrowing

The data presented showed that borrowing was a strategy used by compilers to create mathematical terminology in Northern Sotho. On tables 1, 3 and 4, the term **block** has two different spellings and orthographic representations, ***diploko and dipoloko***. The term **block** has a foreign cluster combination /***bl***/, which is foreign in Northern Sotho. In Chapter 8, rule 108 (paragraph 8.2) regarding Spelling and Orthography, says *Mo mantšung ao a tšwago malemeng a mangwe gomme mantšu ao a na le ditumammogo di šalana morago, go swana le kr, sf, pr, tr, ft, sk, rk go bewa tumanoši magareng ga ditumammogo tšeo.* [Foreign words which have consonants that follow each other, such as *kr, sf, pr, tr, ft, sk, rk* a vowel should be placed between the words]. However, the rule for cluster combination of ***bl*** words is not addressed. This creates confusion and inconsistencies when spelling words of this cluster combination, as there are no clear guidelines of spelling such borrowed words. It seems as if the rule applies to only the consonants mentioned in the spelling and orthography. It is unclear whether these consonants are regarded as the only ones in English, or they represent a larger class of consonants. Furthermore, it creates a lack of uniformity and standardised terminology for teaching Mathematics in the foundation phase. In Northern Sotho, different learners will probably write the term **block** as either ***dipoloko*** or ***diploko***, thus creating confusion and redundancy.

The strategy that was used is effective and learners will understand it, as it is closer to the English concept which the learners already know. The term will not bring any confusion. However, the term ***dipoloko*** on table 3 for **blocks** might create confusion as it resonates with an existing word ***poloko***, which means **burial**. So, there is no

difference between spelling technical words and normal words, which creates confusion. Therefore, borrowed terms should not fully adapt the CV structure, they should retain the root to show that they are not general language but belong to specialised language for specific purposes; for example, the equivalent on table should be ***ploko.***

On tables 3 and 4, there is also another inconsistency of spelling borrowed term equivalents with a foreign cluster combination of ***br*** and ***lg***. Rule 108 of *Melao ya Mongwalelo le Mopeleto ya Sosotho sa Leboa 2019*, there are no rules on how to translate cluster combinations such as ***lg*** and ***br*** from English into Northern Sotho. It is unclear whether a vowel should be inserted between the ***lg*** consonants or not, but the compilers translated **algebra** as ***altšebra*** in Northern Sotho on tables c and d. The compilers used transliteration, which is a form direct borrowing by translating the word while retaining the root of the English words to keep the term intact and to show that it is a borrowed word. The compilers also phonologised and tolonogised the English word into Northern Sotho by translating the ***/g/*** sound in English to /***tš***/ to Sothoise the sound. By transliterating the term, the learners will be able to relate it to the English concept and understand it because it is transparent.

Another example is seen on table 2, the term **algorithm** is translated as ***alegoritheme*** in Northern Sotho. It can be noted as well that there is a cluster combination of ***lg*** foreign in Northern Sotho. However, it can be noted that the compilers of the document in this case inserted a vowel between the letter combination ***/al/*** to conform it to the CV structure of Northern Sotho. However, interestingly, in certain instances, the same cluster combination of ***lg*** is treated differently by different compilers. For example, on tables 3 and 4, for **algebra**- ***altšebra***, there was no vowel inserted between the two consonants but on table 2, for the term **algorithm**, a vowel was inserted, ***alegorithime***. So, there is no consistency regarding when a vowel should be inserted and excluded.

The translator also retained th***e /g/*** sound when translating ***alegorithime*** on table 2 into Northern Sotho. According to Molao wa 107, in *Melao ya Mongwalelo le Mopeleto ya Sosotho sa Leboa 2019*, "*Ge mantšu a amogelwa go Sesotho sa Leboa, mopeleto wa ona o a fetoga gomme a tšea medumo yeo e dumeletšwego polelong ya rena*" [When words are accepted into Sesotho sa Leboa, the spelling of those words should

take the sounds of Northern Sotho words]. According to this rule, the */**g**/* sound in English is translated **k, tšh** and **tl** in Northern Sotho, as in algorithm***-alekorithime****.* On tables 1, 2, 3, 4, 5 and 6, the term **kilogram** was directly borrowed from English into Northern Sotho and had different spelling and orthographic representations on all the tables. On tables 1 and 2, it was translated as ***khilokramo*** whereas on tables 3 and 4, it was translated as ***kilogramo***. On tables 5 and 6, it was translated as ***kilokramo****.* The compilers directly loaned it so that it could be understood in Northern Sotho.

The term **kilogram** shows quantity; therefore, it is more understandable when as a direct loan word. On tables 1 and 2, the spelling and orthography are the same, ***khilokramo***, where the /**k**/ sound in English becomes an aspirated explosive /**kh**/ when translated into Northern Sotho**.** However, on tables 3, 4, 5 and 6, the translated term **kilokramo** does not have aspirated consonants. There are inconsistencies of when to use or when not to use aspirated consonants when translating borrowed terms in Northern Sotho (Mabulana, 2022). However, in the current *Melao ya Mongwalelo le Mopeleto ya Sosotho sa Leboa* (2019), the rule says when translating /**k**/ from English, it becomes /***kh***/ in Northern Sotho; for example, **kernel > *khenele***. When translating words from Afrikaans, the /**k**/ becomes /**k**/; for example, ***koek-kuku***. Based on the above examples, the terms with aspirated sounds were translated directly from English whiles the non-aspirated terms were translated from Afrikaans. For example, in the Sesotho sa Leboa Terminology No 4 1988, the term **kilogram** is ***kilokramo***. The examples do not follow the CV structure of Northern Sotho, thus creating confusion regarding when the CV structure should be followed or not. However, since *Sesotho sa Leboa Terminology No 4 1988* is the base for terminology in Northern Sotho, the latest compilers should have used the existing spelling and orthography instead of developing a new one to avoid a duplication of the same term. Moreover, on tables 3 and 4, the term **kilogram** was partially translated as ***kilogramo*** in Northern Sotho. The compilers of the document retained the root word -**gram**- and added the vowel /**o**/ to make it ***kilogramo*** so that it sounds Northern Sotho. Again, the term **gram** on tables 1, 2, 4, 5 and 6 was translated as ***kramo*** in Northern Sotho, but on table 3, it was translated differently as ***gramo*****.** These inconsistencies create a lack of standardised terms in Mathematics in Northern Sotho, where concepts that have different spellings create confusion. Moropa (2010) agrees that technical language demands a degree of standardisation far greater than general language because it is a Language for

Specific Purposes (LSP). Nchabeleng (2011) asserts that Northern Sotho has a fundamental problem of spelling rules, which creates inconsistencies and confusion during term creation.

Another challenge of translating borrowed terms with foreign cluster combination is seen in the combination of /**tr**/ consonants. According to *Melao ya Mongwalelo le Mopeleto ya Sosotho sa Leboa* (2019), when translating words with the /tr/ cluster combination, a vowel is inserted between the consonants; for example, in the case of **trapezium**, it would be ***terapesiamo***. However, the term **trapezium** on tables 1 and 5 is directly translated as ***trapesiamo*** into Northern Sotho, which is unambiguous. However, the term equivalent ***trapesiamo*** already existed in Northern Sotho and a rule concerning its spelling and orthographic representation has been proffered in the 2019 booklet. In this case, does it mean that the former terms with /**tr**/ cluster combination are overridden by the new rules? Terminographers should not override the former rules but build upon them as they revise the rules because having many words spelled differently for one concept is confusing. Furthermore, the data on the tables reveal inconsistencies regarding whether a vowel should be placed at the end of borrowed term equivalents. The term **cone** on tables 1, 2, 3, 4 and 5 has different spellings and orthographic representations. On tables 1 and 2, the term ends with the same vowel /e/ ***khoune***, while on table 3, it ends with vowel /o/ ***khouno***. On table 4, it ends with /u/ ***khounu*** and on table 5, it ends with /i/ ***khouni***. However, the current *Melao ya Mongwalelo le Mopeleto ya Sesotho sa Leboa* (2019), is silent on giving rules of spelling borrowed words that end with vowels. The transliterated word had four different spellings, in which the choice of a final vowel is not consistent. This inconsistent choice of a vowel creates a proliferation of spellings for one word, creating confusion and a multiplicity of words. Mabulana (2022:101) says where the choice of final vowel for translated words is inconsistent, the scholar gives the following examples, ***apole*** versus ***apola*** for **apple** and ***peterole*** versus ***peterolo*** for **petrol**. According to Mabulana (2022:101), this creates a proliferation of spellings for a similar word, thus creating confusion to the language community. There seems to be a problem of working in silos among terminology compilers from different institutions. Another challenge is that compilers do not do conduct research before embarking on a translation to check if there is any existing vocabulary before creating a new one. For example, the equivalent for ***khouni*** table 5 is found in *Sesotho sa Leboa*

Terminology No 4 1988. The compilers should have used the term ***khouni***. The transliterated term ***khouni*** is clearer and direct, learners will not be confused. Another problem emanating from the inconsistencies of placing different vowels at the end of the translated term equivalent is seen in the term **cylinder**. The term equivalent has different spelling and orthographic representations. On tables 1 and 3, the spelling is the same, ***silintara*** while on tables 2 and 3, the spelling is the same ***silintere*** and on table 5, the spelling is ***selintere***. On table 5, the spelling is ***selintere*** with a vowel /e/ after the letter /s/ making it different from all the terms. ***Selintere*** was created first in the *Sesotho sa Leboa Terminology No 4 1988*. Therefore, the compilers should have consulted it first. Seemingly, the compilers do not consult previous work by other terminographers. Another term that was spelled differently is **prism**. On table 1**, prism** is translated as ***prisima*** whereas on table 2, ***prism*** is translated as ***prisimo***. On table 3, it is translated as ***prisima***. Clearly, there is a challenge of choosing vowels when spelling transliterated words in Northern Sotho. A lack of proper guidelines causes these inconsistencies. National Language Bodies (NLBs) should develop clear guidelines for addressing these issues. Nevertheless, the term equivalent is clearer and understandable; as such, learners will not be confused.

Similarities in spelling and orthography are seen on the term **centimeter** on tables 1, 2, 3, 4 and 5, which was translated directly as ***sentimitara.*** This term is translated accurately, and learners will understand it. The translators borrowed it directly because it would be challenging to translate Latin prefix ***centi.*** On all the tables, the spelling was consistent and there was uniformity. Similarly, the term **square** on tables 1, 2, 3, 4, 5 and 6 was translated directly into Northern Sotho as ***sekwere.*** The translators transliterated it because it is the name of a shape, and it is clearer as a directly borrowed term. From the data presented above, there is a fundamental problem of spelling borrowed words in Northern Sotho. These inconsistencies are caused by a lack of standardised guidelines for spelling technical terms. The CTT proffers that the applications that are developed should be appropriate and meet the needs of the specific user. If the applications have different spelling, they will confuse the end user and in the case of this study, learners will be affected in their knowledge of Mathematics. Therefore, the compilation of dictionaries should combat inconsistencies in spelling to avoid compromising the quality of Mathematics in education.

5.3.2 Paraphrasing

The data presented on the tables showed that paraphrasing is a strategy used to create Mathematics terminology by different compilers. The data presented types of paraphrasing, namely, paraphrasing sing unrelated words, paraphrasing using related words, explicative paraphrasing, distributive paraphrasing and paraphrasing characterised by borrowing.

5.3.2.1 Paraphrasing using unrelated words

Paraphrasing using unrelated words is used as a strategy to create terms where a term equivalent does not relate with the original source concept. The term equivalent is described by using indigenous vocabulary that is not related to the head term in the SL. This can be seen on table 7 regarding the term, **ascending order - *maemo a go namelela***. The compilers used unrelated words to create an equivalent term in Northern Sotho. The word ***maemo*** has two different meanings in Northern Sotho. The first meaning, according to *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete*, "*ke setulo goba bodulo bja motho setšhabeng , mošomong ,sehlopheng, bjalobjalo, bjo bo bonagalago kudu ge bo bapetšwa le bja ba bangwe ,maemo a batho a a bapetšwa gomme gwa bonwa a ka fase le a ka godimo a taolo*." *[(The position of a person in the society, work, community often compared). The second meaning of maemo – tebelelego ya dilo go ya ka mokgwa wo di lego ka gona (the way things appear to be) The compilers created a term equivalence by trying to use unrelated words to describe the source word. Maemo according to the definitions from the monololingual dictionary, seems to be giving a different meaning. By using the word maemo creates confusion because it is not related to Mathematics context.]*

On the other hand, *namelela,* is defined by the *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete namelela go sepela lefelong leo le rotogelago la go swana le thaba moo e lego gore mosepedi o sepela ka boima ka lebaka la go lapišwa ke morotoga* [to walk heavily on a slopy place like a mountain]. In other words, *maemo a go namelela* gives a different meaning different from the original source concept, creating confusion and ambiguity. So, creating paraphrasing using unrelated words creates confusion and ambiguous term equivalents in Northern Sotho. In table 8, the compilers used unrelated words to describe the source concept using existing words in Northern Sotho. The term **analogue clock** translated as ***sešupanako sa manaka*** in Northern

Sotho by using unrelated words that does relate with the original source concept**.** The word ***sešupanako*** which means (that which points time) is made up /**se**/, which is a pronoun class 7, and the verb ***šupa*** (to point) and ***nako***, which is time. The word ***sešupanako*** an equivalent term for **clock** was coined by explaining the function of the source concept, which is something that shows time. On the other hand, the word, ***manaka***, which is an equivalent **analogue** is a plural of the word ***lenaka*** (literally: horn), which has two meanings in Northen Sotho. In *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete lenaka is sekalerapo se sethata sa bogolo le dibopego tša go fapana seo se hwetšwago hlogong ya diphoofolo tše bjalo ka kgomo,tlou, tholo, bjalobjalo [a big bony hard shaped structure on the head of different animals like, cow, elephant etc*.]. The compilers used unrelated words by extending the original meaning of the word ***lenaka*** to the context of Mathematics so that it can be understandable and clear in Northern Sotho. In the mathematical context, ***lenaka*** is a term equivalent of **analogue** in Northern Sotho, which is a clear and understandable term equivalent. In other words, translation by using unrelated words, can create term equivalents that are more effective and clearer in Northern Sotho.

On table 9 the term, **different orientation- *dikhutlo tša go fapana*** (literally: different corners), the compilers used unrelated words to describe the concept; however, the use of unrelated words results in deviating away from the original source. In Northern Sotho, ***dikhutlo***, which is an equivalent for orientation is a plural for ***khutlo***, which is explained by the *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete ke lefelo leo le lego makopanong a dilo tše pedi, go swana le magahlanong a meboto, maboto, maswika, bjalobjalo, leo le sa bonagalego ke ge le bontšha go khuta* [a place where two points meet in places where they are invisible like stones and walls]. The term equivalent ***dikhutlo tša go fapana*** does not relate to the original source concept. Although this kind paraphrasing is effective, it can sometimes create confusion and distort the meaning of the original concept. Mtolo (2008) says paraphrasing uses words that move away from the original source word. On table 10, the term **concrete objects - *dilo tša go swarega***, the compiler used words in Northern Sotho that does not relate with the source English head term. When the equivalent term is broken down, ***dilo*** which is a translation equivalent for **objects** (literally: things) and ***tša go se swarege*** which is an equivalent for **concrete** (literally: that which cannot be touched). So, the compilers described the term by using unrelated words the source

head term to create an equivalent in Northern Sotho. The equivalent term is descriptive, and the learners will understand the equivalent.

5.3.2.2 Paraphrasing using related words

Paraphrasing using related words is seen when translators paraphrase using related words to create mathematical terms in Northern Sotho. This is when the concept in the SL is lexicalised in a different form in the TL; however, using words that relate to the original source concept. On table 7, the term **cardioid** is translated as ***sebopego sa pelo***, which is translated by using related words to the original concept. The composer used words that explains the original source concept by using words that relate to the source concept. The term equivalent ***sebopego*** (literally: shape) ***sa pelo*** (literally: heart) is the term equivalent in Northern Sotho, which explains the source concept by explaining that it is a shape of a heart, which is related to **cardioid**. The term equivalent is clear and understandable. Another example is seen on table 8, the term **ball shapes - *dibopego tša kgwele*** is described by using related words to the source concept, in that ***dibopego*** is a translation equivalent **of shapes** and **ball** is translated as ***kgwele*.** The term equivalent is effective, and the learners will understand it without confusion, as it is not ambiguous. On table 9, the term **repeating patterns *- dibopego tša go boeletša***, the compiler used related words to paraphrase the term equivalent, **repeating** is translated as ***boeletša*** and pattern is translated as **paterone**. On table 10, the term **recognition of pattern** - ***temogo ya dipatrone***, the words are related to the head term in English, recognition is translated as ***temogo*** and **pattern** is translated as ***– patrone***. So, the translator used words that related with the English head term. The equivalent makes sense and is clear, the learners will be able to understand it.

5.3.2.3 Distributive paraphrasing

A distributive paraphrase was used as a strategy when the translator distributed information in the form of a sentence. This kind of paraphrase deals with the distribution of information that is different from the information in the ST. This kind of paraphrase alters the word order that affects the information structure or word order in the TT. This can happen if it is a form of split or fused sentences.

On table 7, the term **automatic teller machine *- motšhene wa tšhelete wa go itiriša***, the compiler used sentences to explain the source concept in Northern Sotho. The

compiler distributed information that was different in the TL to create an equivalent term in Northern Sotho. The equivalent term ***motšhene wa tšhelete wa go itiriša*** has different information in the TL that is absent in the SL. The term equivalent is easier, and the learners will understand it without any confusion although it is long and seems more of a sentence rather than a term. Another example is seen in table 10, regarding the term **two-digit number - *palotee ya dinimoro tša 2***, where the compiler distributed the information in a sentence form to describe the English concept.

5.3.2.4 Explicative paraphrasing

Explicative paraphrasing, which involves the selection of words and adding of words in the TL text, was also used by the compilers. In explicative paraphrases, the words in the TT seem to be longer than the original ST, as there is more clarification in the TT. On table 7, the term **constant function- *khii ya sebaledi ya go fa karabo***, the compilers selected words and added them to the target term equivalent to clarify what was explained in the target term equivalent. However, the term creates confusion because the head term is different from the equivalent term. In other words, the Northern Sotho term equivalent will be difficult to understand if it appears on a text on its own, as it will need the English head term to refer to understand it. On table 8, regarding the term **bathroom scale - *sekala sa ka ntlwaneng ya bohlapelo***, the compiler added words in the TL to create an equivalence in Northern Sotho. However, this made it an excessively long term and uneconomical to use, especially in technical texts. On table 10, for the term **assymetry *-go ripa gare ka go swana***, the compilers added words to explain the head term to describe the equivalent term in Northern Sotho. However, the terms were complex and too long to be a term and risk a rejection by learners because of length.

5.3.2.4 Paraphrasing characterised by borrowing

Paraphrasing characterised by borrowing, which uses traces of borrowing in the explanations of the term equivalent, is seen on table 7, where the term **kite shape- *sebopego sa khaete*** was added by the compilers. They added borrowed word to the indigenous word while explaining the term equivalent in Northern Sotho. The term equivalent is understandable and clear; the learners will understand it without confusion. This can also be noticed in table 8 in the term ***compass direction-ditaetšo tša khamphase***, the compilers added borrowed words to the indigenous word to explain the term in Northern Sotho. To achieve non-equivalence, translators combined

borrowed words with an existing word to create a term in Mathematics. This can also be seen in table 9, where **geometric shapes** - ***dipobego tša tšeometri*** appears. In table 10, paraphrasing characterised by borrowing is noticed in the term **mental maths – *mmetse wa hlogo***. The compiler explained the source head term by using borrowed words to further explain the target equivalence. From the above discussions, the researcher is of the view that the difficulty in Northern Sotho is that, when there is a lack of equivalent of certain concepts, paraphrasing is used to achieve non-equivalence. Furthermore, where there is a lack of single equivalent terms, paraphrasing is used. In Northern Sotho, the term equivalence is not a single equivalent but are short descriptions, sometimes, they are paraphrased phrases. Furthermore, paraphrasing sometimes leads to lack of specificity and terms that are diluted or deviating from the original source concept. However, Mathematics is a specialised language, these long-phrased terms are not economical and not user-friendly. However, in other instances, the equivalent terms are more descriptive and explain the terms to make it clear so that the target reader will understand; however, they are just sentences that sound like a normal language.

5.3.3 Compounding

The data presented in the tables showed that compounding is a strategy used to create Mathematics terminology by different compilers. The data presented types of compounding, which are complex compounding with two nouns and three nouns, phrasal compounding in a sentence form and phrasal compound that starts with a verb.

5.3.3.1 Complex compound with nouns

Complex compound are terms which are complex with more than one lexical item. The terms can be made up with two or more nouns or adjective. These terms are usually called multiword terms or complex compound. On table 11, the term **base** is translated as ***motheopalo***, the term equivalent is a complex compound as it comprises two nouns. ***Motheo*** is a noun (literally: foundation) and ***palo*** is a noun, which means (**number**). The term equivalent is more descriptive and easier to understand. In table **12**, the term **odd numbers** are translated as ***dinomorotatelano***, the term equivalent is a complex compound with two nouns, ***dinomoro*** (literally: numbers) and ***tatelano*** is a noun (literally: order). The term equivalence is more self-explanatory as it is descriptive, it will not cause any confusion to the learners. Another example is seen in

table 13 the term **3 dimensional** translated as ***mahlakoremararo***, the term equivalent is a complex compound with a noun ***mahlakore*** (literally: sides) and an adjective three (literally: three). The term equivalent is descriptive as it matches the intended meaning in Northern Sotho, which explains that a figure has three sides. The learner will clearly understand the term equivalent easily without any confusion. In other words, compound can be used to create terms that are clearer and more descriptive so that the target users can understand what is being described.

Another example where compound nouns are more descriptive can be seen in table 14, the term **digit-*palotee*** comprises a noun ***palo*** **(number) and *tee* (one) which is an enumerative)**. The equivalent term is understandable, and it will not create any ambiguity for learners, as they will understand the term easily. Another example can be seen in the table 15, the term **straight line-*mothalothwii***, which is made up of a noun ***mothalo*** **(line) and *thwii*** (which is an ideophone which means straight). The term equivalent is clearer as it describes the type of a line that it is in a straight manner. The learner will therefore understand that the line that is being described is straight. In other words, compounds are useful as they combine different lexical items to coin a term by describing it. Citing Gilreath (1933), Gumbo (2016:66) says this is "*the degree to which a term's literal meaning matches the intended meaning*". In other words, coined or created terms should be self-defined or contained, it should not be difficult for a target user to understand the term without consulting a dictionary.

5.3.3.2 Complex compound with three nouns

In table 11, the term **bisector - *mothaloseripagare***, the term equivalent is a complex compound with three nouns***,*** ***mothalo*** (literally, **line**), ***seripa*** (literally: **half***)* ***gare*** (literally: **middle** or **centre**). The term equivalent has a lengthy orthographical element, which might be difficult to understand by the learners. In other words, the learners will not easily understand the term equivalent as it is packed with several lexical elements. On table 12, the term **odd number** is the translated as ***palothlokatatelano***, the term equivalent ***palo*** (**number** or **sum**), ***tšhupa*** (that which points), ***tatelano*** (**orderly**). It should be noted that in Northern Sotho ***palo*** has two meanings; it can be literally number or a group of numbers, which is a sum in English, and it can mean the quantity of something. In other words, ***palo*** can be used in three contexts in Mathematics to explain three different things, which might also bring confusion for the target users. It seems as if it will be up to a learner to put context to the target equivalents as to when

palo means number or sum or quantity. The target equivalent is long and not economical in its usage and very packed with nouns. It might not be easily understood by the learners because of its complex nature. Gumbo (2016:68) says that terminographers should coin comprehensible and simple terms that can be understood by the target users.

On tables 13 and 14, the terms **position**, **orientation** and **views** have different term equivalents. On table 13, **position**, **orientation** and **views** are translated as ***maemo***, ***peakanyo le dipono***. The terms equivalents are clear and understandable. On table 14, the terms **position, orientation** and **views** are translated as ***boemo***, ***tsebišo le dipono***. It is interesting to note that the same term is translated differently by different compilers, which creates confusion on whether which is correct, and which is not. Another example of a concept that has different term equivalents is **numbers**, **operations** and **relationships**. On tables 13 and 14, the equivalent terms are ***dinomoro, tirišo le tswalano*** and ***dinomoro***, ***diophareišene le ditswalano*** on table 14. There is a lack of standardisation of certain mathematical concepts. This creates confusion and a lack of uniformity of terms in the mathematics domain. Ramuedzisi (2016) says that a lack of policy that regulates terminology standardisation is the cause of confusion and inconsistencies. Gumbo (2016:69) says that a systematic approach to terminology helps maintain consistency.

5.3.3.3 Compound phrase in a sentence form

Another form of compound nouns is phrasal or a sentence form, which appear as long or short phrases. For example, on table 11, the term **pen** and ***paper method*** is translated as ***mokgwa wa pene le phephe***. The equivalent term ***mokgwa wa pene le lephephe*** comprises a noun ***mokgwa*** (literally: **manner**), ***pene***, which is a transliteration of **pen** and ***lephephe***, which is also a direct borrowing of **paper**. The equivalent is clear; the learners will understand it. Another example is seen on table 12, ***long and short hand on clock***, which is a fixed expression in a sentence form in English. The term equivalent term ***lenakana le letelele le lekopana mo tšhupanakong***, has many lexical items and seems like a sentence rather than a term. Gumbo (2016: 68) says that, sometimes, the practices and traditions of particular fields should be considered when creating terms in indigenous languages. Mathematics is a highly technical field with long complex fixed terms, which will also affect the length of the target equivalent terms. On table 13, the term **copy and complete patterns** is

translated as ***go kopolla le go feleletša dipatrone.*** The term equivalent is clearer and easier to understand. Clearly, the rule of conciseness and brevity of terms does not apply all the time. There are terms in certain specific domains that are fixed expressions meaning that the equivalent terms will also be lengthy. Another example is on table14, where there is the term **building up and breaking down - *go agantšha le go hlahlamolla dinomoro***. The equivalent term has added extra information. The compiler added the word ***dinomoro*** which is an extra word that does not appear in the head term in English so that it can be clear and well understood by the learners.

4.3.3.4 Compound phrase that starts with a verb

Compound phrases with verbs are in the form of sentences and verbal phrases form of structure. They start with a verb at the beginning of a sentence. From table 11, the term **perform a calculation** is a compound term which has verbal lexical items in it, as it starts with a verb **perform.** In Northern Sotho, it is translated as ***šoma palelo*** which comprises a verb ***šoma*** (**work**), and a noun ***palelo*** from the verb ***bala*** (**count**). The compiler translated it into Northern Sotho as a verbal compound to make it clearer and understandable to the target user.

Another compound term with a verb is in table 12, where the term **add hundreds** starts with the verb **add**. In Northern Sotho, the equivalent is ***hlakanya makgolo***, which entails the verb ***hlakanya*** which means **add** and ***makgolo***, a noun which means **hundreds**. On table 13, for the term **build 3D objects - *aga dilo tša 3D***, the equivalent term is made up of a verb ***aga*** (build) and a noun ***dilo*** (**things**). The term equivalent is more understandable, and the learners will not be confused. On table 14, the term **subtract from 999- *go ntšha go thoma ka 999*** also starts with a verb. Compound terms with verbs are easily translated into Northern Sotho. The equivalent terms are clear and understandable and not packed with complex lexical items but are clear and simple lexical items. The learners will not find it difficult to understand the equivalent terms. Gumbo (2016:67) says that it is expected that terms should be efficiently used by target users. She further says that terminologists should create terms that are effective and efficient for communication.

5.3.4 Loan translation

Loan translation is another strategy that was used to create mathematical concepts into Northern Sotho. Loan translation is when words are translated word for word in

the indigenous language to create a new term. From the data presented on the tables, loan translation appeared in three categories; total loan translation, partial loan translation and loan translation where both components of the word are borrowed words.

5.3.4.1 Total loan translation

On table 16, the term, **number skill - *bokgonipalo***, is a total loan word as it has replaced the ST with indigenous lexical words or forms in the recipient language. The term equivalent comprises ***bokgoni*** (literally: **ability**) and ***palo*** (**a group of numbers**). The compiler used existing words to create a new word in Northern Sotho, and the term is clear and understandable. Another example of total loan word is seen on table 17, the term **number phrase - *sekafokopalo***. The compiler used literal word for word lexical items to replace the ST to create a new word in Northern Sotho. The equivalent term comprises ***sekafoko*** (literally: **that which looks like a sentence**) and ***palo*** (**group of numbers**). The term equivalent is, however, too artificial and very confusing. It does not render the intended meaning in the TL. Sometimes, using total or integral loan words does not make the terms effective for communication. Describing the function of the word in Northern Sotho would have rendered a clear meaning. Artificial terms that created through loan translation and are confusing discussed by Madiba (2000:196) using examples in Tshivenḓa, such as ***tshikalamaina*-minor scale, *tshikalo* > scale + *maina* (minor)** (cf. **tshikalo tshiṱuku)**, and says that loan translations are sometimes confusing and artificial. On table 18, the term **number name** is translated as ***leinapalo***, where existing lexical components were used to create a new term equivalent in Northern Sotho. The term equivalent ***leina*** (literally: **name**) and ***palo*** (literally: **number**) yielded a term equivalent that is unambiguous.

There are similarities that can be observed from tables 16, 17, 18, 19, 20 and 21, with term equivalents that are similar. On the term, **line-*mothalopalo***, the equivalent term, is made up of ***mothalo*** **(line**) and ***palo*** (group of numbers). The compilers translated the term by using the same method of integrating indigenous words to create a new term in Northen Sotho. The equivalent term is clear and easy to understand. Another term equivalent that is similar in all the tables is the term **whole numbers-*dipalotlalo***, and the term **number-name-*leinapalo.*** All these term equivalents are translated the same on all the tables. There is consistency and uniformity in the mathematical

concepts. This uniformity creates harmony and terms that are clear and standard across the mathematics domain in Northern Sotho. Gumbo (2016:69) says consistence maintenance is an indispensable part of terminology.

5.3.4.2 Partial loan translation

Partial loan translation is when the term equivalent has a borrowed component and indigenous component. In other words, the term equivalent is made up of a borrowed word and an existing indigenous word of a particular language**.** On table 16, the term **percentage sign -*leswao la phesente*** was translated considering one component of the ST through borrowing and other components replaced with a Northern Sotho word. ***Sign*** is translated as ***leswao*** (literally: sign) and **percentage** translated as ***phesente*** which is a direct borrowing. The equivalent term is clearer and understandable. Another example of partial loan translation is on table 17, **box shapes-*dibopego tša lepokisi***, where **shape** is translated as ***sebopego*** and **box** is translated as ***lepokisi*** which is a direct borrowing. The term equivalent is clear and understandable. Another term is on table 18, the term, **tape measure-*theipi ya go lekanetša***, where **measure** is translated as **lekanetša** (literally: **to make equal**) and **tape** is translated as ***theipi*** which is a direct borrowing. However, the term equivalent is clear, and the learner will understand it.

5.3.4.3 Loan translation with fully borrowed components of the word

Loan translation is when the term equivalent has both borrowed components in the TT. The term equivalents have both the components of the ST, which are translated through borrowing to create a new term in Northern Sotho. On table 16, the term **pair of compass- *phere ya khamphase***, both the components of the ST are replaced by the borrowed lexical item in Northern Sotho. The equivalent term is made up of ***phere*** (**pair**) and ***khamphase*** (**compass**). In this term, the combination of both borrowed words is confusing and does not render the intended message. In this term equivalent, the lexical units are translated but not the meaning of the term equivalent. It is a very confusing term. This strategy is not effective for creating new words in Northern Sotho. The learner will not understand it at all. Another example is seen in table 17 with the term **geometric solid-*soliti ya tšeometriki***, where the equivalent term is created by literally replacing the words in the ST in a word for word sense to create the TT

equivalent. The term equivalent is not translated in a way that renders meaningful communication, but lexical items are translated. The term equivalent does not make sense at all. Another example is seen on table 20, where the term **number cards** is translated as ***dikarata tša dinomoro***. The term equivalent is understandable and effective as the learners will understand it.

5.3.5 Coinage

Coinage or neologism is referred to by different scholars as a process of creating or inventing new words that do not exist in a particular language. These new words are therefore accepted permanently and used by the speech communities that did not have the invented concept or word. On table 22, the term **compass -*tšhupakhutlo*** is made up of two nouns ***tšhupa*** **f**rom the verb ***šupa*** which literally means **point** and ***khutlo*** which literally means **corner**. The equivalent term describes the function of what is being explained. The composer coined a target equivalent by describing the function of the term in Northern Sotho. The target equivalent makes sense and is clear. However, the composer gave a synonym to accompany the newly coined term ***tšhupakhutlo*** through transliteration which yielded ***khamphase*** as a synonym so that it makes more sense and does not confuse the learner. Indeed, when a newly coined term is introduced in a linguistic community, a loan word should accompany it as a synonym to avoid confusion. Mojela (2010:707) concurs that the loan words can be used as synonyms to the coined indigenous lexical items.

Another example is on table 23, the term ***axis-mothalogare*** comprises two nouns, ***mothalo*** which means **line** and ***gare*** which means **centre**. The equivalent term, however, is too ambiguous as it suggests that any line can be in the centre. The term equivalent should have been accompanied by a loaned synonym ***mothalogare/ eksisi***, to explain that ***mothalogare*** is not any line but specifically axis. Mojela (2010:707) says loan words can be used as synonyms to the coined indigenous lexical items. This is because a learner might be confused by the newly coined term, as it is ambiguous.

On table 24, the term **heptagon -*khutlošupa*,** is made up of a noun and a verb, ***khutlo*** and ***šupa*** which means **point**. The term equivalent is clear as it is descriptive to explain the term in Northern Sotho so that the learner will clearly understand without confusion. However, there are inconsistencies or a lack of standardised terms for

certain concepts in Mathematics. In other words, one concept is translated differently by different institutions. For example, on table 22, the term ***pentagon*** is translated ***sebopegohlakorekhutlohlano***. This term equivalent is made up of four lexical elements, ***sebopego*** a noun***, lehakore*** a noun, ***khutlo*** a noun and an adjective, ***hlano***. This term equivalent is too long and violates the rule of creating simple and concise terms. Lengthy terms will be hard to articulate or read, and learners will not use the term. Gumbo (2016:68) says longer words are unlikely to be used whereas shorter terms are easily popularised and used effectively. Terminologists should consider the length of the terms that they coin, so that they can be used and accepted easily by the target users. Gumbo (2016 :66) says that when composers coin terms through coinage strategy there is a violation of the principle of creating appropriate simple terms.

On table 24 and 26, the same concept **pentagon** is translated ***khutlohlano*** by other composers, which creates a lack of standardised specialised concepts in Northern Sotho. This creates confusion and inconsistencies where in one domain, there are many terms for one concept. Another example of a lack of proper standardised terms is seen on table 22 with the term **hexagon-** ***sebopego sa tekanyopedi goba tharo sa hlakorekhutlotshela***, and on table 24 **hexagon** is ***khutlotshelela***. This challenge is caused by compilers working in silos and not checking existing work before embarking on a terminology development project. The term on table 22 ***sebopego sa tekanyopedi goba tharo sa hlakorekhutlotshelela*** is a lengthy phrase. The translator used unrelated words such as ***sebopego*** **(shape)** ***tekanyopedi*** **(equal by two) and** ***hlakore*** **(side)** to describe the source concept in Northern Sotho. The equivalent term should only describe the English concept in such a way that it does not deviate from the main original concept in English. In other words, coinage can lead to the translator describing the concept by using unrelated words that deviate from the original source concept. However, the equivalent term in table 24 the term **hexagon -*khutlotshelela*** is made up of ***khutlo*** a noun and ***tshelela*** a noun, which is concise and agrees with the rule of appropriate and simple terms. The term equivalent is descriptive, and the learners will understand it clearly. Another example is seen in table 22, where the term **nonagon** is translated ***sebopego sa hlakorekhutlosenyane***, but different from table 24 where there is ***khutlosenyane.*** One concept is translated differently creating confusion. On table 22, ***sebopego sa***

hlakorekhutlosenyane describes the term by using other unrelated words to the source concept such as ***sebopego* (shape)** and ***hlakore* (side)**, which deviates from the original source concept in English. The term is too lengthy and complex in its structure. While on table 24, the term ***khutlosenyane*** is precise and understandable.

Another example is seen in table 22 with the term **octagon-*sebopego sa hlakorekhutloseswai***, and on tables 24 and 26, where the translation equivalent is ***hlakoreseswai***. The same concept is translated differently by different terminographers, creating inconsistencies. Ramuedzisi (2016:105) observes that in Sesotho, one concept is translated differently by the Department of Arts and Culture and Free State Department of Arts and Culture and Recreation on the soccer terminology project. For example, the term **advantage rule** is translated ***molawana o fanang ka ka monyetla*** by TCS DAC and is translated by FS DSACR ***molao o fanang ka monyetla***. Ramuedzisi (2016) says that this is created by a lack of standardisation by National Language Bodies (NLBs). On table 22, the term **polygon** translated ***sebopegohlakorentšhithwii*** and on table 26, **polygon** is translated ***khutlontši.*** The compilers who coined the term on table 22 should have consulted and checked with the compilers who coined the term on table 26. The term on table 26 ***khutlontši*** is found in the *Sesotho sa Leboa Terminology No 4 1988*; it was created first before the term on table 22, ***sebopegohlakorentšhithwii*** by the Department of Sport Arts and Culture in 2013.

Another example of the same term equivalents that are translated differently is seen in the term multiple which has different term equivalents in Northern Sotho. On table 22, the term **multiple** is translated as ***palokatišanetšwa***, and on table 25, **multiples** is translated as ***dipalokatišanetšwa*** in a plural form. On tables 26 and 27, **multiples** is translated ***katišanetšwa***. It is confusing as whether the term is ***katišanetšwa*** or ***dipalokatišanetšwa*** in Northern Sotho. Having different equivalents from different institutions creates a lack of hamonisation in technical vocabulary in Northern Sotho. This lack of harmony further creates confusion and inconsistencies in how term creation should be done. King`ei (1999:155) reports that in Kiswahili, a lack of harmonising technical vocabularies creates differences in usage and in some cases, difference exists among universities, departments and individual lectures; for example, **text** is translated as ***makala/matini/kifungu/habari/maandishi*** in Kiswahwili. Ramuedzisi (2016) also states that if terminology is not coordinated and managed,

there are inconsistencies which create a duplication of work among terminology developers. In other words, the *DAC Multilingual Mathematics Dictionary for Grade – 6,* on table 22 should have consulted *Sesotho sa Leboa Terminology No 4 1988* on table 26, before coining a new term that is different from an already coined term. Gumbo (2016:69) says that there should be a systematic approach when dealing with terminology so that there can be consistency in its usage. Another problem is that the National Language Body authenticated the DAC Multilingual Mathematics Dictionary should have first checked with the Spelling and Orthography No 3 of 1988 to avoid duplication of terms and reinventing the wheel. On this note, Ramuedzisi (2016:105) says that the National Language Body as it is their responsibility to verify, they should also make sure that they do not reinvent the wheel by verifying same term equivalents by different institutions.

Another aspect of coinage is that the newly coined term is attached to the existing indigenous word of a particular language. The principle that is called etymological purity. Gilreath (1990:90) says this is where "a word constructed from elements derived from a single language is preferable to a hybrid word which combines elements derived from more than one language." In other words, it is better to use an indigenous word rather a loan word. For example, on table 22, regarding the term **hand [clock]** is translated ***lenaka*** (which is literally a **horn**), the translator used an existing word and attached it to the source English word to coin a term equivalent. ***Lenaka*** has two meanings in Northern Sotho. The first meaning, according to the *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete*, proffers *"lenaka(1) sekalerapo se sethata sa bogolo le dibopego tša go fapana seo se hwetšago hlogong ya diphoofolo tše bjalo ka kgomo, tlou, tholo bjalobjalo [a hard bonelike shaped structure on the head of animals like cow, elephant]; (2) mothaladi o motelele wo madira goba batsomi ba o dirago ge ba nyaka go rakelela manaba goba diphoofolo [straight line that is used to capture animals by hunters].* The compiler used ***lenaka*** to attach the meaning to the word ***hand of a clock*** to make it more understandable in the TL. Another example is on table 22, where the term brackets translated as ***mašakana***. The composer used an already existing word and attached it to the concept in the brackets in Mathematics. In *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete, lešaka ke lefelo gantši la nkgokolo leo le dirwago ka mafat, dikota, go lona go hlahlelwa diruiwa.* The compiler coined ***mašakana*** by attaching it to the shape of the original ***lešaka***. Using indigenous

words to coin words is an effective way to create terminology. However, attaching a new meaning to an already existing indigenous word creates polysemous terms that lack specificity. On table 22, the term **activity** is translated ***mošomo*** or ***modiro***, and **assignment** is translated ***mošomo*** or ***modiro***. In *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete*, ***mošomo*** has three meanings, the first *(1) ke tšhomišo ya maatla a mmele goba maatla a mogopolo go pethagatša tiro ye e itšego, [the use of energy to perform a certain task; (2), tiro ye e fiwago motho gore a e dire letšatši le lengwe le le lengwe gomme a fiwe moputso morago ga go e phetha, [work or job that you get paid for doing it]; (3) maikarabelo ao a fiwago motho go phethagatša tiro ye e itšego [responsibility that you have to do a certain task].* In the Mathematics context, **activity** is work that is done in the classroom daily. The translator attached the meaning of ***mošomo*** to the mathematics context to have a target equivalent for activity. ***Mošomo*** generally means work that is done, so it is related to activity in Mathematics. The term equivalent will be understood by the learners. However, in the example of ***assignment***, which is translated ***mošomo*** or ***modiro***, the term equivalent is not specific in terms of differentiating between activity and assignment. The translation term seems to create confusion because there is no difference between activity and assignment. In other words, ***mošomo*** or ***modiro*** are equivalents for two different specific concepts. However, in Northern Sotho, the difference in specificity is not clear and there is no difference between **assignment** and **activity**. Sometimes, instead of coining new words, it is better to borrow to avoid creating polysemous words for different specific concepts. According to Gilreath (1993:85), the principle of unequivocalness is that “the equality of a term which has only one meaning within a particular field of knowledge or within a particular nomenclature.” In other words, a designated term should denote one meaning not several to avoid polysemy. The term **assignment** should have been translated as ***asaenemente*** to avoid having one concept or designation being denoted by several meanings, as this creates ambiguity and confusion for the target users. Mojela (2010: 707) says ambiguous coined lexical items which are polysemous are not easy to lemmatise.

Another example is seen on table 22, the terms **dot** and **angle** are translated as ***khutlo***. ***Khutlo*** is an existing word in Northern Sotho and has two meanings attached to it. In *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete, khutlo (1) leswao la polelo la sebopego sa nkgokolwana, leo gantši le bewago mafelelong a lefoko ge go ngwalwa*

khutšofatšo ya mantšu. Khutlo (2) lefelo leo le lego makopanong a dilo tše pedi go swana le magahlanong a meboto, maboto, maswika, bjalobjalo, leo le sa bonalego gabotse ka ge le bontšha go khuta. In short, the word ***khutlo*** is attached to grammar context as a punctuation mark, and it is also a place which is invisible where two things meet or joined together. However, in Mathematics, the term ***khutlo*** has been extended to fit the meaning of an **angle** which is a position and a dot shape. The translation equivalent in Northern Sotho is polysemous, as it designates two different concepts which are not related to each other. The translator should have transliterated **angle** as ***enkele*** to avoid confusion with **dot**, so that the learners can see that these are two different concepts.

Another example is seen on table 23, with the term **area-*sekgoba* and distance-*sekgoba***. These two examples show that polysemy is created when a designated concept is denoted by different meanings. In the *Pukuntšutlhaloši ya Sesotho sa Leboa ka Inthanete*, the word ***sekgoba*** has to meanings, *sekgoba or sekgala (1)lefelo leo le se nago selo, leo le lego magareng ga dilo tše pedi and sekgoba (2) poso ya mošomong yeo go yona go nyakegago motho.* The translator shifted the meaning of ***sekgoba*** and attached it to the mathematics context by designating it to the concept **area** and ***distance***. However, in Mathematics, **area** is an amount of space measured in square meters, which is different from the general word ***sekgoba*** in Northern Sotho. In other words, attaching meaning to a new word that does not exist in Northern Sotho does not aways work as an effective strategy for term creation because the newly coined word might not mean the same thing as the original concept in English. In Northern Sotho, ***sekgoba*** and ***sekgala*** are synonyms; however, on table 23, the term **interval** is translated as ***sekgala***. So, there is redundancy of polysemous words designating different concepts, ***interval -sekgala***, **area-*sekgoba***, **distance-*sekgoba***; in Northern Sotho, the equivalent terms are the same. This creates ambiguity, and it hinders the language from growth.

Coining as a strategy also creates terms that are too general and lacks specificity, which means the equivalents are too general and do not satisfy the specialised meaning of register. For example, on table 22, the term accessory is translated as ***setlaleletši*** or ***seoketši***. Still on the same table, the term **addendum** is also ***setlaleletši. Setlaleletši*** (literally meaning something that adds on) is a noun made from the verb ***tlaleletša***. Anything can be ***setlaleletši***. ***Adendamo*** will be a popular

term used by the learner as opposed to a coined indigenous word ***setlaleletši***. Another example on the same table with the term **cursor- *sešupi*** which is a noun from a verb ***šupa*** meaning that which points. However, ***sešupi*** does not mean **cursor**, because anything can be used to point. ***Sešupi*** lacks specificity. The term should have been borrowed and translated as ***khesa*** which is more specific and unambiguous. Gumbo (2016:69) says that sometimes adopting popular terms in use is better than coining indigenous terms.

Another example is seen on tables 22, 23 and 27, the term **total** is translated ***palomoka,*** however it can be seen as well that in table 23 the term **tally** is translated ***palomoka***. It can be noted that in table 22 the term **total amount** is translated ***palomoka*** in Northern Sotho. In other words, the term equivalent ***palomoka*** is an equivalent for three different concepts in Mathematics. This creates confusion and shows that terminology is created in silos. The researcher is of the view that compilers should check existing work before embarking on a particular project, then the issue of duplication would be avoided. For example, in the Sesotho sa Leboa Terminology No 4 1988, the term **total** is translated ***palomoka***, so in other words, the term **tally** and **total amount** should have their own term equivalents created so that there is a difference between **tally**, **total amount** and **total** in Northern Sotho. *Sesotho sa Leboa Terminology No 4 1988*, is the foundation of where terminology is sourced in Northern Sotho, it should be the first point of reference when term is created. If it is consulted, there would be no need for reinventing the wheel and duplication of work. Another example is seen on table 22 the term **calculator** and **counter** have the same equivalents ***sebaledi.*** On table 24 and 25, **counter** is translated as ***dibaledi***; however, on table 27 is translated as ***dipadišo.*** In other words, in Northern Sotho **calculator** is ***sebaledi*** and **counter** is ***sebaledi***, this creates redundancy and polysemous words that mean the same thing for different concepts. The researcher is of the view that, for ***calculator*** the translated term should be borrowed as ***khalekhuleitha*** to avoid using the same term equivalent as **counter** in Mathematics. In other words, the ambiguity is created by the fact that, **counter** is translated ***sebaledi*** and **calculator as *sebaledi*** meaning that in Northern Sotho there are many words for the same concepts.in the context of Mathematics a **counter** can be anything used for counting and is different to a **calculator**. However, in Northern Sotho it seems as if even though the term equivalents are polysemous they are related which is not true because **calculator** and

counter are different concepts, counter is anything that is used for counting in Mathematics. So, both calculator and counter are two different concepts which are not related. However, in Northern Sotho the equivalents are the same. This means that the vocabulary of Northern Sotho does not grow and accept newly acquired concepts from foreign languages. Mojela (2010: 707) says that through coining lexical items, a language will not have enough lexical items to name newly acquired foreign concepts.

On table 24, the term **data** is translated as ***tshedimošo*** (which literally means information). The term equivalent lacks specificity and does not satisfy the specialised meaning of the mathematics register. The term should have been borrowed directly as ***datha*** which is more specific and denotes the concept that it is designating. Another problem of attaching new words to existing indigenous words, is a challenge because they create confusion and equivalents that are not relating to the original source concept. For example, on tables 22 and 26, **abacus-*mmadiphetana*** or ***mmadifegana***. In the term, ***mmadiphetana*** comprises beads; hence, in Northern Sotho, the equivalent is ***mmadiphetana***. ***Mmadiphetana*** is made up of two compounds words ***mma*** (mother or woman) + ***diphetana*** (literally the mother of beads), this word creates a confusion because an **abacus** is not always made up of beads and it is not a person as the Northern Sotho word refers. In the term ***mmadifeegana*** is made up of ***mma*** (**mother** or **woman**) ***difegana*** **(arm)** so in other words the coined term equivalent does not relate to the original concept in the source language.

On table 25, the term **flash cards-*papetlakgadima*** comprises an adjective ***papetla*** which means flatness and noun ***kgadima*** from the verb ***gadima*** which means to look back at something. The term equivalent is ambiguous as does not describe the concept clearly in Northern Sotho. ***Papetla*** is an adjective used to describe the flatness of an object, and it does not clearly describe what flash card is. The term equivalent is not accurate and confusing; learners will not understand it. In other instances, coinage was used to coin terms by describing the function of the concept in Northern Sotho.

5.4 CHAPTER SUMMARY

This section discussed term creation strategies such as borrowing (direct or indirect) paraphrasing, loan translation, compounding and coinage. The term creation

strategies were analysed whether they are effective, understandable and unambiguous in Northern Sotho. The next chapter presents a summary, conclusion and recommendations of the study.

CHAPTER 6: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The study aimed at investigating the use of term creation strategies used to develop mathematical terms in Northern Sotho. The strategies that were discussed were borrowing, compounding, paraphrasing and coinage. This chapter discusses the findings, general summary, limitation and the recommendations of the study.

6.2 FINDINGS

6.2.1 Borrowing

There were inconsistencies in the adaptation of foreign cluster consonants, the data was collected from Multilingual Mathematics Dictionary Grade R- 6, Mmetse/Mathematics Pukuntšu/Dictionary grade R-3, Pukutlhahlo ya Mareo Mphato wa R, CAPS/SETATAMENTE SA PHOLISI SA LENANEOTHUTO LE KELO MPHATO WA R-3 MMETSE, and Sesotho sa Leboa, Terminology and Spelling and Orthography No 4 1988. The study found that there are inconsistencies when terms are borrowed from English to Northern Sotho. The study revealed that in the terms which have a foreign cluster combination of ***bl, tr, al, gr and bl*** there is a challenge of whether to follow the CV or not to follow the CV structure of Northern Sotho. For example, the term ***block*** is translated as ***ploko or poloko***. Another example is the cluster combination of ***gr***, the term ***gram*** is translated as ***kramo***, while the term with the same cluster combination ***graph*** is translated ***kerafo.***

There are inconsistencies of spelling and orthography when translating borrowed words from English into Northern Sotho. The study found that the inconsistencies are caused by the fact that the current Spelling and Orthography 2019 does not address the rules for spelling foreign cluster of ***bl, gr, al.*** the study further found that other translators retained the root when translating borrowed words, they partially translated other terms, for example **kilogram** is translated ***kilogramo*****.** It is not clear as whether, the spelling and orthography explains the issue of certain concepts to be partially of fully translated. This is also noted in the term **gram** which is translated partially as ***gramo*** in Northern Sotho.

There were inconsistencies in spelling borrowed words ending with a vowel /e/ the data was collected from Multilingual Mathematics Dictionary Grade R- 6, Mmetse / Mathematics Pukuntšu/Dictionary grade R-3, Pukutlhahlo ya Mareo Mphato wa R,

CAPS/SETATAMENTE SA PHOLISI SA LENANEOTHUTO LE KELO MPHATO WA R-3 MMETSE, and Sesotho sa Leboa, Terminology and Spelling and Orthography No 4 1988.

The study found that there is challenge of spelling borrowed words which end with the vowel {e}. The study found that in the current Spelling and Orthography of Sesotho sa Leboa 2019, is silent on giving rules of spelling borrowed words that end with vowels. The study found that there are instances where the term ending with a vowel {e} will end with different vowels at the end. For example, the term **cone** is translated as ***khoune, khouno, khounu*** and ***khouni***. It is not clear which vowel to place at the end of the translated equivalent in Northern Sotho. The study found that even in instances where the equivalent exists in Terminology Spelling and Orthography No 4 1988, for example ***khouni***, terminologists or translators seem to not consult Terminology Spelling and Orthography No 4 1988 as their first point of departure. Therefore, it creates an inconsistent choice of a vowel leading to proliferation of spellings for one word creating confusion and multiplicity of words.

There were inconsistencies in spelling the borrowed terms ending with /er/ the data was collected **f**rom Multilingual Mathematics Dictionary Grade R- 6, Mmetse / Mathematics Pukuntšu/Dictionary grade R-3, Pukutlhahlo ya Mareo Mphato wa R, CAPS/SETATAMENTE SA PHOLISI SA LENANEOTHUTO LE KELO MPHATO WA R -3 MMETSE, and Sesotho sa Leboa, Terminology and Spelling and Orthography No 4 1988. The study found that there are inconsistencies with borrowed terms ending with {er} at the end. It was found that there are instances where the same word will be spelled with different vowels after the letter {s}. For example, the term cylinder is translated ***as silintara, silintere, silintara, silintere and selintere***. It can be noted that, there is a confusion on what vowel should be placed at the end of the translated equivalent in Northern Sotho. The study revealed that even when the equivalent exists in the Terminology and Spelling Orthography No 4 1988, it seems as if translators do not consult it as their pint of departure, they rather reinvent the wheel and create more terms with different spellings. This leads to proliferation of words creating confusion to learners. The study found that there is a confusion of which vowel to place when translating words ending with {m} for example prism is translated as ***prisimo*** and ***prisima.***

There were inconsistencies when spelling borrowed terms with aspirated sounds , the data was collected from Multilingual Mathematics Dictionary Grade R- 6, Mmetse / Mathematics Pukuntšu/Dictionary grade R-3, Pukutlhahlo ya Mareo Mphato wa R, CAPS/SETATAMENTE SA PHOLISI SA LENANEOTHUTO LE KELO MPHATO WA R-3 MMETSE, and Sesotho sa Leboa, Terminology and Spelling and Orthography No 4 1988. The study found that the spelling of one term is written differently, where one term has aspirated sounds and the others do not have the aspirated sounds. The study found that the terms with aspirated sounds were translated from English while the non-aspirated terms were translated from Afrikaans for example, the term ***kilogram*** is translated ***khilokramo, khilokramo, kilogramo, kilogramo*** and ***kilokramo***. The study found that the current Spelling and Orthography 2019, states that the k sound in English is aspirated and Afrikaans k is not aspirated. It is noted that based on this rule, both sounds are acceptable. The study found that there were translated equivalents which were spelled the same in a consistent manner. For example, the term **centimetre** is translated **centimetre*, square*** is translated ***sekwere*** which is the same in all the tables. This then creates uniformity and harmonisation of Mathematics equivalents in Northen Sotho.

6.2.2 Paraphrasing

Paraphrasing is one of the strategies used to create terms in Northern Sotho. The study found that there are types of paraphrasing used to create terms namely paraphrasing using related words, paraphrasing using unrelated words, explicative paraphrasing, distributive paraphrasing, and paraphrasing characterized by borrowing. The study further revealed that in all the types of paraphrasing, the most used is the explicative paraphrase followed by paraphrasing using related words, and the least used is paraphrasing characterised by borrowing and paraphrasing using unrelated words. The study found that paraphrasing using unrelated words to explain the target term often leads to term equivalents that are not making sense as they move away from the original source concept**.** For example**, ascending order- *maemo a go namelela*.** It is found that term equivalent used words that are not related to the source concept words leading to confusion and deviating from the meaning of the original concept. The study found that when using unrelated word often leads to polysemous terms that are same but meaning different things for example, ***mental arithmetic*** which is translated ***dipalo tša hlogo*** ,it was found that the word ***dipalo*** is an equivalent

for sums in plural form, so it is seen that the equivalent ***dipalo*** is also an equivalent for arithmetic and sums in plural form. The study found that using unrelated words in paraphrasing sometimes leads to terms that are polysemous leading to confusion. This strategy creates equivalent terms that use the same words however meaning different concepts.

The study found that when terms are created through paraphrasing using related words, they are easier to understand as they are explaining the concept using words related to the source concept. For example, **ball shapes** translated as **dibopego tša kgwele,** it is noted that the words that the translator used relate to the original source concept. Another example is the term **cardioid** translated **sebopego sa pelo,** the translator used words that relate to the original source concept**.** The study revealed that term equivalents are easier to understand and do not cause confusion.

Another paraphrasing that causes confusion is paraphrasing by distributive as it creates long sentences that might not be regarded as terms. The study revealed that distributive strategy creates long and lengthy terms that might not be understood by the learners. For example, the term ***automatic teller machine*** is translated ***motšhene wa go ntša tšhelete wa go itiriša*** , the study found that the term equivalent is long and not economic to be a term. Although is descriptive and explains the term equivalent in a sentence, it creates terms that are not economic and user-friendly. On the other hand, explicative paraphrasing found to be creating long sentences are not even regarded as terms. The study revealed that because of the context of Mathematics other term equivalent is likely to be longer and lengthier. For example, the term ***bathroom scale*** translated as ***sekala sa ka ntlwaneng ya bohlapelo*** . Furthermore, the study revealed that paraphrased terms are guided by the definitions which informed the term creation process, for example, the term ***assymetry -go ripa gare ka go swana*** and the term ***triangular based pyrami***d is translated ***phiramiti ya botlase bja khulotharo.*** Although this strategy is effective it creates long and lengthy terms in a form of a sentence.

The study revealed that paraphrasing characterized by borrowing was used to create terms in Northern Sotho. For example, the term ***kite shape*** is translated as ***sebopego sa khaete***, and diagrammatic form is translated ***sebopego sa taekramo*** it is noted that the translator used added borrowed words while explaining and creating the

Northern Sotho term equivalent. The findings showed that this strategy can be effective if the learner already knows the concept in English. However, if the learner is unfamiliar with the concept in English it will be difficult to understand the term equivalent which has borrowing elements in it.

6.2.3 Compounding

The study revealed that compounding is used as a strategy to create terms in Northern Sotho. The study found that there are types of compound terms namely, complex compound with two or three nouns, phrasal compound and compound that starts with a verb phrase. The study found that complex compound with two nouns is the most used by translators when creating terms in Northern Sotho. Then complex compound with three nouns is the least used. Furthermore, verbal phrase compound and phrasal compounds are used by translators.

The study revealed that in complex compound terms seem to be complex and packed with many lexical items. In the complex compounds which are two nouns, it was noted that the equivalent was clear and understandable as they are descriptive in nature, for example, ***3 dimensional – mahlakoretharo, and the term digit -palotee,.*** The study found that in compound complex with two nouns are clearer and more understandable and the learners will understand them as they are self-explanatory and descriptive in nature. However, it is noted that in complex terms with three nouns, the term equivalents are lengthy with lexical elements making them packed and complex. The study revealed that packed complex term equivalents are hard to understand and are too long and not economical to be used, for example the term **bisector-** ***mothaloseripagare*** or **ordinal number** translated as ***palotšhupatatelano.***

On the other hand, phrasal compound that start with a verb are easier to understand and clear. It was found that phrasal compound term equivalents are also easier to understand as they are explanatory, for example, the term ***perform a calculation*** is translated ***šoma palelo,*** and **add hundreds** translated as ***hlakanya makgolo are*** more understandable and the learner will understand them. However, the study revealed that in long phrasal compounds that are in a sentence form, the term equivalents are lengthy, for example, the term **pen and paper method-** ***mokgwa wa pene le lephephe*** .Although terms should be concise and brieve, , it is however not possible, especially in specific domains such as mathematics.

6.2.4 Loan translation

Loan translation is another strategy used as a strategy to create terms in Northern Sotho. The study revealed that there are types of loan words namely total or integral loan word and partial loan word. The study revealed that translators mostly used total or integral loan words to coin term equivalents in Northern Sotho and then followed by partial loan words. From the study, it is noted that total or integral loan words create term equivalents that are hard to understand as they fail to render the intended meaning in the target language for example***, number phrase*** is translated ***sekafokopalo***, however, the study found that using total or integral loan words create term equivalents that are understandable and clear for example, ***number skill*** is translated ***bokgonipalo.*** Furthermore, the study revealed that translators used partial loan to crate terms in Northern Sotho. However, it is noted that the term equivalents are clear and more understandable for example, the term ***percentage sign*** is translated ***leswao la phesente and box shapes*** is translated ***dibopego tša lepokisi.***

Another finding is that it should is noted that the translators in other instances created term equivalents by loaning two components of the source concept.to create the Northern Sotho term equivalent for example, ***pair of compass is translated phere ya khamphase and geometric solid translated soliti ya tšeometriki*** The study found that this strategy is not effective as it translates only lexical meaning but not the meaning , creating more confusion.

6.2.5 Coinage/Neologism

Coinage is used as term creation strategy for creating Mathematics terms. The study found that when translators coined new words, they created words which are in a form of multiword or compound which are made of different lexical items such as nouns and verbs; for example, the term ***heptagon*** is translated as ***khutlošupa and pentagon*** translated as ***sebopegohlakorekhutlohlano*** which is a coined multiword term. The study found that in multiword term equivalents are too long to be understandable by learners because of their length. The study found that when coining words the translators attached the new word with the existing indigenous words to create a new term equivalent in Northern Sotho, for example, the term hand [clock] is translated ***lenaka***, which is a word already existing in Northern Sotho, however, it was to the concept of English. Another example found in the study was the term ***brackets*** translated as ***mašakana,*** using the existing word and attaching to the new word. The

study found that attaching new word to existing is an effective way of creating terms in Mathematics. However, the study found that attaching new words to existing indigenous word can create polysemous words in a specific domain, where one concept has the same term equivalent in Northern Sotho. For example, the term activity is translated ***mošomo*** and again the term ***assignment*** is translated ***mošomo.***

The study found that in there are different concepts in English which are translated with the same term equivalents in Northern, creating confusion and redundancy of word., for example, the term ***total is translated palomoka***, and the term ***tally is translated palomoka***, and another term ***total amount is translated palomoka*** . It can be noted from the findings that in Northern Sotho, one term equivalent is a translation for different specific concept. This creates term equivalents that are polysemous and not designating a specific concept in Northern Sotho.

Another issue noted in the study is that coinage creates term equivalents that lacks specificity which are too general and not designating a specific concept in a certain domain. For example, the term ***calculato***r is translated ***sebaledi***, and the term ***counter*** is translated as ***sebaledi.*** The study found that the coined term equivalents might cause confusion as they might not necessarily designate the specific concept for example, the term ***addendum*** is translated ***setlaleletši*** and ***curso***r is translated ***sešup***i, this might create confusion as they are too general. The study found that, learners will understand the borrowed terms as they are closer to the English source concept unlike using a new coined word that might cause confusion.

6.3 CHALLENGES OF MATHEMATICAL TERM CREATION IN NORTHERN SOTHO

6.3.1 Lack of harmonisation of translated equivalents in Mathematics concepts in Northern Sotho

The study found that there is a lack of harmonisation of translated equivalents whereby one concept is translated differently creating inconsistencies in the orthography of the borrowed concepts. The study found that, translators and terminologists are working in silos and not consulting previous work done in the same domain of specific field. It is also noted that, the study found that even when term equivalents are available in sources such as the Terminology Spelling and Orthography No 4 1988, terminologists still create their own term equivalents without consulting the Terminology and Spelling

and Orthography No 4 1988. Creating new terms that are not even related to the term equivalents created first. This creates lack of harmony and multiplicity of terms in one domain. For example, the term ***pentagon*** is translated ***khutlohlano*** in the Terminology Spelling and Orthography No 4 1988, however it is also translated ***as sebopegohlakorekhutlohlano*** in the Multilingual Mathematics Dictionary for Mathematics for Grade R-6. Another example that was found in the study is the term ***octagon*** is translated ***hlakoreseswa***i, while the same term is translated differently as ***sebopego sa hlakorekhutloseswai.*** The study found that this creates confusion and a lack of harmonised terminology system in the field of Mathematics in Northern Sotho.

6.4 RECOMMENDATIONS

Having made an analysis of term creations strategies used to create Mathematics terminology in Northern Sotho, the researcher came up with the main recommendations.

- **Recommendation for government, Language Bodies, linguists, terminology experts and stakeholders**

The National Language Body for Terminology Technical Committee should produce a standardised spelling and orthography guidelines for technical domains. In other words, the guidelines should address the spelling and orthography of technical terminology in specific fields. This will ensure a harmonised standardised terminology in specific domains. It will further avoid confusion of various terms in one domain. Moreover, it will avoid multiplicity of terms in one domain.

- **Recommendation for National Language Bodies and Terminology Technical Committees, language practitioners and linguists**

Provide clear rules that addresses words with foreign cluster combinations. The rules should cover as much as possible the foreign cluster combination from English and other foreign languages. This will ensure consistencies with regards to the issue of spelling words with foreign cluster combination Furthermore, the National Language Bodies should come up with clear rules on how to borrow words from other languages, especially in technical specific domains.

- **Recommendation for collaboration amongst terminology developers and translators**

There should be a collaboration between private companies and publishing companies which develop and translate educational materials with the government. Private publishing companies should work together with department of education to avoid duplication and working in silos when it comes to terminology development. This will ensure a harmonisation and consistent systematic terminology. This will avoid the issue of having different equivalents for one term by different institutions.

- **Recommendation for terminology developers to register their terminology projects on the National Terminology Register with the Department of Sports Arts and Culture**

Terminology developers in the private and public sector should register their project before starting to develop terminology. This will ensure that before starting with any work, existing work should be done so that reinvention and duplication of work should be avoided. This will ill also avoid working in silos whereby different institutions develop their own work creating many term equivalents for one concept in one specific domain.

6.5 LIMITATIONS

The limitation of the study is that it focused on analysing term creation strategies for Northern Sotho in Mathematics, in other words, it cannot be generalised with other languages. The findings of this study might be different from the findings that can be done in any other languages. The study only focused on Mathematics domain; however, it does not mean other fields cannot be explored. The researcher further recommends that for future research can be done on other subject fields such as engineering, science, and technology in Northen Sotho.

6.6 CONCLUSION

The study aimed at investigating the use of term creation strategies used to develop mathematical terms in Northern Sotho. The strategies that were discussed were borrowing, compounding, paraphrasing and coinage. This section discussed the findings, general summary, limitation of the study and the recommendations of the study.

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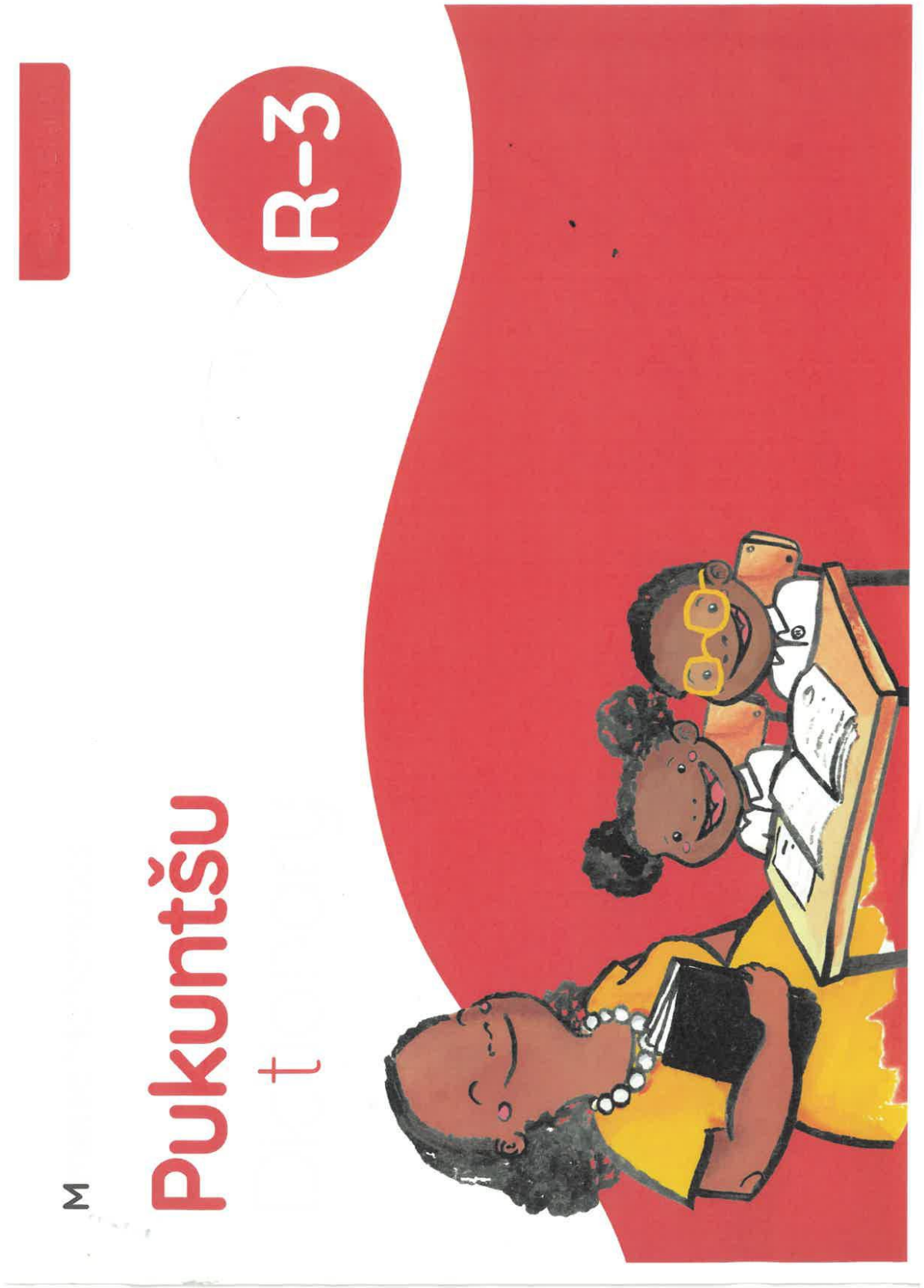
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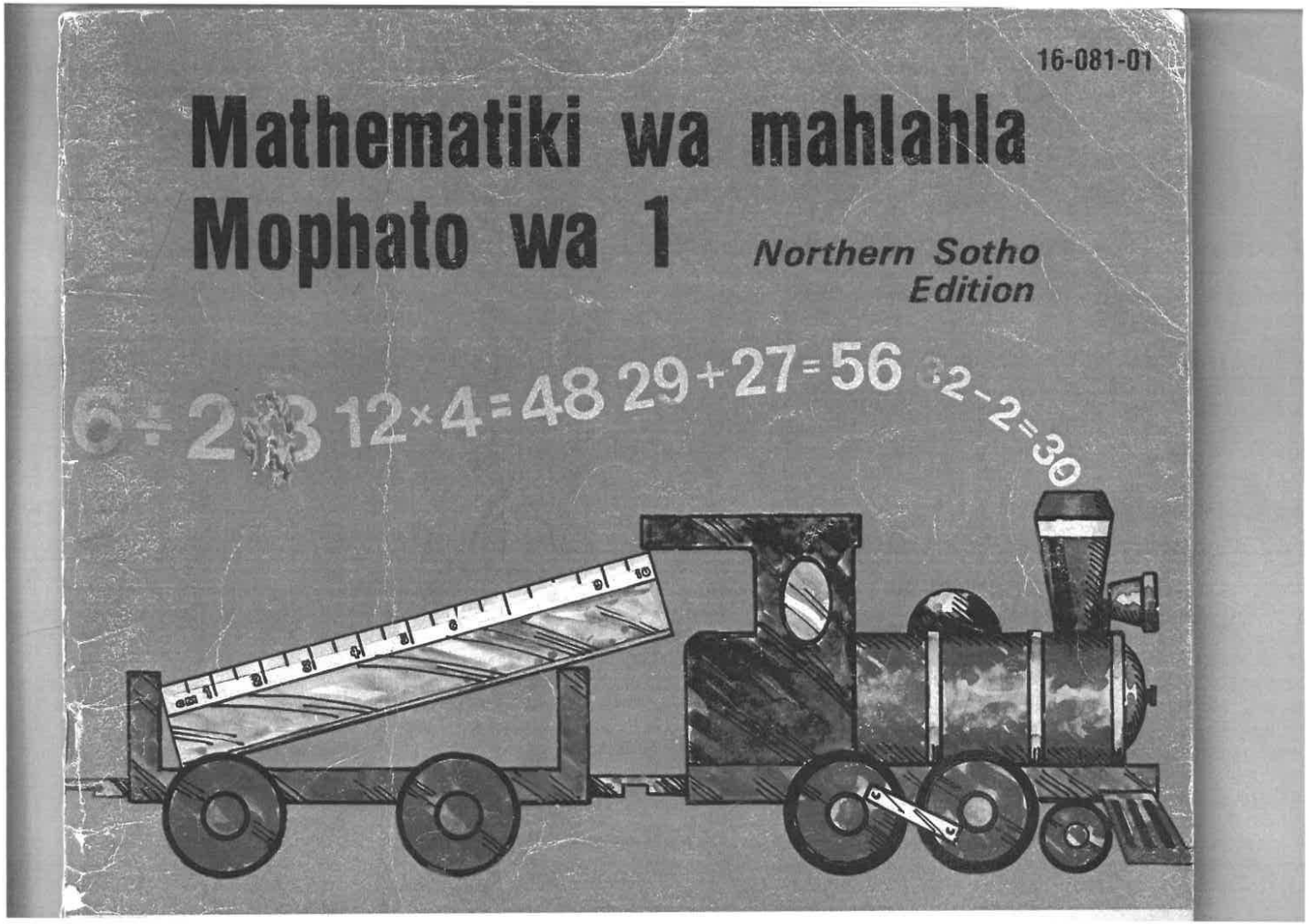
Grade R Mathematics Improvement Programme

Pukutlhahlo ya Mareo

Concept Guide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Mathematiki wa mahlahla
Mophato wa 1
Northern Sotho
Edition
6÷2=3 12×4=48 29+27=56 32-2=30

basic education

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