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Intellectualisation of Northern Sotho through English terminology adaptation

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This study aimed to investigate and propose a pragmatic approach in the adaptation of English terminologies for scientific purposes into Northern Sotho. This is necessary because of the lack of terminologies to describe and define scientific phenomena in the language. Languages are constantly evolving, and speakers drive their evolution. The study aimed to overcome the scientific terminology development challenge for Northern Sotho by analysing existing data and using corpus linguistics as a method. The *Multilingual Natural Science and Technology Dictionary Grade 4–6* (2013) was used to provide illustrative examples and clarify linguistic complexities in scientific terminology. The study revealed the complexity of the linguistic adaptation of Northern Sotho and the challenges and pitfalls linked to the integration of borrowed English terminology into academic discourse, encompassing apprehensions concerning accuracy, clarity and cultural appropriateness. Furthermore, the findings indicated that the puristic term adaptation approach tends to be perplexing.

Contribution: This study contributes to the intellectualisation and revitalisation of Northern Sotho by enhancing the language and equipping its speakers to engage more efficiently in scientific contexts, illuminating intricacies and potential misrepresentations inherent in the process of adaptation. Moreover, the research underscored the significance of employing adaptation strategies that are suitable for the Northern Sotho context and are consistent with linguistic patterns and semantics.

Keywords: intellectualisation; language modernisation; language adaptation; pragmatic approach; lexicography; terminology development; coinage; corpus linguistics.

Introduction

In the context of South Africa, and given this study's limitations, intellectualisation refers to an organised method that accelerates the growth and advancement of indigenous official African languages to make them functional in all academic fields such as research, technology, science, and teaching (Khumalo 2017:252).

The United Nations Educational, Scientific and Cultural Organization (UNESCO) Report on Culture and Development (1995) emphasises that all languages are equal instruments of communication and have the potential to become global languages. However, the idea that languages are like living organisms is deceptive. Languages are tools and products of societies, with their destinies determined by social and political environments, particularly power distribution. The extension of the intellectual frontiers of African languages, requires equipping terminology to embrace modern science and technology, thereby extending their potential ('Our Creative Diversity', p. 179).

Our observations indicate that Northern Sotho is deficient in indigenous scientific terminologies. Historically, the language lacked a comprehensive and culturally resonant vocabulary for effectively communicating scientific concepts and phenomena. Consequently, this limitation has hindered the language's capacity to partake in scientific discourse in a meaningful manner.

The lack of appropriate terminology to describe and define scientific phenomena, resulted in South African indigenous languages, like many African languages, not being utilised extensively for scientific purposes. This restriction hinders the intellectualisation and development of these languages, as scientific discourse and knowledge play a vital role in defining the cultural identity of a society. To address this issue, it is essential to investigate strategies for the adaptation and incorporation of scientific terminologies into indigenous South African languages.

Sager (1990) asserts that:

[T]he vast majority of new terms are coined as and when new concepts are created in instances such as new discoveries, restructuring of existing knowledge, incidental observations, and planned developments. (p. 62)

Increasing demand for such terms in scientific and technical discourse motivates the development of new terms. When we look at the following words in English and their equivalents in Northern Sotho, we see the need for adaptation. For instance, the equivalent of a term like 'premature' is '*ya go tla pele ga nako*', which translates to 'something that came before time'. This equivalent places Northern Sotho in disadvantage when describing a scientific phenomenon. However, when we look at the equivalent of 'pollination', which is transliterated as '*pholineišene*', in terms of terminologies it gives hope that the language can progress to another level. The alternative equivalent '*kgotlelo*' is ambiguous, as it is loosely translated as 'making something dirty'. The provided examples present two approaches to the adaptation process, the pragmatic and puristic approaches.

Similar to cultures, languages are in a constant state of evolution, driven by their speakers. In recent years, the pervasive influence of English has become evident, as non-English speakers in South Africa increasingly incorporate the language into their everyday speech. Seabi (2005:1) notes that 'English seems to be gaining influence and that speakers of indigenous languages clearly prefer this language'. Moreover, Wardhaugh (1996:348) is of the opinion that 'English is gaining speakers all over the world and is frequently viewed as a threat to numerous local languages'. However, this new language trajectory presents a unique opportunity to capitalise on the adaptability and dynamism of indigenous South African languages by incorporating English terminologies for scientific purposes. Term creation and lexicography are integral components of this process, allowing for the intellectualisation and revitalisation of these indigenous languages.

Cruz and Llamzon, cited in Alexander (2003:38), assert that intellectualisation can be understood as the adaptation of a language '…to the goal of making possible precise and rigorous, if necessary, abstract statements', that is, a tendency towards increasingly precise yet abstract expression. This tendency primarily affects lexical and, to a lesser extent, grammatical structure.

The study aims to investigate and propose a pragmatic approach in the adaptation of English terminologies for scientific purposes into Northern Sotho by analysing existing data and using corpus linguistics. It acknowledges the importance of context and collaboration in the adaptation process, with linguists and native speakers responsible for aligning terminologies with the language's structure, semantics and cultural nuances. The goal is to empower the language, its speakers and the community by facilitating the linguistically appropriate expression of scientific concepts and knowledge. The research contributes to the intellectualisation of South African indigenous languages by presenting a practical and sustainable approach to scientific terminology development. Enhancing scientific vocabulary and discourse in Northern Sotho can unlock new opportunities for education, research and cultural preservation, fostering a greater appreciation for and use of the language in scientific domains.

The development of South African indigenous languages

In recent years, there has been an increase in interest and concern regarding the intellectualisation of South Africa's indigenous languages (see Mlambo, Matfunjwa & Skosana 2022), particularly Northern Sotho. The usage of indigenous languages in South Africa has not been as pervasive in science as it has been for international languages like English, French or Spanish. This is explained by the lack of terminologies in these languages that can be used to define and describe scientific phenomena. Indigenous language development and advancement are hampered by the lack of scientific discourse, which also perpetuates a reliance on outside languages for scientific communication and comprehension. Referring to the fact that 'developed languages', such as English, have passed through the same phases as African languages, and that their intellectuals worked with fervent dedication to 'overcome similar claims of inadequacy', Ngugi (2013:10) argues that African languages require a similar commitment from African intellectuals, keeping in mind that no language has a monopoly on cognitive vocabulary and that, as Cheikh A. Diop once argued, every language is capable of developing its own terms for science and technology.

Language development entails three objectives: (1) the construction of a common orthography and spelling system; (2) the expansion and modernisation of a language's vocabulary; and (3) the development of new registers for the fields of education, law, journalism and report writing (Cluver 1992:68). This is ultimately the intellectualisation of languages, which Finlayson and Madiba (2002:40) define as the deliberate process of accelerating the growth and development of our indigenous languages in order to improve their interoperability with modern developments, concepts and theories. This implies the establishment of a 'counter-hegemonic' trend in order to displace English as the sole language of power and cultural capital (Sibayan 1999:448).

Phaahla (2006:39) argues that language planning in South Africa must undergo a reversed process of the language shift from what Fishman (1991:xii, in Cooper and Spolsky 1991:30) refers to as Level 1 usage (which is informal intergenerational utilisation at home, in the context of the family and the neighbourhood) to Level 2 usage (in domains such as outside ethnolinguistic influences, languages of education, the workplace, the mass media and government language). Fishman (1991) argues persuasively that attempting to govern Level 2 without adequately protecting Level 1 would be futile.

In his analysis, Haugen (1997:350) outlines a comprehensive four-step approach to language development. To transform a language into a modern tool for a nation, he suggests that it must first select a norm, establish a standard form through codification, enhance its functional capabilities through elaboration and obtain acceptance from the community it serves (Haugen 1997:348). Haugen's viewpoint emphasises the complexity and inclusiveness of a completely developed language, emphasising its capacity to accommodate diverse communities, social classes, occupations and interests. Haugen acknowledges the significance of writing as a technological tool for language development, but he views it as a means to accomplish codification and elaboration rather than as the primary objective.

In contrast, Ferguson (1997:264) presents a three-step model for language development that is more straightforward. He places significant emphasis on the function of writing, referring to it as 'graphisation', and 'standardisation' as crucial milestones. According to Ferguson, 'modernisation' of a language occurs after these steps, suggesting that a language must first be reduced to writing and standardised before it can be considered modern. Moreover, he emphasises the necessity of standardisation to supplant regional and social dialects, possibly advocating for greater language uniformity.

Overview of previous studies on language adaptation

In recent years, scholars have focused on the intellectualisation of South African indigenous languages, as researchers and language advocates have recognised the significance of promoting these languages as vehicles for scientific discourse and knowledge.

Several studies have highlighted the difficulties indigenous South African languages encounter in the development of scientific terminology. In Van Huyssteen (1999), nine issues relating to the development of terms in African languages, including Zulu, were discussed. It was discovered that African languages are hampered by the colonial and Eurocentric mindset prevalent in Zulu. Standardisation processes were found to be inefficient and sluggish, and the Zulu alphabet has not adopted foreign accents. The application of semantic shifts in coinage can result in less transparent synonyms. These phonological and lexical alterations should be acknowledged as part of the language's development and mutual influence in South Africa's multiple languages. Borrowing is permissible, but coinage should be pursued within a framework that is indigenous. Compounding, an indigenous method of creativity, is also demonstrated in Zulu. Sesotho terminology development is still in its infancy, with limited expertise in term development and documentation. This issue can be resolved by promoting standardisation and coordination in African language term-creation activities (Van Huyssteen 1999:186).

Numerous scholarly works have highlighted the significance of terminology development and lexicography in the intellectualisation of indigenous languages. A study conducted by Khumalo and Nkomo (2022) noted that terminology development is a pivotal precursor in the compilation of subject field dictionaries in African languages. Critical factors include the repositioning of African indigenous languages in knowledge organisation, knowledge creation, knowledge access 'and knowledge dissemination in (higher) education in order to improve epistemic access and student success' (Khumalo & Nkomo 2022:154), which has been the bane of higher education.

In their study, Letsoalo, Mabaso and Gouws (2022) examined the approaches utilised when translating English robotics terminology into three indigenous languages: Sepedi, Xitsonga and isiXhosa. The researchers also assessed the suitability of the translated equivalents in order to facilitate the retrieval of robotics-related information. This research was conducted with the intention of demonstrating how translation can revolutionise the teaching and learning of robotics programmes in indigenous languages. It was suggested that the creation of open educational resources could be advantageous for speakers of indigenous languages, as it would enable them to access educational content in the language that most interests them. Priority consideration should be given to strategies such as compounding, semantic transfer and derivation when developing terminology, according to the recommendation. Borrowing ought to be avoided at all costs, as it permits the intrusion of a source language into a target language, which may result in the pronunciation of indigenous languages as alien. This is another typical example of a puristic approach.

Similarly, Moropa's (2013) study examined 30 technical terms from the Multilingual Information Communication Technology Terminology List to facilitate communication in technical fields and specialised areas within the information and communication technology (ICT) environment. Borrowing is a natural and universal process where individuals borrow words to meet their communicative requirements (Crystal 2010:48) and fill lexical gaps in their languages. As languages evolve, new inventions emerge, necessitating the creation of new words to identify new objects. Terminologists use strategies such as indigenising the source language term, inserting a prefix or terminative vowel, forming new consonant combinations or clusters and forming new vowel combinations to eliminate foreignness in borrowed words and create a more inclusive and diverse language (Moropa 2007:191–192). Moreover, Moropa (2013:248) found that most South African indigenous languages have adopted loan terms for words like airmail, computer, internet, cable and email, among other words. Moropa concludes that borrowing should not be viewed as a threat to the purity of the language but as a way to describe something that has never existed in that culture or language before and cannot be accurately expressed by existing terms.

Moreover, Mojapelo and Mojela (2009) conducted a comparative study to contrast the user-friendliness of natural science and technology terminology coined and transliterated in

Sesotho sa Leboa. The example terms come from the *Multilingual Natural Science and Technology Dictionary* (Department of Arts and Culture 2005). The analysis revealed that most scholars and theorists favour coined lexical items in formal publications and written language but employ them infrequently in everyday speech. As a result of ambiguity and compounding, coined lexical items were found not user-friendly, and lemmatisation of coined lexical items can be difficult. Lexicographers must understand the etymology of each component of a compound term in order to provide a comprehensive and accurate lexicographic definition. Most newly coined words were entered as polysemous words, rendering them ambiguous. Additionally, some coined compound lexical items are lengthy, making their entry as lemmas into the dictionary less convenient (Mojapelo & Mojela 2009:445).

Mojapelo (2018) investigated the approaches taken in the development of terms for Northern Sotho, taking into account obstacles including informal language, inadequate terminology, inconsistent terminology lists and inexperience in terminology creation. Compounding, borrowing, transliteration, paraphrasing and semantic transfer are all frequent methods of term creation. Nevertheless, it was discovered that the most effective methods for developing sound terminology in the target language were transliteration and paraphrasing. The lack of experience in terminology development, inconsistent terms in orthography and spelling resources and the unavailability of specialised dictionaries all contributed to the ineffectiveness of terminology development in the language.

Theoretical background of intellectualisation process

Guided by Havranek's (1932) definition of intellectualisation, Khumalo (2017:254) qualifies it as a clear process of (functionally) cultivating, developing, elaborating and modernising a language so that its terminology can carry the full weight of scientific rigour and precision and its sentences can accurately express logical judgements, resulting in a language that can function in all domains.

Language planning

In the context of South Africa, language planning refers to intentional efforts made by the government to manage and foster linguistic diversity in the country, especially post-apartheid. Drawing from Jernudd and Das Gupta (1971) and Fishman (1973), Cooper (1979, in Alatis and Tucker [1979]) defines language planning as a systematic endeavour to identify and implement resolutions for language-related challenges, typically on a national scale.

As complex as language planning is, Cooper (1989) classified language planning into three distinct domains: acquisition planning, corpus planning and status planning. Drawing from Cooper (1989), Hornberger (2006:6) conceptualised these domains thus: status planning pertains to the distribution of functions of languages or literacies within a specific speech community; corpus planning concerns itself with the sufficiency of the form or structure of languages or literacies; and acquisition planning attempts to impact the allocation of users or the distribution of languages or literacies through the creation or enhancement of learning opportunities or incentives, or both. Furthermore, Ndimande-Hlongwa (2010:210) defines acquisition planning as 'organised efforts to promote the learning of a language'.

Cooper (1989:157–163) categorises acquisition planning based on its explicit objective, which he delineates as maintenance, foreign language or second language acquisition, reacquisition and shift. Hornberger (2006:10) supplements this with the inclusion of shift as a fourth potential objective, thereby establishing an exact correspondence with the four status cultivation objectives. In contrast, corpus planning refers to elements that are fundamentally linguistic in nature and therefore intrinsic to language, such as the development of orthographic material for language materials (Kaplan & Baldauf 1997:38). Having discussed the three main categories of language planning, the study adopts acquisition planning as a conceptual framework.

Acquisition planning is an essential component of the research concerning the adaptation of English scientific terminology to indigenous languages spoken in South Africa. Developing effective adaptation strategies for language learners necessitates an awareness of their cognitive abilities, linguistic proficiency, cultural contexts and personal histories (see Ramlan 2018). This assists in identifying suitable initial stages and subsequently constructing learning scaffolds. The formulation of effective adaptation strategies, including instructional materials, curriculum frameworks and teaching methodologies that maximise language acquisition and retention, is guided by acquisition planning (see Cummins & Swain 1986; Ramlan 2018). It assures the accessibility of the language by considering syntactic complexity, cultural relevance and vocabulary difficulty. Acquisition planning fosters active language use and engagement by providing learners with opportunities to apply scientific terminology in meaningful contexts. The assessment of learning outcomes is critical to determine the efficacy of adaptation initiatives. By conducting this type of study, researchers can enhance language learning experiences by refining adaptation strategies, identifying areas that require refinement and making decisions based on empirical evidence.

Language modernisation

The term 'modernisation' generally means to make or become modern; to conform to current usage, expression or characteristics (Webster 1978). It has been used in relation to society, culture, religion, social relations, technology and language, among other aspects (ed. Weiner 1966). In this study, the focus is on language modernisation, which Cooper (1989:149) defines as 'the process whereby a language becomes an appropriate medium of communication for modern topics and forms of discourse'. This process entails lexical modernisation and the creation of modern registers.

Cluver (1992:44) defines lexical modernisation as a deliberate creation of new terms or the (semantic) adaptation of existing words to identify new concepts in a developing language into which concepts have been borrowed too quickly for natural naming processes to function. This is typically accomplished through the compilation of dictionaries, glossaries and specialised terminologies, and it is regarded as an imperative task (Phaahla 2006). However, as Fishman (1974) cautions, one should not fall into the trap of viewing lexical modernisation as merely a linguistic exercise that focuses solely on words. Lexical modernisation entails additional elements, including social, religious, and economic.

One of the factors in the language modernisation process is the creation of modern registers. The creation of specialised registers in languages is evidence of the adaptability and originality of human language. These specialised registers play a crucial role in promoting effective communication among professional, academic and technical communities. They facilitate precision, efficiency and the preservation of knowledge, ensuring that language remains a potent instrument for human advancement. As disciplines develop and grow, so will the specialised registers that accompany them, continually pushing the boundaries of linguistic innovation.

Puristic approach

A puristic approach to language modernisation is motivated by a desire to preserve or rid a language of foreign or undesirable elements (Thomas 1991:12). This approach can be a manifestation of underlying social or political forces, such as in France, Israel, Italy, Germany and Turkey (Madiba 2000:268). Language planning is often part of a more politically motivated agenda.

According to Madiba (2001), puristic tendencies also exist in the modernisation of certain African languages, such as Amharic, Swahili and Luganda. These models emphasise the use of language-internal term-formation strategies instead of borrowing from foreign languages. Borrowing from foreign languages is considered a last resort in a puristic approach, with only borrowings from regional dialects and neighbouring languages allowed.

In South Africa, the puristic approach to Afrikaans is an example of the puristic approach to language development. The adoption of this strategy has been controversial, as it was seen as a political policy to enforce separate development and prevent borrowing (Botha 1983:234–235). However, borrowing from languages like Afrikaans was encouraged to bolster its dominance and combat the influence of English (Webb 1994:193).

Language purism, a practice in some African nations, is often criticised for not being based on scientific studies of language development tendencies. Joshua Fishman has criticised the puristic approach to language modernisation, arguing that it

is not conducive to effective terminology development. Puristic approaches are language-centred, focusing primarily on language and overemphasising its importance, which can lead to losing touch with linguistic realities and the actual linguistic requirements of the target population. Several studies (Mwansoko 1990; Samsom 1988) have shown that the general public prefers borrowed terms over puristic terms developed.

Madiba (2001) is of view that the puristic approach is unsuitable for the modernisation of African languages. Most African languages have traditionally been underdeveloped and lack scientific words to 'express modern realities' (Rettová 2002:130) compared to languages used in higher domains, such as English and Afrikaans. To function in these domains, a rigorous terminology development programme is needed. Puristic indigenous methods are slow and take time to disseminate (Madiba 2001:59). The development of terminology in African languages should be viewed as a reaction to changes in sociocultural, economic and political contexts. Some scholars prefer a puristic approach, while others favour a liberal approach based on borrowing.

Pragmatic approach

Several academics recommend the pragmatic approach to terminology modernisation for the development of standard languages (Jernudd 1977; Madiba 2001). This strategy includes two phases: the borrowing phase and the indigenisation phase (Joseph 1984). The borrowing phase promotes the unrestricted use of borrowing in terminology development, incorporating all extant loanwords that have not yet been officially incorporated into the target language (Madiba 2001:65). The selection of borrowing strategies is contingent on variables such as the subject field, level of specialisation and intended audience of the terms.

In the borrowing phase, term developers may use internationalisms, loanwords or loan translations, depending on the subject field, level of specialisation and intended audience of the terms. Internationalisms are predominantly employed by subject-matter experts in highly technical subject disciplines or at advanced communication levels. Loanwords or local technical terms are recommended in semitechnical disciplines (Madiba 2001:65–66).

In the indigenisation phase, terms borrowed in Phase 1 (the borrowing phase) are replaced by indigenous terms. This phenomenon is observed when spontaneous borrowing has occurred, particularly when foreign concepts expressed by such terms become commonplace in the language community. It is possible to replace borrowed terms with indigenous terms, but it is essential to comprehend the causes of the need for indigenisation (Madiba 2001).

Indigenisation of a language is contingent on the level of development of the intended users, as many indigenous speakers in developing nations lack specialised subject knowledge and are unfamiliar with the source language.

Because they are more transparent than imported terms, indigenous terms facilitate effective communication. Loanwords have a brief lifespan and are frequently replaced, whereas indigenous terms are more likely to endure. Indigenisation is a systematic procedure that employs a well-established conceptual framework to organise knowledge in a subject area. Borrowed word forms are less productive, so indigenous term formation is more productive in generating new terms to express foreign concepts (cf. Mwansoko 1990; Sager 1989).

In summary, previous research has highlighted the difficulties indigenous South African languages, such as Northern Sotho, encounter in developing scientific terminologies. The research on language terminology development, intellectualisation and corpus linguistics has yielded valuable insights and methodologies that can inform the adaptation of English terminologies for scientific purposes. The present research seeks to contribute to the intellectualisation of Northern Sotho and to promote its incorporation into scientific discourse, ultimately empowering the language and its speakers in the realm of scientific knowledge by building on previous research.

Methodology

Corpus linguistics was utilised in this study as a methodology. Corpus linguistics is a methodological approach to the study of language that adopts an empirical stance (Adamou 2019). Analysing extant linguistic data from English and Northern Sotho provided insights into the semantic nuances, syntactic structures and lexical gaps in scientific discourse. This analysis guided the adaptation process and ensured linguistic authenticity.

Corpus linguistics is a valuable methodology for this study because it permits a thorough analysis of language patterns and usage within a particular context. The *Multilingual Natural Science and Technology Dictionary* (Department of Arts, Culture & Technology 2013) terminology list was utilised to achieve the goals of this study.

The selection of terms from this list was made with a specific objective in mind: to facilitate illustrative examples that enhance the clarity and breadth of our findings. In other words, random purposive sampling was employed. Random purposeful sampling increases sample credibility when the potential intentional sample size is excessively large (Miles & Huberman 1994:28). This dictionary consists of 2896 terms from English to the Sotho languages.

By selecting and incorporating these terminologies on purpose, we hoped to clarify the nuances of language usage and terminology formulation. This strategic decision allowed us to effectively demonstrate and analyse the linguistic complexities underlying the central concepts and phenomena of our research objectives. In this way, we ensured that our research not only contributes to the field of corpus linguistics, but also provides valuable insights into the specialised language (scientific terminology).

Findings

The principal objective of this research was to examine and suggest strategies for adapting English terminologies to indigenous languages of South Africa, with a specific emphasis on Northern Sotho. By means of meticulous scrutiny and investigation, the research endeavoured to tackle the difficulty associated with establishing scientific terminology in this language, with the overarching goal of advancing its intellectual integration and assimilation into scientific discourse. Furthermore, the challenges and pitfalls that emanate from using the puristic adapting strategies will be outlined.

Adaptation strategies

We present a comprehensive analysis of each suggested adaptation strategy – borrowing, transliteration, coinage and compounding – along with an illustration of how each strategy might be implemented to render English scientific terminology suitable for application in Northern Sotho.

Borrowing

Borrowing is either a direct transmission from another language or a loan translation. A word borrowed by means of direct transfer will possibly alter its meaning in the target language. Cluver (1989:270) identified borrowing as a distinct term formation process through which technical languages can expand their vocabularies, resulting in an internationally acknowledged terminology that facilitates technical communication across language boundaries. In Northern Sotho, loanwords are adapted to the morphological and phonological structure of the language, as demonstrated by the examples in Table 1.

Table 1 presents English words that do not have direct equivalents in Northern Sotho but which were borrowed and adapted to the morphological and phonological structure. For instance, terms like 'Internet' were borrowed and adapted as '*inthanete*' in Northern Sotho. *Inthanete*'s morphological structure has been arranged in an acceptable Northern Sotho orthography. The syllables were divided as thus: *in-tha-ne-te*. There is no direct equivalent for 'bank' in Northern Sotho, so the English version was adapted as '*panka*' in Northern Sotho. The borrowed version is pronounced as *pa-nka*. 'Switch' as a noun is another example of a word that did not exist in Northern Sotho, so in the adaptation process its sound in

TABLE 1: Borrowing from English to Northern Sotho.

English	Northern Sotho
Internet	*inthanete*
Bank	*panka*
Switch (noun)	*switši*
Syringe	*serintši*
Tank	*tanka*
Television	*thelebišene*
Temperature	*themphereitša*

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

English was maintained for recognition and relatability: '*switši*' is the borrowed version into Northern Sotho. 'Syringe' is also foreign in Northern Sotho and most South African indigenous languages; it was adapted to '*serintši*' in Northern Sotho. Like 'switch', the 'syringe' sound was maintained. 'Tank' could have an equivalent in Northern Sotho as '*bo bolokelo*' (*bja meetsi* – water tank), but this equivalent is descriptive for scientific use and can contribute to confusion as its literal translation is 'a place to be safe', which is not accurate enough. '*Tanka*' is convenient and can be naturalised easily by the speakers. The same applies to 'television' and 'temperature'; there are no equivalents in Northern Sotho as these are modern phenomena. '*Thelebišene*' and '*themphereitšha*' are the adapted borrowed equivalents. While this approach provides a direct means of introducing novel scientific terminology, it might present difficulties in ensuring appropriate morphological structure for some concepts. A distinct 'characteristic of borrowed words is that they become assimilated in the linguistic system of the recipient language' (Tsvetkov & Dyer 2016:66). A typical example of this is the borrowed word '*panka*', which does not sound foreign anymore. Borrowing is a pragmatic approach to adapting English terminologies. It would be most acceptable with new generations, as several studies have indicated that they are leaning on the English side.

Transliteration

According to the *Longman Modern English Dictionary*, transliteration is the substitution of letters from one alphabet with letters from another alphabet that produce the same phonetic sounds. Borrowing and transliteration are easily confused strategies. According to Tsvetkov and Dyer (2016:66), 'transliteration refers to writing in a different orthography, whereas borrowing refers to expanding a language to include words adapted from another language'. Table 2 shows some examples of transliteration in Northern Sotho.

Table 2 presents transliterated words from English to Northern Sotho in order to maintain the phonological structure of the source text. These do not have direct equivalents, and coining new terms may tend to confuse the speakers of the language, as it was argued before that the speakers of the language are its drivers. 'Factory' and 'fax', respectively, contain letter combinations and letters that do not exist in Northern Sotho. The combination of 'ctory' is foreign, and the letters 'c' and 'x' are only allocated to exclamations like '*nca nca nca*' and '*nxae nxae*'; those are the only instance in which these letters are used. '*Feketori*'

TABLE 2: Transliterated terms from English to Northern Sotho.

English	Northern Sotho
Factory	*feketori*
Fax	*fekse*
Glass	*galase*
Grease	*krisi*
Helicopter	*helikhophthara*

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

and '*fekse*' successfully manoeuvre within the suitable phonological structure. The letter combinations in the term 'glass' are also not part of Northern Sotho, and in fact the speakers of the said language are leaning towards the Afrikaans pronunciation of '*glas*'; hence, it is spelt '*galase*' because phonologically and morphologically it is close to Northern Sotho in this regard. Lastly, 'helicopter' is also a modern form of transportation, and its transliteration is phonologically sound and relevant to Northern Sotho '*helikhophthara*'. Transliteration is another pragmatic terminology adaptation strategy that is practised on a daily basis.

The third adaptation strategy is **coinage** – the *Longman Modern English Dictionary* defines 'coinage' as the creation of new words, phrases or idioms. This form of linguistic borrowing, in which only the meaning of a word is adopted, is sometimes referred to as a neologism. The meaning of the foreign term (the scientific term) is associated with a native word, particularly a word referring to a sensation that is more or less related. Some examples follow in Table 3.

Table 3 presents purposefully random sampled coined terms from English to Northern Sotho. By means of coinage, English scientific terminology is connected to pre-existing Northern Sotho words in order to generate novel terms that communicate scientific concepts. For example, '*kgatelelopitlelo*' was coined for 'compressive force'; the coined term is a direct translation where, in isolation, '*kgatelelo*' may mean suppression or pressure instead 'force', which was targeted for translation in the first place. '*Pitlelo*' in isolation would translate to 'compress'. Using '*kgatelelopitlelo*' may be ambiguous in most cases. The Northern Sotho equivalent of 'purify' is coined as '*hlwekiša*', which again may be mistaken for 'cleaning'. 'Camouflage' is another example where it is complicated to find its equivalent; its coined equivalent is '*boiphihlakalefelo*'. To break down this coined term, '*bo-iphihla-ka-lefelo*' can be translated loosely as 'to hide within an environment'. 'Desktop computer' is descriptive in its origin, and its Northern Sotho equivalent is '*lefaseterekhomphutha*'. This coined term translates as 'window computer'. Most coined terms are characterised by ambiguity. They are the kind of terms that may leave the hearer confused and wondering. This strategy is puristic, as it seeks to maintain the language in its puristic state by formulating a complicated and ambiguous equivalent. The disadvantage of this approach is that it produces unusual lexicons.

TABLE 3: Coined terms from English to Northern Sotho.

English	Northern Sotho
Compressive force	*kgatelelopitlelo*
Purify	*hlwekiša*
Camouflage	*boiphihlakalefelo*
Desktop computer	*lefaseterekhomphutha*

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

Compounding

Compounding is another method for creating or coining new words or phrases. Compounding is the process of creating a new term by combining existing phrases in the target language. As the lexical item is derived from the meaning of the foreign term rather than the term itself, the majority of coined lexical items pertaining to science and technology concepts are descriptive compound words (Mojapelo & Mojela 2009:441).

Table 4 presents examples of compound words, meaning a combination of two or more existing words in Northern Sotho. For example, 'dehydration' is translated into '*tlhokišomeetse*' which can be divided as '*tlhokišo*' (deprivation) + '*meetse*' (water) = deprivation of water (literal meaning). The same applies to 'disinfectant' which is translated into *sebolayatwatši* (*sebolaya* + *twatši*). *Sebolaya* can be translated into 'something that kills' + *twatši* can be translated into 'virus' or 'germ'. The equivalent of 'drainage' in Northern Sotho is compounded into '*kela-boela-tšhila*', which is made up of three words, of which the first two have the same connotation of 'flowing', and '*tšhila*' refers to dirt. Lastly, 'stability' is compounded as '*boematia*', which when separated translates to '*boema-tia*', a position of standing still. Compounding is another example of a puristic approach that formulates equivalents by breaking down the English term and translating it into Northern Sotho and combining the translation, as can be seen in the provided examples.

Challenges or pitfalls in precision and clarity

Having discussed the adapting strategies that are at our disposal, we should state that these strategies may present several challenges and/or pitfalls. Our findings indicate that adapting English terms can lead to ambiguity, dependence on borrowed lexicons and user preference, and a lack of culturally appropriate terminologies.

Ambiguity

According to Kooij (1971:7), a sentence is inherently equivocal when it sounds the same but has multiple meanings. Furthermore, Hurford and Heasley (1983:122) state that a word or phrase is ambiguous if it has two or more synonyms that are not themselves synonyms. In addition, Mojela (1991:26) states that ambiguity occurs when a loan word and an indigenous Northern Sotho word are used synonymously to refer to the same referent. Firstly, because sex (*thobalano*) and gender (*bong*) are two distinct concepts in Northern Sotho, the term 'sex' in English may

be translated to '*thobalano*' (intercourse) in Northern Sotho. Secondly, 'rope' can be considered '*thapo*', '*lerala*' or '*lenti*', depending on the context. These three lemmas are not synonyms because they refer to distinct concepts with the same meaning.

Mojapelo and Mojela (2009:439) note that the definition of coined lexical items poses the greatest challenge to lexicographers when lemmatising them. In the Sesotho sa Leboa monolingual dictionary, the definitions of coined scientific and technology terms are more complicated than those created through transliteration. The examples of this assertion can be seen under adaptation strategies.

Dependence on borrowed lexicon and user preference

A significant portion of scientific discourse in Northern Sotho significantly relies on borrowed English terms, resulting in a linguistic environment where English terminologies are frequently used to communicate scientific concepts. This dependence, while functional to some extent, raises concerns about the potential loss of linguistic and cultural authenticity. However, it also provides an opportunity for terminology development, as many languages derive from so-called international languages.

Crystal (2010:48) defines borrowing as 'a natural and universal process, and people borrow words to meet their communicative needs – specifically to fill a lexical gap in their language'. As languages expand, new words are added, and whenever new inventions come into existence, new words must be created to designate them. According to Aitchison (1994:145), many contemporary English words were adopted or derived from foreign languages and have been anglicised to the point where they no longer appear foreign. Some examples are included in Table 5.

Table 5 presents examples of terms that have Northern Sotho equivalents, yet the speakers would prefer using the adapted equivalents in Column 3. This shows how much the speakers are dependent on the borrowed word. Even though some scholars see this as a threat, we regard it as an opportunity, especially in instances where there are no Northern Sotho equivalents. Speakers would prefer to use terms that are convenient to them, regardless of whether there are available coined terms. This is because no one will police spoken language. However, the researchers do concede that these could be a potential threat that could lead to language death. This user preference clearly

TABLE 4: Compound terms from English to Northern Sotho.

English	Northern Sotho
Dehydration	tlhokišomeetse
Disinfectant	sebolayatwatši
Drainage	kelaboelatšhila
Stability	boematia

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

TABLE 5: Examples of dependence on borrowed lexicons and user preference.

English	Northern Sotho	Preferred equivalents
Plantation	sethokgwabjwalwa	pholantheišene
Poisonous	ya tšhefi ya	phoesene
Post (verb)	romela	posa
Questionnaire	lenaneotšhomo	khwešenee
Quality	boleng	khwalithi
Recycle	šomišagape	risaekhela

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

indicates that strategies like borrowing and transliteration are relatable to the speakers of the language because of their convenience.

Lack of culturally appropriate terminologies

The urgent need for scientific terminologies that are culturally pertinent is a recurring theme in our findings. The lack of such terminology not only impedes the intellectualisation of Northern Sotho, but it also threatens to alienate the language from its cultural origins, as scientific knowledge plays a crucial role in forming and preserving a society's cultural identity. This process is known as 'indigenisation'.

Moropa (2013:244) explains indigenisation as the process of eliminating the foreignness in the spelling of a borrowed word. An example of this is the word 'cable' of which the equivalent is *kheibole* in Northern Sotho. The word *kheibole* is an English borrowed word, which was indigenised. The examples in Table 6 indicate that borrowed words were morphologically and phonological altered to fit within Northern Sotho orthography and pronunciation.

Table 6 presents examples of the lack of culturally appropriate terminologies, which were borrowed and then indigenised for acceptance in Northern Sotho. Like most borrowed terms, these terms did not exist in the Northern Sotho culture. Yet, currently these terms are acceptable and used in general.

In essence, the absence of culturally suitable terminology during the process of adapting Northern Sotho presents considerable obstacles to intellectual advancement, the maintenance of culture and efficient communication among members of the language community. Thorough implementation of measures to promote the utilisation of indigenous terms and indigenise terminology is imperative to guarantee broad acceptance and comprehension.

This section explored methods to adapt English terminology to Northern Sotho, aiming to improve intellectual integration into scientific discourse. However, these methods face challenges like ambiguity, reliance on imported lexicons and the absence of culturally suitable terminologies. Ambiguity arises from differences in understanding and situation, while reliance on imported lexicons raises concerns about language preservation and authenticity. The lack of culturally significant terminologies can hinder intellectualisation and potentially estrange the language from its cultural roots. Addressing these challenges is crucial for the Northern Sotho language community's acceptance, comprehension and cultural preservation.

TABLE 6: Examples of the lack of culturally appropriate terminologies.

English	Northern Sotho
Satellite	*sathalaete*
Printer	*printhara*
Laptop	*lepthopo*
Aerial	*eriele*

Source: Adapted from Department of Arts, Culture & Technology, 2013, *Multilingual information communication technology list*, viewed 04 September 2023, from http://www.dac.gov.za/sites/default/files/terminology/science-dictionary-sotho.pdf.

Conclusion

To conclude, the main aim of the study was to investigate and propose a pragmatic approach to the adaptation of English terminologies for scientific purposes into Northern Sotho. The research highlights the substantial obstacles that indigenous languages, such as Northern Sotho, encounter as a result of the lack of scientific terminology, which impedes their incorporation into academic contexts. While recognising the widespread impact of the English language on Northern Sotho, there is an exceptional opportunity for adaptation that could enhance the scientific lexicon of the language.

Nevertheless, the research also exposes the intricacies linked to the integration of borrowed English terminology into scholarly discourse, encompassing apprehensions concerning accuracy, clarity and cultural appropriateness. This emphasises the critical nature of developing scientific terminology that is culturally relevant in order to safeguard the cultural heritage of Northern Sotho and other indigenous languages. Additionally, the results reveal that Northern Sotho terms that were ambiguous and lacked accuracy were under coinage and compounding. These are the strategies that are aligned with the puristic approach.

Furthermore, endeavours ought to be directed towards the establishment of an all-encompassing lexicon that is culturally attuned to scientific principles and occurrences in Northern Sotho. This should encompass approaches to ensure indigenisation. Ensuring consistency in the indigenisation process is of the utmost importance, considering the diverse array of word forms prevalent in Northern Sotho.

Ongoing investigations in the field of corpus linguistics have the potential to enhance the process of adaptation and assess the effects of adapted terminologies on scientific discourse within Northern Sotho-speaking communities. Further research should investigate the implications of language adaptation for the intellectual development of indigenous languages and their applicability in modern scientific domains.

The preservation of culture and intellectual development of indigenous South African languages, including Northern Sotho, is fundamentally dependent on the adaptation of English scientific terminology. By adopting a practical methodology towards the development of terminology, with an emphasis on cultural resonance and linguistic authenticity, novel prospects can be created in the realms of education, research and the conservation of cultural heritage. This will guarantee the ongoing vitality and significance of Northern Sotho in the contemporary era.

In the future, it is crucial to methodically translate scientific terms from English into Northern Sotho, taking into account linguistic structure, semantics and cultural subtleties. To ensure the efficacy of adapted terminologies, collaboration

among linguists, the National Language Service (NLS), the Pan South African Language Board (PanSALB) and native Northern Sotho speakers is vital.

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Competing interests

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Authors' contributions

M.L.M. conceived the presented idea, was responsible for the implementation of the research, the analysis of the results and the writing of the first draft. T.D. conceptualised the study, provided supervision for the study and contributed to writing the article by reviewing and editing the article.

Ethical considerations

An application for full ethical approval was made to the Tshwane University of Technology: Faculty Committee for Research Ethics (FCRE) and ethics consent was received on 02 August 2022. The ethics approval number is FCRE/APL/STF/2022/13.

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Data availability

The data that support the findings of this study are openly available and can be requested from the corresponding author M.M., on reasonable request.

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