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LOCALISING AN ONLINE COMPUTER SOFTWARE TO INCLUDE SETSWANA, AN INDIGENOUS AFRICAN LANGUAGE, FOR THE SOUTH AFRICAN TEACHER

by

Meganathan Moodley

A Thesis submitted to the Faculty of Education, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree Doctorate in Education

Supervisor: Dr R. Dlamini

June 2020

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the PhD degree at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.



_____

Signature of Candidate

31 August 2020

Date

ABSTRACT

The introduction of information and communication technology (ICT) into the South African education sector has brought optimism that ICT can enhance education, and at the same time trepidation whether it will benefit all South Africans. Research, in general, has shown that acceptance of ICT in education is low because of limited access and low ICT skills. However, emerging research shows that the acceptance of ICT is influenced by context, culture, and language.

There exists an erroneous belief that ICT is more suited for the richer countries and communities, which has resulted in the need to rethink the traditional conceptualisation and design of ICT resources. Evidence shows that South African English speakers are no longer the main users of ICT and that there is steady growth among Indigenous African language speakers. Hence, it is important to accommodate the country's diverse linguistic groups in ICT. The continued dominance of English in ICT will only serve to alienate potential users.

This study aimed to examiner how the introduction of educational software with a dual English-Setswana interface and content can influence teachers' user experience of the software and their attitude towards the use of African languages in ICT. The conceptual framework adopted in this study merged the Technology Acceptance Model and the theory of colonial mentality to explain the findings. The study's population was teachers from the North West province who were introduced to the dual-language software. Data was collected using systematic self-observation, participant observation and interviews. Trustworthiness of the study was achieved using several data collectors and external data transcribers. To maintain a high level of ethical compliance, names of participants and schools were excluded from the research report.

The findings indicated that while the teachers felt pride and easiness using the Setswana software and were happy with the translation, they were concerned about the non-translated terms and the neglect of dialect accommodation. Even though the teachers completed the tasks on the Setswana version with ease, they acknowledged that English was better suited for use in ICT. The conceptual framework adopted in this study merged the Technology Acceptance Model and the theory of colonial mentality to explain the findings. Based on these findings, it is recommended that

consultations with relevant language and cultural experts and the target end-users are necessary for software localisation. Furthermore, more research is needed on the role of colonial mentality in the acceptance of technology by Indigenous populations.

KEYWORDS AND PHRASES

- Assessment
- Colonial mentality
- Graphical user interface (GUI)
- Information and communication technology (ICT)
- Indigenous languages
- Localisation
- Multilingual
- TARMII
- Technology acceptance
- Translation

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A journey without hardship is not a journey; hardship without learning is not hardship. The experience garnered during this journey taught me a great deal of my being. My experiences during this journey are aptly captured in these words:

> It matters not how strait the gate, How charged with punishments the scroll,
> I am the master of my fate, I am the captain of my soul.

In the spirit of my journey, I wish to acknowledge the support and assistance of Dr Reuben Dlamini, my supervisor, who gave me both the independence and support to write this thesis in my own voice. A sincere thanks goes to Mr Ashraf Dawood and my colleagues at HSRC and the University of Johannesburg who played a critical part in my journey of becoming and who served as sounding boards during those moments I needed clarity. In every journey you find someone who opens a door for you, a special word of thanks goes to Meneer Owen Margardie who gave me a helping hand when I was down, to him I will forever be indebted. A special thanks to Mrs Nancy Tshoma from the North West Madibeng District who greatly supported and assisted in the data collection phase. A special word of appreciation to Mr Roche' Compaan who was instrumental in the technical aspect of the multilingual platform.

And finally, to my family, my wife, and children, who provided the support and patience for me to travel this road and who were always there to keep me going; to my mother and late father, who valued education above all; and to my brothers for their continued words of support.

And to the almighty God, who provided me with the opportunity to travel this road. This journey taught me so much about myself and tested my limits as a person.

LIST OF ABBREVIATIONS

ARB	Assessment Resource Bank
ATM	Automatic Teller Machines
CD	Compact Disc
DBE	Department of Basic Education
DVD	Digital Video Disc
GUI	Graphical User Interface
HSRC	Human Sciences Research Council
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information and Communication Technology
IDI	In-Depth Interview
IETF	Internet Engineering Task Force
ILS	Indigenous Language Study
LangTag	Language Task Group
LISA	Localisation Industry Standards Association
MDGs	Millennium Development Goals
Mp4	MPEG Layer-4 Audio
PO	Participant Observation
PDF	Portable Document Format
SMS	Short Message Service
SSO	Systematic Self-Observation

TAM	Technology Acceptance Model
TARMII	Teacher Assessment Resources for Monitoring and Improving Instruction
T-DL	TARMII Dual Language
TerminOrgs	Terminology for Large Organisations
URL	Uniform Resource Locator
USAid	United States Agency for International Development
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology 2
W3Techs	World Wide Web Technology Surveys
www	World Wide Web
XLIFF	XML Localisation Interchange File Format)
XML	Extensible Mark-up Language

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CHAPTER 1
RATIONALE AND BACKGROUND TO THE STUDY

We are going to emancipate ourselves from mental slavery
because while others might free the body, none but ourselves can free the mind.

(Bob Marley, 1980)

1.1 Introduction

The 21st century has been characterised by the expansive growth and development of information and communication technology (ICT). ICT applications hold the potential to support and fast track educational development in the developing world through its vast repository of digital information. However, this has never been the case (Osborn & Osborn, 2010; Thapa & Hatakka, 2017). Even with the availability of these vast digital repositories factors such as poverty and the lack of basic formal education in developing countries have resulted in underutilisation of these ICT applications. As such, the benefits presented by ICT cannot be fully used. Within the South African educational context, poverty and the disparity in educational access, in regards to ICT, is widespread, especially in predominately Black and African[1] areas years into a non-racial democracy. Most of the educational ICT resources available to the average South African teacher and student exist in English.

Indigenous languages, localisation, ICT, assessment, graphical user interface,

1.2 Background

1.2.1 History of the TARMII software

In the early 2000s, the Human Sciences Research Council (HSRC) secured funding from the United States Agency for International Development (USAid) to develop the Assessment Resource Bank (ARB). The ARB was essentially a repository or collection of high-quality literacy items in a paper-based booklet that teachers could use to build quality class tests by selecting pre-developed items from the booklets. In-depth research of the ARB concept formed part of the larger District Development Support

[1] In the context of this thesis, the term African will be used only when referring specifically to the Indigenous African population of South Africa, while the term Black will refer in general to African, Coloured [mixed race] and Indian race groups in South Africa.

Programme that was commissioned by the Department of Basic Education (DBE). The rationale behind the District Development Support Programme intervention was to provide 450 under-performing schools, which were predominately located in African townships and rural areas, with the necessary resources and support in the hope of improving their teaching and assessment practices.

The assessment items that constituted the ARB encompassed all aspects of the official South African curriculum, which was referred to as the Revised National Curriculum Statement. The ARBs were developed in English and then translated into seven South African languages (six Indigenous African languages and Afrikaans). Based on the findings of the ARB study, in 2009 the HSRC secured funding from the Royal Netherlands Embassy to investigate the feasibility of digitising the ARB resource book. This was the start of the TARMII (Teacher Assessment Resources for Monitoring and Improving Instruction) concept, as reflected in Figure 1.1.

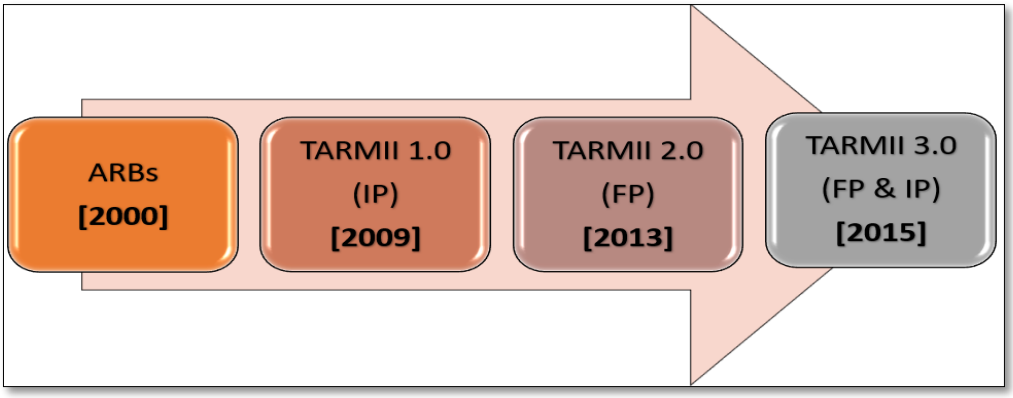

Figure 1.1: Development of the TARMII software

The first digital version of the ARB was the beginning of the TARMII software. The first version, aptly named TARMII 1.0, was developed as a CD-installer version for use by the Intermediate Phase (Grades 4–6) teacher. The TARMII 1.0 software was essentially a bank of test items in a digital format. In the context of this thesis, the use of the words *item* or *test item* essentially refers to the traditional test question in a paper-based test. In the domain of digital test question banks, the term *item* is used in place of the term *test question* (Weiss, 2013). The digital item bank consisted of a collection of high-quality Intermediate Phase Mathematics and English assessment items with an automated test-builder functionality. This functionality provided the teachers with the facility to build an assessment task compiled of test items which were randomly selected by the software based on criteria defined by the teacher. A study

was conducted to investigate if the use of TARMII 1.0, a digitised item bank, would influence the literacy performance of students at underprivileged and under-performing schools in four provinces (Free State, Gauteng, Mpumulanga and Western Cape) in South Africa. The findings that emanated from this study showed that the schools did not provide teachers easy access to computers, and as such teachers could only gain access to the office computer at the end of the school day, which also influenced their digital confidence and basic computer skills. The findings further showed that their limited insight and understanding of assessment processes as stated in the Revised National Curriculum Statement, severly influenced their engagement with the different levels of assessment items found in the TARMII 1.0 software.

These findings were central to the future development and modification plans for the TARMII software concept.

In 2013, the HSRC in collaboration with the DBE received funding from USAid, ALMA Philanthropies and JP Morgan for the modification and upgrade of TARMII 1.0. This funding led to the development of TARMII 2.0 (Figure 1.1), an assessment software that was developed and distributed as a DVD-based installer version aimed for use by the Foundation Phase (Grade 1–3) teacher at underprivileged schools. The software included (1) an item bank of high-quality Foundation Phase literacy items; (2) an automated test builder; (3) a PDF resource bank containing a wide range of English resources; and (4) a series of automated class and student diagnostic reports. As part of the research design, a TARMII 2.0 study was conducted in four provinces in South Africa (Limpopo, Free State, North West and Mpumulanga). The aim of the TARMII 2.0 study was to investigate the influence technology can have on the formative assessment practices of Foundation Phase teachers. The key findings that emerged from this study showed that due to the limited exposure to computers, teachers lacked basic ICT skills and digital confidence, this was further exacerbated by the belief that Foundation phase teachers had no pedagogic reason to access and use computers. The study also highlighted the teachers lack of understanding of the practices of formative and summative assessments, which ultimately influenced their perception and appreciation of the TARMII 2.0 formative assessment software.

Another important insight that came out during the software usability testing2 was that two of the study participants disclosed that engaging and using the TARMII 2.0 software in English made them nervous and uncomfortable, as English was not their natural language, and that they had no choice but to use the software. It is important to note that both TARMII 1.0 and TARMII 2.0 used English as the graphical user interface (GUI) default language. This practice is widely used in the design and development of educational and generic computer software and online platforms (Osborn & Osborn, 2010). According to most of the study participants, the apprehension when engaging the software arose when they were expected to complete a series of technical tasks that required them to activate interface commands and drop-down menus that were in English, which was not their first or second language.

Based on the findings of the TARMII 2.0 study, USAid extended the grant and requested the modification of the TARMII 2.0 software based on their and the DBE's recommendations. This extended funding and modification resulted in the creation of TARMII 3.0 (Figure 1.1). The TARMII 3.0 assessment software was a fully online software platform that included (1) an online assessment bank; (2) a test-builder platform; (3) automated diagnostic reports generated at class and student level; (4) ability for teachers to develop test questions online; (5) an online learner test-taking application; and (6) machine marking capability (e-marking) that allowed the software to automatically mark students' responses for multiple-choice and single-word questions. The modification and development of TARMII 3.0 followed a similar design process as the previous two versions, and once again, English was the default language of the user interface.

1.2.2 Study within a study

As stated earlier in this chapter, a critical insight during the TARMII 2.0 study was that a participant felt uneasy using English to complete the activities on the software. The participant noted during the usability test interviews that using the software by following commands and drop-down menus in English created a sense of

[2] The usability testing was not part of the research design but was deemed to be an important part of the software development process, and as such, the HSRC and USAid accepted the usability testing process as necessary to inform the software development process.

apprehension. This comment led me to conceptualise and eventually present the proposal of my PhD study to the HSRC, USAid, and DBE. Subsequently, these three organisations permitted me to conduct my PhD study within the larger TARMII 3.0 study. This smaller study would focus on the localisation of the TARMII 3.0 software by introducing and using an Indigenous African language as a second language for the TARMII 3.0 software (hereinafter called the TARMII dual-language software or T-DL). Núñez (2017) explained the concept of localisation as the translation and adaptation of a software application to a specific market, country, locale or culture, and the concept localisation will henceforth be used in the thesis within the context as elucidated by Núñez.

1.2.3 Study environment

The smaller study called the Indigenous Language Study (ILS) was conducted using a sample of seven teachers from the Madibeng education District in the North West province in South Africa. The Madibeng District, as reflected in Figure 1.2, is a local district found within the Bojanala Platinum Municipality of the North West Province. Madibeng consists of urban areas, rural areas, villages, and farm portions, as well as an established and serviced industrial zone. The Madibeng Municipality is centrally located in relation to Pretoria, Johannesburg, Rustenburg, and Krugersdorp, making it easily accessible to these key economic areas.

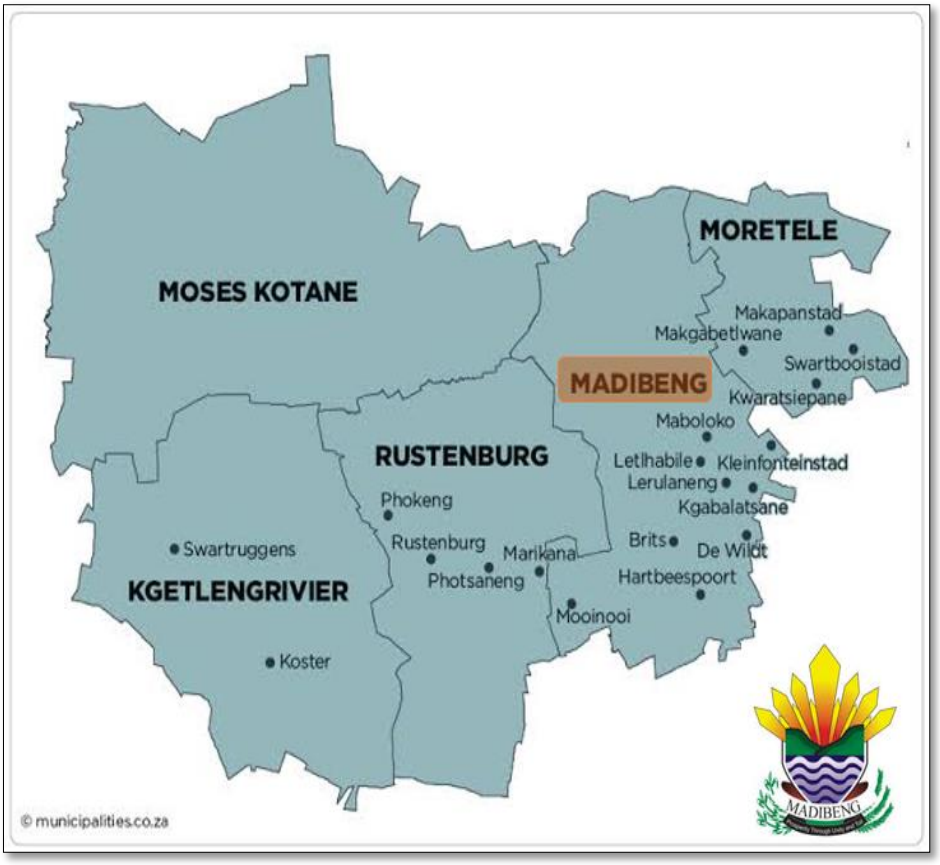

Figure 1.2: Madibeng District

The schools in this district range from well-established schools to schools that have difficulty accessing basic services. The schools selected for the ILS study were considered disadvantaged and located in townships in Madibeng (Figure 1.3). The language used by most teachers and students in these schools is Setswana.



Figure 1.3: TARMII project school in Madibeng

1.2.4 Setswana, an Indigenous African language

The Tswana people voyaged from East Africa to Southern Africa during the 14th century. They were primarily hunters, herders, and cultivators, and the high plains of Southern Africa suited them well (Otlogetswe, 2005). The Tswanas speak Tswana or Setswana, which is one of the Southern Bantu languages located within the big Niger-Congo language group. Most Tswana people live in South Africa, with some living in Botswana, Namibia, and Zimbabwe. Setswana is closely related to the other two Sotho languages, Southern Sotho and Northern Sotho (SouthAfrica.com, 2018). Setswana has been recognised as one of the 11 official languages of South Africa. It is also one of the nine Indigenous African languages. Setswana speakers make up the fifth-largest language group in South Africa. It is spoken by about 8% of the population, which is more than 4 million people (SA-Venues, 2019).

1.3 Introduction to ILS

The introduction of the T-DL software formed the basis of the ILS intervention. It investigated whether the use of Setswana, an Indigenous African language, as a language for the T-DL software would influence the user experience. It also examined the attitude of Setswana-speaking teachers towards the use of an African language in ICT.

1.3.1 Development of the TARMII dual-language software

Findings from the previous study informed the design and development of a softwrae with a dual language user interface. Once I had secured permission to conduct the ILS intervention, the software design and execution plan for a dual-language TARMII interface was developed in consultation with software developers and African language translators.

South Africa has 11 official languages, nine of them are Indigenous African languages, and the remaining two are Afrikaans and English. Due to the uniqueness and complexity of this research, I decided to focus on a single African language. As the North West province was already part of the larger TARMII study, it made sense to conduct the ILS intervention there but at different schools and with different teachers.

Hence, the T-DL software used Setswana, the dominant language of the North West province, as the second language of the software.

To ensure the translation of the T-DL software was both technically and linguistically accurate, the services of a translation company that had experience and had worked on the African language version of the South African Google Firefox platform was secured. According to Osborn and Osborn (2010), most online educational applications and educational software are only available in English, and as such, the design and development of the TARMII 3.0 software used English as its default language, as reflected in Figure 1.4. The process of adapting or localising the TARMII 3.0 software involved a series of steps that will be discussed in detail in this section.

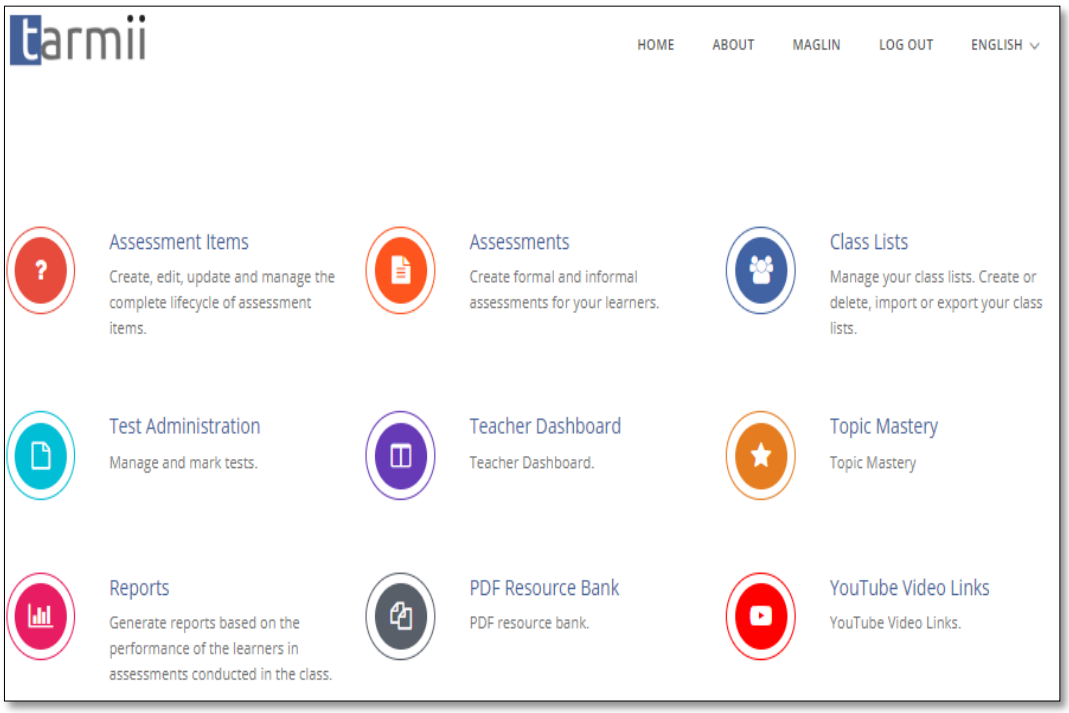

Figure 1.4: T-DL software default user interface

To prepare the T-DL online platform to accommodate both English and Setswana required the creation and hosting of multiple mirror sites. A mirror site is a replica of the original site with its own Uniform Resource Locator (URL). The mirror site would be used for the translation of the TARMII software into Setswana. As stated, it was decided to translate the software only into Setswana; however, after consultation with the developers and the HSRC, it was decided to create the functionality within the T-DL software to accommodate multiple South African languages. This would allow

for future translations and adaptations of the software into the other South African languages. As such, a graphical control element was included that saw the use of a drop-down menu that would allow the user to select the software language version from the list of the 11 official South African languages, as shown in Figure 1.5.

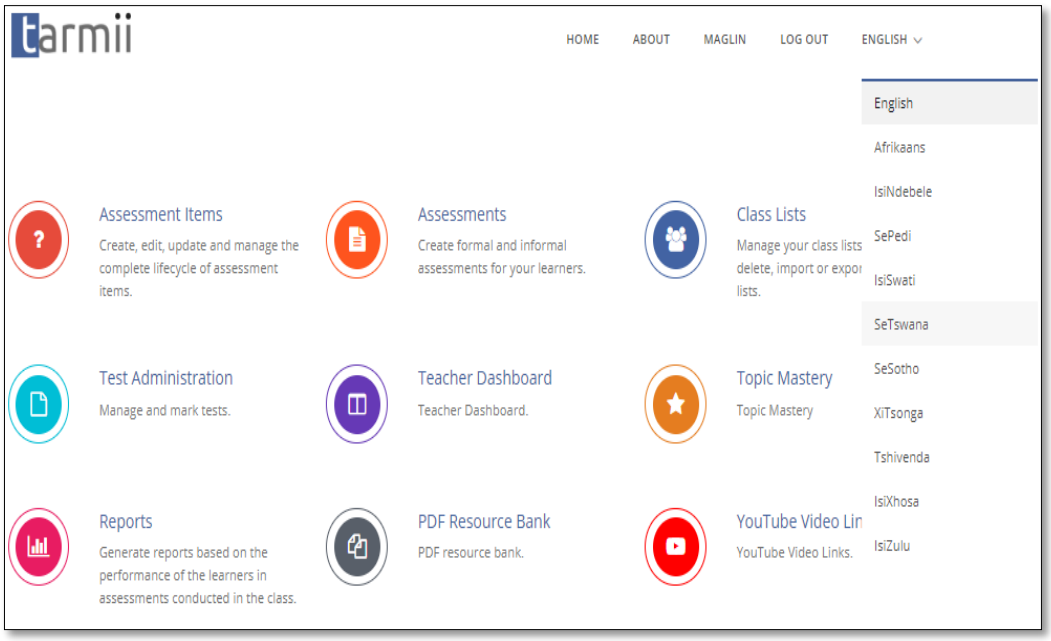

Figure 1.5: T-DL multiple language selector

Localisation software is the adaptation of an application to accommodate the context of the target user. This concept will be discussed in greater detail in Chapter 2. Within the context of the localisation of the T-DL software, a key process was to ensure that every English term or phrase that appeared to the user on the GUI was translated into Setswana, the target language. After consultation with the preferred translator and software developer, it was decided to use VIRTAAL 0.7.1 (Figure 1.6), an open-source translation programme designed for the translation of software programs and Computer-Aided Translation.

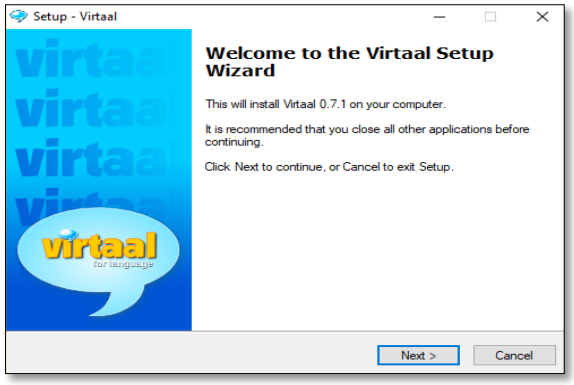

Figure 1.6: VIRTAAL translator platform

The next part of the localisation process required the collection of all the English terms and phrases that the user sees when they use the TARMII 3.0 software. These terms were then uploaded onto the VIRTAAL translation platform, as shown in Figure 1.7. In total, 149 English terms and phrases were identified and uploaded onto VIRTAAL 0.7.1 in an Xliff[3] terminology file format.

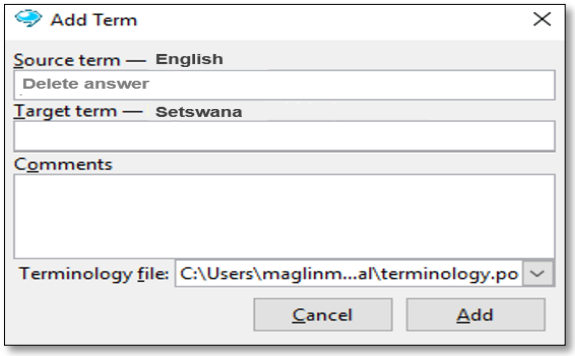

Figure 1.7: Add Term function

Once the terminology list (Figure 1.8) was assembled, it was submitted to the translation company in an Xliff file format, and in turn each of the translators were provided with the T-DL Xliff file. Each of the translators who were located at remote sites in the North West province completed their translations on the VIRTAAL 0.7.1 platform as part of the translation process. Each English term and phrase was translated by a team of three translators. These translations were then submitted to a team of moderators. The responsibility of the moderators was to back translate the Setswana terms and phrases to English to ensure contextual accuracy. However, 22

[3] An XLIFF (XML Localization Interchange File Format) is an XML-based format created to standardise the way localisable information is transmitted between tools during a localisation process and a common format for Computer-Aided Translation tool exchange. XLIFF was standardized by OASIS in 2002.

of the 149 English terms and phrases were not translated because of issues relating to their technical complexity. Based on the argument of Bamgbose (2011, p. 3) that "terms emerge through actual use of a language by different stakeholders, such as teachers, writers, and media practitioners", it was decided that the non-translated terms would remain in English and that the use of the T-DL software by the teachers and district officials would be used as a starting point to help develop these terms.

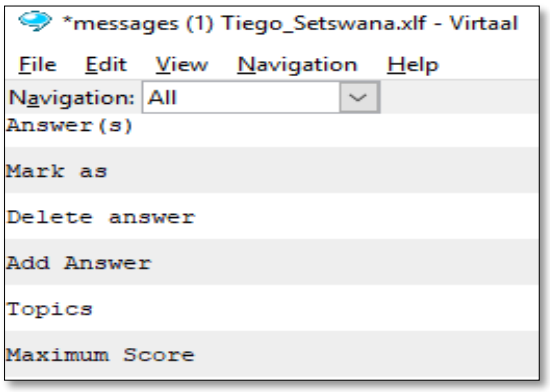

Figure 1.8: Term translator list

Once a translated term or phrase was accepted and approved by the moderators, it was programmatically allocated a unique ID number by the VIRTAAL platform (Figure 1.9).

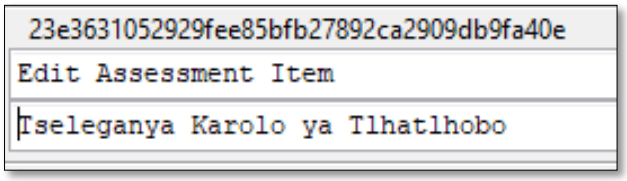

Figure 1.9: Unique item bank ID

All terms or phrases that were moderated and accepted were included in the final master batch file (Figure 1.10). The masterbatch file was then synced and prepared for uploading onto the T-DL mirror sites.

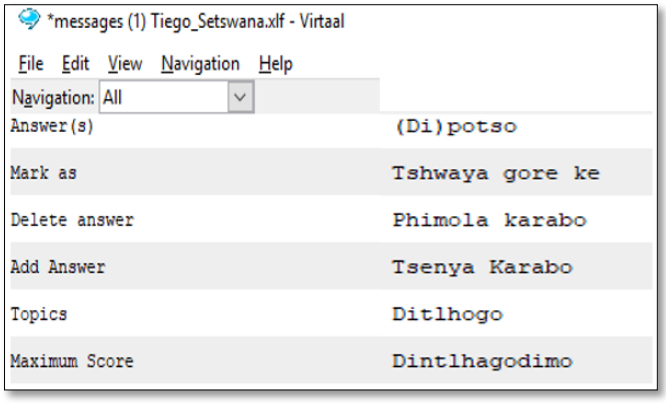

Figure 1.10: Final translated file

The masterbatch file was uploaded onto the T-DL publishing platform (*http://tarmii.thekays.co.za/*)[4]. The translation company closely consulted with the developers of the VIRTAAL software to ensure that the migration and import of the terms and phrases were consistent with the TARMII 3.0 platform. An in-house verification process followed to ensure a synergy between the uploaded Setswana terms and phrases and the final output of the Setswana terms and phrases on the T-DL software interface. During the verification process translators and language moderators accessed the T-DL website and navigated the various functions of the software to verify quality, accuracy, and contextual appropriateness of the translated terms and phrases. Thereafter, the suggested edits and reviews between the first translator and the Setswana moderator were agreed upon and signed off. The lead translator then approved the final uploading of the master files and submitted the *pull request* to the software engineer. The *pull request* is the go-ahead to upload the master translation files onto the main T-DL platform (Figure 1.11). The final product consisted of the T-DL software translated into Setswana as well as a bank of 345 Grade 3 Setswana test items.

[4] Due to the complex process of system development, several mirror sites had to be created to ensure multiple development processes could continue simultaneously. This URL was specifically created for the localisation process.

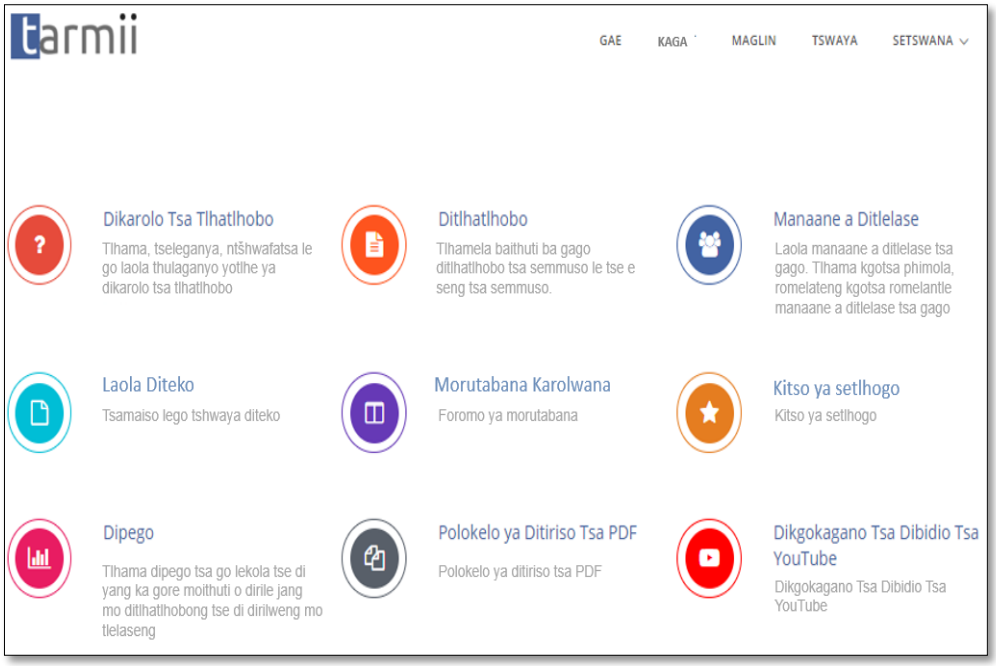

Figure 1.11: Translated website

1.4 Background to the ILS Intervention

Various studies (Bagchi, 2005; Chen, Lin, & Lai, 2010; Sein & Furuholt, 2012) have alluded to the potential benefits ICT offers end-users. However, there simultaneously exists a growing body of literature that argues that the introduction of ICT has served to widen the disparity between those who can access and engage with available ICT applications and those who cannot (Cancro, 2016; Omojola, 2009; Pimienta, 2011).

Literature (Cancro, 2016; Looi, Sun, Seow & Chia, 2014) has also identified factors that serve as potential barriers to the acceptance and use of ICT by teachers within developing countries. In an attempt to address some of these barriers or technology divides, governments of developing countries and large ICT companies have invested large sums of money and resources to ensure that everyone are skilled in ICT and have physical access to a range of ICT applications. However, even with these large investments, acceptance and adoption of these interventions in developing countries have been generally poor. This has resulted in questions being posed as to why the introduction of ICT in developing countries has failed so dismally. It is only recently that the issue of language, especially Indigenous African languages, and its role in the digital age have been receiving some attention. According to Osborn and Osborn (2010), Indigenous people, especially those from the African continent who only speak

an Indigenous language, are being disadvantaged and discriminated against when they are forced to access and use ICT applications in a language that is alien to them. Looi et al. (2014) and Osborn and Osborn (2010) argued that for any ICT innovation to be accepted by an Indigenous population, the application must accommodate the needs and context of that population. In South Africa, most of the population speaks an Indigenous African language, yet 97% of ICT applications available exist only in English (Mapi, Dalvit, & Terzoli, 2008; Ndebele, 2014).

The South African national and provincial departments of education have initiated various intervention programmes to introduce the latest technologies into schools to prepare students to be effective citizens of the 21st century. The irony behind the efforts of the departments of education is that the technologies they are introducing use English as the default language, yet the schools, teachers, and students they are targeting are not English first or second language speakers. As such, teachers and students have no option but to engage with educational software in English, a language with which they are uncomfortable. The ILS intervention was prompted by the responses collected during the TARMII 2.0 research, during which isiXhosa[5] first language speaking teachers living in rural areas and townships who had to interact with the TARMII software in English commented on their unease using English.

The problem of including Setswana in ICT required the problem to be viewed through six lenses in order to appreciate the depth and complexity of the problem of including Setswana in ICT. Each lense had to be considered intensively to thoroughly and effectively address the research problem (Figure 1.12).

[5] isiXhosa is a widely spoken Indigenous African language that is also an official language in South Africa.

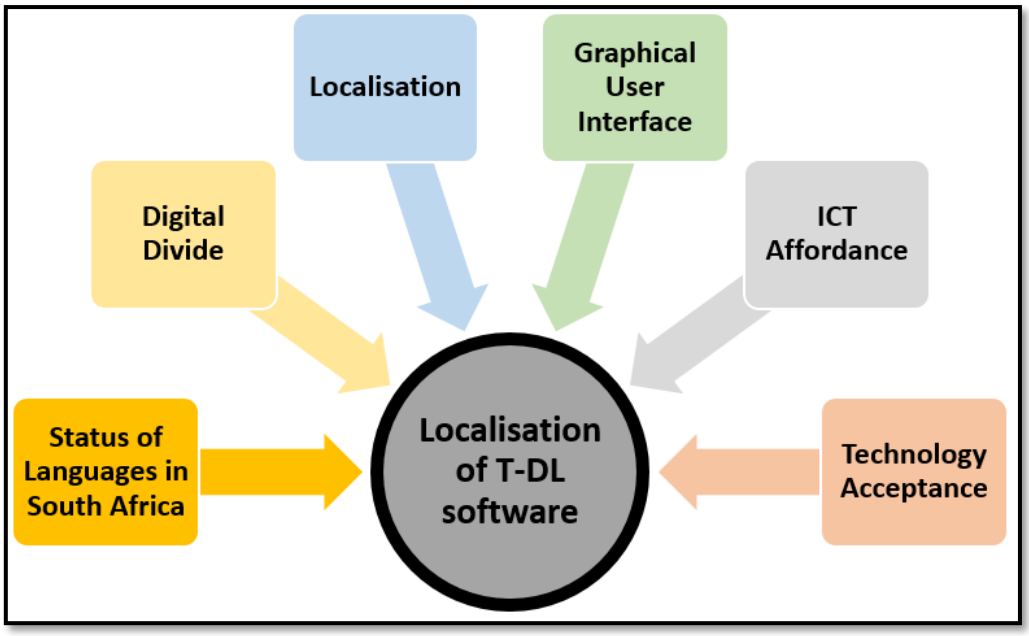

Figure 1.12: Aspects of the research problem

1.4.1 Status of languages in South Africa

The issue of languages in South Africa is very controversial and has been at the centre of South Africa's freedom struggle. English dominates almost all aspects of South African society, yet it is not the most commonly or widely used language in South Africa. As such, current discourse attempts to look at ways to raise the status of Indigenous African languages and to ensure that African languages play a role in the digital and information age (Bamgbose, 2011; Chukwuere, 2017; Gudhlanga & Makaudze, 2012; Ndimande-Hlongwa & Ndebele, 2017; Omojola, 2009).

1.4.2 Digital divide

The digital divide in South Africa has traditionally been viewed from the angle of ICT access and ICT skills or the lack thereof. There is however a smaller but growing discourse that the lack of representativity of Indigenous African languages in ICT is a possible contributing factor to the sustained existence of the digital divide. This expands and supports the argument that successfully addressing the digital divide means providing more than physical ICT applications and skills (Bagchi, 2005; Cancro, 2016; Pimienta, 2011; Sein & Furuholt, 2012).

1.4.3 Localisation

To ensure that every individual, irrespective of socio-economic status, educational accomplishments, or language, enjoys the benefits of ICT, it is imperative that all ICT applications are modified to accommodate the linguistic and cultural differences in the target society. Localisation should entail ensuring that the ICT application is culturally and linguistically appropriate and relevant (Avgerou, 2010; Hart & Laher, 2015; Mapi et al., 2008; Osborn & Osborn, 2010; Sasikumar & Hegde, 2004).

1.4.4 Graphical User Interface

The GUI is the first line of engagement a user will experience when using the software. If the GUI is uninviting or not user friendly, then the user will in all likelihood not engage with the software. Therefore, the design of the interface must be done with the culture and language of the intended user in mind (Thapa & Hatakka, 2017).

1.4.5 ICT affordance

The sustained development of and advances in ICT have resulted in benefits to humanity that are far beyond what we imagined. The actual benefit that teachers derive from ICT affects whether they will use the application to support and enhance teaching, learning, and assessment within their classrooms (Anderson, 2004; Day & Lloyd, 2007; Gaver, 1991; Haines, 2015)

1.4.6 Technology acceptance

For any ICT innovation to be accepted in education, all possible barriers that may hinder its acceptance and use should be identified early and steps should be implemented to address them (Ghavifekr, Kunjappan, & Ramasamy, 2016). The acceptance of the technology was an important component of the ILS intervention because what might be acceptable to some teachers may not be acceptable to others. Therefore, the introduction of an ICT innovation must accommodate all possible barriers to technology acceptance (Prah, 2007; Scherer, Siddiq, & Tondeur, 2019; Taherdoost, 2018). The modification of the T-DL online platform provided teachers with the opportunity to access and use a unique South African software innovation that accommodates Setswana as well as English speaking teachers.

1.5 The Research Question

It is essential to localise ICT applications for it to be accepted and enjoyed by everyone (Anderson, 2004; Day & Lloyd, 2007; Prah, 2007; Sasikumar & Hegde, 2004). As noted earlier, in an attempt to address the digital divide many countries have become fixated on and tackled only the issues of physical resources and ICT skills. These interventions have yielded some good results, which were most evident in developed countries. Despite exorbitant financial investments, most ICT interventions in developing countries have failed (Anthony & Padmanabhan, 2010; Etoundi, Onana, Eteme, & Ndjodo, 2016). This leads to the question: If the key issues of lack of access and lack of skills were addressed, why did the interventions fail?

Little, if any, attention was given to the issues of culture and language, especially Indigenous African ones, during the planning of these ICT intervention programmes. This was evident during the literature review conducted for this thesis. Likewise, during the TARMII 1.0 and TARMII 2.0 studies the issue of Indigenous African languages was not even considered, even though these versions of the assessment software were intended for use predominately by teachers from Indigenous African language speaking backgrounds. Even in the early stages of conceptualising the design and development of TARMII 3.0 no mention was made of Indigenous African languages, and as with the previous versions, the design and development of TARMII 3.0 was done in English. However, the feedback during the TARMII 2.0 study about the use of English led me to reflect on the issue of African languages in ICT. It is evident from the literature review that there is a dire lack of empirical literature from a South African and African perspective on the introduction and use of Indigenous languages in ICT.

The aim of the ILS intervention was to investigate if the localisation of an English online assessment software to include Setswana would influence the Setswana-speaking teachers' software experience and their attitude towards the use of Indigenous African languages in ICT. This research was guided by the main research question and supported by four investigative questions.

The main research question of this study is:

How does the use of Setswana as the language of the TARMII dual-language online assessment software influence Setswana teachers' software experience and their attitude towards the use of African languages in ICT?

The first investigative question for this study is:

What is the difference between the ease-of-use experience of the Setswana-speaking teachers when accessing and using the English version of the TARMII dual-language software and when accessing and using the Setswana version?

This investigative question used the data collected with (1) the systematic self-observation (SSO) instrument, (2) the participant observation (PO) instrument, and (3) the in-depth interview (IDI) instrument to compare and explain the teachers' user experiences when using both versions of the TARMII software.

The second investigative question of this study is:

How do the English and Setswana TARMII dual-language software support Setswana-speaking teachers' assessment practices?

This investigative question used the data collected with (1) the SSO instrument, (2) the PO instrument, and (3) the IDI instrument to understand how the participants viewed the use of ICT to support their assessment practices.

The third investigative question of this study is presented below:

How does exposure to the TARMII dual-language online assessment software influence the attitudes of Setswana-speaking teachers towards the use of Indigenous African languages in ICT?

This investigative question uses the data collected with the IDI instrument to understand the attitudes of the teachers to the use of Indigenous African languages in ICT.

The fourth investigative question of this study is:

What is the relationship between Setswana-speaking teachers' view of the use of English in the TARMII dual-language software and the use of Setswana?

This investigative question used data collected using the IDI tool to compare how teachers' view of the use of the English-only version of the TARMII software and the Setswana-translated version differed.

1.6 Research Methodology and Design

To examine whether the localisation of an online assessment software to include Setswana would influence the users' software experience and the attitude of Setswana-speaking teachers towards the use of an Indigenous African language in ICT, it was imperative that the adopted research design be flexible, suitable, and effective while at the same time maximizing the reliability and minimising the bias of the data collected.

This research was grounded in an interpretive research philosophy that used an inductive reasoning approach, which is commonly applied to the case study methodology (Bhattacherjee, 2012; Kothari, 2004). The data collected in this study was collected in a setting that was both natural and familiar to the participants so that the interpretation of the interactions between the phenomena (T-DL) and the participants occurred in a real-life working context (Creswell, 2007). Bhattacherjee (2012) suggests that the use of a case study allows for the collection of richer, more contextualised, and authentic data since the phenomena under investigation can be studied from multiple participants' perspectives using multiple levels of analysis. The research design is summarised in four stages, as illustrated in Figure 1.13.

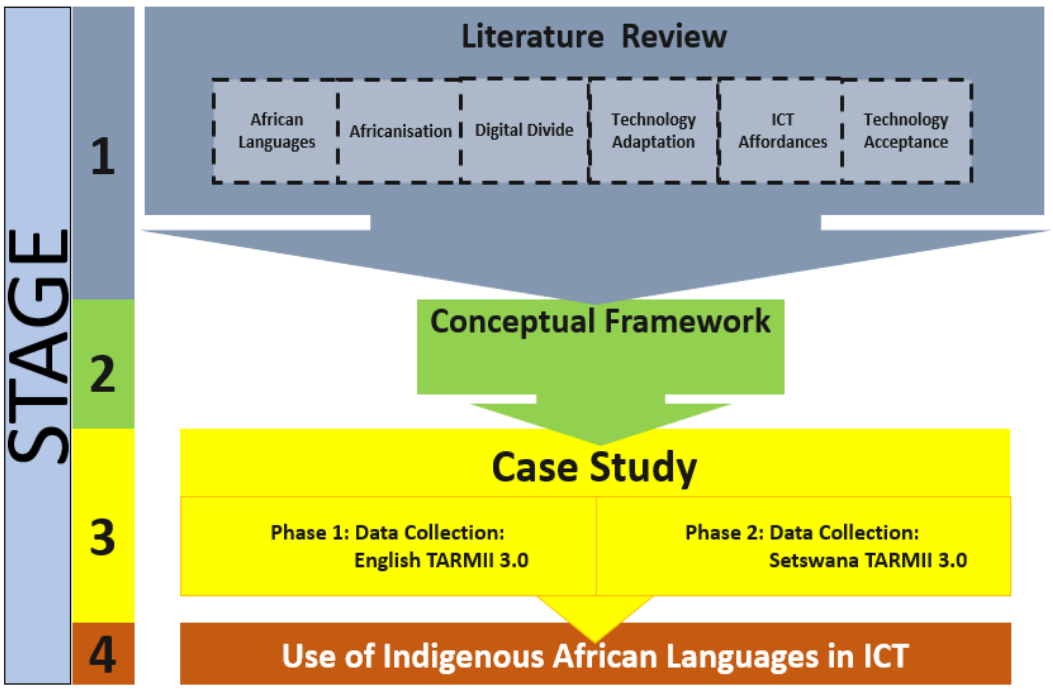

Figure 1.13: Stages of the research design

1.6.1 Stage 1: Review of Literature

The first stage of the research consisted of a review of literature relevant to the study. Due to the uniqueness of the ILS intervention within the South African education context, a thorough review of the literature was necessary to place the proposed study in context with what has been done as well as the current discourse around the localisation of ICT into Indigenous African languages. Literature sources were sought from both South African and international viewpoints. However, the lack of eminent pieces of literature about the inclusion of Indigenous African languages in the field of ICT at both a South African and international level compelled me to expand the literature search scope into different but related fields. According to Nakano and Muniz (2018) and Young (2017), such action is necessary when a study is conducted in a new or developing area, and as such, the following six new fields that would contextualise the ILS were identified:

1. **African languages**: This aspect of the literature focused on the status and perception of African languages with an emphasis on the position of African languages during the precolonial, colonial, and postcolonial periods.
2. **Africanisation**: This aspect of the literature focused on the position of African languages in the 21st century and the issue of intellectualisation of African languages.
3. **Digital divide**: This part of the literature focused on the broad description of the digital divide within a South African context and the steps taken to address the digital divide.
4. **Technology adaptation**: This aspect of the literature focused on the software localisation industry and the importance behind adapting software within particular contexts.
5. **ICT affordances**: This aspect of the literature concentrated on the concept of affordance and how it has been brought into the field of ICT to explain how the user perceives the benefits offered by ICT applications.
6. **Technology acceptance**: This aspect of the literature focused on the concept of technology acceptance and the factors that influence the acceptance of an innovation.

The goal of the literature review in the ILS intervention was two-fold: First, to identify and summarise the relevant literature available about the study, and second, to synthesise the various bodies of literature into a conceptual framework that would explain the data collected from the investigation on the use of an Indigenous African language (i.e., Setswana) on an online assessment platform (T-DL) in the Madibeng District of the North West province.

1.6.2 Stage 2: Conceptual Framework

The synthesis of the six reviewed literature fields, as reflected in Stage 1, led to the development of a conceptual framework. The acceptance and use of the T-DL software had to be investigated from the traditional view of technology acceptance and use, focusing on access, skills, and benefits. However, the acceptance of technology within a developing context like South Africa required the concept of technology acceptance to be viewed from a different perspective; a perspective that would accommodate the traditional factors of technology acceptance as well as the factors that had dominated the periods of colonisation and apartheid. As such, to acknowledge and accommodate the factors of culture and language, the conceptual framework adopted in the ILS was a fusion of the technology acceptance model (TAM) and the colonial mentality theory. Both are relevant to ICT acceptance in a model relevant to South Africa in a postcolonial/post-apartheid South Africa.

1.6.3 Stage 3: Data Collection

This stage relates to the case study design that was adopted for this study and had two phases:

- **Phase 1**: Collecting data about the use of the English version of the T-DL software using three data collection instruments (IDI, PO, and SSO)
- **Phase 2**: Collecting data about the use of the Setswana version of the T-DL software using three data collection instruments (IDIs, PO, and SSO)

1.6.4 Stage 4: Findings and Discussion

Any empirical research aims to arrive at a satisfactory conclusion based on findings derived from the analysis of the collected data to understand a complex phenomenon (Langlois, Nie, Thomas, Hong, & Pluye, 2018). The conceptual framework formulated

in Stage 2 is used to support and explain the data collected during the two phases to explain the attitude and user experience of the participants as they use an African language version of a software.

1.7 Scope and Context of the Study

The focus of the ILS intervention was on the introduction of a dual-language online assessment software (T-DL) that included an English and Setswana version. The study was conducted with a sample of seven Grade 3 Setswana-speaking teachers located in the Madibeng Educational District of the North West province in South Africa during the 2018 school academic year. Within the South African educational context, teaching in the Foundation Phase (Grade 1, 2 & 3) is done in the learners' home language, hence the seven Grade 3 teachers all use Setswana as their language of learning and teaching. The teachers were exposed to and used the T-DL software and completed a series of activities during which three data collection instruments were administered for each of the two phases of the study. While the study did present some thought-provoking findings, the issue of a small sample size was a limitation that should receive more attention if any future studies were to be conducted in this field. According to Oppong (2013), the results from a study with a small sample size is more likely to draw attention to researcher bias. More of the study limitations will be discussed in Section 7.6.

1.8 Benefits and Significance of the Study

The findings from this study will be beneficial to linguists, educational researchers, software developers, policymakers, and policy implementers as it relates to the inclusion and use of Indigenous African languages in the field of ICT. This study will serve as an incentive to drive the development and intellectualisation of Indigenous African languages in the field of ICT as well as in other specialist fields. Hopefully, this study will initiate further discourse around the topic of localisation of educational software within the South African ICT and education community. Though this study was implemented within a school ICT context, the findings and results could have wide-ranging implications to work environments where it could be possible to introduce and use Indigenous languages in ICT or other specialist fields. The ILS intervention could serve as a pilot for similar studies worldwide, and the findings and limitations

from this should be used as a roadmap or conceptual guide for the introduction and use of other Indigenous languages in ICT platforms.

1.9 Ethical Considerations

According to Saunders, Lewis and Thornhill (2009), whether research is conducted at an individual, societal, or global level, it is crucial that the research process is morally and legally acceptable. In the process of collecting data, the researcher must ensure that the code of ethical research is adhered to from the onset of the research cycle through to its conclusion (Creswell, 2007).

Within the context of this research, it was essential to ensure that all ethical procedures were considered and followed so that the rights and interests of the individual teacher participants were adhered to according to the principles of informed consent, voluntary participation, privacy and anonymity.

Educational research primarily engages human subjects, and as such, a researcher must maintain high ethical standards and ensure that the protection and sanctity of the participants' rights and welfare are guaranteed. In this study, institutional consent was obtained from the three schools where the participant teachers work (Creswell, 2007). The participants were all Foundation Phase teachers in the employ of the South African public school system, and as a result, permission for them to take part in the research had to be obtained from the North West Province Department of Education. Upon receipt of permission and clearance from the Department, the principals of the three schools were notified by the Department. All three principals consented for their schools and teachers to participate in the research. All necessary ethical guidelines for informed consent, confidentiality, and anonymity were strictly adhered to.

The seven teachers were purposively sampled to participate in this study, and they were subsequently informed about the research and were officially invited to participate in the research. The teachers were assured about confidentiality and anonymity, as well as informed of their right to withdraw from the research at any given time. The design of the data collection tools included a place for participant names, but participants were informed that they had the option of leaving it blank. To ensure the anonymity of the participants, each participant was allocated a pseudonym that was used throughout the data collection process as well as the reporting process. According to Lahman et al. (2015), the use of pseudonyms allows the reader to

attribute a personality to the participant, which in the social sciences makes the reading much more personal. The participants were satisfied with their pseudonyms (Elize, Evelyn, Jose, Lydia, Molly, Rebecca, and Thandi) and agreed to participate in the research.

The data collected in this study were stored in an electronic format and filed electronically onto a secured server at the HSRC. A back-up copy of the three datasets was kept on a secured cloud account. The hard copies of the completed instruments and observation forms were stored in a safe storage area that was out of bounds to the public and under lock and key. All these data formats will be preserved and archived for five years, as is the policy of the HSRC.

1.10 Organisation of the Thesis

The layout of the chapters of the thesis is illustrated in Figure 1.14.

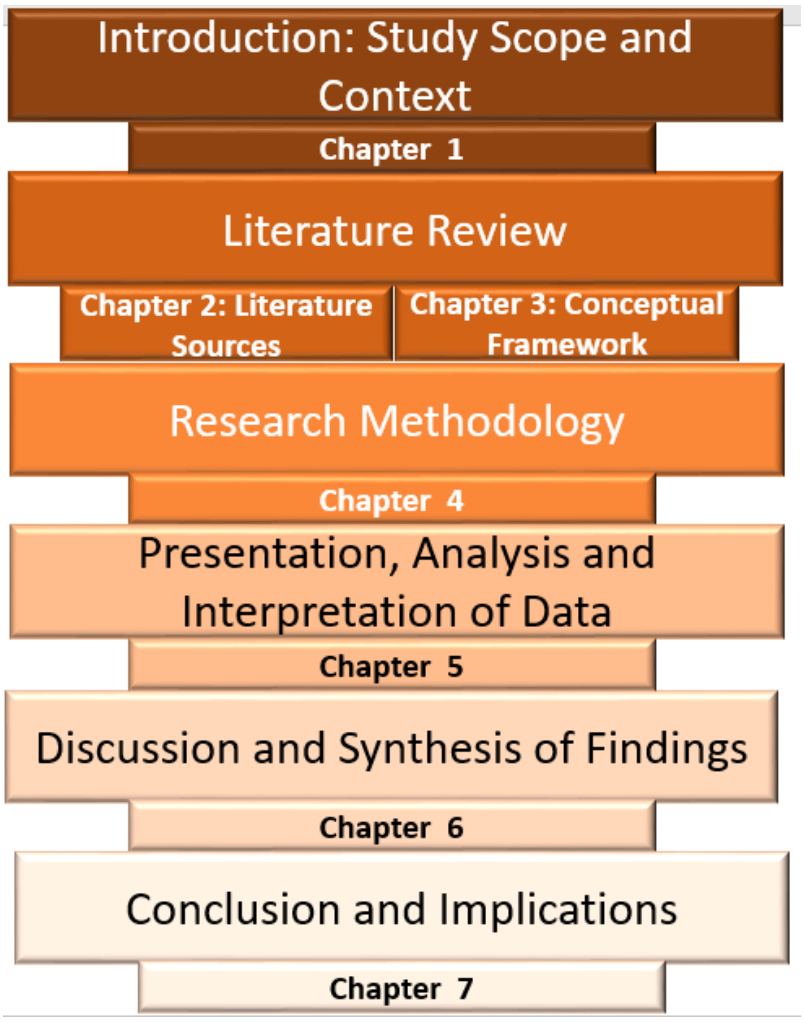

Figure 1.14: Outline of thesis chapters

This study is reported within the chapters outlined below:

- Chapter 2 reflects on both local and international literature across the six areas of review (Figure 1.12) that relate to African languages and ICT in a developing African context.
- Chapter 3 reflects on the synthesis of the different bodies of literature and build the conceptual framework and the rationale behind adopting this framework.
- Chapter 4 presents a review of the research methodology used in this study. The research onion is used to explain the research process by focusing on the philosophical perspective, research approach, research strategies, and data gathering tools used. The ethical deliberations are expanded on and the emerging themes introduced and explained.
- Chapter 5 presents analyses and interprets the collected data using the three data collection instruments (IDI, SSO, and PO).
- Chapter 6 presents a discussion and synthesis of the findings derived from the study.
- Chapter 7 presents a conclusion of the study, which includes its limitations and recommendations that could serve to inform and guide further research.

1.11 Summary

This chapter has presented a summarised background of the evolution of the TARMII concept and software. The TARMII 3.0 software provided the basis of this research, which aimed to determine if the use of an Indigenous African language (Setswana) as the GUI language of the TARMII 3.0 online software would influence the users' experiences of TARMII 3.0 and their attitudes towards the incorporation of Indigenous African languages in ICT. This chapter further provided the aim of the research, the research question, the research methodology, and the research design, which were prompted by a broad literature review. The scope and context of the study were jointly outlined, the significance of the study was explained, and the ethical considerations were expressed. Going forward in this thesis, it is important to note that reference will be made to English as an ex-colonial language, even though I am aware that there are different ex-colonial languages.

CHAPTER 2
LITERATURE REVIEW

In so far as every advance builds upon that which has gone before,
every single such discovery, invention or insight belongs, in principle, to all of humanity.

Neville Alexander (2005)

2.1 Introduction

In Africa, culture and language play critical roles in society, the economy, and education; hence, these factors are central to Africa's development. The introduction of ICT to Africa has brought with it a mixture of benefits and challenges. However, within the African context, these challenges are often magnified because of the issues of infrastructure and poverty. Nonetheless, the ICT sector can contribute greatly to the "infrastructure, networks, ICT service industries, and media, which also indirectly reduces poverty", (World Bank, 2012, p. 10). "Africa is looking to leverage on expanded ICT infrastructure, to realise the continent's digital potential aimed at supporting emerging and existing digital enterprises, which are catalysts in job creation (African Union, 2017 p. 1). Hence, if culture and language are central to Africa's development and if ICT has been identified as a tool that can greatly support Africa's development, does it not then stand to reason that the factors of culture and language cannot or should not be ignored when looking at the introduction of ICT or any other innovation in Africa?

This question becomes even more pertinent given that most African countries still use ex-colonial languages as official languages, and as such, these languages serve as sanctioned languages of education, science, and technology, even though most the population speak an Indigenous African language (Miti, 2017). According to Osborn and Osborn (2010), English still dominates the field of ICT in almost all its key disciplines such as programming, web page design and development, and software content development. This dominance of one language has adverse effects on countries and individuals who are fluent in an Indigenous language because they will be unable to benefit from the value of ICT. As a result, Barrios (2005) and Jørgensen, Pedersen, Benedek, and Nindler (2017) argued that the exclusion of Indigenous African languages from ICT is tantamount to an infringement on the basic human rights of every African person.

The aim of this study was to investigate whether the localisation of an English online assessment software to include Setswana would influence the Setswana-speaking teachers' software experience and their attitude towards the use of Indigenous African languages in ICT. The initial search for literature pertaining specifically to the localisation of educational software started from a South African perspective; however, the lack of relevant and empirical research in the field of software localisation into Indigenous African languages within the South African context required the broadening of the literature search to include relevant literature from the African continent. However, the review of literature exposed a lack of empirical studies in the field of software localisation. However, what was conspicuous during the review of literature from an African context was the limited evidence of empirical studies in the field of software localisation in Africa, while there seems to be more theoretical studies in this area. This lack of literature grounded on empirical studies in the field of software localisation within the South African and African context convinced me that my proposed study was needed to initiate further discourse in this field.

Due to this lack of relevant literature, specifically in the area of software localisation in South Africa, the scope of the literature search had to be expanded to include new areas. Although these new areas, as shown in Figure 2.1, may not be directly linked to the localisation of software, they are crucial to the adoption and use of Indigenous African languages in ICT within a South African context.

As alluded to in Chapter 1 (Section 1.11), going forward in this thesis, I will refer to English as an ex-colonial language, even though I am fully aware that there are other ex-colonial languages.

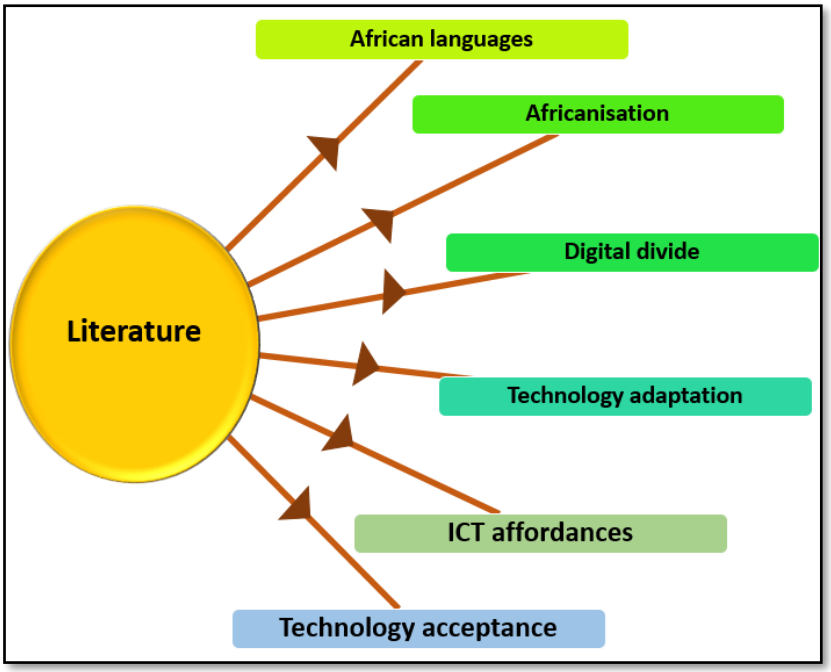

Figure 2.1: Literature review focus

2.2 African Languages

According to Mutembei (2014), the earliest known civilisation can be traced back to Africa, which implies that the earliest used language was undoubtedly an African language. Indigenous African societies are traditionally multilingual, giving most Africans the ability to switch from their first language to a second language if and when necessary, a practice common in South Africa (Bodomo, 1996).

2.2.1 Indigenous African language

According to Rwantabagu (2013), language in education in most African countries are still marginalised by colonial languages such as French and English. This was further elaborated on by Adegoju (2013), who also noted that efforts geared towards effective knowledge production in most African states have suffered setbacks owing to their extreme dependence on foreign languages to mobilise the population for national development. So even though while African languages are spoken more widely throughout African countries than the European languages, they are still perceived as being of high-status knowledge. As a result, Magwa and Mutasa (2007), raised the question whether Africa can achieve stable development while the speakers continue to use foreign languages that appear to hamper the education of the majority.

According to Chukwuere (2017), there is a widely held perception among both Indigenous and non-Indigenous African language speakers that African languages lack the intellectual depth and capacity to be used in technical and specialised subjects. However, Chukwuere (2017) dismissed this perception and argued that before the arrival and colonisation of Africa by the Europeans, Africans were educated and conversant in specialist subjects like metal smelting, mining, farming, and astronomy, and the knowledge and skills required to support these activities were acquired through the medium of an Indigenous African language. Maseko, Nosilela, Sam, Terzoli, and Dalvit (2010) also suggested that the negative perception of African languages has greatly contributed to the lack of use and low status of African languages in the 21st century.

However, both Buzasi (2012) and Chukwuere (2017) placed the blame for the diminished use and status of Indigenous African languages squarely on colonisation. This view was supported in the earlier work of Němeček (2010), who noted that due to the continued ascendency of ex-colonial languages across Africa, African languages experienced a decline in its use and status. Contrariwise, Gudhlanga and Makaudze (2012) presented a counter-argument in which they stated that the diminished use and status of African languages cannot be blamed purely on colonisation, but that to a great extent the inattention of Africans themselves has contributed to its decline in use and status. Furthermore, Galla (2016) pointed out that supplementary social, cultural, political, economic, and governmental factors as well as deficient language policies and their inefficient implementation could also have played a role in the continued decline of African language use and status. As such, African languages need to become globally relevant so that it can be used in specialist domains and subjects and not just for social and cultural gatherings (Kaschula & Maseko, 2014). This notion of specialist domain use of African languages was also proposed by Bamgbose (2011, p. 3), who stated that a common feature of a weakening language is when Indigenous speakers “no longer see any meaningful purpose of the language in the community”. As such, it becomes imperative that African languages develop and possess the capacity and ability to be used effectively in specialist domains like law, science, education, medicine, business, and ICT, which will allow for the elevation of the status of African languages in the 21st century. If this

is not achieved and African languages do not reach the relevant status, then Africans will have no choice but to adopt and use a foreign language, which according to Gudhlanga and Makaudze (2012) equates to a new form of colonialism, a state of mental colonialism.

2.2.2 Colonialism and African languages

Ocheni and Nwankwo (2012) explained colonialism as a practice that sees the direct physical domination by one country over another, where the power of governance rests in the hands of a foreign authority whose aim is to ultimately exploit the natural resources of the colonised country. According to Hill (2014), colonialism maintained and extended control over foreign dependencies, while Spennemann, Birckhead and Atkinson (1996) defined colonialism as the physical on-the-ground presence of a colonial power occupying a foreign land. According to McPhail (2014), colonialism has three key characteristics: (1) The acquisition of scarce assets, (2) securing a confined or controlled market for products, and (3) the physical possession of land and people. All the above definitions and descriptions of colonialism can be précised as the domination of one culture over another culture in the attempt to possess the natural and human resources of the colonised land. Colonisation of Africa spanned from the early 1800s to the 1960s, during which time most of the countries in Africa were colonised by the European world powers of Great Britain, France, Portugal, Germany, Spain, Italy, and Belgium.

The premise of colonisation revolves around the concept of exploitation. Oliver and Oliver (2017) suggested that while the traditional explanation of colonisation presented by many researchers (Hill, 2014; Ocheni & Nwankwo, 2012; Spennemann et al., 1996) is correct, their descriptions, however, falls slightly short. As such, Oliver and Oliver (2017) expanded on the description and stated that the success of colonisation rested not just on the exploitation of physical and natural applications, but that the exploitation of the Indigenous person's character and mind was crucial.

Ultimately, over the years all colonised lands in Africa gained independence; however, this independence was simply a political independence, formalised through pen and paper. According to Dascal (2009, p. 8), most newly independent African countries are still heavily dependent on their ex-colonial 'masters', politically, economically or culturally. They further stated that even after the official independence, the sustained

“evils of the ‘colonial system’, persists and might have even worsened” (Dascal, 2009, p. 8). This unremitting presence of colonialism, according to David and Okazaki (2006), has greatly contributed to the dependency on the coloniser, which has resulted in a condition where even though the physical colonial exploitation and control of land and applications may have ended, the ex-colonial powers still retain subtle control over and continue to exploit the Indigenous population through their culture and language. In the same vein, Anastácio (2016) noted that the subtle control and exploitation by the ex-colonialists has led to a situation in which the Indigenous African population has adopted the perception that the culture and language of the colonist is superior to their own Indigenous culture and language, a situation that David and Okazaki (2006) referred to as a state of colonial mentality.

David and Okazaki (2006, p. 1), used the term *colonial mentality* to explain the phenomenon that saw members of the Filipino American community forming an attachment and attraction to American culture and American English, resulting in a “form of internalised oppression among Filipinos and Filipino Americans”. This internalised oppression led many Filipino Americans to believe that to attain “superiority, pleasantness, or desirability” within American society meant they had to adopt *“*cultural values, behaviours, physical appearance, and objects that are American or Western” (David & Okazaki, 2010, p. 850). Sharmin (2010) shared this opinion and referred to this condition as a state of mental defeat, which occurs when the colonised or oppressed are led to believe their Indigenous language and culture are inferior to those of the colonial powers and adopting the values and habits of the oppressor will essentially allow them to join the class of the coloniser. This state of mental defeat is crucial for the colonisation of an Indigenous population since economic and political control can never be complete without the mental control of the Indigenous population (Dascal, 2009). Sharmin (2010, p. 22) further stated that even though the colonised individual may identify mentally with the coloniser, the stark differences of language, culture, tradition, and religion will ensure that the colonised individual will never successfully be associated or assimilated with the coloniser; as such, the colonised individual will suffer from a condition of “dislocation, fragmentation, and loss of identity”. Based on the early findings of Ngũgĩ (1992, p. 16), the successful subjugation of the colonised requires the *“*destruction or the deliberate devaluing of Indigenous culture …, and ultimately leads to the elevation of the colonisers language

at the expense of the Indigenous language". Léglise and Migge (2007) reinforced this view and maintained that the elevation of colonial languages promoted and sustained colonial rule, which saw the coloniser using language as a mechanism to dominate the mind of the Indigenous population.

Within the South African context, colonisation resulted in the marginalisation of Indigenous African languages and cultures, which according to Van Der Westhuizen, Greuel and Beukes (2017), resulted in the colonisation of the African mind. A condition that is still prevalent today, decades after the end of colonial and apartheid rule. This condition was alluded to in the early work of Ngũgĩ (1992), who stated that the mental subjugation of the Indigenous population resulted in the Indigenous population perceiving colonial languages as having a higher intellectual status than Indigenous languages. Léglise and Migge (2007) claimed that the mental subjugation of the South African Indigenous population and, ultimately, the devaluing of African languages were a process that started with the first European missionaries who described African languages with negative and flawed interpretations. This view was corroborated by Miti (2017, p. 105) who provided historical evidence in the form of a statement made by William Boyce, a Wesleyan missionary, who referred to the Khoe and San languages of Southern Africa as "uncouth and inharmonious dialects" and that the "dialects are abound in those peculiar and barbarous sounds called clicks". As a result of this perception of African languages, South Africa's early colonial rulers were able to introduce and impose a foreign language as the official language, supported by language policies that were dominated by foreign ideology and values, on the Indigenous African population (Miti, 2017). The imposition of a foreign language on an Indigenous population does not result only in linguistic changes, but in the larger scheme of things, it can affect the Indigenous population's emotional and cognitive wellbeing as well as the loss of Indigenous knowledge (Mda, 2015). Khan (2014) expanded on this point, arguing that the imposition of a colonial language on an Indigenous population was not just an introduction of colonial words but that the colonial words were deep-rooted in Western ideologies and culture.

During the colonial period, Africa's Indigenous languages were largely ignored, and according to Alexander (1999), the colonial rulers did very little to empower and promote Indigenous African languages. As a result, when African countries gained independence, the Indigenous languages of the respective countries were not

adequately prepared or modernised to be used as functioning languages in key sectors to support and promote national development. As a result of the perceived lack of adequacy of African languages, many of the newly independent African countries, including South Africa, adopted ex-colonial languages as official languages to promote national development (Léglise & Migge, 2007). This situation was essentially an impasse faced by African leaders. Bamgose (2011) explained the impasse confronting the leadership as a decision to focus either on the decolonisation of the country and its structures or to focus on nation-building. However, due to the socio-economic conditions of the African countries at the end of the period of colonialism, most African countries opted for nation-building over decolonisation, which greatly swayed their decision to adopt an ex-colonial language as the official language. Plonski, Teferra, and Brady (2013) highlighted the decision taken by most African leaders to adopt the use of an ex-colonial language because they believed that the ex-colonial language would unify the diverse Indigenous linguistic groups of their respective countries, and in so doing, would promote nation-building and development. However, the findings of Khan (2014) challenged the view of African leadership and stated that the decision to adopt and use ex-colonial languages has in reality slowed down Africa's rate of development.

The question about maintaining an ex-colonial language as an official language was further problematised by Anastácio, (2016) and Léglise and Migge (2007), who concurred that Africa's dependency on the West and its colonial 'masters' has resulted in the ex-colonial powers retaining a significant control of Africa's natural and physical applications. However, Dascal (2009) clearly warned that the control of Africa's natural and physical applications is not the ultimate form of control of a country, and that the ultimate form of control is the control of the mind of the people. As explained in the earlier work of Alexander (1999), the control of the human mind is an essential aspect of colonisation and language becomes the crucial factor to control the human mind. This view is supported in the writings of Vree (1984, p. 1), who quoted Saul Alinsky, an American social activist and political theorist, who stated that "he who controls the language controls the masses".

A false narrative created by missionaries, explorers and historians produced a perception that the mind and intellect of an Indigenous person were inferior and lacked basic intelligence, simply because the Indigenous person was not able to

communicate in an ex-colonial language (David & Okazaki, 2006; Ikuenobe, 2018). This perception or view resulted in the Indigenous population being forced to learn an ex-colonial language; however, many Indigenous people voluntarily accepted learning these languages as they perceived the ability to communicate in them was a sign of intelligence. As such, language played a significant role in sustaining the programme of colonisation and remains a dominant factor in African countries and other developing countries in the 21st century.

Within the South African context, the continued use and dominance of English occurs at the expense of the various Indigenous African languages (Seti, Elirea & Pedro, 2015). This view holds in a post-1994 South Africa, where English remains the dominant language in the different key sectors of the country. This situation, according to Ndimande-Hlongwa and Ndebele (2017), is a result of the decisions taken by the South African leadership from 1994 to present: They have endorsed the use and allowed the dominance of English, even though various post-1994 legislation were enacted to promote the status and use of Indigenous African languages in all sectors of South African society. According to Alexander (1999), the rationale behind the government's decision to allow English to assume a higher status and use was based on the reasoning that English is seen as a more mature language with a highly developed and expansive vocabulary in key disciplines such as law, science, education, medicine, technology, and business, while Indigenous African languages did not have that maturity and modernisation and hence could not compete on the global stage. However, Adegoju (2013) cautioned that if the South African leadership maintains this view of the link between English and African languages, then the long-lasting implication would be that only those South Africans who are fluent in English will be deemed to be educated and able to become active participants in the key sectors of South African society. This concern was further emphasised in the findings of Yu and Dumisa (2015), who noted that in South Africa, the use of and fluency in English equate to intelligence and upward mobility in society and the workplace, while the use of Indigenous African languages equates more to non-official or cultural gatherings. This acuity around the differentiated role of African languages within the South African context was described by Alexander (2003), who coined the term *static maintenance syndrome*, which implies that most South African Africans perceive that Indigenous languages can only be used within the context of family, community, and

religion and that African languages do not hold any intellectual authority or status when compared to English.

The reality of the static maintenance syndrome concept is apparent within the current South African society where even though the percentage of Indigenous African language speakers far exceeds those of English, the Indigenous population perceives English as better suited for use in key sectors of South African society. According to Prah (2007), this situation is made possible simply because both African and non-African language speakers perceive English to be an intellectual language that will allow for progress, while Indigenous languages are seen to lack the intellectual depth and capacity to be used in disciplines like law, science, education, medicine, technology, and business, and is thus considered to be non-intellectual. To counter these perceptions, Dascal (2009) argued that the effective eradication of the ills of colonialism requires more than the physical independence of government and country, but that it requires the healing and liberation of the colonised mind. This approach is supported by David and Okazaki (2006), who stated that it is easier for the physical decolonisation of land than it is to decolonise an individual's mind and thinking.

2.3 African Languages in a Pre- and Post-1994 South Africa

The history surrounding many African countries can be divided into precolonial and postcolonial and South Africa can be divided precolonial, colonial, apartheid and post-apartheid. On 27 April 1994, South Africans of every race over the age of 18 were allowed to vote for the first time in a free and democratic election, making the year 1994, a pivotal point in South African history. Hence, pre-1994 refers to the period representing colonial rule followed by white apartheid rule, and post-1994 refers to the current period of a non-racial South Africa. According to Miti (2017), as in any other global freedom struggle, language formed the substance of the struggle for South Africa's struggle for freedom and democracy.

To fully grasp the complexity of the South African language situation, the issue of language can be viewed over three periods. The first period is the colonial period (1652–1948), the second is the apartheid period (1948–1994), and the third is the post-apartheid period (1994–present).

The first period (1652–1948) saw the first European settlers colonising South Africa. They spoke Dutch, which later evolved into present-day Afrikaans. This period also

saw the second colonisation of South Africa by the British during which time English was declared the official language, resulting in all Indigenous African languages being marginalised (Finlayson & Madiba, 2002).

The second period, called the apartheid or pre-1994 period, saw English and Afrikaans being declared as the official languages of South Africa, and these two languages were viewed as languages of high status and intellect, while Indigenous African languages were relegated to a low status (Ndimande-Hlongwa & Ndebele, 2017). Tshotsho (2013) further added that during this period all key sectors, from education to legal to commerce, were designed around these two languages and positions in these sectors were occupied by people who were fluent in these two languages. Most often these people were white. It was during this period that the apartheid government introduced the South African Bantu Education Act of 1953. Mda (2015) and Miti (2017) explained that at the core of the Bantu Act was the view that Africans should be trained and prepared for a life of manual labour and unskilled jobs, which was deemed aptly suited for the African individual by the apartheid government. However, both Alexander (1999) and Prah (2007) noted that the Bantu Act did more than simply prepare the African child for manual labour, the Act greatly contributed to the promotion of African social inferiority while promoting white cultural and linguistic supremacy, an ideology that was challenged during the Soweto Student Uprising of 1976.

The third period or the post-1994 period saw attempts being made to rewrite the injustices of the apartheid era and saw the growing call for the recognition of Indigenous African languages in South Africa. In the post-1994 South Africa, attempts were made through various policies and acts to rewrite the injustices, of which recognition of South Africa's various Indigenous African languages was foremost. The newly elected government declared isiNdebele, Sepedi, Sesotho, siSwati, Xitsonga, Setswana, Tshivenda, isiXhosa, and isiZulu alongside English and Afrikaans as the 11 official languages of South Africa. Ndimande-Hlongwa and Ndebele (2017) stated that the inclusion of multiple languages created an opportunity for the protection and the promotion of collaboration and tolerance among South Africa's different ethnic and racial groups. Early in the post-1994 period saw the initiation of various strategies to rejuvenate and promote Indigenous African languages in South Africa, of which the newly framed Constitution of the Republic of South Africa (1996) became an integral

part. With the new South African Constitution in place to support social reform, a series of language acts and policies intending to promote and expand the use of Indigenous African languages were introduced.

The Constitution of the Republic of South Africa (1996) essentially had two goals: The first was to address the decolonisation of the country's structures and regulations, and the second was to revise and where necessary rewrite the policies and actions of the previous apartheid government. The proclamation of the Constitution in 1996 marked the end of apartheid language policies and the beginning of a new era of language planning aimed at addressing past disparities within the legislative context of South Africa's Constitution (Alberts, 2014; Finlayson & Madiba, 2002). The drive to address past inequalities saw various pieces of legislation being introduced to guarantee the promotion, development, and equitable use of all 11 official languages of the country (Alberts, 2014; Jack, Singh, Hlombe & Mars, 2014).

Under the decree of the Constitution of the Republic of South Africa (1996), the government instituted the following policies and organisations to fulfil its duties in promoting and rejuvenating Indigenous African languages:

- The Pan South African Language Board established in 1995
- The Commission for the Promotion and Protection of Cultural, Religious and Linguistic Communities established in 2002
- The Language Task Group (LangTag) was formed in 1996: Findings and recommendations from LangTag led to the appointment of the Language Policy Advisory Panel and the National Language Service that developed a draft language policy
- The Language Policy in Education was adopted in 1997
- A language policy for Higher Education was developed in 2002
- The *National Language Policy Framework* and Implementation Plan
- The Use of Official Languages Act 12 of 2012 was adopted in 2013

Despite the introduction of these policies and organisations to promote and rejuvenate Indigenous African languages, Ndebele (2014) and Phaahla (2014) questioned the success of these policies in promoting and recognising South Africa's Indigenous languages. Mda (2015) and Taylor and Von Fintel (2016) also took this stance and maintained that due to the unsuccessful implementation of these policies by the

government, the promotion and status of Indigenous African languages in a post-1994 South Africa has essentially not changed. However, Bamgbose (2011) opposed this view and argued that the blame for the lack of promotion of African languages in post-1994 South Africa should not be seen purely as bad policy implementation by government and suggested that a number of additional factors may have contributed. Bamgbose, (2011) identified negative language attitudes, defective language planning, globalisation, national integration, colonial legacy, and to a great extent, modernisation as possible contributors to the lack of promotion and low status of Indigenous African languages.

It thus becomes clear that for Indigenous African languages to be successfully integrated into a modern South African society, a number of supporting factors must be considered and resolved, of which language policy formulation and implementation are central. Botha (2010) and Chukwuere (2017) cautioned that as long as language policies are not effectively implemented in South Africa, the legacy of colonialism and apartheid will survive, English will remain the dominant language in South African society, and only those fluent in English will join the “economic and social class elite” of South Africa (Chukwuere, 2017, p. 235).

2.4 Dominance of the English Language

According to Léglise and Migge (2007) and Lieberman (2003), the perception that English with its strong spoken and written convention is better suited for use in specialist fields such as legal, business, technology, medicine and education than Indigenous African languages has greatly sustained its adoption and dominance in postcolonial Africa. Alexander (1999) noted in his early work that this flawed perception of English formed the basis which postcolonial African leaders presented to support their argument. According to the leaders the adoption and use of an Indigenous language could destabilise the country due to the separatist dynamics prevalent in most African countries, hence a colonial language would minimise disruptions as it was a common language. The leaders further argued that the use of a colonial language would make it easier in the discipline of economics and technology since books, publishers, dictionaries, and registers were already in place.

In partial support of Alexander’s (1999) view, Ndebele (2014) and Rwantabagu (2011) defended the decisions of the leadership of independent African countries, stating that

the leaders viewed the unification of their nations and its diverse populations as their main priority, and as a result, many leaders marginalised Indigenous African languages and the African identity and adopted English or an ex-colonial language as an official language.

Within the South African struggle context, Ndimande-Hlongwa and Ndebele (2017) noted that the adoption and use of English took on a more strategic role because English managed to unify different racial, religious and linguistic groups under a common banner, which was opposition to the apartheid government's policies of racial oppression. Ironically, the objective behind the South African freedom struggle was to empower the disenfranchised majority Black and African population, yet an unintended legacy of the freedom struggle saw the growth and dominance of the English, an ex-colonial language, at the expense of Indigenous African languages (Prah, 2007). A parallel can be drawn between the positions of English in a postcolonial post-apartheid South Africa to that of English in a postcolonial India. Gupta-basu (1999) explained that the mental subjugation of the Indian population by the British ensured that Indians saw fluency in English as the only way to elevate themselves out of poverty. As part of India's nation-building programme, Indian government departments recruited Indian nationals who were fluent in English to occupy all the high-level political, military, scientific and cultural seats of government. As such, Indians saw the ability to speak English as necessary to progress socially and professionally. Similarly, in a post-1994 South Africa, Gudhlanga and Makaudze (2012) and Phaahla (2010) stated, the ability to speak English is viewed as the first step to economic prosperity, which leads to a higher social status. Ndebele (2014) noted that at the same time, Indigenous African languages are seen as irrelevant languages in the fields of employment and academia.

Currently, in South Africa, English is still held in high esteem by many South Africans and has become the dominant language in the fields of law, science, education, medicine, technology, and business (Seti et al., 2015). According to Ndimande-Hlongwa and Ndebele (2017), while English may have served as a unifying language during the freedom struggle, it does not serve as a language for nation-building after the freedom struggle. Bamgbose (2011) supported this view and stated that in a post-1994 South Africa, the empowerment and use of Indigenous African languages are vital for the success of nation-building. This view has been widely accepted by Gudhlanga and Makaudze (2012), Ndimande-Hlongwa and Ndebele (2017), and Yu

and Dumisa (2015), who further argued that the continued marginalisation of Indigenous African languages will not only impact the status of African languages, but will have a lasting impact on the psyche of the African individual by instilling in them a sense of inadequacy and inferiority compared to those who speak English, as fluency in English is perceived as a gateway to higher social standing, economic mobility, and higher intellect.

In South Africa, English will always remain a foreign language for most of the African population, thus it becomes imperative that Indigenous African languages are allowed to progress and modernise so that the majority who speak an Indigenous language have access to the same opportunities and resources as those who speak English. Phaahla (2014) supported this view and acknowledged that for African languages to achieve the same status as English and not be seen as a liability, it becomes necessary that Indigenous African languages be empowered and modernised to be used in key fields like law, science, business, and ICT. Phaahla (2014) further argued that the use of African languages should not be seen as a burden, but rather as an asset and that for practical and cultural reasons, Africans should embrace African languages and counter the belief that African languages impede African unity at national and regional levels (Zeleza, 2006).

2.5 Status of African Languages

The 1885 Berlin Conference saw the banning of the European slave trade, while at the same time the conference encouraged European nations to colonise and exploit Africa's human and natural applications. This Declaration ultimately led to the growth and dominance of colonial languages in Africa (Bamgbose, 2011). Currently, in the 54 African countries, Indigenous African languages are recognised as official languages in only 10 countries, Arabic in 13, and in 49 African countries an ex-colonial language is used as an official language (Ebatamehi, 2020; Wanjiru, 2020). Upon attaining independence, only a handful of African countries attempted to promote Indigenous languages by including an African language as an official language alongside the ex-colonial language. However, even in these countries the ex-colonial languages still enjoyed a higher status. According to Alexander (1999), South Africa is a perfect example of the dominance of English as English is not the most widely spoken language, yet it enjoys a higher status and dominance over the other nine Indigenous

African languages. It is important to note that the low status occupied by the different Indigenous African languages is not an official pronouncement, but is based on the perceptions held by individuals, a perception that has been influenced by attitudes, beliefs, and history.

This widely held view of the low status of Indigenous African languages in South Africa has led to both African and non-Africans adjudging English as being intellectually a superior language and thus indirectly proclaiming that English is more suited for use in specialist and technical subjects (Léglise & Migge, 2007; Ndimande-Hlongwa & Ndebele, 2017; Shakib, 2011; Tshotsho, 2013). This belief can have a detrimental effect on the African psyche. According to Van Der Westhuizen et al. (2017), Africans must accept that African cultural knowledge and language occupy a high status, and only then will they address the emotional, intellectual, and spiritual needs of the African people. To achieve what Van Der Westhuizen et al. (2017) proposed, it becomes necessary to raise the status and prominence of African languages. However, Bodomo (1996) and Kaschula and Maseko (2014) argued that raising the status of African languages is not only the responsibility of the individual African but that African leaders and academics must take the necessary steps to develop and implement language policies and intervention programmes to ensure African languages are intellectualised and modernised to stay on par with changes in society and technology.

2.6 Indigenous African Languages and Information Access

Information access helps individuals make the correct decisions, contribute actively to society while protecting their rights, and ensure their support and participation in the democratic governance of the country (OECD, 2018). Section 32(1) of the Constitution of the Republic of South Africa (1996) gives every citizen the right to access any piece of information collected by the state as well as any information held by another individual in the public domain. However, in South Africa, access to information has an unwritten ‘right of admission’ proviso, which is dictated by language. As alluded to earlier in this chapter, the vast majority of South Africa’s population speaks an Indigenous African language, yet the vast majority of information available in the public domain exists in English, a language that is foreign to most of the population.

A similar condition prevails in the digital space, where almost all ICT applications and resources available to South Africa’s people exist in English. Hence, most of the South

African population who speak an Indigenous language will be disadvantaged when it comes to accessing and benefiting from the information housed within these ICT applications (Barrios, 2005; Omojola, 2009; Osborn & Osborn, 2010). According to Bamgbose (2011), to achieve the promise of the Millennium Development Goals (MDGs), which was to use ICT to fast track development programmes in Africa, the traditional concept and design of ICT applications must be reimagined so that the unreached can be reached and the excluded be included. Adegoju (2013) and Mutonyi and Norton (2008) raised their scepticism around the MDGs by questioning the success and influence of the MDGs programmes in Africa and suggested that many of the development programmes involving ICT did not achieve their objectives because of factors such as geographical location, infrastructure, politics, civil unrest, culture, and language. From these factors, most often issues around infrastructure, security, and the political climate was given more attention, with little or no attention given to language. This point was also noted by Gudhlanga and Makaudze (2012) who maintained that the sustainability of any development or ICT intervention programme in Africa will not be successful simply because the programmes are developed and based on a foreign ideology and in a language that is not contextually or culturally appropriate to the target users. This view was further supported by Khan (2014), who stated that if future interventions do not accommodate the language of the target recipients, then these too will fail. The failure to acknowledge and use African languages in ICT intervention programmes, especially if these programmes involved social and educational development, will mean these intervention programmes do not serve their purpose (Bodomo, 1996).

The discourse around Africa's development is a relevant issue and as such the topic of development in Africa most often is tabled at global conferences or as research topics, and most often the focus falls on issues about the economy, security, labour, social services and the ICT infrastructure of African countries (Coulibaly, 2017). However, Bodomo (1996) insisted that very little attention is given to the role of culture and language, especially the role Indigenous African languages can play to support and sustain Africa's development, especially in the field of ICT.

2.7 Intellectualisation of African Languages

The imposition and use of an ex-colonial language as a language of teaching and learning in Africa impede the educational progress of most of Africa's population (Adegoju, 2013). Miti (2017) expanded on this statement and acknowledged that modern knowledge production in most African countries has been adversely influenced by Africa's reliance on the language of the West or ex-colonial countries. This situation was explained in more detail by Bamgbose (2011) and Rwantabagu (2011), who stated that in their desire to achieve rapid national growth and development, many African leaders compromised the position and status of their Indigenous languages in favour of an ex-colonial language, as they believed that ex-colonial languages had already achieved language modernity. According to Bodó, Fazakas, and Heltai (2017), the concept of language modernity "does not only imply inventing a modern standard language, but also the change which occurs in the way speakers think about language … compare their utterances determined by the conventional pattern of everyday discourses to the ideal of the standard" (p. 332). In essence, for a language to become modern, it does not have to be invented, but rather, language modernity is achieved through everyday discourse. According to Nürnberger (2012), achieving language modernity is easier for the world's dominant or ex-colonial languages than for the weaker Indigenous languages because the dominant languages' turn-around time for producing results, information and solutions in the form of new terms and concepts is much quicker. As a result, weaker Indigenous languages are forced through direct or indirect pressure to conform and accept the information and solutions produced using a dominant language like English. This situation manifests itself in Africa, where Osborn and Osborn (2010) lamented that digital educational material produced in English is being introduced to Indigenous African communities. As a result, African communities have no alternative but to accept and try to engage with these ICT applications that use English as its default language. However, this imposition of digital applications in a foreign language can have negative consequences. Nürnberger (2012) cautioned that the adoption of Western educational solutions by an Indigenous population can result in a state of *cultural lag*, which sees the Indigenous cultures being less motivated and less competitive than the dominant culture, hence they will simply adopt what is being given without an attempt to improve their language.

The growing demands brought on by the 21st century have created a situation that demands of African countries and African people to produce African information, knowledge, and innovative African solutions using African languages. This view was supported by Prah (2007), who argued that for African countries to successfully decolonise, it is imperative that the language used in education, information and ICT be a language that all Africans are comfortable using; hence, the need for the modernisation and advancement of African languages. This view of language modernisation was supported in the early work of Alexander (1999), who stated that an important condition for language advancement or language modernity is that the development and advancement of the language be guided by the needs and demands of society. The concept of language advancement as alluded to by Alexander (1999) was proposed in 1932 by Havranek, a linguist from the Prague School, who explained language advancement as a step in the intellectualisation process of a language. In essence, language intellectualisation, as coined by Havranek (cited in Khumalo, 2017) is:

> A clear process of cultivating, developing, elaborating, and modernising a language so that the terminology of the language can carry the full weight of scientific rigor and precision, so that the language can be effectively used in highly complex subjects and fields. (p. 252)

The phrase *intellectualisation of African languages* can be controversial, according to Finlayson and Madiba, (2002), because it could imply that African languages are not intelligent. However, Finlayson and Madiba (2002) and Prah (2007) explained the origin of this perception and stated that the 'unintelligent' label attached to African languages originated from the skewed perceptions held by former colonial rulers and Western linguists like the missionary William Boyce. Kaschula and Maseko (2014) argued that throughout human history all languages, including the current ex-colonial languages, at some point had to go through a process of intellectualisation or modernisation and that many are still advancing as society modernises and advances. A simple example to explain language modernity or advancement can be related to the invention of the telephone by Alexander G. Bell, who on 10 March 1876 made the first *call*. Before this date, many terms related to telephones and telephone usage did not exist; however, with this invention, the English language had to modernise and new terms related to the innovation of the telephone had to be developed or adapted,

terms like *dial*, *hang-up*, *headset*, etc. As such, the phrase intellectualisation of African languages should not be perceived negatively but should be seen as positive as it deals with the development and advancement of an African language, which would allow the language to function effectively in an information and technology-specific age where new technical concepts and technical solutions are created daily (Finlayson & Madiba, 2002). Van Genabith (2009) expanded this argument of language advancement by stating that specialist ICT terminologies like hypermedia, internet, intranet, email were not part of the English vocabulary, yet with the introduction of these digital solutions, these terms had to be developed so that the English language could function in these new fields.

Similarly, Finlayson and Madiba (2002) explained that for South Africa's Indigenous African languages to be used in new and emerging fields like ICT, there must be a process during which the intellectualisation of these languages occur through the development of field appropriate terminology so that they can be used effectively in fields of high complexity. Khumalo (2017) elaborated on this view by stating that the intellectualisation of South Africa's Indigenous African languages is essential to ensure their survival, which will be guaranteed if these languages are developed to function in key fields such as ICT. The intellectualisation of a language is definitely not easy, especially when there are competing demands facing the country. According to Finlayson and Madiba (2002), the process of intellectualising an African language will not be a simple and straight forward process, and the process can be affected by administrative, logistic, social and political hurdles. However, Omojola (2009) contrasted the view held by Finlayson and Madiba (2002) and argued that while administrative, logistic, social and political factors might hinder the intellectualisation of African languages, the key factor hindering the intellectualisation of an African language is the negative attitude that African language speakers themselves have towards their languages and its use in specialist domains.

The introduction of ICT has created opportunities for interventions and solutions that could promote the intellectualisation of African languages within the South African context (Ndebele, 2014). However, Miti (2017) argued that for the intellectualisation of African languages and their inclusion into the field of ICT to be successful, there has to be an intensive effort through language intervention programmes for the development of domain-specific terminology. While Finlayson and Madiba (2002)

applauded the post-1994 government's commitment to intellectualising and promoting African languages through the different policies and acts, Dia (2014) argued that the plethora of language policies and acts to promote the use of Indigenous African languages in South Africa are meaningless without a dedicated and intensive programme for the development of Indigenous African language terminology and content for required fields. Miti (2017) supported this argument. Khumalo (2017) further emphasised the importance of terminology development by stating that as part of the process of decolonisation and, ultimately, the intellectualisation or modernisation of Indigenous African languages in South Africa, there must be a concerted effort to accelerate the development of content and terminology in the different African languages. The development of content and terminology would empower these languages to function effectively in complex disciplines like ICT. According to Mapi et al. (2008), as long as English remains the dominant language in ICT, most of the South African population who are not fluent in English cannot access and benefit from ICT applications. As such, Mapi et al. (2008) highlighted the need for intensive and in-depth discussions and implementation programmes around the use of Indigenous African languages in the field of ICT, especially in regard to terminology and content development.

Broadening the discussion around the development of field-specific content and terminology into an Indigenous African language, Van Der Westhuizen et al. (2017) suggested that Africans need to develop their African knowledge, understanding, and skills to contribute to the continent and the global agenda of community and social wellbeing. However, Hoffer (2005) and Léglise and Migge (2007) disagreed with this suggestion and argued that the development of terms in specialist fields into an Indigenous African language does not imply the development of these terms from scratch. According to Lusekelo (2018), world languages tend to borrow nouns, adjectives, verbs and adverbs from other languages. This concept or technique of terminology borrowing is supported by Alexander (2010) and Miti (2017), who stated that the intellectualisation or modernisation of local African languages does not only mean developing new terms but also includes the translation of existing English terms and sources into an African language. Adegoju (2013) and Msila (2009) also promoted this approach by explaining that since Africa needs to be part of the global community, their progress and development in the globalised world must see the merging of both

Western and African knowledge systems. It is only when this is achieved that both Africans and non-Africans will view Indigenous African languages as being intelligent and not simply a collection of sounds and clicks (Khan, 2014; Miti, 2017).

According to Adegoju (2013), intellectualising and modernising Indigenous African languages in the 21st century will ensure that Africa's population has access to digital knowledge and information in a language that is natural and familiar, which will help promote education and, ultimately, national development. However, Phaahla (2010) cautioned that with the modernisation of African languages, a balance must be maintained between meeting global demands and preserving Indigenous identity, culture, and language. Attaining language modernity as the expense of cultural integrity is highly controversial, and as such, the modernisation of African languages must be cognisant of the dangers as well. It is thus important to prioritise issues of culture during language modernisation. According to Prah (2007), much can be learned from the process of language modernisation of Afrikaans, which in a short period of 50 years became a language of modernity within the South African context

2.8 Development of Afrikaans, A Language Success Story

Afrikaans originated in the Cape region of South Africa and has its roots in a variety of different languages, including Dutch, French, German, English, Arabic, Malay, Khoi, and various Indigenous African languages. It was initially used by slaves and un-educated workers (De Kadt, 2006; Giliomee, 2004; Van Rooy & Van den Doel, 2011). Over a very short period, Afrikaans developed into a fully-fledged and functional language and was used to differentiate between the white English population and the white Dutch or Afrikaans population.

According to De Kadt (2006), with the development of Afrikaans, a variety of dialects emerged from the non-white speaking Afrikaans population. However, white Afrikaners saw these dialect variations as a perversion of their language, which they considered as being a pure language, spoken only by true white Afrikaners. The white Afrikaans population saw the Afrikaans language as God's way of communicating His will to and through them, which according to De Kadt (2006), was the first sign of the perception of the Afrikaner that they viewed their language and themselves as superior to the English and the Indigenous African population.

By 1920 at least two Dutch language universities introduced Afrikaans as a teaching language, which came to play an important role in the promotion and future development of the Afrikaans language. According to Giliomee (2004), the shaping of the Afrikaners' political identity was greatly due to the growth of the Afrikaans language. The characteristics of Afrikaans speakers were that they were poor, lacked basic education, and lived in the rural areas, while the English were more educated, wealthier, and lived primarily in the urban areas. According to De Kadt (2006), by the 1920s Afrikaans was still a relatively immature language that was used primarily during religious and cultural gatherings as there was a perception that the Afrikaans language lacked both intellectual capacity and ability. De Kadt (2006) maintained that this perception is very similar to that which is held currently about South Africa's Indigenous African languages. According to Blackshire-Belay (1994), many Afrikaans parents opted to have their children attend English medium schools so that they would be English educated and have better opportunities for employment and upward social mobility. While De Kadt (2006) commented that many Afrikaans parents saw the education of their children in Afrikaans as an attempt to further subjugate and separate them from English speakers. However, during this period, a concerted effort from a sector of the Afrikaner community saw Afrikaans academics, politicians and the clergy instilling programmes to promote the use of Afrikaans, and within a short period, Afrikaans started to gain a foothold in South Africa. In 10 years, Afrikaans evolved from a fledgling language to a language that was adopted for use in courts, government departments, was extensively used in the financial sector as well as in secondary and tertiary education (Giliomee, 2004).

The development and eventual high status of Afrikaans as a language did not occur immediately even though it had government support (Mda, 2015). There needed to be a concerted effort that focused on terminology and content development. It was only when the appropriate terminologies were developed that the language could be used in the different specialist domains (De Kadt, 2006). This achievement attained by the Afrikaans language is best explained by Giliomee (2004), who cited Heinz Kloss who noted that:

> [u]nless we consider Arabic an African tongue... Afrikaans is the only non-European/non-Asiatic language to have attained full university status and to

> be used in all branches of life and learning... All other university languages have their main basis in either Europe or Asia. (p. 3)

What lessons can be taken from the modernisation of Afrikaans that could assist and guide the modernisation of African languages in South Africa? According to De Kadt, (2006), while there are similarities between the position Afrikaans was in and the position South Africa's Indigenous African languages find themselves currently, there are also some obvious differences in the challenges African languages face. De Kadt (2006) identified the following four modernisation challenges that Indigenous African languages face. One is the international context plays an important role. Currently, the increasing levels of globalisation make it difficult for the African languages to compete against English; this was not the case in the 1920s. Secondly, in a post-1994 South Africa, the low status of Indigenous African languages is just one of many challenges the government faces. Structural, political, financial, and educational challenges must be addressed at the same time. In the 1920s, the focus was predominately on the recognition of Afrikaans as a language. Third, the population that was involved in the language issue in the 1920s was a very small (white Afrikaners) population; currently, the government needs to address the Indigenous language problem among a larger population with multiple competing problems. Finally, in the 1920s, the focus was just on promoting one language, Afrikaans. Currently, there are nine Indigenous languages, and the aim is that each must receive equal attention, and on top of that is the competing challenges the government must address.

The struggle for language recognition in the 1920s compared to the 2000s is different and so too are the challenges. According to Mda (2015), the struggle of the Afrikaner during the 1920s was essential for the certainty of existence for a politically important language community, while De Kadt (2006) stated that the struggle of the 2020s is for social equality and the language is just part of the struggle (De Kadt, 2006). According to De Kadt (2006) and Alexander (2010), despite the political importance of language, the post-1994 government has not given Indigenous African languages high priority, which the Afrikaner government in the 1920s did. However, the deficiency of governments' focus on Indigenous languages is not due to a lack of 'political will' as alluded to by Alexander (1999) and Bamgbose (2011) but is rather due to the high number of competing developmental issues inherited by the post-1994 government. Steps have to be taken to rewrite the injustices and inequalities of the past. Within the

context of education, this rewriting would entail the adaptation of the curricula and syllabuses to guarantee that teaching, learning, and the subject content are adapted to African realities and situations that will bring about the birth and revitalization of Africa and the African way.

2.9 Modernisation of African Languages

2.9.1 Africanisation

According to Letsekha (2013), the concept of Africanisation carries different meanings for different individuals within different contexts. This is demonstrated by this range of definitions or explanations extracted from different literary sources:

- Botha (2010) defined Africanisation in terms of an individual or an institution attempting to retain its African character to achieve certain academic, economic, political, and cultural aims.
- Chukwuere (2017, p. 236) defined the concept as “a characteristically African cultural feature, such as a belief, custom or linguistic feature”.
- Dick (2014) explained that the concept of Africanisation ultimately must and will feature aspects of cultural relevance, indigenisation, and modernisation.
- Louw (2010, p. 44) described Africanisation as “shared beliefs, values, and assumptions that can be found in the language practices and beliefs of all African cultures”.
- Mashabela (2017) explained Africanisation as the promotion of human rights, culture, and dignity, which assists in the cultivation and enhancement of education in Africa.
- Urch (1968, cited in Msila, 2009, p. 311) defined Africanisation as “a regeneration of that which was good and respected in African culture, a rejection of subservience to foreign masters and the assertion of the rights and interests of the African”.

Although these descriptions vary, they do have a common underpinning, which speaks to the rejuvenation of African culture and society. The explanations presented above emphasise the need for Africa’s individuality within the context of development. However, Msila (2009) commented that Africa’s dependence on the West should not be seen as a sign of weakness, but as an indication that Africa is part of a growing

global society that is interlinked and interconnected in which countries, cultures and people work, live, and study together; so essentially, just as Africa needs the West, so too the West needs Africa. Adegoju (2013) supported this view but cautioned that many contemporary descriptions and explanations of the concept of Africanisation fail to acknowledge that Africa's development and growth should take place within the context of a global society that is interlinked and interconnected.

The explosion of ICT together with the expansion of innovations supported by Web 2.0 technologies have promoted the interconnectedness of the world, which subsequently resulted in a situation that demands that Africa strategically position itself on the global stage (Louw, 2010). However, for Africa to be viewed as a contributor to the global community, especially in the field of ICT, it is vital that Africa can guarantee the cultivation, promotion, and renewal of its own Indigenous knowledge and skills in support of ICT, while at the same time using the acquired Indigenous knowledge and skills to compete and contribute to the global technological and information society. However, to achieve this, Africa has to reclaim what was taken from Africa and Africans, which essentially is the sense of pride in African culture and language, while at the same time acknowledging the benefits of certain Western concepts and knowledge. Letsehka (2013) used this stance to foster this new approach to explain the concept of Africanisation:

> The need to seek out our commonalities, affirm African culture, traditions, and value systems, foster an understanding of African consciousness, and finding ways of blending Western and African methodologies. (p. 2)

Van Der Westhuizen et al. (2017) expounded on this statement and described Africanisation as a vehicle for defining, interpreting, promoting and transmitting African thought, philosophy, uniqueness, and culture to empower the previously disadvantaged while at the same time ensuring that Africa's disadvantaged is not isolated from the rest of the global society and modernisation.

The start of the 21st century saw African scholars and academics envisioning an African education system that was grounded on African philosophy and African culture and values (Msila, 2009). Letsekha (2013) supported this and viewed the Africanisation of the education system as essential since the implemented curricula in most African countries serve to alienate most of the population because of its Western

and ex-colonial influence and slant. However, at the same time, Letsekha (2013), together with Chukwuere (2017) and Rwantabagu (2011), maintained that the Africanisation of education should be undertaken on condition that there should not be a total break from non-African knowledge, but rather that the Africanisation of education should also prepare students for a technologically interconnected world that is ever changing. Ndebele (2014) expanded on this point and claimed that Africa's development is highly dependent on ICT, as specified in the MDGs document; however, the future and success of ICT applications in Africa will greatly depend on the ability of ICT applications to accommodate Indigenous African languages, which, on one hand, will deal with the past linguistic and social biases and, on the other, address the disparity in the use of Indigenous African languages in ICT.

2.9.2 African languages in the digital age

The value and benefits that ICT hold for development in underdeveloped countries are no longer in question. However, for these countries to truly benefit from ICT, ICT access must be prioritised (Avgerou, 2010; Etoundi et al., 2016; Venkatesh & Sykes, 2013). According to Venkatesh and Sykes (2013), attempts to address the issue of access has generally been successful in the last two decades, which has seen an increase in access to physical ICT applications and end-user skills training. This has been made largely possible through the introduction of cheaper ICT applications and expanded internet connectivity. However, Omojola (2009) disputed this view and stated that even with the issue of physical access and connectivity being greatly addressed, Indigenous populations of Africa still need to use ICT gadgets and applications that are developed in languages alien to them. Like Omojola (2009), Osborn and Osborn (2010) noted that available ICT applications for African use are dominated by English, a language foreign to most Africans. As such, Dia (2014) stated that individuals who only speak an Indigenous African language will undoubtedly encounter problems, not so much in accessing the application, but in navigating, engaging with the content, and retrieving the information stored within the ICT application. This problem occurs simply because the interface commands and content exist in English, a language many Africans are unfamiliar with. This condition, according to Seti et al. (2015), has globally seen the emergence of a new form of

disparity in ICT. This time the disparity or inequality is not predicated by physical access but by language.

According to Pimienta (2011) and Njoh (2018), the inequality in the use of African languages in the field of ICT has essentially relegated language to the position of a gatekeeper in that language either permits or rejects access to ICT users, and if this is the case, then the promise that ICT held for fast-tracking development in Africa as identified by the MDGs is simply unattainable. As such, the use of ICT in a foreign language to promote African development will, according to Ponelis (2015) and Thapa and Hatakka (2017), not only slow down and impede Africa's development but will also jeopardise the status of Indigenous African languages and culture. To counter this threat, Chukwuere (2017) and Osborn and Osborn (2010) advocated for the modification of ICT applications to accommodate African languages, which in large will ensure that Africans will be able to access, accept, and use ICT applications in languages that are natural to them. However, it is important to note that modifying any ICT application, computer software or web interfaces, into an African language will in itself not ensure acceptance of the technology. According to Ndebele (2014), the acceptance and use of an ICT application by an Indigenous population is highly dependent on the cultural appropriateness of the Indigenous terminology and phrases used in the software modification process.

2.9.3 Indigenous African language and terminology development

Language development and language modernisation have essentially been non-existent for Indigenous African languages in South Africa. As a result of the lack of development and modernisation, African languages have a label of being unintellectual as people believe them to lack the intellectual capacity or depth to be used in complex fields and subjects like ICT and the sciences (Léglise & Migge, 2007; Mutembei, 2014). However, Finlayson and Madiba (2002) challenged this view and argued that South African Indigenous languages have for centuries used Indigenous terminologies in specific subjects like hunting, cattle farming, mining, farming, food preparation, and religious and cultural gatherings. These terms were not passed down from generation to generation, but rather grew and developed as new subjects arose. This argument is sustained by Prah (2007) and Zeleza (2006), who commented that the development of African languages is not a new concept and that African languages

have always undergone the process of intellectualisation and modernisation, and as such, Indigenous African languages have the ability to intellectualise and modernise, become relevant, and be used in specialist fields and ICT in the 21st century.

Finlayson and Madiba (2002) maintained that even with the implementation of various language acts and policies aimed at the empowerment of Indigenous African languages, little has been accomplished in the intellectualisation and modernisation of Indigenous African languages post-1994. According to Miti (2017), this inconsistency, can largely be attributed to the poor implementation and monitoring of language policies and acts, and African languages must be deliberately developed and modernised to be effectively used in key subjects. Osborn and Osborn (2010) noted that ensuring the intellectualisation of African languages is not simply about producing policies and acts to expand the use of African languages but these policies and acts should clearly define steps and procedures to develop and modernise African languages so that it may be used in new and evolving disciplines and subjects like the sciences and ICT. Ikuenobe (2018) supported this view and added that the intellectualisation of African languages will give African languages a wide field of use, legacy and immortality. This becomes clear when looking at the *Use of Official Languages Act 12 of 2012* that aims to provide the following:

> Regulation and monitoring of the use of official languages by national government for government purposes; … to provide for the establishment and functions of a National Language Unit … provide for monitoring of and reporting on the use of official languages by national government. (National Language Unit, 2012)

The aim of this Act is progressive and clearly demonstrates the intent to expand the use of African languages across the different government departments, which can be seen in these extracts from the Act:

> (6.1.a.i) to regulate and monitor the use of official languages by national government for government purposes;
> (6.1.a.ii) to promote parity of esteem and equitable treatment of the official languages of the Republic and facilitate equitable access to the services and information of national departments,

(6.1.a.iii) promote good language management within national departments, national public entities, and national public enterprises;

(8.d) monitor and assess compliance with the language policy of the national department, national public entity or national public enterprise concerned. (National Language Unit, 2012)

The Act essentially targets the expanded use of official African languages within South African government departments. However, Miti (2017) argued that promoting the use of African languages involves more than acts and policies and an effective programme that develops terminology and content in the Indigenous language is needed so that the language can be used effectively. If any of South Africa's nine African languages are to be used in government departments, as stated in extract 6.1.a.ii (National Language Unit, 2012), the language must possess the necessary terminology and capacity to be used effectively within the specific government department context. Thus, the intellectualisation of African languages is truly only achieved with the development of a repertoire of terminologies for new and developing fields and subjects, which De Kadt (2006) and Giliomee (2004) argued took place in the intellectualisation of Afrikaans. However, can a comparison be made between the need to intellectualise African languages and the intellectualisation of Afrikaans? It is important to remember that in a pre-1994 South Africa, the apartheid government only had to focus on two languages and Afrikaans received the most attention. The post-1994 government needs to focus on 11 languages and ensure that all these languages, especially those that were previously neglected, are given the required attention and status by ensuring that they can and will be ready to be used in new and evolving 21st century subjects and fields.

According to Prah (2007), the discourse to include African languages into complex subjects and fields like ICT has been met with some level of scepticism, which is largely due to the existing notion that Indigenous African languages do not possess the intellectual capacity and technical terminologies to allow it to be used in specialist fields like ICT. This notion was also alluded to in the early work of Bodomo (1996), who stated that many individuals felt that using languages such as English in specialist technical subjects were more appropriate than using an African language, simply because African languages were incapable of expressing certain technical concepts essential to specialist subjects. However, Lusekelo (2018) and Mafela (2010)

challenged this notion and maintained that within the South African context, if Indigenous African languages adopt the process of 'term borrowing', they too can grow and develop to be used in subjects and fields like ICT. Lusekelo (2018) clarified the concept of term borrowing as when one language borrows terms or phrases from another language and then translate the original terms into the target language (Indigenous). This process is also part of language development. Osborn and Osborn (2010) alluded to a similar process that they coined *language adaptation*. They explained it as a process that African languages can use to modernise by either modifying or borrowing terminology from another language to explain new and foreign concepts.

The lack of specialist subject and field terminology in Indigenous languages is often cited as the key reason why African languages are deemed unsuitable for use in fields like ICT (Khumalo, 2017; Miti, 2017). However, this lack of field specialist terminologies should not hinder the modernisation of African languages. Based on the development of Afrikaans and its rise, it is possible that the intellectualisation of Indigenous African languages can take place within the current South African context. Alberts (2014) stated that if ICT is to serve as a tool to support Africa's development, then the continued use of English as the language of ICT needs to change to accommodate the Indigenous African languages of South Africa.

2.9.4 ICT and Indigenous African languages

According to Kibbee (2019), ICT has become an increasingly popular platform for the storage and dissemination of digitised data and information, which is greater than the pooled collection of the largest libraries around the world. Keegan (2008) stated that because of the benefits this trove of data and information hold for humanity, ensuring all restrictions or barriers of access are invalidated becomes the priority of governments around the world. However, while policies and acts may address some restrictions and barriers of access, certain restrictions or barriers are inherently part of the architecture and infrastructure of the ICT application, and language was identified as one of the foremost factors (Spennemann et al., 1996).

This finding corresponded with the writings of Osborn and Osborn (2010) and Prah (2007), who identified language as a key factor that restricts access to ICT applications; and hence, they insisted that language should not in any way serve as

an obstacle to an individual accessing knowledge and information in the digital space. However, the current design and configuration of ICT applications tend to favour a single language, English. This disparity in language representation in the digital space has resulted in the world's Indigenous populations being prevented from accessing and benefiting from ICT, primarily because of language inequality.

In 2011, UNESCO published a policy brief titled *ICT and Indigenous People* that called for the establishment of national e-strategies that will promote the inclusion of Indigenous people in the knowledge society. The aim of the brief was to ensure Indigenous communities are given the opportunity to access information in their Indigenous languages in the same way individuals fluent in English can access information (Osborn & Osborn, 2010). Bamgbose (2011) and Lieberman (2003) supported the concept of Indigenous language use in ICT but reiterated that access to information should be seen as the cornerstone of every individual's right to national life. Hence, the issue of language in ICT must become a central point of discourse when addressing issues around the introduction, acceptance, and use of ICT in the developing world. Jørgensen et al. (2017) supported this opinion and asserted that every individual should have the right to access and use ICT applications so that they can reap the benefits of the application. However, for this to be realised, ICT applications must be conceptualised, designed, and developed to accommodate multilingual and multicultural communities. According to Rincon (2013), this entails the translation of web content into Indigenous languages.

Galla (2016) and Mazango (2014) acknowledged the importance of translating content into Indigenous languages, but stated that the translation of content should not be seen as the end-point and that the adaptation of the web or software GUI is just as important, since if the interface remains in English and the content in an African language, the user will still have trouble accessing the relevant content, which would influence their acceptance of the ICT application. The argument around the adaptation of the GUI is supported by Drucker (2011) and Keegan (2008), who maintained that the adaptation of the GUI with the translation of the content would greatly aid and assist Indigenous African languages to survive and thrive in the 21st century. This argument was sustained by Phaahla (2014), who noted that during the 2011 *Conference on Open Access to Knowledge in the Sciences and Humanities* a pronouncement was made that saw delegates being urged to exploit the opportunities

and benefits offered by ICT and e-learning platforms to create software programs to advance languages other than English, which was identified as a language that monopolises ICT.

2.10 Monopolisation of the Digital Space

2.10.1 English dominance in ICT

The digital revolution is radically transforming the way humans communicate and socialise. Developments in ICT, especially in regard to Web 2.0 technology, over the last two decades have seen the introduction of various digital platforms to support and enhance human communication and engagement. These include:

- Desktop publishing software
- Email that allows files to be sent and received
- Skype, Zoom, Bliss and other video conferencing software that allows the user to conduct virtual meetings
- Advanced functionality on web search engines
- Social media platforms such as Facebook, Twitter, and Google+ that simplify communication, collaboration, and information sharing

However, the benefits offered by these digital tools and applications are helpful to only a select few in the global community since most of the tools lack the required infrastructure and capability to support and service those from a multilingual and multicultural society. Keniston and Kumar (2003) claimed that a great inequality exists in regard to the representation of the languages of the world on the World Wide Web (www). This is further supported by the most recent statistics provided by W3Techs, released on 24 March 2020, which showed that of the 38 world languages that have a footprint on the www, 59.7% of the websites use English as the content language, followed by Russian at 8,6%. From the 38 languages, the top 10 languages that dominate the web are seven European languages, one Persian language, and Japanese and Chinese, while the two lowest-ranked languages are Estonian and Latvian at 0,1% each, both of which are European languages. These statistics further showed that of the 38 languages represented on the www up to 24 March 2020, not a single African language has a digital footprint, even though 30% of the world's languages are African (Nour, 2015). Additionally, findings from Kibbee (2019) showed

that 57% of the global internet content exists in English, while the remaining 43% are in various non-African languages. This inequality has dire consequences for most Africans who only speak an African language. These statistics provide a holistic view of the extent to which the ICT environment is dominated by English and the possible influence of Western culture on the world's Indigenous populations.

According to Hill (2014), the concept of ICT domination can be described at two levels, unintentional domination and intentional domination. Unintentional domination essentially refers to barriers that hinder accessing ICT, and these can be the cost of ICT applications, licence costs, and ICT infrastructure. Intentional domination occurs when Western concerns dominate and control the right of admission into organisations like the Internet Engineering Task Force (IETF), that regulates internet norms and standards and the Internet Corporation for Assigned Names and Numbers (ICANN). These organisations oversee the technical maintenance work of the Central Internet Address pools and Domain Name System (DNS) that register and control domain names and registries. Hill (2014, p. 90) further emphasised that at the intentional level, the domination by the West of the digital space is sustained by creating "barriers to participation in those organisations, including the ability to speak English, to travel, and having sufficient technical knowledge". What this essentially implies, is that those individuals and countries that are proficient in English, including well-resourced Western countries, will benefit from the various ICT applications and be able to contribute to and populate the digital world with information that is relevant to their context, while countries in Africa and the rest of the developing world will automatically be excluded from contributing and ultimately benefiting from ICT. Furthermore, Hill (2014) noted that because of the exclusion of African countries from ICT governing bodies such as the IETF and ICANN, Africa's decision-making powers related to the growth and management of the ICT applications and the internet is greatly controlled and diminished. Mazango (2014) stated that Africa's exclusion from these key ICT governing bodies serves to perpetuate and sustain the domination and subtle colonisation of the digital space and stated that early in 2014 the European Commission called for greater and wider participation in the regulation of the web with particular emphasis on ICANN.

According to Phaahla (2010), the continued and growing dominance of English in the field of ICT in Africa can be attributed to a variety of reasons, of which Alexander's

(2010) static maintenance syndrome appears to be the most likely reason. This is supported by Adegoju (2013), who stated that many Indigenous Africans perceive ex-colonial languages, especially English, to be more intellectual than African languages, hence ICT is better served in English and their fluency and use of English will afford them greater scope and opportunity for personal and professional growth in the digital age. Bamgbose (2011) and Kenniston (1997) presented an alternative view to the continued dominance of English in Africa and argued that most people think that modernisation in Africa can only be achieved in an imported language like English, hence the continued use of English as the default language in ICT applications is obvious since English already has the relevant technical terminologies for ICT. Omojola (2009, p. 39), on the other hand, attempted to explain the dominance and use of English in ICT as a combination of the West's aggressive language drive and the passive language position taken by many African leaders, which he explained as the "convergence of a domineering foreign force and a lackadaisical local attitude". Finally, Venkatesan and Nambiar, (2003) proposed that English still dominates the ICT space in many developing countries, including countries in Africa, because most developing countries do not possess the technical applications or the technical expertise to manage and publish digital content, and thus, become dependent on ICT applications and digital content created in English by technically well-established Western companies, perpetuating the dominance of English.

Venkatesan and Nambiar (2003) elaborated by presenting another dynamic to the relationship between the creation of ICT applications and content in English by well-established Western companies and the adoption and use of these ICT applications and digital content by African countries. According to their findings, the ICT applications and content that is produced for African consumption is most often culturally and linguistically inaccurate since the developers and content writers of the ICT applications are most often not related or familiar with the context for which they are producing the ICT applications. This discrepancy and concern between ICT production and ICT acceptance were further evidenced by Khupe and Keane (2017) and Spennemann et al. (1996), who submitted that when digital applications and content are designed and developed by an external organisation, it can lead to a situation where the country's social, cultural, economic and political condition becomes contaminated with inaccurate views and values. As such, Jandrić and Kuzmanić,

(2015) and Phaahla (2010) indicated that subject-specific knowledge and content must be developed in Indigenous languages with the support of Indigenous people so that they can engage with these subjects in a language they are familiar with. In the earlier work of Janke (2002, p. 14), this notion of Indigenous participation is supported based on findings from an Indigenous Australian study context that essentially stated that "a partnership situation with Indigenous communities or individuals is important to understand that it is the community or the individual who should have the power to be the final censor of the work, not the editor".

To combat the monopolisation of ICT applications and digital content by a single country or organisation, Troumbley (2013, p. 95) suggested that a state of "net neutrality" must be reached, and within this state, the development of ICT applications or content should not have just one individual or organisation accountable but should include a team that comprises software technicians, linguists and representatives of the intended end-user audience of the ICT application. Achieving such a state, according to Alberts (2014) and Dalvit et al. (2008), is essential if we want to ensure that communities and individuals across the globe, especially those in Indigenous African communities, can access information and services in their languages.

2.10.2 Dominance of English in ICT in South Africa

The continued dominance of English as the default language in ICT must be addressed at all levels of South African society. As such, both the Department of Education in 2004 and the Department of Science and Technology in 2007 acknowledged that speakers of Indigenous African languages often encountered problems engaging and extracting information from ICT applications due to the continued use of English as the default language of the GUI and the content of these applications. Both these departments suggested wide-ranging remedial measures to remedy this problem. The Department of Education's (2004, p. 28) remedial measure was published in the *White Paper on e-Education* in which it was suggested that "in collaboration with the Department of Arts and Culture, will promote the adaptation and development of local content into Indigenous languages". The Department of Science and Technology (2007, p. 77) proposed its remedial measures in their strategy document *Information and Communication Technology Research and Development and Innovation Strategy for South Africa*, which stated that by "supporting the

development of strong skills in computer science and software engineering will enable the development of Indigenous technology and applications". In line with the vision of empowering and developing African languages to be used in the field of ICT, in 2006 ABSA, a South African commercial bank, modified the GUI of their automatic teller machines (ATM) to include a multilingual interface option that would allow users to choose from six Indigenous African languages (isiZulu, isiXhosa, Sesotho, Sepedi, Xitsonga, and Tshivenda) in which they could perform their financial transaction (Klein, 2009; Phaahla, 2015). However, Phaahla (2015) noted that the results from this intervention were not very promising: The findings showed that the total usage of ATMs in South African Indigenous languages only accounted for around 1.5% of total ATM usage. Furthermore, the low usage statistics at ATMs, according to Phaahla (2015), could be attributed to the fact that South African Indigenous language speakers were not confident to use their home language conducting an activity on an ICT device, which contradicted the opinion and stance put forward by the Department of Education and the Department of Science and Technology with regards the low engagement and extraction rate of information from ICT applications by Indigenous African language speakers.

In 2011, findings from a study conducted by the Department of Communication titled *Towards an Information and Communications Technologies (ICT) Rural Development Strategic Framework* identified the following six challenges that hindered the implementation of ICT in South Africa's rural areas:

1. ICT Infrastructure
2. Lack of skills
3. The exorbitant cost to communicate
4. Scarcity of local content
5. Language barrier
6. Lack of entrepreneurial acumen and culture

So, almost 16 years after the remedial actions proposed by the Department of Education's White Paper (2004) and 12 years since the Department of Science and Technology's strategy document (2007), there is not much evidence of success in the promotion and use of Indigenous African languages in ICT in South Africa. This lack of evidence is further supported by points 4 and 5 of the challenges identified within

the strategic framework published by the Department of Communication in 2011, which in itself is nine years old. Fast forward to 2020, the situation is very similar to what existed in 2004, 2007 and 2011: English continues to serve as the 'gatekeeper' of digital content and information, while Indigenous African language speakers still have a problem engaging and extracting information from ICT applications due to the continued dominance of English across both the GUI and digital content.

The continuing domination of English in the digital space is attested to by the fact that most websites and their content accessible to South Africans still exist in English. As part of the literature review component of the ILS study, two web-based reviews were undertaken to achieve a first-hand understanding and perspective into the distribution and use of South African Indigenous African languages on websites. The first review considered the top five ranked websites identified by using a particular search term when using the Google search engine, and the second review looked at the Google search results when searching for information on a specific educational topic in six official languages of South Africa.

2.10.2.1 Review 1: Google Search

This review aimed to identify the top five Google results from a search that used a particular phrase that contained specific keywords (*African, languages, South Africa*). This helped to identify the GUI language, the content language, and website focus of these top five ranked websites.



Figure 2.2: Google website search (Search: 1 March 2020)

Using Google's search option with the search phrase "African language websites in South Africa" (Figure 2.2), the search conducted on 1 March 2020 produced the top five Google ranking results shown in Table 2.1. It is apparent from the top five search

results that all the websites identified using the search phrase used English as their default language for both the GUI and the digital content.

Table 2.1: Indigenous African language websites (Search: 1 March 2020)

Google Ranking	URL	GUI Language	Content Language	Content Focus
1	https://africanlanguages.com/	English	English	This website contains information about African languages and language related applications.
2	https://www.unisa.ac.za/sites/corporate/default/Unisa-Open/OER-@-Unisa/Learn-to-speak-an-African-Language	English	English	This website provides basic phrases in different African languages.
3	https://www.sa-venues.com/language-afrikaans.htm	English	English	This website focuses on the history of the Afrikaans language.
4	https://www.sa-venues.com/language-xhosa.htm	English	English	This website focuses on the history of the isiXhosa language.
5	http://www.alasa.org.za/	English	English	This website deals with the African Language Association and gives its background and purpose.

The focus of the content of four of the five top websites highlighted Indigenous African languages; however, the emphasis of the content was more from a narrative aspect and looked at the history and background of South Africa's Indigenous African languages. The exception was website 2, which had a slight linguistic slant targeting tourists and provided the user (non-African speaking) with the opportunity to learn certain basic Indigenous African terms and phrases in four of South Africa's Indigenous languages (Northern Sotho, Tswana, Zulu, Southern Sotho and Xhosa[6]). The terms and phrases covered certain everyday topics relevant to specific fields (greetings and courtesies, human body, numbers, days, seasons, and question words). Website 3 also targeted tourists and provided a historical perspective of Afrikaans as a language. However, it is important to note that all five websites used English as the default language for navigation command icons and buttons as well as for the digital content. So essentially these websites do not serve any purpose to an Indigenous-speaking South African. The content of Table 2.1 provides further

[6] The spelling of these languages was extracted as-is from the website [UNISA Open]

empirical evidence of the lack of progress made in the promotion and use of Indigenous African languages in ICT in South Africa, even with the plethora of policies and acts to promulgate African languages post-1994.

2.10.2.2 Review 2: Google African Language Search

This review aimed to determine how Google's multilingual search engine option would respond when searching for educational content in six of the nine South African official languages. The current multilingual version of the Google search engine included Afrikaans, Sesotho, isiZulu, IsiXhosa, Setswana, and Northern Sotho (Figure 2.3).

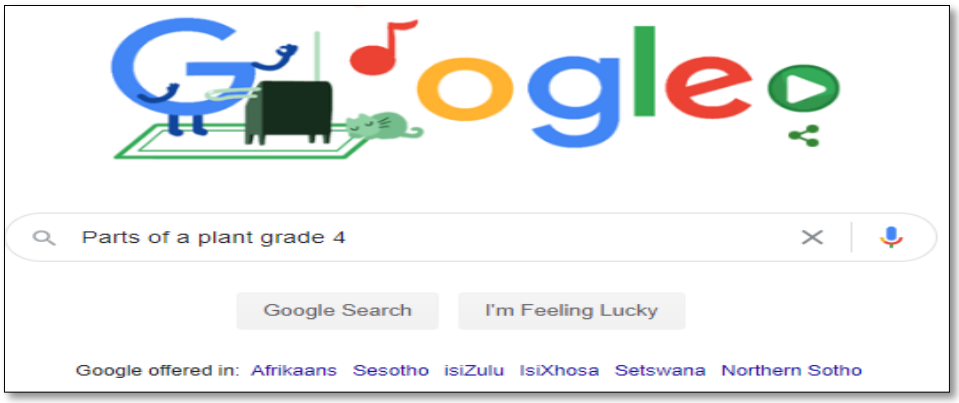

Figure 2.3: Google multilingual subject content search (Search: 1 March 2020)

The topic selected for this web-search exercise was a Grade 4 Physical Science topic, *Parts of a plant***.** The topic phrase was inserted into the Google search engine and each time one of the six official South African languages were selected as the search language (Figure 2.3). In all six instances, the search results produced one common website, www.thunderboltkids.co.za. The website Thunderbolt Kids is a multilingual educational platform that was part of an educational initiative run by the Siyavula, SASOL Inzalo Foundation and the DBE since 2008 to provide quality science content for South African primary school students across the language spectrum.

The digital content for the topic *Parts of a plant* on the Thunderbolt Kids web page was translated into Afrikaans and three of the five Indigenous languages, isiZulu, IsiXhosa, and Sesotho (see Appendix A); however, the content for this topic was not translated into Setswana and Sepedi and still existed in English (see Appendix B) even though the Indigenous language was selected. It is interesting to note that the search results (see Appendix C) still provided the description of the web site in English, even for sites

that were translated into an Indigenous African language. This has a serious implication for African language speaking students who might be looking for that specific topic because they still have to be proficient in English to understand the description of the content of the website. So even though some of the websites include an Indigenous African language, the user must still understand English to navigate through the search engine to find and access these sites. Another interesting aspect to note is that even within the translated websites, there are still instances where some terms and phrases were left untranslated and appeared in English (see Appendix D). This condition is explained and supported by both Keegan (2008) and Osborn and Osborn (2010), who noted that when Indigenous languages are being used for the first time on ICT applications, not all interface commands and icon descriptions can and will be translated, and some will have to be left in their original language, and over time, through user interaction, language development, and modernisation these terms will eventually develop.

Thus, the challenge that currently confronts many developing countries in education is no longer the question of gaining access to physical ICT applications but rather to gain access to educational ICT applications that are culturally and linguistically appropriate (Conole & Dyke, 2004). Gudmundsdottir (2010) echoed this view by stating that because of the dominance and infiltration of English in ICT, a perception has developed that sees language (English) as the new barrier to accessing ICT applications. Ndebele (2014) contextualised this argument and stated that for South Africa to introduce and promote the use of ICT across all sectors of society, especially in education, the issue of the disparity in ICT access has to be redefined and the focus should not only be on ensuring physical access to ICT applications but should include the question of language, and more specifically, the development of Indigenous African languages in the ICT field. This prioritisation will lead to Indigenous African language speakers having the opportunity to access and benefit from accessing ICT applications.

2.10.3 Domination of the World Wide Web

The absence of growth parameters and control of the internet has witnessed the unprecedented growth of large Western companies such as Google, Facebook, Twitter, etc. The growth of most of these large internet companies has resulted in a

situation where the end user, including individuals from the developing world, are seen merely as products whose personal details can be transacted or shared. As a result, Leetaru (2018, para. 5) claimed that users, especially those from the developing world, are dehumanized and become “merely data points …, whose lives are being exploited and monetized for its benefit”. This continued domination of the www by the West is further demonstrated by the fact that the composition of the Internet Society as recent as 2020 is composed primarily of Western representatives. From the 13 current Board of Trustees, 10 members are from the West, with one member each from Yemen, Japan, and Argentina (Internet.Society, 2019). What is glaring about the structure of the Internet Society, is the lack of African representatives. This lack of representatives from Africa, according to Anastácio (2016), creates a perfect environment for the sustainability and spread of a colonial mindset and colonial like environment within the digital space. This inability to ensure inclusivity and representativity of structures and ICT governance will perpetuate and sustain the digital gap or divide when it comes to ICT (Gillwald, 2017).

2.11 Digital Disparities

2.11.1 The digital divide

The rapid growth of ICT accompanied by its benefits have seen an increase in its use in intervention programmes with the expectation that using ICT will fast track development in developing countries and communities (Bagchi, 2005; Herselman & Britton, 2002). However, Sein and Furuholt (2012) maintained that the benefits that ICT holds for speeding up development have to a great extent not lived up to its promise as suggested in the MDGs. A broader viewpoint regarding the lack of progress in development using ICT was suggested by Chen et al. (2010), who submitted that a possible reason is that how an individual views, engages, and experiences ICT is greatly influenced by contextual factors such as culture and language. These findings resonated with the explanation proposed by Sein and Furuholt (2012), who stated that if contextual factors such as culture and language are not addressed adequately, then the disparity or divide in ICT access will persist, even after addressing the issues of ICT access and ICT skills. This argument was also supported in an early study conducted in America by Hoffman and Novak (2000), who found that there was a strong correlation between ethnicity/race and ICT acceptance

and use. Their findings further reflected that engagement and use of the internet among African Americans and Hispanics were relatively low due to the lack of available digital content to attract these sectors of the American population. Hoffman and Novak (2000) used their findings to argue that the concept of the *digital divide*, as coined by Lloyd Morrisett, president of the Markle Foundation, lacked depth and magnitude since the digital divide according to Morrisett alluded to the gap between the users of the internet, which he suggested was based on wealth and education.

However, the vast majority of the world still perceive the digital divide as the inequality or disparity between those that have access to ICT applications and ICT skills and those that do not, or as Lloyd Morrisett articulated, the *haves and have nots* (Bagchi, 2005; Naidoo & Raju, 2012). Nevertheless, there is a growing body of literature that argues that the digital divide is much more than the haves and have nots of ICT access and ICT skills, but that the digital divide also encompasses those who benefit from ICT and those who cannot (Fuchs & Horak, 2008; Hsieh, Rai & Keil, 2008; Sikhakhane, Lubbe, & Klopper, 2005; Wong, Law, Chu Fung & Ping Lee, 2010). Troumbley (2013) and Van Dijk, Hacker, and Van Dijk (2003) supported this assessment and maintained that the digital divide is a complex problem that needs to be understood and investigated from multiple perspectives.

Pimienta (2011, p. 1) attempted to explain the digital divide from a social perspective lens and added that the divide is not simply about access to ICT, but that the “digital divide is nothing other than the reflection of the social divide in the digital world”. Cancro (2016) and Omojola (2009) also maintained this opinion of the social dimension of the digital divide, explaining that the digital divide is essentially a social partition, defined by those who are involved in technology and those who are not. Fuchs and Horak (2008) viewed the digital divide from a socio-economic and cultural perspective, where factors such as poverty, poor infrastructure, lack of applications, education, and religion are seen as key factors that contribute to and sustain the digital divide. However, there is also a growing discourse asserting that the digital divide is greatly influenced and stimulated by factors such as language, culture and the lack of contextualised content (Gudmundsdottir, 2010; Omojola, 2009; Osborn & Osborn, 2010; Prah, 2007; Sein & Furuholt, 2012). As such, Pimienta (2009) advised that the design and development of ICT applications and technological interventions must be multi-dimensional, multicultural, and multi-linguistic if they are to be accepted and

adopted by the target audience. Petrie, Savva, and Power (2015) agreed and maintained that the diversification of ICT software will ensure that every individual and community, irrespective of context, culture, or language, will be able to access, engage and use the respective software.

According to Osborn and Osborn (2010), most of Africa's population are not English first or even second language speakers, and in most instances, English is the default language of ICT software programs and online platforms. This status quo has resulted in most Africans being unable to engage with, benefit from and use the vast array of ICT applications available (Prah, 2007). The imposition of English-based ICT applications on Indigenous African people who are not literate in English will greatly impede them accessing, engaging and accepting the software, which on the long run will hamper the development of Africans and African countries (Broadbent & Papadopoulos, 2013; Keniston & Kumar, 2003; Mapi et al., 2008; Ndimande-Hlongwa & Ndebele, 2017). Consequently, Galla (2016) and Osborn and Osborn (2010) insisted that for an ICT application to be successfully accepted and used by Indigenous African communities and individuals, the design and development of the ICT application must ensure cultural and linguistic appropriateness.

Within the South African context, a limited number of ICT intervention programmes in education have been rolled out over the past decade. However, most of these interventions have attempted to address issues of inequalities in ICT access and inequalities in ICT skills (Epstein, Nisbet, & Gillespie, 2011; Hsieh et al., 2008; Naidoo & Raju, 2012). These interventions include the following projects:

- Gauteng Online Project
- Khanya Project
- Multi-Purpose Community Centres
- Computers for Africa
- Mindset Network

These projects had mixed results, one key feature that was noted was that school and teachers within the South African context are unique, and as such, for these projects to succeed required that the uniqueness of schools and teachers be considered in the planning and rollout. The GoL project initiated by the Gauteng provincial government in 2007 committed R500 million to the project, which aimed to equip more than 2500

schools with a minimum of 25 computers over the coming three years (Otter, 2002). However, this initiative was fraught with lack of planning, corruption and mismanagement, which resulted in the MEC Mandla Nkomfe from the Gauteng Department of Finance placing the initiative under review in 2013 (MyBroadBand, 2013). So, while some schools received the computers, most of these schools saw the computers simply being packed away due to lack of support from the department. The Khanya Project which was based in the Western Cape aimed to use technology to enhance teaching and learning. It was launched in April 2001 and attempted to equip every school in the Western Cape by March 2012 with the necessary ICT resources and to ensure that every teacher is trained to use the ICT resources to deliver lessons to every learner in the province. So while this project had a number of successes, there were challenges in that the disparity between well-funded and impoverished Western Cape schools, led to the project roll-out in many schools not achieving its ultimate goal (SMART Technologies, n/d).

Jack et al. (2014) and Mafela (2010) claimed that for any ICT application or technology-driven intervention to be effective and to successfully address the digital disparity within the South African context, it is crucial that Indigenous African languages be included as essential languages alongside English for both the GUI and the content of the software. If, however, English is maintained as the sole default language of educational ICT applications, it will be at the expense of South Africa's Indigenous African languages. Such a situation would result in a condition that will see the minority of the African population who speak English being able to benefit from these educational applications, while most of the African population who speak only an Indigenous African language will be excluded from accessing and benefiting from the affordances provided by ICT. This will lead to a situation where Indigenous African language students will become dependent on the English dominated ICT applications and will develop the perception their Indigenous African language is inferior to English (Fuchs & Horak, 2008; Hill, 2014). Anastácio (2016) cautioned that reaching such a state essentially equates to a new form of colonialism, a state of digital or electronic colonialism.

2.11.2 Digital colonialism

The introduction of ICT brought with it much expectancy to support the fast-tracking of Africa's development, and as a result, many African countries in striving to speed up development in sectors like health, economy, and education introduced ICTs (Graesser, 2013). Within the African and South African context, the adoption and use of ICT for educational purposes is not a simple procedure, and various factors can influence the acceptance and use of ICT (Osborn & Osborn, 2010). These factors may be obvious or subtle. Obvious factors include lack of connectivity and access to physical ICT applications, while a subtle factors include the use of culturally inappropriate content and language in the ICT application (Gillwald, 2017). According to Van Der Meer, Smith, and Pang (2015), for computer systems and programmes to be accepted and used by the Indigenous population, the systems and programmes must be developed in the language of the target audience. Anastácio (2016) alluded to the paradoxical nature of the introduction of ICT in a developing country context, where on one extreme ICT can empower Indigenous African communities and on the other extreme it can promote inequalities and impose foreign views and values on the Indigenous communities.

A parallel can be drawn between physical colonialism and digital colonialism, according to Spennemann et al. (1996): While Great Britain, France, Spain, and Portugal were the main powers during the period of colonialism of the physical world, McPhail (2014, p. 3) identified the main powers in the colonisation of the digital world as "Bill Gates of Microsoft, Steve Jobs of Apple, Hewlett and Packard, IBM, Bell Labs as well as the internet, Google, Yahoo, Amazon, Facebook, Twitter, and others". The concept of a digital colonist was defined by Jandrić and Kuzmanić (2015, p. 90) as an individual who is "curious, adventurous, brave, bold, organised, white, middle class, and male". While McPhail (2014) stated that the digital colonists impose software and ICT applications produced in the West on the Indigenous population, and in most instances, these ICT applications are available only in English. This imposition of ICT systems using English as a default language can result in a situation that sees the rejection or overlooking of Indigenous African culture and language in the field of technology. An occurrence reminiscent of physical colonisation that saw Indigenous African languages and cultures rejected because they were perceived as being inferior by the Indigenous population. According to Dia (2014), the rejection of the use of

Indigenous African languages in the field of ICT is largely based on the perception that African countries lack the technical and intellectual capability and depth to develop or adapt ICT applications into an African language and to make the application uniquely African. As a result, Borrero (2010) claimed that a new kind of colonisation of Africa is unfolding, one where Western software designers and developers are instilling Western cultural and linguistic values on the Indigenous African population through ICT applications, while the cultural and linguistic factors of Africa are neglected. Avila (2018) supported this claim and added that this imposition of Western cultural and linguistic values on an Indigenous population is done without their explicit approval. This situation of unwitting domination of an Indigenous population, according to Sardar (1995) and Spennemann et al. (1996), has been achieved through the diffusion of ICT into developing countries through the means of digital media platforms like television, the internet, and social media, which has exposed the Indigenous population to a dominant culture and language that is foreign to them. This domination of the Indigenous population, according to Oppenneer (2009), shows that digital colonisation is not simply a colonisation of the physical person but rather the colonisation of the person's mind.

Thus, to achieve a state where Africans can access, accept and use ICT applications and ultimately benefit from the affordances of these applications, it is vital that ICT applications be culturally and linguistically appropriate for the African population. According to Gudhlanga and Makaudze (2012), empowerment and promotion of Indigenous African languages are central to the programme of decolonisation, and as such, African languages need to be empowered and intellectualised so that they can be used in ICT, which can only be achieved through the process of localising ICT software and online platforms so that it can support Indigenous African languages, which ultimately will assist in the decolonisation of the digital space.

2.12 Digital Access in the 21st Century

2.12.1 Technology adaptation

As stated earlier in this chapter, for developing countries to benefit from ICT, it is imperative that the ICT applications express and meet the needs and context of the target users. Anthony and Padmanabhan (2010) contended that it is only when this is achieved that ICT can be considered a platform to support social development and

resolve social injustices rather than deepen it. Galla (2016) supported this view, stating that while technology may have the ability to foster and accelerate development, if the cultural and linguistic appropriateness of the ICT application is not accommodated, it will merely perpetuate the digital divide.

As stated earlier in this chapter, the digital divide is much more than the lack of access to ICT applications and low ICT skills, language has become a key factor to the protraction of the digital divide, and as such, Gudmundsdottir (2010) and Prah (2007) insisted that the inclusion of African and other world Indigenous languages in the field of ICT needs much more attention. This argument around language inclusivity to bridge the digital divide was also sustained by Omojola (2009) and Osborn and Osborn (2010), who stated that the absence of Indigenous African languages in ICT applications is one of the key factors that has sustained the digital divide in many African countries. While Spennemann et al. (1996) and Jandrić and Kuzmanić (2015) supported the argument around language and the translation of ICT applications, they further argued that the adaptation of ICT applications should not only focus on language adaptation, but that it must also ensure that the cultural context of the target user population is accommodated. It is only then that Indigenous people will benefit from ICT. While many of the studies cited above acknowledged the importance of the adaptation of software (language and context), very few mentioned the conceptualisation and design phase of the localisation process.

Osborn and Osborn (2010) introduced a new dimension to the process of localisation or software adaptation by arguing that the process of conceptualising, designing and developing the localised software should take place within the context and confines of the target audience and that linguistic and cultural experts from the target population should be intimately involved in the conceptualisation, design, and development of the software from the onset. In other words, software for use by isiZulu or Setswana speakers cannot be developed in California's Silicon Valley.

Within a post-1994 South Africa, the lack of penetration of Indigenous African languages in the field of ICT was acknowledged by the new government, and as such, various government departments attempted through policies and acts to include African languages in ICT. These included the following policies and acts:

- The Department of Arts and Cultures' 2003 *National Language Policy Framework*: "We are faced with the challenge of globalisation and that our Indigenous languages should be part of the rapidly expanding technological environment" (Section 1, p. 3).
- The Department of Education's 2004 *White Paper on e-Education*: "The Department of Education, in collaboration with the Department of Arts and Culture, will promote the adaptation and development of local content into Indigenous languages" (Section 5.20, p. 28).
- The Department of Science and Technology's 2007 ICT Research & Development and Innovation: "A vibrant, sustainable, and innovative Indigenous ICT industry with a strong export focus, contributing significantly to reducing the ICT balance" (Section 2.3, p. 6).
- The Department of Communication's 2011 ICT Rural Development Strategic Framework: "Government has initiated a number of programmes that aim to accelerate the development of relevant local content that will enhance the use of ICTs in the country" (Section 7.1, p. 19).

2.12.2 The field of localisation

According to Mapi et al. (2008), the success of the introduction of any new technology depends on the acceptance of the technology by the target users. To achieve acceptance of the technology, the target user must develop a sense of awareness and ownership of the technology. Pimienta (2011) expanded on the concept of technology ownership by distinguishing between two forms of ownership, namely technical ownership and cultural ownership. Technical ownership refers to when the user embraces the ICT tool because of its technological capabilities and benefits, while cultural ownership refers to when the user identifies with the software because of its compatibility with their cultural and linguistic needs and expectations. Within a developing country, context achieving a state of cultural ownership of ICT is imperative if the goal is to ensure that the ICT application be accepted and used by its target users. However, the design, development, and rollout of ICT applications have always targeted technical ownership rather than cultural ownership. Borrero (2010, p. 2) supported this claim by citing an extract from a UNSECO report that referred to the low acceptance rate of ICT in African countries and stated the following:

> Generally, Indigenous people have low computer ownership, low computer literacy, low connectivity to the internet and … Exacerbating factors are the remoteness of many Indigenous communities—often located in regions where connectivity is difficult—and poor levels of literacy, particularly in English, the main computer language.

All the factors cited in this report clarifying the low acceptance rate of ICT in Africa focused on tangible issues, from ICT application ownership to connectivity, and finally associating the low levels of literacy that was equated to the inability to speak English. However, the report failed to associate the low acceptance rate of ICT in Africa as a result of the lack of use of African languages in ICT applications as well as the inequality of Africa's participation in the conceptualisation, design, and development of ICT applications (Avgerou, 2010). Osborn and Osborn (2010) maintained that ICT applications must be tailored to the needs and expectations of the targeted users if applications stand any chance of being accepted and used by the Indigenous population. Hart and Laher (2015) added that the adaptation of ICT applications to accommodate Indigenous African languages and cultures would allow Indigenous speakers to engage ICT applications in a language that they understand both instinctively and naturally.

According to Keniston (1997), the concept of localisation of computer software began with American software companies in the early 1990s when specific features of software applications were adapted from English to Spanish, French, and Japanese. However, the results of these early attempts at software localisation were in most instances inconsistent because they were direct translations done after the software development process. However, Keniston (1997) argued that these early inconsistent results in the localisation of software could have been avoided if the planning and implementation phase of the localisation was part of the initial software conceptualising, design, and development phase rather than done post-development. The concept of localisation has thus become a vital feature when dealing with the introduction and acceptance of ICT within a developing country context, more so in the last two decades with the rise in awareness of social inequality and the ever-growing discourse around national development. As such, the plethora of localisation descriptions include the following:

> The translation of programmes originally written in and for one language into intelligible and user-friendly versions or another language. (Keniston, 1997, p. 7).
>
> Adapting software written in one language for members of one culture to another language for members of another culture. (Keniston, 1999, p. 2)
>
> Adapting a software system to a particular locale, so that it presents the image of a locally developed system aimed at that locale. (Sasikumar & Hegde, 2004, p. 1)
>
> Localisation is the process of adapting digital content to culture, locale and linguistic environment. (Van Genabith, 2009, p. 4)
>
> The translation and cultural adaptation of user interfaces and software applications, as well as the creation of internet content in diverse languages and the translation of content from other languages. (Osborn & Osborn, 2010, p. 7)

Even though these descriptions span the period 1997 to 2010, the consistency between all these descriptions can be summed up simply as *the adaptation of computer software to meet local needs*.

Thus, the aim behind localisation of software applications has largely been to counter the continued use and dominance of one language in the field of ICT, viz. English. However, attempts at the localisation of software have seen a dearth of developers taking up the challenge to adapt software applications into Indigenous languages, especially Indigenous African languages. Doherty (2016) stated that the few attempts at localisation have tended to be more cosmetic adaptations rather than adaptations guided and informed by contemporary social and linguistic concerns.

Recent studies have revealed that the exclusion of African languages in the field of ICT greatly contributes to the growth and continuity of the digital divide in Africa, since most Africans are not proficient in English, the dominant language used in ICT applications (Avgerou, 2010; Sasikumar & Hegde, 2004; Van Genabith, 2009). Galla (2016) advised that more attention must be given to the localisation and translation of ICT applications to include Indigenous African languages, which is in agreement with Keniston (1999), who argued for the inclusion and adaptation of ICT applications to embrace Indigenous African languages. The rationale behind Osborn and Osborn's (2010) argument for localisation of software mirror that of Galla (2016) and Keniston

(1999) in the context that the availability of translated software applications in Indigenous African languages would greatly influence the acceptance and use of these ICT applications by the Indigenous populations to support national development. Miti (2017) contended that while the process of software localisation is task intensive and has some challenges that must be confronted and addressed, nevertheless the localisation of software applications will make a significant contribution to the intellectualisation of African languages by making available translated versions of scientific and technological information within adapted software applications that can be used by African communities.

According to Sasikumar and Hegde (2004), even though the localisation of any ICT application may be simply explained as the adaptation of software, software localisation is a much more complex process. They identified four broad components of localisation to support this, reflected in Figure 2.4.

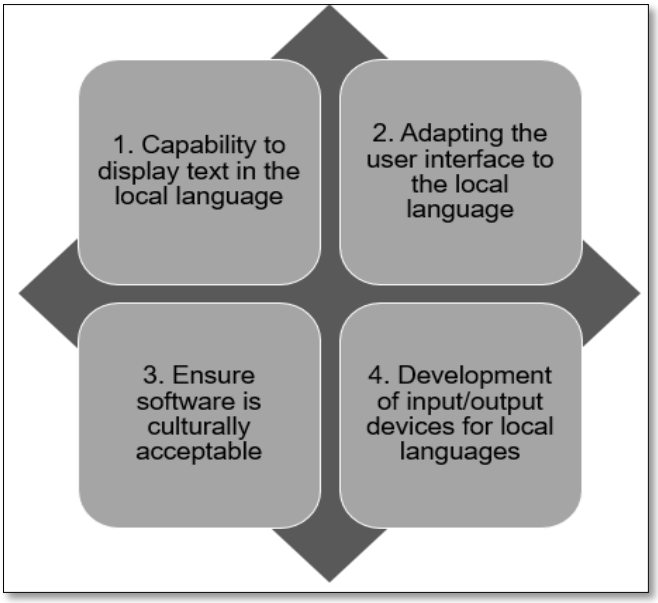

Figure 2.4: Components of localisation (adapted from Sasikumar & Hegde, 2004)

These components are essential in the localisation of ICT software and online platforms and include:

1. Capability to display text in the local language (Display Localisation): This element ensures that the display text is in the local script or font and not in the commonly used Roman Script.

2. Adapting the user interface to the local language (Language Localisation): Ensures all text material used in the system is translated into the local language.
3. Ensure the software is culturally acceptable (Cultural Localisation): Software must be convenient to the target community, including the use of icons, error messages, and conventions.
4. Development and use of input/output devices (Device Localisation): The QWERTY keyboard is most commonly used, however, it would not work when using a non-Roman font.

Mato, Keegan, and Naera (2016) further emphasised the complexity of localising software applications and stated that the process of localising goes much further than simply adapting software to accommodate a second or third language. They stated that the localisation of software applications must consider localisation as a multiple adaptation process that sees both the user interface and the content housed within the software needing to be adapted This aspect was neglected in earlier studies (Galla, 2016; Keniston, 1999; Sasikumar & Hegde, 2004). Mateos (2010) supported the notion of multiple adaptations in the process of software localisation by stating that the first adaptation is of the user interface to accommodate the local culture and language, while the second adaptation is the adaptation or translation of the software content into the Indigenous language of the target users.

Lieberman (2003) and Omojola (2009) expanded the argument around localisation of software and argued that in order for the localised software to be accepted and used by Indigenous African language speakers, it is imperative that Africans develop African digital content to populate the software. To achieve this, the development of terminologies and concepts specific to specialist subjects and fields like ICT becomes necessary.

2.12.3 Terminology development

In the early 1990s, the Localisation Industry Standards Association (LISA) was established in Geneva. Its purpose was two-fold: Firstly, to bring together software developers, localisers, translators and publishes, and secondly, to support software companies establish a dedicated localisation department that would manage localisation initiatives. However, only a few software companies established these

dedicated localisation departments (Keniston, 1999). In 2011, the Localisation Industry Standards Association (LISA) programme closed, leading to the creation of Terminology for Large Organisations (TerminOrgs), whose purpose was essentially to manage and support the development of new terminologies across all disciplines and to ensure the relevance, accuracy, and consistency of the new terminologies, which would ensure that target users accepted and engaged with the new terms used in the different software applications.

As most ICT applications are developed using Western languages and terminologies or incorrect versions of translated terminologies, there is always the chance that when these ICT applications are introduced into a new cultural or linguistic milieu the application will either be underutilised or discarded, resulting in additional work (Jonas & Rai, 2012), making the work of TerminOrgs all the more important. This view is evidenced in the starter guide by TerminOrgs (2012, p. 51), which stated that "unclear direction regarding terminology often necessitates re-work during authoring and translation projects and when incorrect terminology is propagated into products, the costs of imposing consistency is multiplied". As such, the use of local languages that has contextually and culturally appropriate terminologies is vital for the acceptance and success of localised ICT applications.

However, Ouane and Glanz (2010, p. 21) maintained that there is a widely held perception that African languages lack the necessary terminologies for use in specialist fields simply because of the belief that "it would require too much time and too many resources to develop the vocabulary of these languages", which could explain why there is a lack of specialist terminologies in African languages. Ndebele (2014) suggested that this causal nexus has resulted in African languages being labelled as unintellectual, simply because of their inability to be used in complex and specialist fields. Nevertheless, Finlayson and Madiba (2002, p. 53) noted that the creation of new terminologies in Indigenous African languages should not be seen as a protracted process but that terminology development in African languages can occur through "deliberate and conscious use of word-formation patterns such as borrowing, compounding, derivation, loan translation, semantic shift, blending and clipping". This statement directly dismissed the perception that Ouane and Glanz (2010) alluded to concerning the protracted nature of African language development.

Osborn and Osborn (2010), in support of Finlayson and Madiba's (2002) notion of language borrowing, also noted that the development of terminology in Indigenous African languages should not rely purely on borrowing terms from other languages, but that the language development process should also ensure the engagement and inclusion of African language experts in the language development process, and that it would be advantageous if these language experts were familiar with the specialist technical areas for which the terminology is required.

Within the South African context, terminology development has been beset by problems from a sociolinguistic, ideological, historical, and educational perspective (Alberts, 2000). In an attempt to address the issue of the lack of specialised subject terminologies in the various Indigenous African languages in a post-1994 South Africa, the National Language Services was formed in 1998 through the amalgamation of the South African National Terminology Services and the State Language Services. The National Language Services is housed within the Department of Sports, Arts and Culture (Alberts, 2000). Within the National Language Services, the Terminology Division has the responsibility to manage and develop terminology in all the South African languages, which would afford these languages the opportunity to be used in specialised subjects and fields (Alberts, 2000; Finlayson & Madiba, 2002). The core responsibility of the Terminology Division is to compile multilingual technical dictionaries in different languages. Figure 2.5 shows some of the dictionaries found on the official website of the Department of Sports, Arts and Culture as it pertains to terminologies developed by the Terminology Division. The series of dictionaries shown in Figure 2.5 include dictionaries of multilingual terminologies that can be used across 13 fields or subjects, including financial terminologies, school subject-specific terminologies, soccer terminologies, and terminologies relevant to elections.

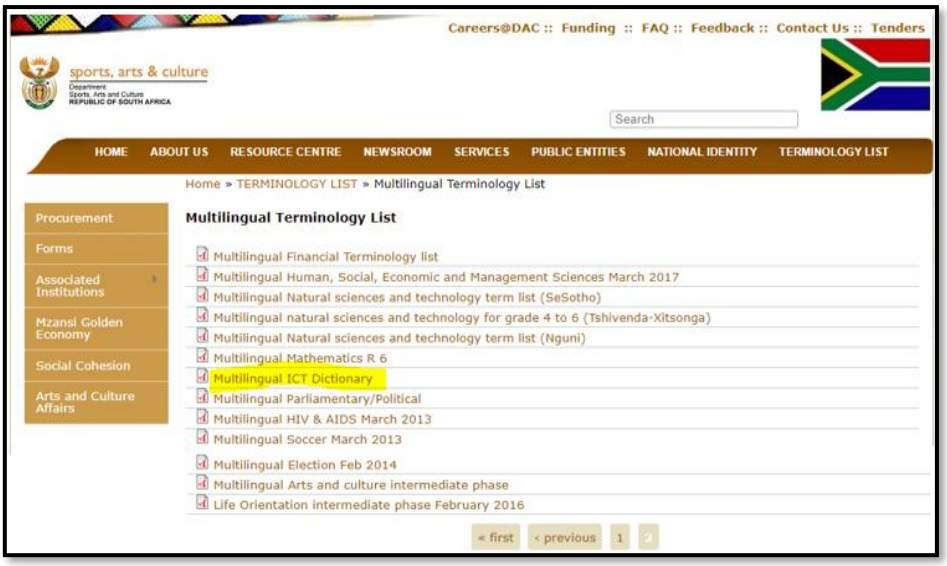

Figure 2.5: Department of Sports, Arts and Culture Terminology Development repository

A quick review of four of the field terminology dictionaries conducted on 18 May 2020 showed a concerning pattern, set out in Table 2.2.

Table 2.2: Terminology dictionaries

	Dictionary	No. of Pages	Approximate No. of Terms
1	Election Terminology Dictionary	170	± 420
2	Financial Terminology Dictionary	198	± 500
3	Soccer Terminology Dictionary	246	± 1 100
4	ICT Terminology Dictionary	51	± 180

Source: Adapted from Department of Sports, Arts, and Culture (2013)

The level of inequality in the multilingual terminologies across some of the fields is noticeable in this table. The area of concern is the dire lack of relevant Indigenous African languages terminologies in the field of ICT, which only has 51 pages of translated terms, compared to the 246 pages of translated terms for soccer and 170 pages of translated terms for elections. Further review of the *ICT Terminology Dictionary* revealed another area of concern, the lack of up-to-date and relevant terminology within the dictionary. The current list of terms is focused more on ICT logistics and administration and has terms like a postage stamp, postal code, postcard, website, antenna, money-order, philatelist, technology, software, server, online, network, digital, multimedia, channel, bandwidth cyber-crime, cellular operator, infrastructure, cyber law, etc. This raises the question of the appropriateness and

relevance of some of these terms to a person using everyday ICT applications, like the internet, MS Word, MS Excel, and email.

The dire lack of relevant end-user ICT terminologies in the various South African Indigenous African languages as evidenced from the National Language Services' ICT Terminology Dictionary brings back into focus the issue of terminology development, and more specifically, the approach of terminology development using "borrowing, derivation, compounding, and loan translation" as suggested by Finlayson and Madiba (2002, p. 53).

2.12.4 Localisation and translation

Contextualising or adjusting computer software to the needs of Indigenous speakers of African languages is not an easy process and, as was alluded to by Keniston (1999), localising software is a multi-dimensional operation. According to Mapi et al. (2008), this process consists of system modification and translation, two distinct and key aspects of software localisation. Modification relies on structural changes that are influenced by cultural factors such as colour, fonts, scroll styles, character types, and text boxes, which are more relevant to the user interface. Translation refers to the linguistic aspect of the localisation process and has the following five phases: (1) Translation into the target language, (2) back-translation into the original language, (3) comparison between the two versions, (4) adjustments to the version in the target language, and finally, (5) integration onto the localised interface. Keegan (2008) and Pym (2006) stressed that the localisation of software is not simply the verbatim translation of digital texts to the target language, but that the translated texts must be unambiguous, authentic as well as culturally and linguistically sensible and appropriate for use in the context of the software, as inaccurate translations will have an effect on user acceptance. This view is supported by Phaahla (2015, p. 185), who stated that the findings from the South African multilingual ATM interface initiative noted that when Indigenous African language speakers interacted with the ATM in an Indigenous language, at times the banking transaction "had to be aborted or interrupted" because the translated commands had not been translated accurately into the South African Indigenous language versions offered by the ATM interface.

This argument was furthered by Osborn and Osborn (2010), who acknowledged that software localisation encompasses more than a direct translation and that it includes

the translation and cultural adaptation of user interfaces, plugins, drop-down commands, and help files as well as the translation of the subject content. As noted, translation is central to the process of localisation, whether it be for the content of the software or interface adaptation. However, Keegan (2008) argued that translating every word into an Indigenous language may not be possible because of the lack of depth or modernity of certain Indigenous languages, and as such, certain terms or phrases may be left in the original language. Ouane and Glanz (2010) concurred with this view and cited the UNESCO Institute for Lifelong Learning policy brief, which referred to the universal principle pertaining to language development that concludes that a language develops and matures as it is used, which essentially means that certain terms may not have an immediately translated equivalent, however, with use and engagement these “untranslated” terms will eventually develop an equivalent in the respective Indigenous language, which would be accepted by the Indigenous population. Therefore, those terms Keegan (2008) referred to would develop over time with use.

2.12.5 Localisation and culture

With regards to software relevance, Etoundi et al. (2016) claimed that most ICT applications available are not appropriate for use on the African continent, as African language and culture were not considered during the phases of software conceptualisation, design and development. Earlier findings from Chen, Lin, and Lai (2010) and Venkatesh and Sykes (2013) also noted that within a developing country there will be a handful of Indigenous language speakers who may be comfortable using the dominant language of the software, however, most of the Indigenous population will be excluded from using the software and its benefits simply because the issues of language and culture were not suitably addressed.

The Declaration adopted at the *Global Forum of Indigenous Peoples and the Information Society* held in Geneva in 2003, succinctly stated that ICT should be used to support and encourage cultural diversity to preserve and promote Indigenous languages (Borrero, 2016). Ponelis (2015) and Thapa and Sæbø (2014) acknowledged the importance of this Declaration and emphasised that the success behind the use of any ICT application for development is greatly dependent on socio-economic, linguistic, and cultural factors. Lieberman (2003, p. 7) noted that the

introduction of localised software provided Indigenous language speaking individuals a “sense of belonging to their Indigenous group and a deeper commitment to their language and culture”. However, Borrero (2010), while applauding the localising process, cautioned against the total infiltration of localised ICT applications into the Indigenous population and cited that at the *Global Alliance for ICT and Development by the Indigenous Media Alliance* in 2006 it was emphasised that the introduction of localised ICT should not result in the erosion of Indigenous cultural heritage. Doherty (2016) also cautioned against cosmetic localised adaptations and insisted that localisation initiatives must be informed by contemporary issues.

To counter the cosmetic changes to software localisation, Adera et al. (2014) suggested that the process of localisation becomes even more impactful when the localisation includes not only the interface but also the content, giving the user a sense of pride and respect for their language and culture.

2.12.6 Localisation of software

It is widely acknowledged that never before has humanity been subjected to so much knowledge and information. People have access to a vast repository of digital information on almost any conceivable topic, which they can access at any time, from anywhere and using any device (Deb, 2014; Osborn & Osborn, 2010). However, the irony is that even with the enormous repository of information within the digital space, most of Africa’s populace cannot benefit from or access this infinite repository of information (Gillwald, 2017).

Information in the digital space has an unwritten *right of admission* clause attached to it that is regulated by language. Access and use of information in the digital space are dependent on the user’s fluency and adeptness in the English language as English remains the dominant and the default language of most ICT applications (Jonas & Rai, 2012). Given this situation, Lieberman (2003) noted that many speakers of African languages have adopted the perception that African languages are inferior and incapable of being used in specialised fields such as ICT, while ex-colonial languages, like English, are superior and more suited for use in ICT. However, Ponelis (2015) argued that any language, including Indigenous African languages, can be modified or modernised to be used in ICT, and as such, when ICT applications are adapted to

meet the linguistic needs of the African population, the Indigenous African language speakers will accept and use ICT.

Oppenneer (2009) stated that for any Indigenous population to accept and use localised ICT applications, the application must be culturally and linguistically consistent with their everyday use of the language. Oppenneer (2009) insisted that to achieve cultural and linguistic consistency, the software must be adapted to the user and the user should not be expected to adapt to the software. In order to achieve Oppenneer's (2009) state of cultural and linguistic consistency, Jonas and Rai (2012) suggested that Indigenous African language speakers must become central to the design and development of the localised software applications. Chukwuere (2017) also asserted that there must be a strong African presence not only in digital content creation, but also in the conceptualisation, design, and programming of the functionality of localised software, which will result in a truly African system developed by Africans for Africans. However, Ndebele (2014) argued that such a suggestion can be problematic because of the lack of technological expertise in Africa, which is mostly as a result of the exclusion of Africans from key ICT decision-making bodies like IETF and ICANN (Hill,2014; Mazango, 2014). However, Mapi et al. (2008) and Miti (2017) maintained that the localisation of ICT applications within the African context is vital for Africa and its people as it will ensure the exposure and intellectualisation of Indigenous African languages.

2.12.7 Localisation projects

With the vast array of affordances offered by ICT, various initiatives have been rolled out globally to ensure that every person has access to and can benefit from ICT, even those whose first or second language is not English (Osborn & Osborn, 2010). As a result, localisation projects have been initiated to support and promote the use of Indigenous languages in ICT applications (Jonas & Rai, 2012). The importance of the localisation of ICT applications in Africa cannot be underestimated. Osborn and Osborn (2010) identified the following key reasons why localisation is important within the African context:

- Ensuring access to the latest technological advancements for the populations of poorer African countries

- Increasing the relevance of ICT to the lives, needs, and aspirations of African people
- Bridging the digital divide in Africa

Table 2.3 presents a summary of various international and South African localisation projects.

Table 2.3: Global localisation projects

	Project	Country	Description	Language
1	Ara Iritija Project (2015)	Australia	Online preservation of aboriginal culture and language artefacts among the Yarnangu community (Van Der Meer et al., 2015)	Aboriginal language
2	The Māori Niupepa DL (2006)	New Zealand	The development of a digital library that made available large collections of legacy newspapers and access to the Niupepa documents primarily written in a Māori Indigenous language (Keegan, 2008)	te reo Māori and English
3	Carnegie Mellon University's Avenue Project	Chile	Developing machine translation software to permit automatic translation from Mapudungún to Spanish and vice versa (Lieberman, 2003).	Mapudungún
4	Somitek Hikaadiye	Somalia	Somali language word processor and spell checker (Osborn & Osborn, 2010).	Somali
5	Afri-Alpha	Benin	Software for the production of diverse West African languages (Osborn & Osborn, 2010).	French
6	Internet Living Swahili Dictionary	Africa	An online translation platform for Swahili (Osborn & Osborn, 2010).	Swahili
7	Kualono web page	Hawaii	Bilingual dictionary (Lieberman, 2009)	Hawaiian
8	IIT Madras	India	Development of a language font renderer for Windows 2000 (Sasikumar & Hegde, 2004)	Hindi
9	Google Yoruba	Africa	Google search engine to promote Indigenous African languages (Omojola, 2009)	Yoruba, Hausa, isiZulu & Swahili
10	The Four Directions Project: An Indigenous Model	USA	Serving Indigenous children in all parts of the USA by using ICTs to help develop a culturally responsive curriculum (UNESCO, 2011).	English
11	Honey Bee Network	India	Multilingual database of primary educational applications in native languages (UNESCO, 2011).	Hindi
12	Mozilla Firefox, Google & Webmail	South Africa	The localisation of these platforms conducted at Rhodes University (Ndebele, 2014).	Indigenous African languages

	Project	Country	Description	Language
13	Wikipedia 2007	South Africa	A series of articles translated into Indigenous African languages (Mapi et al., 2008).	Indigenous African languages
14	iLanga	South Africa	A web-based interface and a telephone-based audio interface (Mapi et al., 2008).	isiXhosa
15	ABSA Bank	South Africa	Localisation of the user interface of a commercial banks' ATMs	Six Indigenous African languages

The 15 projects listed in Table 2.3 reflect localisation initiatives that I identified during the broad review of the literature. The following interesting features were noted about the 15 projects during the evaluation of these localisation projects:

- Four projects were South African.
- None of the South African projects were in the area of formal education.
- Four projects were African (excluding the South African projects).
- Two projects focused on education (India 1 & USA 1).
- Two projects focused on cultural preservation (Australia 1 & New Zealand 1).
- Six projects focused on access to the internet (Africa 4, India 1 & Hawaii 1).
- One project focused on a commercial platform (South Africa 1).

The review of these localisation projects reinforces Osborn and Osborn's (2010) argument that very little work in the area of software localisation was being done within the African context. Omojola (2009) also stated that the limited number of localisation initiatives in Africa only focused on the few major African languages (isiXhosa, Yoruba, Hausa, isiZulu, and Swahili), while the minor African languages were once again sidelined. However, Ndebele (2014) argued that having digital content in an African language does not equate to localisation and that to attain true software localisation, the digital content must be contained or housed in a software application that uses Indigenous African languages for the GUI.

2.13 Graphical User Interface

Merriam-Webster defined a GUI as "a user interface that allows a computer user to interact easily with the computer typically by making choices from displayed menus or groups of icons", or in other words, the interface of a computer is the surface or 'face' with which the user interacts when using a software application or website. According

to Norman (2018), a single device cannot work for everyone, thus it is essential that the design of any device or interface must accommodate different contexts and different people. Keegan (2008) also emphasised that a software's GUI must be logical and consistent for a user to navigate using easy to read buttons and icons. The discipline of ensuring users find and experience ease of use when interacting with a GUI is termed human-computer interaction. The concept of human-computer interaction sees the merging of human use and experience to the design, evaluation, and implementation of interactive computer systems (Belmekki, 2013). According to Drucker (2011), the field of human-computer interaction informs and guides the effective design and display of virtual environments to accommodate and cater to the users' ease-of-use experience and efficiency of use. However, Theophilus and Bidwell (2017) argued that the field of human-computer interaction is deeply rooted and dominated by Western epistemology, which opens the argument whether the design and display of current GUI's accommodate users from a non-Western and Indigenous background. Thapa and Sæbø (2014, p. 1) also maintained that the design of a software's GUI must be cognisant and consistent with the "complex social, political, economic and cultural context" within which the technology may function, and more so if the technology is to be considered as a tool for social development. This point was also recognised by Norman (2013), who identified culture as a vital element in the field of GUI design. In his book *The Design of Everyday Things* Norman provided an example of how culture influenced the insertion of command buttons on an interface of a software program. Norman noticed that in some Australian Aboriginal societies, the users found using software command buttons more intuitive if the buttons were inserted from right to left, or what they perceived as east to west, because of the sacred movement of the sun. While societies that were technologically savvier preferred the commands buttons to be inserted from left to right. This example confirms various research findings (Belmekki, 2013; Drucker, 2011; Keegan, 2008) that emphasised the importance of culture in the design and display of a software's GUI. The findings presented by Norman (2013) further supported the work of Thapa and Hatakka (2017), who noticed that the same ICT application can be acceptable to some users but might be unacceptable to others, concluding that the design of GUI must accommodate differing cultural contexts in which the same ICT application may be used.

However, Keegan (2008) and Petrie et al. (2015), while acknowledging the importance of the influence of culture in the design and display of a software's GUI, also argued that the design of the GUI had to be consistent with the user's experience and social context. It thus becomes essential that the design of the GUI must accommodate the needs and abilities of the end user (Gaver, 1991). Hammond (2010) further stated that the design of the GUI must ensure the optimisation of the interaction between the user and environment, while Belmekki (2013) insisted that the GUI must allow for the intelligent interaction between user and environment. Drucker (2011) cited the world-renowned video game designer and ICT researcher Brenda Laurel who defined what a successful GUI interaction entailed and the role that the design and display of a user interface have in determining the success of a website or software, adding that the success of a website or software is measured by the regularity of interactions or *website hits*. The concept of website hits, according to Rosen and Purinton (2004), refers to the repeat visits or use of a particular website. They further noted that the number of hits and regularity of hits are influenced by factors such as quality of content, ease of use and the speed and frequency of updating content.

Hammond's (2010) explanation of the concept of website hits noted that repeated visits by a user can be greatly influenced by the software's presentation, which includes the aspect of culture and language, since language can serve as a barrier or restrictor of access, something Rosen and Purinton (2004) did not account for in their description. Conole and Dyke (2004) also indicated that the improved design of artefacts (software) would ensure that restrictions present would not restrict a user's accessibility. Hence, a computer application is only beneficial to the user if it is utilised by the user, otherwise, it simply becomes another ICT resource that lays unused. As Rogers (2004, p. 2) stated, the design of computer software must accommodate "all manner of people in all manner of settings doing all manner of things". Rincon (2013) further elaborated on this idea and challenged the importance of technology if the technology requires target users to surrender facets of their language and culture to access and use the technology. As such, Galla (2016) insisted that to ensure optimal user access to all computer applications, the traditional Western-dominated design and display features of all software must be reconsidered and consideration given to languages that have been historically sidelined, like Indigenous African languages.

According to Ndebele (2014), the availability of ICT applications in Indigenous African languages will create opportunities for the African continent, especially in the field of access to information. However, Sasikumar and Hegde (2004) acknowledged that having software applications in multiple languages is beneficial, but cautioned that accommodating different languages on software means not just presenting the content in the Indigenous language but ensuring that the menus, drop-down commands, pop-up messages, instructions, error messages, and software support are in the respective Indigenous language. Brooks, Donovan, and Rumble (2005) and Keegan (2008) agreed with this and stated that software in Indigenous languages will only be beneficial if the content and the interface were in an Indigenous language. As such, Keegan (2008) insisted that the localisation of a computer application should not be done simply because of political correctness but rather from a standpoint that is significant and logical within the context of the country and its people.

According to Hammond (2010), any software application has physical and symbolic aspects. The physical aspect relates to the size, subject composition, and structure of the application, while the symbolic aspect constitutes elements pertaining to the graphics, navigation buttons, and font styles of the GUI. However, Omojola (2009) maintained that for years the infrastructure of most ICT applications had been dominated by Western standards that defined the design and display principles, hence English dominates the symbolic aspect of most ICT applications. This has resulted in the undermining and devaluing of Indigenous African cultures and languages by software designers and developers. It is for this reason that addressing the inadequate use of African languages and culture in the field of ICT is so vital. However at the same time, token inclusion of African languages will in no way effectively address the issue of the unequal use of African languages in ICT or the digital divide in Africa. A much more concerted effort is needed that would see entire websites and software applications available in African languages to the wider African population. It is important to note, however, that the inclusion of African languages in ICT should not equate to the exclusion of English from these websites or software applications. Instead, the process of software localisation should allow for multilingual platforms, that provide the user with the power to choose the language of the platform, rather than imposing a language on them (Oard & Resnik, 1999).

2.14 Affordances of ICT

Gibson (1999, p. 1), the father of the concept of affordance, defined affordance as "what the environment offers the animal, what it provides or furnishes, either for good or ill". However, in the field of ICT, the term affordance has multitude meanings. Norman (2013) explained that in the context of ICT design, the concept of affordance becomes somewhat blurred, since while it is simpler to understand in a physical world, it becomes a bit more perplexing in the virtual digital world. In the virtual digital world, designers and developers have practical problems, and to address these problems, the design becomes the platform that allows the ICT application to become understandable to the user and the point of engagement between the user and the platform is the GUI. Norman (2013) summarised that the concept of affordance in the field of ICT is the interactions between people and the environment, which in the case of ICT, is the GUI.

Within the context of education, ICT has been perceived as the proverbial game-changer; however, the affordances experienced using ICT will not be the same in every context or for every person. The situational context and culture can influence the affordances of ICT applications experienced by the user. Anderson's (2004) and Day and Lloyd's (2007) descriptions of affordances focused more on the general attributes and functional benefits technology brings to teaching and learning. While Haines (2015, p. 166) offered what can be considered the most simple yet accurate description of ICT affordances by taking into cognisance the issue of teacher individuality and context by noting that "affordance is defined as the potential that teachers perceive in a particular technology tool that will support learning and teaching activities in their educational contexts". What can be discerned from Haines's (2015) description is that the affordance of ICT is not based on the functionality of the ICT application, but rather how the teacher perceives the functionality of the ICT application. This view is supported by Stendal, Thapa, and Lanamaki, (2016), who explained that the affordances of ICT can be understood from the perspective of a human and technology relationship and that the affordances of ICT depend on how the person engages and sees the ICT benefits of the ICT application, rather than waiting for the benefits.

In 2000, the United Nations published the MDGs, and its intent was to address a series of pertinent issues confronting the developing world (Mamba & Isabirye, 2015). It is a challenge to address and attain these goals in a developing country, and ICT was identified as a platform to fast track the realisation of these goals (Roman & Wertlen, 2008). As a result, many governments initiated social, economic, and educational intervention programmes to exploit the usefulness or the affordances of ICT in support of the MDGs (Mamba & Isabirye, 2015; Mutonyi & Norton, 2008).

Education, like all other areas of society, has seen an explosion of ICT with the availability of a variety of online digital tools, platforms, and electronic applications at the disposal of teachers and learners (Conole & Dyke, 2004; Webb, 2002). However, Conole and Dyke (2004) maintained that the increase in ICT access did not automatically inspire the acceptance and use of ICT by teachers. A plausible reason offered by Conole and Dyke (2004) and later by Mdlongwa (2012) for the slow uptake of ICT among teachers is the lack of understanding and appreciation on the part of the teacher of the affordances offered by ICT to support the instructional event. However, Deb (2014) offered an alternative reason for the slow rate of acceptance of ICT by teachers by attributing the reason to information overload, which is explained as a situation where teachers are confronted with an abundance of digital information that results in them struggling to identify, extract, analyse, synthesise and then effectively use the extracted digital information to enhance their lessons. This process of information extraction is made even more challenging when we consider that most digital information exists in English, a language most teachers globally are unfamiliar with.

Prah (2007) maintained that language is pivotal in the extraction, analysis, and synthesis of information and knowledge, and as a result, a teacher who is not proficient in the dominant language (English) of the digital world will not be able to transmit and interact with information and knowledge effectively. According to Salomon (1993, as cited in Conole & Dyke, 2004), the affordance of an object is determined by certain design and display features, which can also emerge as restrictions under certain conditions or to certain individuals. As such, Salomon insisted that these restrictions on the ICT application must be addressed through a process of redesign and modification. Based on the findings of Salomon, it can be deduced that within the South African educational context, almost all educational software exists in English,

and this becomes a restriction to most South Africa's teachers and students who speak an Indigenous African language or Afrikaans, and as such this situation requires the redesign and modification of educational ICT applications (Conole & Dyke, 2004). It is only when education software is localised to the different languages in South Africa, that we may find some teachers willing to accept and use the ICT applications to enhance their teaching practice.

2.15 Technology Acceptance

The introduction and use of ICT in the classroom are significant for affording teachers the opportunity to use ICT to enhance their teaching. As such, it is imperative that any restrictions that could hinder the introduction, acceptance, and use of ICT in education be identified early and that plans be put in place to address them (Conole & Dyke, 2004; Ghavifekr et al., 2016).

In an attempt to address issues that impede the use of ICT in teaching, various models of ICT integration in education have been presented. These models have looked at ICT integration from different vantage points, including access to resources, teacher professional development, ICT skills, social inequality, and school leadership (Bidarian, Bidarian, & Davoudi, 2011; Wang, 2008). However, the one area that is critical to the success of ICT integration in teaching is the acceptance of ICT by teachers. The technological advancements currently being made provide teachers with some of the most advanced computer systems, software applications, and online solutions, yet many teachers have not fully accepted these technologies. As such, Scherer et al. (2019) emphasised the importance of understanding the dynamics that influence a teachers' acceptance of technology so that ICT can be successfully integrated into teaching.

Taherdoost (2018) identified a series of technology adoption models that have emerged over the last two decades (Figure 2.6). These various models attempt to understand and explain how new and emerging factors affect the adoption of new technologies by end-users. Software designers and developers need to be cognisant of the issues that can influence end-users' decision to accept and use a software platform, and as such, these issues must be considered during the software's conceptualisation, design, and development phases. Basargekar and Singhavi (2017) noted that a user's acceptance of any software is dependent on their proficiency in

engaging with the software application, and thus, if there are any restrictions present, the possibility of acceptance and effective engagement is decreased.

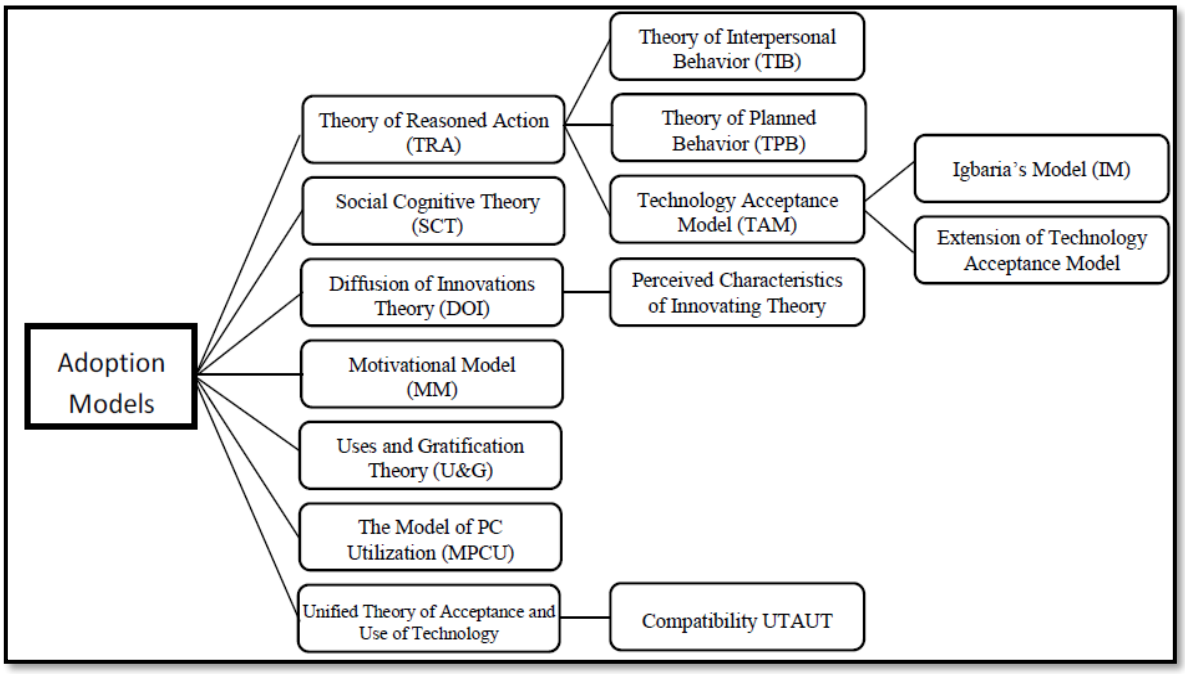

Figure 2.6: Technology adoption models

The various models have attempted to explain how different factors influence the user's acceptance of ICT. The lesser-known technology acceptance models like the theory of reasoned action focused on the aspect of human behaviour; the theory of interpersonal behaviour focused on social and emotional factors; the social cognitive theory focused primarily on human behaviour and performance; and Igbaria's model focused on intrinsic and extrinsic motivators that could influence computer usage and computer satisfaction. The two more widely used models are the TAM and the unified theory of acceptance and use of technology (UTAUT). These two models will be discussed in more detail in Chapter 3.

2.16 Summary

This chapter presented a review of literature about the historical as well as current narratives around certain key areas associated with the localisation of computer software from both an international and South African perspective. Because of the uniqueness of this topic, especially from within the South African education context, I had to review a greater number of literature sources from international perspectives, which included reviewing literature from the African continent. The issues raised in

this chapter foreshadow the discourse in the later chapters. This chapter also focused on colonisation and how it has influenced the perception of African languages. In this study, I view the influence of the colonial mindset, particularly in terms of the acceptance of ICT applications. Further detail on how the colonial mindset influences the acceptance of ICT applications is given in the next chapter, Chapter 3, where the TAM and the colonial mentality theory is detailed.

CHAPTER 3
THE CONCEPTUAL FRAMEWORK

**A people without the knowledge of their past history,
origin and culture is like a tree without roots.**

(Marcus Garvey, 1938)

Introduction

The concepts of a theoretical framework and conceptual framework are commonly used interchangeably in research; however, it is important to note that these terms are neither interchangeable nor synonymous (Grant & Osanloo, 2014). A theoretical framework is developed from an existing theory or theories that over time have been validated by researchers, while a conceptual framework is a "network of interlinked concepts that when brought together to offer a comprehensive understanding of a phenomenon or phenomena" (Tamene, 2016, p. 51). According to Rocco and Plakhotnik (2009), when researchers are confronted with a relatively new, under-researched phenomenon, it is usually advisable to adopt a qualitative research approach. Tamene (2016) supported this view, elaborating that using a conceptual framework in this context is best suited as it helps to develop an emergent theory. Grant and Osanloo (2014) and Imenda (2014) further supported the use of a conceptual framework by stating that it allows the researcher to plot and plan the direction of the research to respond to a new and unique research problem. The benefit of using a conceptual framework in qualitative research is that it accommodates the fusion of different concepts, various empirical research results, and relevant theories into a single framework (Rocco & Plakhotnik, 2009). Based on these arguments and suggestions as well as the context of this study, the most rational approach was to adopt the use of a conceptual framework to support and explain the data collected from the ILS intervention.

It became evident from the literature review at the start of this study that there is dire lack of empirical evidence from reliable research on the acceptance and use of Indigenous African languages in online educational software within the South African educational context. This study's findings will aim to fill this gap and initiate further discussion in this field. Because of the unique nature of this study, the collected data

will have to be analysed through a lens that “lays out the key factors, constructs, or variables, and presumes relationships among them” (Grant & Osanloo, 2014, p. 17).

The T-DL online software was distinct in that the software was created in *South Africa, by South Africans, for South Africans*. As a result, the data collected from the participants in this research was specific to these participants, since they were introduced to untested educational software and at the same time exposed to online educational software that uses an Indigenous African language (Setswana) as the default language of its GUI and subject content. The unique nature of this study made it essential that the data collected during the two data collection stages be analysed so that the multifaceted nature of the study and the data could be correctly interpreted. As such, the framework adopted for this study needed to be flexible yet expansive to explain the deep, rich data that was collected.

This research dealt predominately with two areas, (1) acceptance of technology and (2) the use of Indigenous African languages in ICT; and therefore, the conceptual framework adopted for this research had to accommodate both these key areas. The first part of this chapter will look at the different technology acceptance models, and the second part will look at the perceptions of and attitudes towards Indigenous African languages in the current world context, which will be supported by a theory that will explain how the mental remnants of colonialism still affect and influence Indigenous societies in the 21st century. The third part of this chapter will present the proposed conceptual framework adopted for this study and rationalise why this model is necessary for the field of ICT integration within a multilingual South African educational context.

3.1 Technology Adoption Models

According to Chuttur (2009) and Ma and Liu (2005), technology adoption models help to explain the adoption or acceptance of any technological innovation by a user. The most common models used to explain technology acceptance is Davis’s TAM, proposed in 1986; the UTAUT model developed by Venkatesh, Morris, Davis and Davis and proposed in 2003; and the UTAUT2 model proposed by Venkatesh, Thong, and Xu in 2012. However, the explosion of ICT and the increase in ICT access make the concept of technology acceptance even more pertinent, and more so when ICT was identified in the MDGs as a platform to fast-track development in developing

countries. For technology or ICT to be accepted in the developing world that predominately speaks languages other than English, language and culture become key aspects that must be considered in the acceptance of ICT.

3.1.1 Technology acceptance model

The TAM supports the notion that the perceived ease of use of the technology largely predicts the acceptance of the technology by a user. The TAM (Figure 3.1), proposed by Davis in 1986, attempts to explain the acceptance and behaviour of computer use by a potential user.

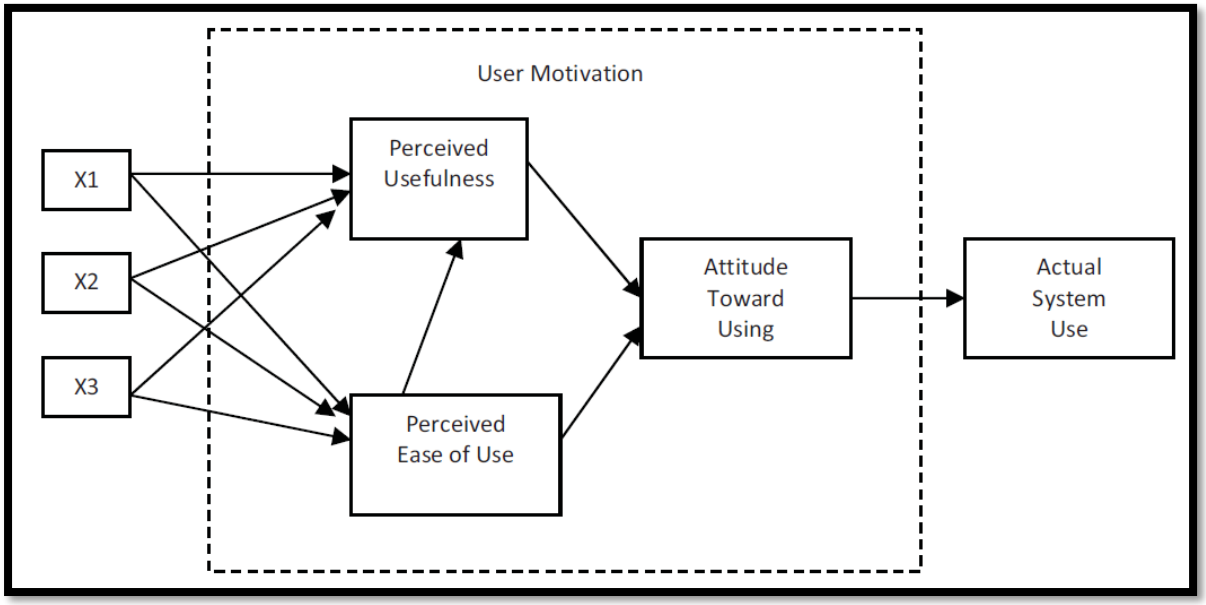

Figure 3.1: Technology acceptance model (TAM)

The TAM focuses primarily on the two aspects of *perceived usefulness* and *perceived ease of use*. Chuttur (2009) explained perceived usefulness as how the end user believes using a particular system or software would improve their performance and explained perceived ease of use as the degree to which the end user believes that using a particular system or software would be free of physical and mental effort. Both the perceived usefulness and the perceived ease of use are assumed to be directly influenced by the design features (X1, X2 and X3) of the system or software.

However, Ma and Liu (2005) conceded that reflections on the TAM show mixed and inconclusive results concerning its use to explain technology acceptance, especially since the factors of access and user context are not considered. Lai (2017) also critiqued the model, stating that due to the advancement and the dynamic nature of

ICT, the rate and extent of how users accept these technologies will depend greatly on factors such as availability of technology, convenience and the contextual needs of the user.

3.1.2 Unified theory of acceptance and use of technology

Venkatesh et al. in 2003 proposed the UTAUT model (Figure 3.2), which is based on previous technology acceptance models, in an attempt to address some of the deficiencies.

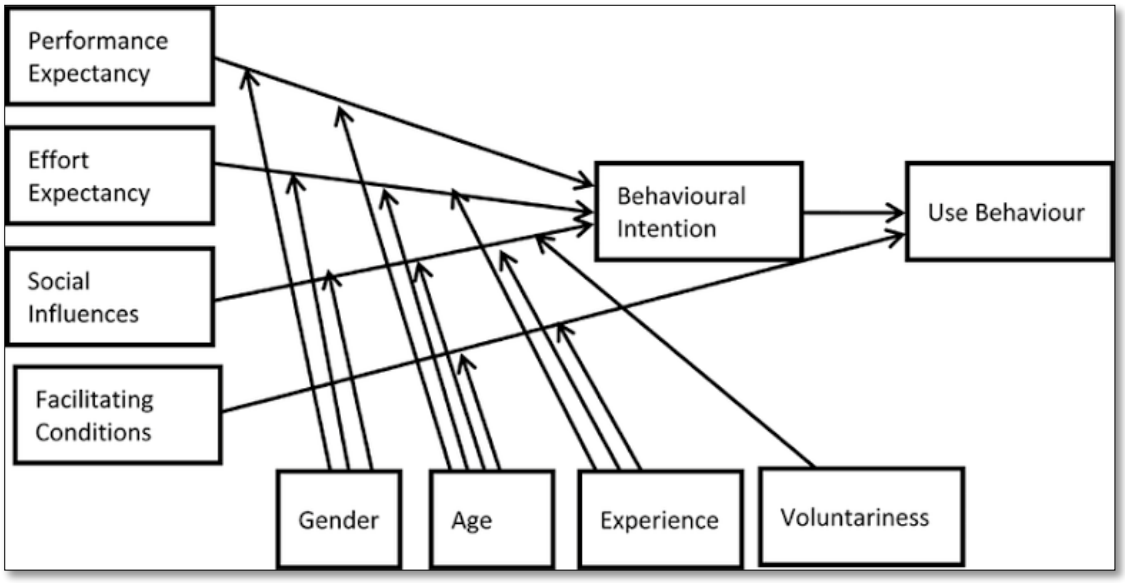

Figure 3.2: The UTAUT model

The UTAUT model identifies the following four constructs that could predict a users' behavioural intention: (1) Performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. Performance expectancy encapsulates perceived usefulness, extrinsic motivation, job-fit, relative advantage and outcome expectations, and effort expectancy captures the notions of perceived ease of use and complexity. Alraja (2016) described social influence as the degree to which family, friends, and peers influence how a user accepts a new technology and facilitating conditions as the situation where technology will be easily accepted if the user has access to the required resources, knowledge, and support to use the new technology.

3.1.3 Unified theory of acceptance and use of technology 2

The UTAUT2 is a modification of the UTAUT and includes the three additional constructs of hedonic motivation, price value, and habit (Figure 3.3). The hedonic motivation construct deals with the fun or pleasure that the user derives from using the technology; price value deals with the user's perceived benefits and the monetary cost of behaviour; and habit explains how the user performs when using the technology (Trojanowski & Kułak, 2017; Venkatesh et al., 2016).

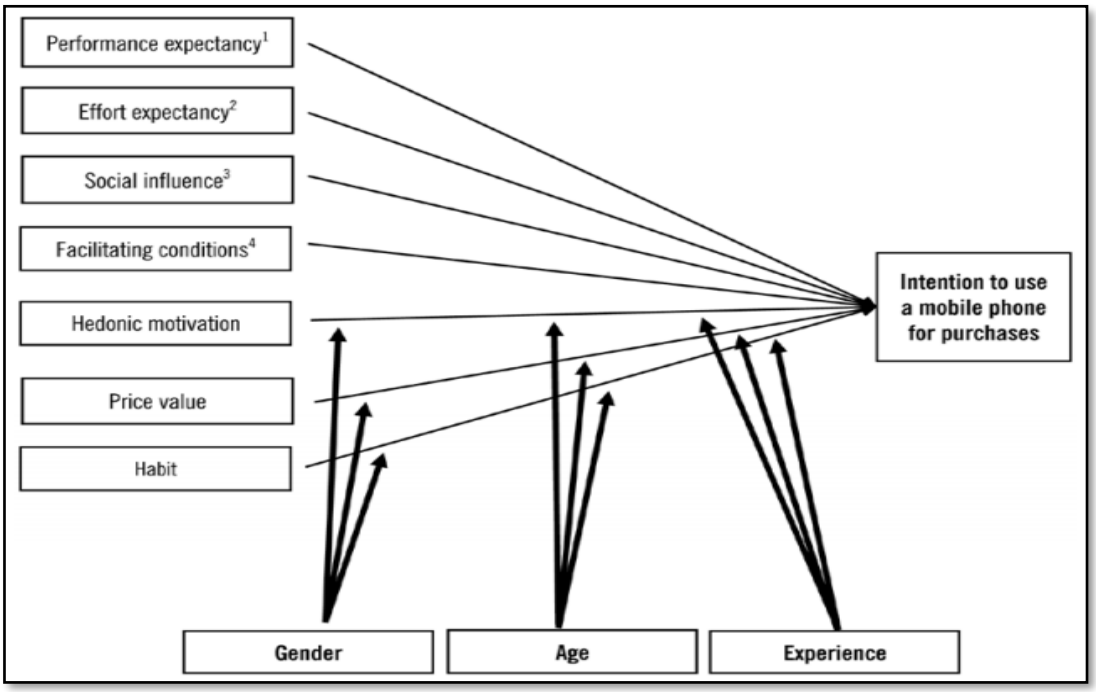

Figure 3.3: The UTAUT2 model

3.2 Review of the Models

The UTAUT and UTAUT2 have a common construct called social influence. It would be assumed that the aspects of culture and language would be aptly suited for the construct of social influences, however according to Alraja (2016, p. 20), the concept of social influence as used in UTAUT and UTAUT2 is defined as "the degree to which family, friends, peers, etc. have either positive or negative beliefs that will affect how and if someone will use the new system". There is no mention of culture or language in this description. Thomas, Singh and Gaffar (2013, p. 76) explained the concept of social influence within the UTAUT models as when "people who influence my behaviour think that I should use mobile technologies", and once again, there is no

mention of culture or language. However, in the recommendation for future research, Alraja (2016, p. 24) suggested that in order to “validate the results, the study model should look … other constructs like age, gender, culture”. Even though language is not mentioned explicitly, a construct like culture can and should not be seen as separate from language, for a true understanding of a language requires an understanding of the surrounding culture. This is aptly described by Ken Hale, a linguist from Massachusetts Institute of Technology, who stated that “when you lose a language, a large part of the culture goes, too, because much of that culture is encoded in the language” (BilingualKidspot, 2019).

The primary reason why I opted to use the TAM over the UTAUT models was that the issue of Indigenous African languages in ICT could not be sufficiently explained within the broad scope of the concept of social influence and needed to be explained within a more precise context of technology acceptance. Looking at the three main technology acceptance models (TAM, UTAUT and UTAUT2), it becomes evident that not one of the three models clearly or directly mention the role of language. Culture receives scant mention in the construct of price value discussed by Trojanowski and Kułak (2017).

In the context of the 21st century, the expansion of ICT to almost all corners of the globe has resulted in the need to understand the factors that influence the acceptance of technology by the different Indigenous communities of the world and not just by the rich, English speaking population. It is for this reason that a technology acceptance model is required that will explain the intricacies of how an Indigenous population that may have been colonised for centuries engages and accepts ICT. Issues of contextual relevance in ICT use have been highlighted in many pieces of literature (Chukwuere, 2017; Mapi et al., 2008; Osborn & Osborn, 2010), but very little has been written about the acceptance of ICT by Indigenous populations, and more specifically, how Indigenous languages influence the acceptance of ICT. The three main models explain the concept of technology acceptance by focusing on specific constructs; however, these models fail to recognise and accommodate for the construct of language, and more specifically, the melee between ex-colonial languages and Indigenous languages and its influence on ICT acceptance.

The three technology acceptance models (Figure 3.1, 3.2, and 3.3) largely accommodate the dynamic nature of technology and, to a limited degree, social

interaction with technology but do not address social aspects like culture and language. Taherdoost (2018) highlighted the deficiencies of these models and stated that while these models might focus on attitudes, values and intentions of the user, the constructs are not clearly defined and aligned to the user's context. Mugo, Njagi, Chemwei, and Motanya, (2017, p. 2) acknowledged the usefulness of these models to explain technology acceptance but suggested that the TAM model is better suited in an educational context because of its "strong theoretical basis" and the fact that it is "the most influential and widely adopted to predict the acceptance and use of various technologies". While these critics have identified some deficiencies in these models, they have failed to recognise other key constructs that are unique to the developing world, such as culture, language and the remnants of a colonial past. These constructs will undoubtedly have an influence on the user's perceived usefulness and perceived ease of use of any ICT resource as present in the TAM model (Figure 3.1). This view was supported by Chuttur (2009), who noted that while various empirical studies showed that TAM is a good model to forecast system usage behaviour and acceptance, the model failed to identify and explain the reasons behind the user's perceived ease of use or the perceived usefulness of the ICT resource. Two aspects central to the acceptance and use of the T-DL software by Indigenous African language speakers in a postcolonial and post-apartheid South Africa.

3.3 Theory of Colonial Mentality

Decena (2014, p. 2) defined colonial mentality as "the perception of ethnic and cultural inferiority and a form of internalised racial oppression" held by members of a society who were previously colonised. David and Okazaki (2006) stated that the state of colonial mentality essentially creates a situation where an individual or members of an ex-colonised society tend to value and hold in high esteem the attitudes, beliefs, language, culture and behaviours of the ex-colonial powers over their own. The existence of physical, emotional, psychological and mental traits within ex-colonised societies are stark reminders of the remnants and legacy of the period of colonisation. According to Osborn and Osborn (2010), a key colonial legacy that still haunts ex-colonial countries in the 21st century is language, especially the dominance of these languages. The dominance of the ex-colonial languages, especially English, has permeated almost all sectors of Indigenous society. The dominance of ex-colonial

languages continues from the early days of independence. The supremacy of English has continued into the digital age, where we find that almost all ICT resources and online platforms exist in English (W3Techs, 2020), as stated in Chapter 2 (Section 2.4).

3.4 Conceptual Framework

Due to the uniqueness and nature of the ILS intervention, a framework was required that would understand the data not just from the perspective of the teachers' perceived usefulness and perceived ease of use of the T-DL software, but from a perspective that would capture the connection of the perceived usefulness and perceived ease of use within the context of the remnants of the colonial past, language, and how the use of Setswana and English within the dual-language online software compared. Hence, the conceptual framework that was adopted merged the TAM with the theory of colonial mentality, as reflected in Figure 3.4.

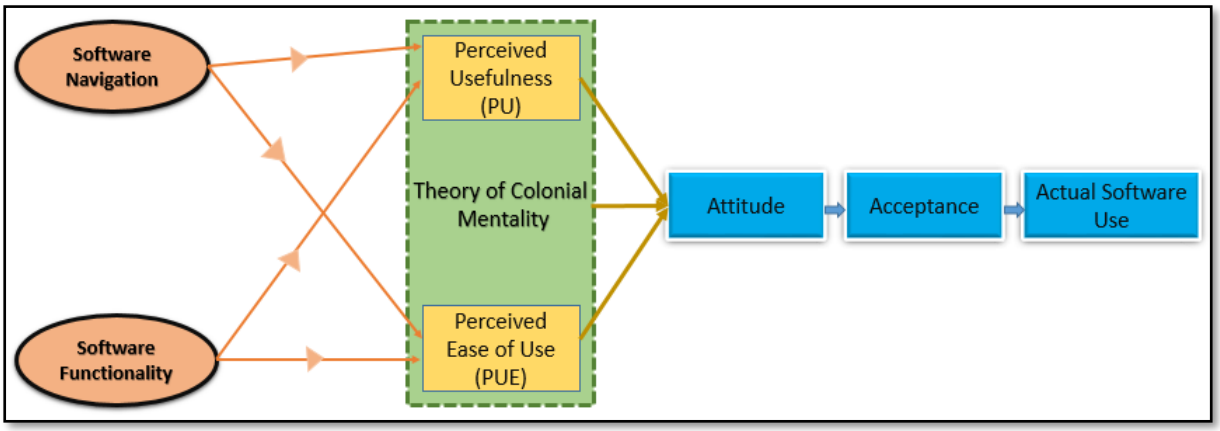

Figure 3.4: Revised TAM

Although TAM (1989) preceded the UTAUT (2003) and the UTAUT2 (2012) models, I opted to use the earlier TAM, supported by the writings of Chuttur (2009) and Mugo et al. (2017) who promoted the TAM because of its construct simplicity for use within the educational context.

In this revised model of technology acceptance, the participants were introduced to the T-DL software. The T-DL software has two key external variables, *software navigation* and *software functionality*. Within the traditional TAM, the two determinants are the perceived usefulness and the perceived ease of use of the external variables.

However, literature has shown that in the context of ICT use and adoption in a postcolonial society, the issue of Indigenous languages has been neglected. As a result, the perceived usefulness and perceived ease of use of the new software are greatly affected by the legacy of colonialism experienced by the potential user. The revised conceptual framework advocates that the perceived usefulness and perceived ease of use of the user must be viewed and explained within the context of the theory of colonial mentality. It is only in this context that a proper understanding of the attitude of the user towards the software, the acceptance of the software by the user, and eventually the actual use of the software by the user can be understood and related to the literature.

3.5 Summary

This chapter introduced the concept of technology acceptance and presented three well-known models that have been used to explain the acceptance and use of technology for the past three decades. However, this chapter also brought to the fore the shortcomings of these technology acceptance models. None of the three models presented and discussed take into consideration issues around culture and language. The revised TAM offers a framework to contextualise and understand how a user perceives the usefulness and ease of use of online software that has both an English and an Indigenous African language GUI.

CHAPTER 4
RESEARCH METHODOLOGY

Knowledge and understanding are life's faithful companions
For knowledge is your crown, and understanding your staff; and
when they are with you, you can possess no greater treasures.

(Khalil Gibran, 1929)

4.1 Introduction

Due to the novel nature of the ILS intervention, the in-depth and broad review of literature conducted in Chapter 2 led to the merging of two important models that would clearly explain the data collected in the study within the context of technology acceptance of Indigenous African language speaking teachers in postcolonial and post-apartheid South Africa. Chapter 3 focused on the conceptual framework that merged the TAM and the colonial mentality model. The blending of these two models led to the emergence of a framework to ground the analysis and discussion of the data collected in the ILS intervention. As such, the significance of this study should not be underestimated: The collected data is one of the few bodies of empirical evidence that looks at the use of an African language as the default language of the user interface of an online educational software within the South African educational context.

Chapter 4 will outline and defend the research design adopted for the ILS intervention. The fact that little or no empirical research has been conducted in the area of software localisation into an African language in South Africa reinforced the need to adopt a research design that would accommodate and effectively interpret the emotions, attitudes, actions and experiences of the teachers within a natural setting (Wa-Mbaleka, 2017). The rationale for using a small sample is supported by Kakulu (2014) who argued that an under-researched or new topical area must be studied with rigorous attention to detail and using a small number of teachers would allow for this focus on detail and subsequently the analysis of the rich collected data to identify structure and direction.

The ILS intervention adopted a qualitative research approach as it was imperative that the voice of the South African teacher be clearly heard as this study delved into the unchartered area of using an educational software localised to Setswana, a South African Indigenous African language. Due to the nature and context of the study, it

was important that the data be collected from the teachers in a setting that was both natural and familiar to them. The data collection process was conducted by two researchers, myself and a researcher from the HSRC. Going forward, the two researchers will be referred to in the third person and be called the data collection team. Creswell (2007) promoted the qualitative approach and noted that it permits the researcher to make more sense of the interaction between phenomena and the participant in the context of the world in which they find themselves. Figure 4.1 reflects Creswell's (2007) nine characteristics of qualitative research, which are essential in the context of this study.

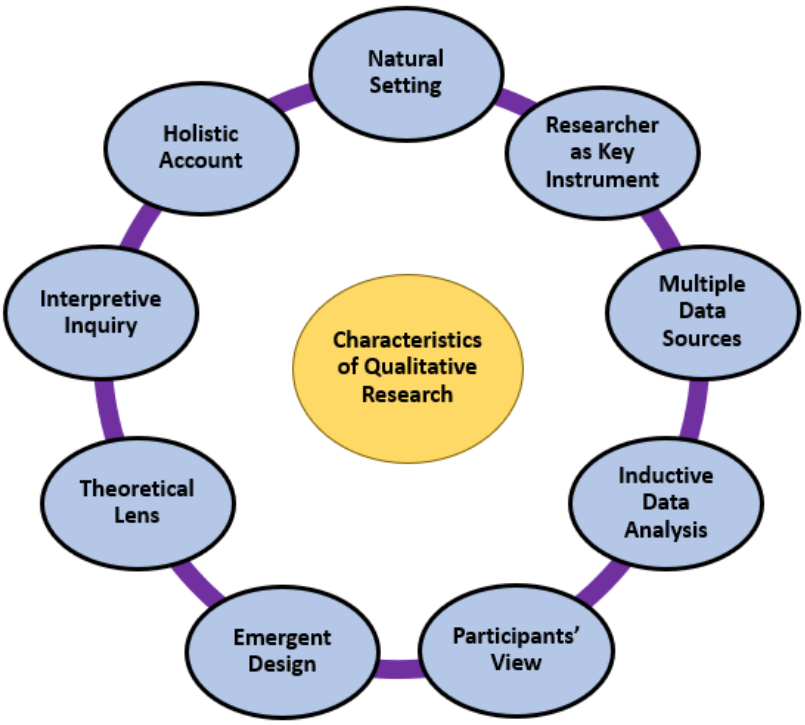

Figure 4.1: Creswell's characteristics of qualitative research

These nine characteristics have no specific order of importance and are:

- Natural Setting: Data collected by the researcher in a natural setting not in a lab. Data collected up-close through a process of talking and observing.
- Researcher as key instrument: Researcher collects data personally through observations, document analysis and interviews and include data collection instruments.
- Multiple data sources: Researcher gathers data using multiple sources such as interviews, observations and documents.

- Inductive data analysis: Qualitative researchers build themes using a bottom-up approach by arranging the data into abstract units of information and then moving these units into themes.
- Participants' view: The researcher constantly focuses on the participant's perspective about the problem and not their own.
- Emergent design: The researcher accepts that the research design will change as work in the field progresses.
- Theoretical lens: The researcher views the research at hand through a lens.
- Interpretive inquiry: The researcher interprets what has been observed and heard. Their interpretation cannot be separated from their own background and context.
- Holistic account: The researcher develops a complex picture of the problem being studied by looking at various perspectives, factors and situations.

Accessibility to the teachers was crucial in this research and its importance and the process of sampling is discussed in detail in Section 4.4.2. As this research was in a new area in the South African context, it was essential to conduct a pilot study to provide insight on how the proposed data collection instruments would function in the real research context. The pilot process is explained in Section 4.3. The findings of these instruments is discussed further in Section 4.3.5. Finally, the data analysis approach is discussed in Section 4.9, issues of trustworthiness in Section 4.11, and the summary of the chapter in Section 4.13.

4.2 The Research Design

The choice of a suitable research methodology is based on the nature of the research problem and the researcher's philosophical orientation and assumptions. The way a researcher thinks, including their world view and experience, can shape the choice of methodology adopted by the researcher (Kakulu, 2014). The research design section expresses the methods and procedures that helped inform and guide me in the collection and analysis of the data that ultimately will help answer the research questions (Sahay, 2016). The research onion model is used to represent the various methods and procedures adopted in the ILS intervention (see Section 4.4).

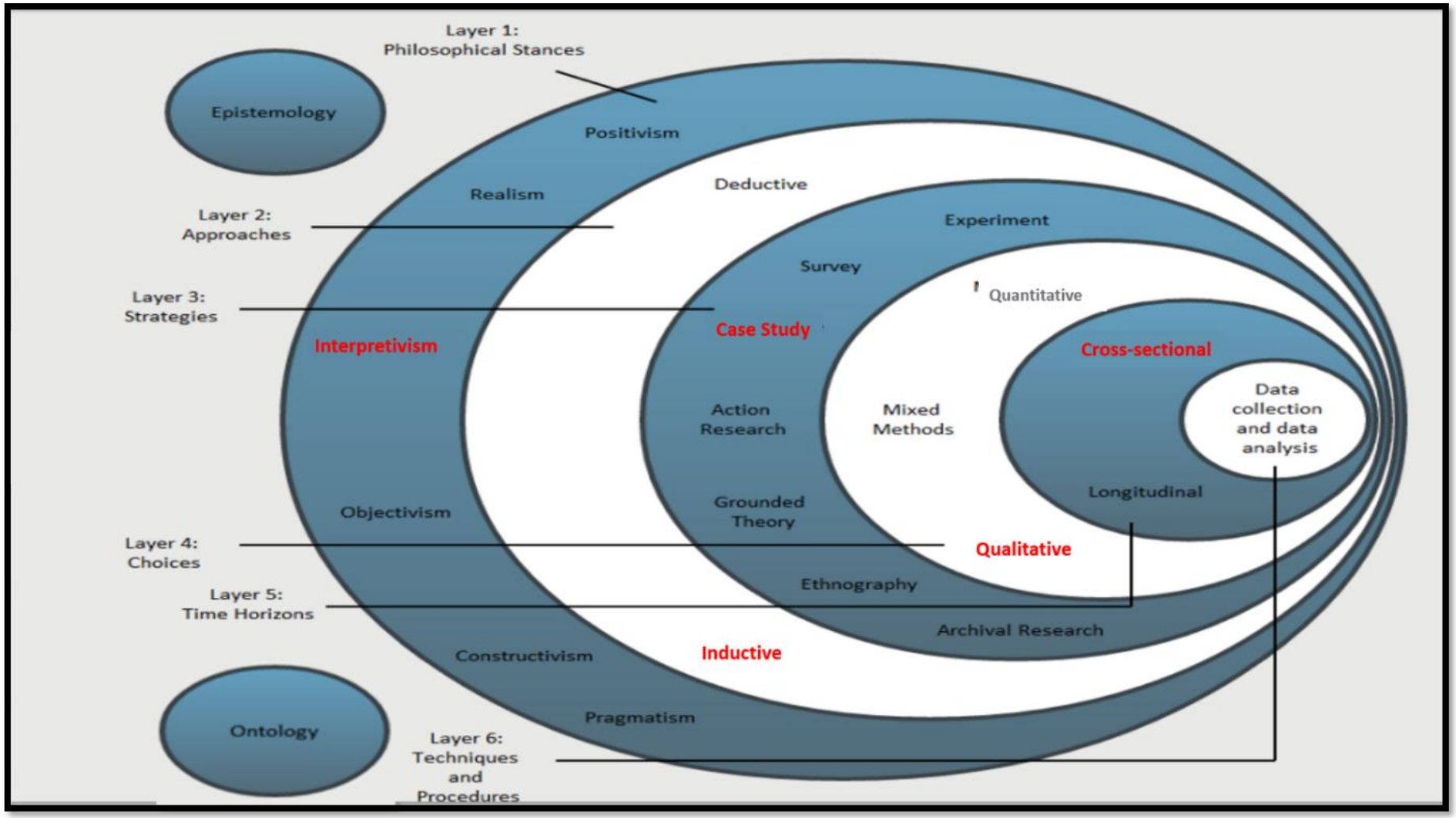

Figure 4.2: The research onion (Saunders et al., 2009)

4.2.1 The research onion

The model of the research onion was developed by Saunders, Lewis and Thornhill in 2009 to describe the stages that a researcher must consider when preparing to conduct research by focusing on the selection of techniques for data collection and data analysis. The ‘onion’ is divided into six layers, and each layer represents these main research components: (1) Research philosophy; (2) research approach; (3) research strategy; (4) research choices; (5) time horizons; and (6) techniques and procedures (Sahay, 2016). This chapter uses a revised version of the model of the research onion that was modified by the University of Derby Online and includes the elements of ontology and epistemology (Saunders et al., 2009). In a typical research process, the researcher will tackle the different layers of the research onion from the outside and peel each layer until the core is reached.

4.2.2 The research philosophy

The research philosophy adopted by a researcher is the vital assumptions about the way in which the researcher views the world. These assumptions underpin the research strategy and the research methods that a researcher chooses (Saunders et al., 2009). This study adopted the interpretivist position as it was primarily concerned with understanding the world from the subjective experiences of the teachers (Kothari, 2004). This position allowed me to provide for the many realities of the different teachers, which included the context of the phenomenon under investigation; the contextual understanding and interpretation of the collected data; and my level of involvement (Saunders et al., 2009). In this study, the interpretivist approach was best suited as it allowed me to focus on understanding what was emerging in the context of the teachers using the T-DL software rather than just measuring their use of the software. Interpretivism allowed for the deeper exploration of the teachers’ experiences with regards to the complexity of everyday activities, experiences, interactions and social structures as they interacted and used the T-DL software (Saunders et al., 2009). The accepted ontological and epistemological approach creates a holistic view of how knowledge is viewed and how the researcher sees themselves in relation to this knowledge. Being cognisant of the ontological and epistemological assumptions allows the researcher to determine the best research strategy and the research methods appropriate to that strategy to improve the quality

of research conducted (Patel, 2015; Saunders et al., 2009). The options are described in Table 4.1 in terms of the ontological and epistemological considerations. Paradigms influence the way the research question is viewed as well as the choice of data collection methods.

Table 4.1: Key research philosophies

	Positivism	**Realism**	**Interpretivism**	**Pragmatism**
Ontology: The researcher's view of the nature of reality or being	There is a single reality or truth.	Exists independently of human thoughts and beliefs or knowledge	There is no single reality or truth. Reality is created by the individual. Multiple realities can exist	Reality is renegotiated, debated and interpreted in light of its usefulness in new situations
Epistemology: The researcher's view of what constitutes acceptable knowledge	Reality can be measured, thus the focus is on reliable and valid tools	Observable phenomena indicate facts	Reality must be interpreted and used to discover the underlying meaning of events and activities	Either or both observable phenomena and subjective meanings can provide acceptable knowledge
Data collection: techniques most often used	Highly structured; large samples; measurement; quantitative but can use qualitative	Methods chosen must fit the subject matter; quantitative or qualitative	Small samples; in-depth investigations; qualitative	Mixed or multiple methods designs, quantitative and qualitative
Method: What techniques can be used to find out?	Uses sampling, measurement and scaling. Statistical analysis	Uses open-ended interviews, open-ended questionnaires, ideological reviews etc.	Usually qualitative. Uses observations, case study, life history, narrative etc.	Uses a combination of approaches, including data mining, reviews, and usability testing

Adapted from Patel (2015) and Saunders et al. (2009)

Ontology is based on the nature of reality, and as such, concerns itself with the key question of whether the social phenomena under investigation should be seen objectively or subjectively (Creswell, 2007; O'Gorman & Macintosh, 2015; Saunders et al., 2009). Objectivism assumes the position that social phenomena and their meanings have a reality that is autonomous or independent of social actors. Subjectivism, on the other hand, recognises that social phenomena is created from the perceptions and resulting actions of the concerned social actors interacting with

the social phenomena (O'Gorman & Macintosh, 2015). The ILS intervention embraced the ontological stance subjectivism, which were constructed around the associations derived from the interactions of the teachers with the assessment software within a particular cultural, linguistic and historical context and subjected to variable behaviours, attitudes, experiences, and interpretations (Ahmed, Mouratidis, & Preston, 2008). Subjective ontology approached the reality in this study in the sense that each teacher experiences their place and time in the world in a different way, and as such, the ILS intervention used research methods and techniques of the interpretive design, including IDIs and POs.

Epistemology is a branch of philosophy that studies the nature of knowledge and the acceptable knowledge in a field of study. Essentialism, historical perspective, perennialism, progressivism, empiricism, idealism, rationalism, constructivism are some epistemological positions that help define what constitutes acceptable knowledge (O'Gorman & Macintosh, 2015).

Layer one of the research onion (Figure 4.2) shows six commonly used epistemological positions. This research adopted the interpretivist position as it was primarily concerned with understanding the world from the subjective experiences of the teachers (Kothari, 2004). This position allowed me to provide for the many realities of the different teachers, which included the context of the phenomenon under investigation; the contextual understanding and interpretation of the collected data; and my level of involvement (Saunders et al., 2009). In this study, the interpretivist approach was best suited as it allowed me to focus on understanding what was emerging in the context of the teachers using the T-DL software rather than just measuring their use of the software. Interpretivism allowed for the deeper exploration of the teachers' experiences with regards to the complexity of everyday activities, experiences, interactions and social structures as they interacted and used the T-DL software (Saunders et al., 2009).

4.2.3 The research approach

The ILS intervention adopted an inductive approach. In the context of this study, inductive logic was used to review relevant bodies of literature and to describe the experiences of the teachers as they interacted with the T-DL assessment software, recording their experiences while using both versions of the T-DL software.

In an inductive approach, the researcher uses the specific or concrete as the starting point, and the end result is general or more abstract. Inductive reasoning can be seen as a form of theory building and moves from facts to establishing a pattern and a tentative hypothesis, resulting in the creation of a general theory, which allows predicting future knowledge (Creswell, 2007; Kakula, 2014). According to Saunders et al. (2009), research adopting an inductive approach must be mindful of the context in which the research is being conducted as this approach allows for the use of holistic and comprehensive explanations that could lead to the generation of new knowledge and generalisation from the details (Thomas, 2006). Figure 4.3 provides a summarised description of these considerations.

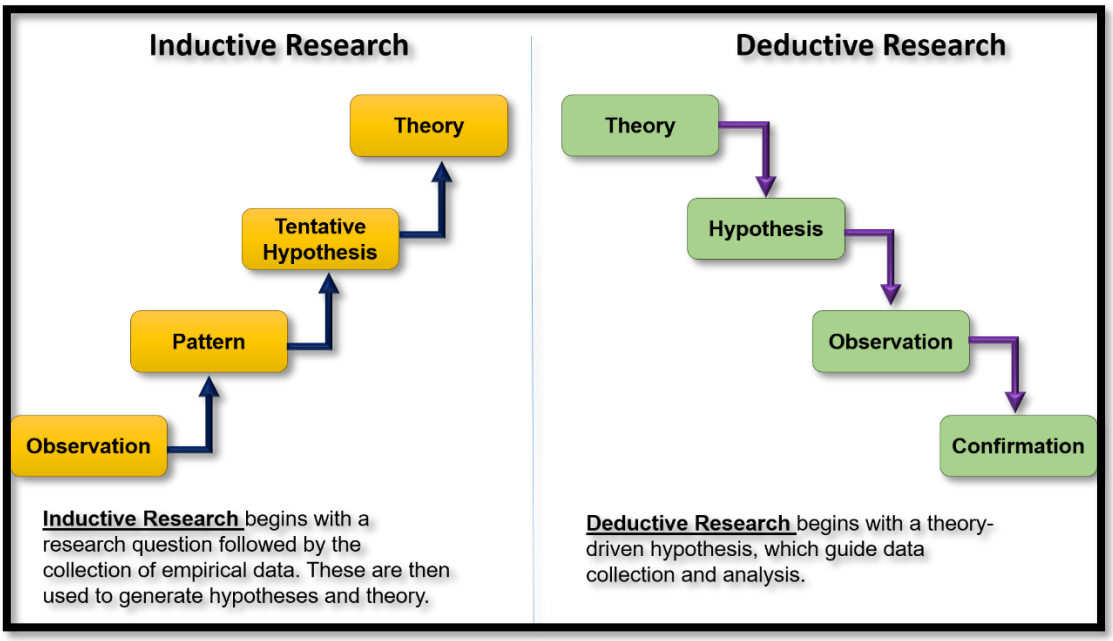

Figure 4.3: Deductive research and inductive research

4.2.4 The research strategies

Layer three of the research onion refers to the choice that a researcher must make about the research strategy be best suited to the proposed study. According to Pavelek (2013), the research strategy provides a systematic plan of action that gives direction to the researcher's thoughts and efforts, thus enabling the study to systematically proceed with actions to ultimately ensure that the research question is answered with quality results followed by a detailed report. In the context of the ILS intervention the research strategy adopted was a product of key decisions made to determine the best approach to answer the research question (Bhattacherjee; 2012 &

Kakula; 2014). As a qualitative study, it was important that the voice of the participants come through. According to Tracy (2013), research strategies for qualitative studies help the researcher derive and interpret a *thick description* of how people make sense of their lives and their perceptions and experiences within a particular event. The concept of a *thick description* was an essential part in the ILS intervention, which saw the researcher immersed with the participants in the context and culture present within the research milieu if the schools in the North West province. In this context rich data was collected through participant observation, systematic self-observation, and interviews.



Figure 4.4: Qualitative research strategies (Adapted from Bhatterchjee, 2012)

Figure 4.4 represents six of the most common qualitative research strategies. These are experiments, survey, grounded theory, ethnography, action research, and case study (Kakula, 2012). The next subsections give a brief description of these qualitative research strategies and a more detailed explanation of the case study, which was used in this research.

4.2.4.1 Experiment

Researchers working within this methodology create an environment in which they can observe and interpret results. This strategy is an empirical approach to collect data. An experiment would typically involve the selection of samples of individuals from known populations and the allocation of the selected samples to different experimental conditions. There is normally a control and experimental group (McGowan, 2011).

4.2.4.2 Survey

Surveys are one of the most commonly used types of quantitative social science research. This strategy is particularly helpful for non-experimental descriptive models that attempt to portray reality and is often used to gather data on attitudes and behaviour (Mathers, Fox, & Hunn, 2013). In survey research, the researcher selects a sample of respondents from a population and administers a standardised questionnaire to them.

4.2.4.3 Grounded theory

Grounded theory is meant to build theory rather than test theory (Patton & Cochran, 2002). It strives to provide researchers with the analytical instruments to interpret and handle large volumes of raw data. It emphasises a simultaneous systematic and creative approach. Grounded theory is a general method suitable for any data set or combination of data. Collection and analysis of data is a simultaneous process.

4.2.4.4 Ethnography

Ethnography is firmly rooted in the inductive approach, which emanated from the field of anthropology. The emphasis of this approach is on exploring the nature of a particular social phenomenon instead of testing hypotheses about it (Reeves, Kuper, & Hodges, 2008). This time-consuming research strategy takes place over an extended period and calls for processes that are flexible and responsive to the researcher‘s needs. According to Hallet and Barber (2014, p. 307), an ethnographer must study the participants in their natural setting where the everyday workings take place to “understand the fissures between practices and discourses”.

4.2.4.5 Action research

Action research is a form of applied research with the aim to develop a solution for a practical problem. In developing solutions for practical problems, it has value for the community participating in the research while simultaneously developing theoretical knowledge that is of value to the research community. When teachers are encouraged to define and collect information on difficult situations in their everyday practice, they join the field of action research (Rossouw, 2009).

4.2.4.6 Case study

A case study approach was used in this study given its open-ended nature. It enabled the researcher to link the use and adoption of the dual language assessment software to the attitudes and perceptions that emerged in the ILS intervention. Almost three decades since the introduction of ICT in education, the lack of adoption, acceptance and use of ICT in South Africa's education system still is largely blamed on issues of access, connectivity and skills (Yin, 2011). However, in the context of the ILS intervention, the issue around ICT adoption, acceptance and use was approached from a somewhat novel and under-researched perspective: The lack of use of Indigenous African languages as the default languages of educational software applications. Because of the uniqueness of the ILS intervention, the case study strategy was deemed the most appropriate due to its flexibility and ability to "understand complex social phenomena" (Yin, 2011, p. 5). The elements that constitute a case study (Table 4.2) reinforce the strength of using a case study.

Table 4.2: Elements of a case study

Element	Description
Purpose	To portray, analyse and interpret the uniqueness of real individuals and the situations
Focus	• Individual and local situations • Unique instances • Group
Key Terms	• Individual uniqueness • In-depth analysis • Subjective • Descriptive

Element	Description
	• Sincerity • Complexity
Characteristics	• In-depth, detailed data from wide data sources • Participant and non-participant observation • Non-interventionist • Holistic treatment of phenomenon • What can be learned from a particular case?

Source: Adapted from Bhattacherjee (2012) and Kakula (2014)

Kothari (2004) and Starman (2013) emphasised that using a case study ensures that the investigation and exploration of an event is both thorough and expansive. Kakula (2014) further argued that a case study allows for complex issues to be studied in minute detail over a period of time through observation and by understanding the lived experiences of the participants in a real-life context, while being guided by the use of research questions rather than a hypothesis. Data is collected from the participants using different data collection protocols or instruments. Kothari (2004) and Rodriguez and Ryave (2002) supported the use of multiple data collection instruments as it allows for the collection of rich data. The greatest advantage of using a case study approach is its suitability for studying a phenomenon that might be new and unique over a period of time within its natural setting (Bhattacherjee, 2012; Starman, 2013). Using a case study can help the researcher to derive rich and contextualised data, while at the same time, provide a more authentic interpretation of the phenomenon under investigation than most other research methods because of its ability to capture a rich array of contextual data (Kothari, 2004). The case study approach allows the phenomena under investigation to be studied from multiple perspectives using multiple methods, as shown in Table 4.3 (Bhattacherjee, 2012).

Table 4.3: Types of case study methods

Type	Description
Interviews	Adequate term for the range of ways people can supply you with information
Observation	Watching people or groups in a specific real-life context performing tasks
Journal Entry	An approach to allow the participants to reflect on their feeling about and experiences of the event under study

Source: Adapted from Baxter and Jack (2008)

4.2.4.7 Strengths and weaknesses of the case study

Case study approach was used in this study given it's open-ended nature. It enabled the researcher to link the use of the dual language software and the reactions, emotions and reflection of the participants in the context of this study. The most important strength of a case study is its open-ended nature, which enables the researcher to explore the links between events and the reactions, decisions, emotions, reflections and behaviours of participants as they interact in real-life situations (Bhattacherjee, 2012; Starman, 2013). Thus, using a case study approach was helpful when working with the ILS teachers who came from different schools with different views and experiences of using ICT for teaching and assessment. Furthermore, using the case study allowed me to detect the teachers' existing views and perceptions around the use of Setswana in educational software. Starman (2013, p. 38) summed this up well by stating that the strength of using a case study is that it allows for the "connectedness to everyday life and is important for developing different views of reality, including the awareness that human behaviour cannot be understood merely as an act that is driven by a rule or a theory".

A key weakness of the case study approach is that the findings derived in the study cannot be generalised to the larger population since data was collected from a select sample of teachers. However, in the context of this study, Kakula's (2014) argument that a case study is the most appropriate to study complex issues in minute detail over a period of time through observing the lived experiences of the participant in a real-life context supported the use of this approach for the ILS.

4.3 Pilot Study

The uniqueness and complexity of the ILS intervention and the fact that the data collection instruments were going to be used in a dynamic study context necessitated the piloting of the instruments and certain key aspects of the ILS intervention. The pilot study was conducted over eight days in August 2018. The data collection instruments for the pilot study were (1) an observation instrument, (2) an interview schedule, and (3) a journal entry book. The pilot study helped to establish the parameters and operational standards that guided and informed the main research (Bhattacherjee, 2012; Gardner, Gardner, MacLellan, & Osborne, 2003).

4.3.1 Location and teachers

The pilot study was conducted at a single primary school in the North West province with a small groups of teachers who were not part of the selected schools and teachers for the final ILS intervention. The selection of teachers for the pilot study was guided by the same selection criteria that was used for the main study. The criteria used for the selection of the teachers were (a) their basic ICT skills; (b) their access to online computers at school: (c) their use of Setswana as the language of learning and teaching; and (d) that they had to be actively teaching Grade 3 in the year of the study (2018). A total of four Grade 3 teachers were selected as per the criteria to participate in the pilot study. The pilot study was conducted over a period of eight school days.

4.3.2 Objectives of the pilot study

The objectives of the pilot study were:

1. To assess the steps and rollout of the TARMII software training programme.
2. Test the appropriateness of all the data collection instruments including interview schedule, PO instrument and Journal entry book.
3. Assess the practicality of the steps that will be followed in the main research.
4. Test the appropriateness of all information and consent documents.

4.3.3 Pilot of software training programme report

The software training programme for the pilot study provided useful insights in relation to the T-DL software training programme. The training programme used in the pilot study was guided by a Training Manual and Training Guide (Appendix P). At the start of the training program, each teacher was given a journal entry book and the expectations for the journal entry book were explained. During the training programme stage, the four teachers were trained on eight T-DL software functions for a total of 24 hours over six consecutive days (Figure 4.5).

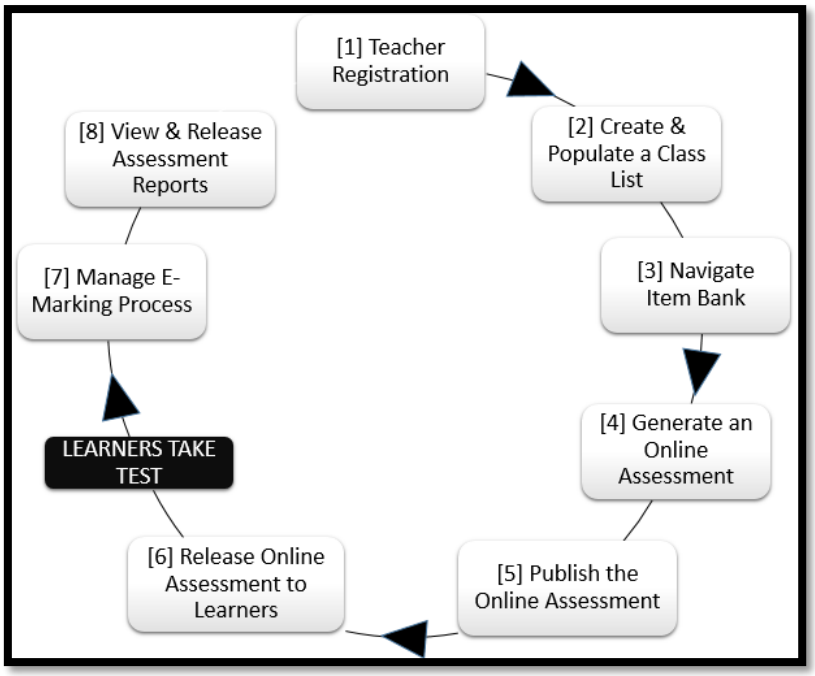

Figure 4.5: Software training cycle

The six days of training saw the teachers being trained in the English version of T-DL software on the first two days and in the Setswana version on the third and fourth day, and on the fifth and sixth days, they were expected to complete a series of recap activities using both versions of the T-DL software. On the seventh day, the teachers were provided with a practical software activity sheet that required them to complete a series of activities using the software while I recorded observations on the observation instrument. On the eighth and final day, the teachers were interviewed individually using the interview instrument.

The software training programme was pivotal for the success of the ILS intervention. Bassi (2010) and Usun (2007) emphasised the importance of preparing and conducting an intensive training programme for teachers, especially when they are introduced to any new ICT resource; hence, the success of the training programme informed the teachers' level of confidence to use the software.

4.3.4 Piloting data collection instruments

Three data collection instruments were identified to support the collection of data for this study, and all three the instruments were tried and tested during the pilot study.

4.3.4.1 Observation instrument

The observation instrument comprised four sections in which I expected to record observations of software use. The observations would focus on how the participants engaged with the five functions of the T-DL software. These five functions were (a) navigating the interface; (b) accessing, navigating and building the assessment task; (c) allocating an assessment task to a class; (d) downloading the assessment task; and (e) viewing the assessment reports. The instrument comprised these two parts:

1. Practical activities that the teachers had to complete while being observed. I rated the participants' ease-of-use experience using a five-level Likert scale to define the level of difficulty.
2. I recorded an overall comment on what I observed as the teachers completed the series of activities.

4.3.4.2 Interview schedule

The interview schedule was divided into three sections: a) Participants' biographical information; b) participants' use of the T-DL software; and c) participants' view on Indigenous African languages in ICT. The interview instrument was structured to interview the participants at the same time for their use of both versions of the T-DL software. I expected to audio record each interview and to take notes.

4.3.4.3 Journal entry book

Reflective journals are used extensively in qualitative research to collect data pertaining to a participant's feelings and activities (Cohen, Manion, & Morrison, 2007). The participant journal entry book comprised of 32 activity tables. Each table consisted of multiple fields that the participants had to complete each time they used the T-DL software, including a field to keep a journal of their training experience. The fields were (a) date, (b) time, (c) activity, (d) purpose, (e) experience, (f) reflection, and (g) general comments. The data derived from the journal entries could be valuable and rich and provide a deep, holistic insight into teachers' feelings and experiences as they used the T-DL software. Teachers were not expected to fill in their names, which hopefully motivated them to give their honest opinions.

4.3.5 Pilot study findings and implemented changes

The findings from a pilot study serve as guides for the eventual main study and plays a vital role in addressing possible flaws and short comings that could impede a successful main study (Bhattacherjee, 2012).

The findings from the pilot study were:

1. The training programme was too long. The eight days had to be shortened.
2. The teachers were trained on separate days for each of the language versions and this created some confusion, especially during the second version training as the teachers tended not to follow the training sequence and jumped to activities on their own as they knew what was expected.
3. There were too many practical activities that the teachers were expected to complete. This was not possible in the time allocated for the training.
4. The teachers spent at least 20 minutes on the item bank activity, which is a system administrator function rather than a teacher's function, meaning they did not understand the value of the function.
5. The teachers noted that completing the journal entry book was time consuming, and only one teacher attempted to use the journal by recording just two entries.
6. During the observation stage, I realised that I was making the observations from my viewpoint; hence, the question of researcher bias came into play.

4.3.6 Changes informed by the pilot study

Based on the findings of the pilot study, the following changes were made to the ILS intervention:

1. The training days were decreased from eight days to three days.
2. The training of the English and Setswana versions of the software would take place simultaneously over two days, rather than in separate sessions. On the third day, the teachers would be expected to complete a series of practical activities.
3. The practical activities were decreased from 31 to 27 activities. The four activities that were removed were part of Function 3 (Navigating the item bank).
4. The item bank activity was removed from the training program.

5. The journal entry book was removed entirely as a data collection strategy because of its lack of use.
6. The observation instrument was divided into two instruments. The first was the SSO instrument, as suggested by Kawulich (2005), and the second was the PO instrument.

The pilot study was done not only to ensure that the study's instruments would yield the needed information, but also as an additional way of increasing the quality of the data for this study. Cohen et al. (2007) emphasised that reliability and validity are the main criteria that determine data quality.

4.4 The ILS Intervention Research

According to Kothari (2004, p. 8), research methodology is "a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically". The concept of *way* really refers to the layers of the research onion (Figure 4.2), namely the research philosophy, research approach, methodological choice, and research strategies (Al Zefeiti & Mohamad, 2015).

4.4.1 The time period

Kothari (2004) and Saunders et al. (2009), explain that the time-period of a research can be either longitudinal or cross-sectional. A longitudinal study involves the collection of data over a period of time, whereas a cross-sectional study includes data collected at a single point in time (Bhattacherjee, 2012; Kothari, 2004; Saunders et al., 2009). The ILS intervention adopted a longitudinal study approach as the study spanned a period of two months and data was collected at two points in time using the same variables.

Traditionally, a longitudinal study collects data over a period of time with the aim of measuring change (Kothari, 2004). However, in the context of the ILS intervention, the collection of data took place at two points over a two month period, and the data collection was not to measure or determine change but to record and analyse the differences in the attitude and perceptions of the teachers as they engaged and used the two different language versions of the same online software application.

During this time period, all participating teachers attended a compulsory training session in which they were trained on the key functions of the English and Setswana versions of the online software. After the training, the teachers were allowed a one week familiarisation period in which they used the software to acquaint themselves with the functionality of the T-DL software. The data collection process happened in two stages. During Stage 1 of the data collection process all the teachers were given access to the online English version of the T-DL software. The teachers were allowed to use the English version of the software for a period of three weeks. At the end of the three weeks, data was collected from the participating teachers using the data collection instruments. On completion of Stage 1 of the data collection, Stage 2 commenced. During Stage 2, teachers were given access to the Setswana version of the software and were then given three weeks to engage with and use the software. At the end of the three weeks, the data collection process started. This process was the same as in Stage 1, and the same data collection instruments and procedures were used.

4.4.2 The teacher participant selection criteria

According to Etikan, Abubakar Musa, and Alkassim (2016), data gathering is central and crucial to any research, and thus the quality of the data collected will ultimately add value to the research. The quality, richness and depth of the collected data are highly dependent on the participants from whom the data is collected. The uniqueness of the ILS intervention made it imperative that the sample of teachers had to provide the appropriate data, which could then be analysed to answer the main research question and the four supporting investigative questions. The participants had to meet certain criteria. Hence, this study had to adopt a purposive sampling approach to ensure that the collected data is both information rich and relevant so as to support the research focus (Kothari, 2004).

As part of the initial teacher selection process to secure the study sample, the E-Learning and Foundation Phase officials of the Madibeng District of the North West Education Department identified 45 Grade 3 teachers from the district. Using purposive sampling, seven teachers from the initial 45 were eventually selected to participate in the research. The selection of the teachers was guided by the following criteria:

- The teacher had to be computer literate
- The school from which the teacher came had to have computers connected to the internet for teacher use
- The teacher must be willing to participate in the study
- The teacher had to be actively teaching Grade 3 learners in Setswana in 2018
- The teacher had to be fluent in both Setswana and English

Patton and Cochran (2002) and Saunders et al. (2009) supported the use of purposive sampling and argued that the criteria defined and used to select participants allow the researcher to ensure that the data collected from the participants would contribute to the research project and help answer the research questions.

4.5 Software Training Programme

The software training programme conducted for the ILS intervention was largely informed by the findings from the pilot study (Section 4.3.5). One of the main criteria used for the purposive sampling was that the teachers had to possess basic ICT skills. This criteria was critical as the entire ILS intervention rested on the teachers engaging with and using the T-DL software after the training and the collected data should in no way have be compromised or influenced by the teachers' lack of basic ICT skills. According to Salinas, Nussbaum, Herrera, Solarte, and Aldunate, (2017), teacher training is a critical element to drive and sustain ICT acceptance and use by teachers. As a result, the ICT training component of this study was essential to ensure that the teacher participants were familiar with all the functions of the T-DL software, as this software has not been introduced to the South African teacher population. The software training programme lasted 12 hours and was spread over three consecutive days from 3 to 5 October 2018. The seven participants had to attend a compulsory training program that was conducted in a boardroom at the Brits Area Project Office of the North West Education Department. The venue, which is part of the VODACOM teachers ICT centre for the district, was selected because it was a common training site that teachers from the district were comfortable with, and it was essential in the context of this study that the environment in which the data was collected allowed the participants to feel comfortable and confident (Wa-Mbaleka, 2017). The training team consisted of myself and the E-Learning official from the Madibeng District office. The entire training session was conducted in English, and the Setswana-speaking district

official were present if there was a need for code switching (English to Setswana) during training. However, all the teachers indicated that they would be comfortable with English being used during the training sessions. The participants were provided with laptops from the North West Department for the training session, but the ILS intervention also adopted the BOYD policy, 'bring your own device', to ensure that teachers could work on their devices as a way to promote their confidence while taking part in the study. Five of the seven teachers brought their own devices.

As explained in Chapter 1, the T-DL online software is a dual-language software consisting of an English and a Setswana version. The design of the ILS training program was such that the teachers were trained on each aspect (Table 4.4) using both the English and Setswana versions simultaneously, based on the findings from the pilot study. The entire training programme was directed by the T-DL training guide and the T-DL training manual (Appendix P).

Table 4.4: Aspects of the T-DL teacher training

	T-DL Function	Training Description
1	Teacher registration	Trained to access the TARMII platform online and then to register a Teacher Account that would permit them to access and use the software
2	Create and populate a class list	Trained to create, populate and manage the class list facility
3	Navigate item bank	Trained to access, navigate and search the T-DL item bank
4	Generate an online assessment	Trained to build an assessment task through the T-DL item bank
5	Publish the online assessment	Trained to publish the built assessment task using the assessment manager
6	Release online assessment to learners	Trained to link and release the assessment to the selected class list
7	Manage e-marking process	Trained to submit completed assessments to the e-marking facility and then to activate the machine marking process
8	View and release assessment reports	Trained to release assessment marks to the statistical report platform

4.6 Data Collection Instruments

Based on the findings from the pilot study, the three original data collection instruments (Section 4.3.4) were either modified, as in the case of the observation instrument, or excluded, as was with the journal entry book. The final three data collection instruments that were used in the ILS intervention were the (1) SSO instrument; (2) PO instrument and (3) IDI instrument. The next subsections describe and discuss the structure and focus on the three final data collection instruments used in the ILS intervention.

4.6.1 Systematic self-observation

According to Rodriguez, Ryave and Ryave (2002), the growth in interest in the qualitative approach for the study of everyday social life has resulted in a departure from positivist inspired data collection methods to new and unique approaches that try to capture the nuances of lived experiences. The growth and infusion of technology into the everyday lives of individuals has also resulted in a need to introduce and use data collection methods that are new and distinctive. According to Kawulich (2005), the use of observation as an approach within a research context allows the researcher to observe events that participants may be unable or unwilling to share, and as such, provides the researcher with the ability to develop a holistic understanding of the phenomena under study. However, Kawulich (2005, p. 11) cautioned that the researcher may have a bias when observing, and as such, the researcher's "observation is filtered through one's interpretive frames". This concern was cited in the findings of the pilot study (Section 4.3.5). In order to address this concern, I incorporated a data collection strategy that is commonly used in software testing and system usability testing, where the use of the SSO instrument has gained much traction and endorsement.

4.6.1.1 The SSO Instrument

The SSO instrument is based on the process of computer system usability testing. Usability inspection, according to Nielsen (1994), is a process of evaluating user interfaces to find usability problems. Initially this approach was used for debugging and improving computer code, however, more recently, usability testing has increasingly been used to evaluate the user experience of the target user when they

interact with the GUI environment. According to Mashapa (2009), usability testing allows the designer and developer to identify the factors that impact the usability and ease-of-use experience of a software system or platform. In order to determine the ease-of-use experience of a software application or an individual function, an instrument is required that allow the user to rate or record their experience on a rating scale. The System Usability Scale was incorporated into the SSO instrument and it allowed the teacher to record their ease-of-use experience while using the T-DL software. The System Usability Scale is similar to a Likert scale. The original System Usability Scale comprised of 10 system usability statements, each with a five-point scale that ranged from *strongly disagree* to *strongly agree*. These statements were standard as they were meant to assess the usability of any ICT product or service (Rodriguez, et al. 2002), however in the context of the ILS intervention, the 10 standard statements were not suitable, and as such, I had to rethink the System Usability Scale process.

4.6.1.2 SSO Data Collection Method

The SSO instrument is a qualitative research strategy that would require the teachers to observe and rate their actions and experiences pertaining to the completion of a particular function. The strength behind an instrument like the SSO is that teachers have to record their response to each question immediately, rather than think about questions for a long time, and as such, the instrument captures rich, real-time user experiences, which according to Brooke (1996), is important when dealing with software functionality.

The rationale behind adopting the SSO instrument is the unique nature of the ILS intervention within the South African educational context. This was the first time that an online educational software using an African language (Setswana) was introduced to Setswana-speaking teachers, and therefore, a unique, innovative instrument was needed to capture the rich experiences of the Setswana-speaking teachers as they interacted and used the T-DL software.

However, the traditional design of the SSO instrument lacked the ability to capture the richness and depth of the experiences of the teachers as they used the T-DL software, since the traditional design contains 10 generic activity statements and uses a 5-point usability rating scale to describe user experience. However, in this study it was

essential that the data collection should collect data that captures the rich and deep experiences of the teachers as they engaged with and used the English and Setswana versions of the T-DL software. I therefore decided to adopt and use a 7-point scale rather than the traditional five-point scale. The modified scale, as reflected in Figure 4.6, ranged from value 1, *very difficult*, to value 7, *very easy*. This decision to adopt the seven-point scale was supported by the work of Finstad (2010, p. 105), who cited that the "insensitivity of 5-point scale items" places a burden on the participants to conform to an item that does not reflect their true user experiences. Diefenbach, Weinstein, and O'Reilly (1993) and Finstad (2010) approved of the use of the 7-point scale as a more reliable scale to reflect the ease of use and accuracy of use of the software by the user. Boone and Boone (2012) further stated that the use of a 7-point scale adds more dimension and depth to the user experience.

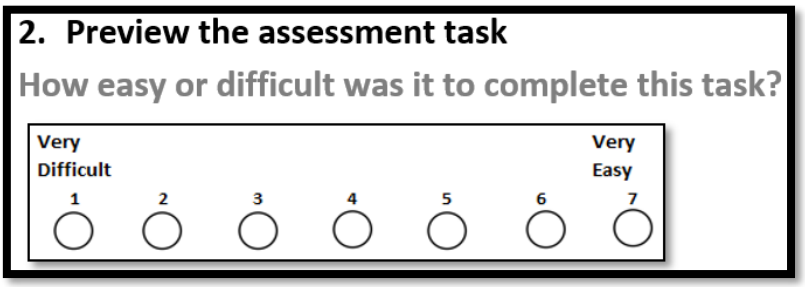

Figure 4.6: Ease-of-use experience scale

The SSO instrument was divided into four sections, with each section representing a function of the software. Figure 4.7 shows the four functions and lists 15 of the 27 activities as listed in the SSO instrument. The full SSO instrument with all 27 activities can be viewed in Appendix F.

The functions with the corresponding activities were arranged in sequence in the SSO based on how a user would engage and use the T-DL software.

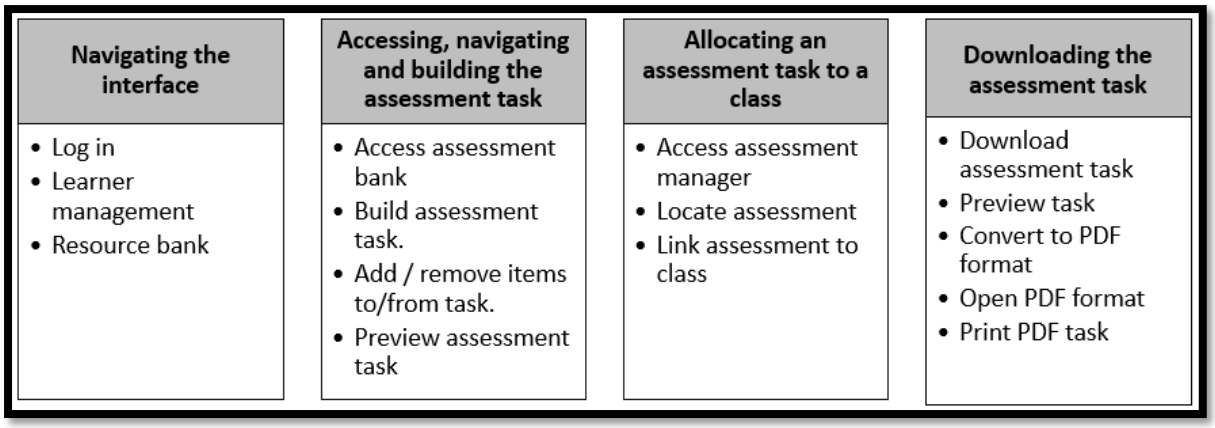

Figure 4.7: Functions as per the SSO instrument

Each function comprised of a series of activities that the teacher had to complete and then record their ease-of-use experience ranging from *very difficult* [1] to *very easy* [7] onto the SSO instrument. Each teacher had to complete a total of 27 activities spread across the four functions

Looking at the use of the SSO instrument within the context of the ILS intervention, an inherent weakness of the instrument is that irrespective of how well structured the SSO instrument is, there will always be the issue of what the participant wants to record and what the participant actually records (Rodriguez, et al. 2002). To counter this issue of participant bias, the PO instrument was introduced, which was administered simultaneously by me while the teacher completed the SSO. However the strengths of using the SSO instrument greatly outweighs its weaknesses. Strengths like it being non-intrusive, its reliability and its ability to prevent observers' bias.

4.6.2 Participant observation

According to Lopez and Whitehead (2013), the use of observation as a data collection method allows the researcher to observe behaviour and events while recognising the physical attributes that occur in the participants' natural setting rather than in a simulated laboratory type environment. There are four types of observation approaches that are commonly used in observation (Figure 4.8).

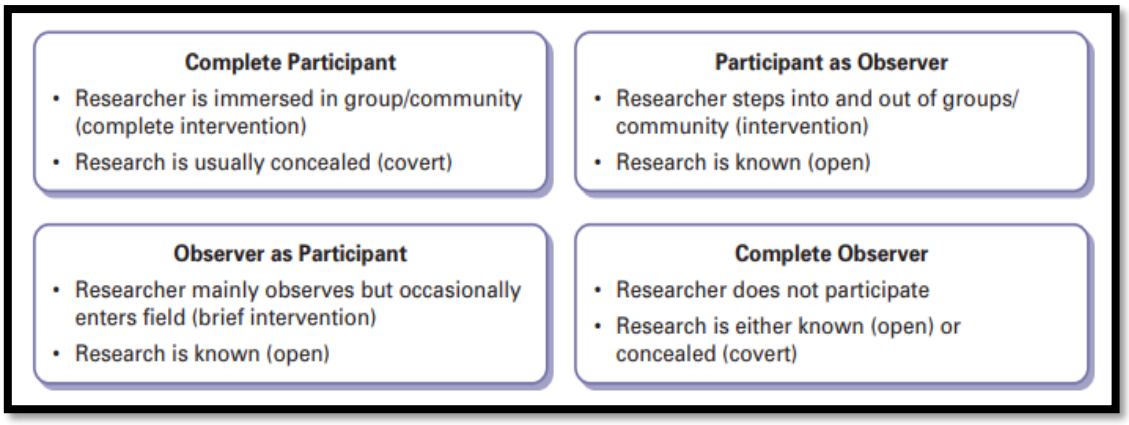

Figure 4.8: Types of observation (Adapted from Lopez & Whitehead, 2013)

4.6.2.1 The PO Instrument

The second data collection method adopted by the ILS intervention was observation, and more specifically, the participant observer (PO) approach (Figure 4.7). The rationale behind adopting this approach was that the entire study was grounded in ICT and that the study was essentially breaking new ground with the use of an Indigenous African language (Setswana) as the language of the online educational software. As such, the use of this particular observation approach for data collection gave the data collectors some flexibility in that we could occasionally intervene, support and guide the teachers when they experienced problems (Lopez & Whitehead, 2013), which was essential as most of the teachers had some basic ICT skills but lacked confidence in using ICT due to their restricted access to ICT resources at their respective schools. The PO instrument was designed as an observation recording instrument using the same four functions as the SSO instrument (Figure 4.7), and it allowed the data collector to record observations using textual entries.

4.6.2.2 The PO Data Collection Method

As the teachers engaged and completed the 27 activities within the four functions, the data collectors would record their observations onto the PO instrument based on the users' actions, comments, body-language and experiences. The use of the 27 predefined activities within an observation framework can be defined as a structured observation approach. According to Lopez and Whitehead (2013), a structured observation approach occurs when the researcher enters the research field with a

predetermined framework that must be followed, which was the case of the ILS intervention. The PO instrument was structured around a predetermined framework with the four key functions of the T-DL software: (a) Navigating the interface; (b) accessing, navigating, and building the assessment task; c) allocating an assessment task to a class; and (d) downloading and printing the assessment task.

The PO data collection process was conducted by the research team who observed the teachers as they completed the 27 predefined activities. Both observation data collection methods (SSO and PO) were conducted simultaneously, so while the teachers were busy with the 27 activities and recorded their ease-of-use experience onto the SSO, the two data collectors recorded their observations in text form onto the PO instrument. The narrative records made by the data collectors covered both visual cues and verbal comments made by the teachers as they completed the 27 predefined activities. The data collectors could interact and assist the teachers if asked. On completion of the PO process, the data collectors spent time expanding and clarifying their observation notes to ensure that the narratives of the observation that was captured was accurate while it was still fresh in the mind.

According to Mulhall (2003), observation, like any other data collection method, does have certain strengths and weaknesses. The use of observations in qualitative studies has the weakness of being biased since the narrative recorded in the observation sheet greatly relies on the memory, insight and experience of the researcher. This view was also supported by Holmes and Bloxham (2007), who argued that a key limitation in using observation as a form of data collection is the possibility of a researchers subjectivity. To allay the concerns of Holmes and Bloxham (2007) and Mulhall (2003), a second researcher with about 20 years of data collection experience was included to assist with the data collection process (See Appendix E). Another strategy adopted to counter observer bias was the inclusion of the SSO data collection strategy. However, Lopez and Whitehead (2013) added that the use of observation is advantageous since the data collector can observe and record actions and experiences that the participant often is not aware of.

4.6.3 In-depth interview

IDI is a qualitative research method that uses concentrated individual interviews conducted with a small number of participants with the aim of exploring their attitude

and perceptions on a particular topic or situation (Boyce, 2006; Lopez & Whitehead, 2013). The use of IDI allows the researcher to interact in a real-life context with the participants. This approach further affords the researcher the opportunity to build and foster an environment of trust and rapport with the participants. Such an environment allows participants to share their individual experiences without fear of being judged or feeling intimidated (Sutton & Austin, 2015). In the context of the ILS intervention, a real-life and a trusting environment had to be created so that the teachers would find themselves in a location that was both natural and safe where they could openly air their experiences, worries and angst about engaging and using a software in an African language.This type of environment is also conducive to a rich data collection experience for both the data collector and participant (Sutton & Austin, 2015). Showkat and Parveen (2017) added that the use of IDIs allows for the collection of deep, rich information from participants about their experience and perspectives on a topic or situation.

4.6.3.1 The IDI Data Collection instrument

This approach of data collection is ideal to collect data from participants who may feel insecure or nervous about making their views and feelings known. In the context of this study, using this data collection method was pivotal in understanding the deeper feelings, attitude and perceptions of the participant as they used the T-DL and engaged with the Setswana version of the software. This view is supported by Boyce and Neale (2006), who stated that the use of IDIs allows the researcher to probe for in-depth, rich information pertaining to a new or complex topic. These views supported the decision to use IDIs as the third form of data collection for this study, so that a deeper understanding of how the teachers reacted and experienced the T-DL software with a GUI and content in an Indigenous African language could be gained.

IDIs can be structured, semi-structured or unstructured. A structured interview sees the researcher having a list of pre-set questions with answer options, which the respondent must select from. During an unstructured interview, the interviewer has no pre-set questions but rather initiates the conversation from a broad topic and uses this to guide the interview. In a semi-structured interview, the researcher uses a list of pre-set questions and the respondent must answer in their own words and the interviewer can probe with further questions (Easwaramoorthy & Zarinpoush, 2006).

4.6.3.2 The IDI Data Collection Method

The ILS intervention adopted a semi-structured interview approach that allowed the data collectors the flexibility to pose the interview questions in a more conversational style rather than follow a rigid sequential manner. Harrell and Bradley (2009) supported this approach and added that by using the IDI method, the data collectors have a more free and natural interaction with the participants, prompting them for information that is rich and more naturally insightful. The IDI process took place a day after the administration of the SSO and PO data collection instruments. The interview process was conducted by the two data collectors who were located in two separate interview rooms at the Brits Area Project Office. The interviews were conducted in English. At the onset of the data collection process, the teachers were given an opportunity to have the Madibeng E-Learning official, who is a Setswana first language speaker, conduct the interviews, but they opted to be interviewed in English by the data collectors. As alluded to earlier in the chapter, the introduction of the T-DL software within the South African educational context is a ground-breaking innovation, and as such, it was vital that the data collected from the ILS should contribute to understanding the feelings, attitudes and perceptions of the teachers when it came to the use of Setswana, an Indigenous African language, in ICT as well as to serve as a stimulus for future research on and development of localised software. The use of semi-structured IDIs greatly supported the collection of the data that reflected the experiences and perceptions of the teachers and provided insight into their understanding and attitude towards the use of an African language in ICT.

The IDI schedule used in this study consisted of 21 pre-set questions that were grouped into three sections, as reflected in Table 4.5.

Table 4.5: Interview schedule framework

Section A	**Section B**	**Section C**
12 Questions	6 Questions	3 Questions
Focus:	**Focus:**	**Focus:**
1. Demographic details	1. T-DL use in teaching and assessment	Use of Indigenous African languages in the ICT field

Section A	Section B	Section C
12 Questions	6 Questions	3 Questions
Focus:	**Focus:**	**Focus:**
2. Teaching experience	2. T-DL as a motivator in the use of technology	2. Perceived barriers in the use of Indigenous African languages in ICT
3. Teaching qualification	3. T-DL and confidence	
4. ICT experience and use		

Section A consisted of 12 questions, and the aim of these questions was to construct a picture of who the teacher participant were. This was achieved by asking questions pertaining to their background, their teaching experience and qualifications and their experience in the field of ICT. Information from this section helped construct the identity of the teacher as an individual as well as the teacher in a group. According to French (2014), having background information about the participants is essential when attempting to explain additional and superfluous data.

Section B consisted of three broad areas with six questions that focused on the teachers use, experience and perception of the T-DL. The aim behind these questions was to try to understand how the teachers viewed the software as an instrument for teaching and assessment and whether the T-DL software motivated and made them more confident in using ICT. Section C consisted of two broad areas with three questions that focused on the teachers' attitude and perceptions pertaining to the inclusion and use of Indigenous African languages (Setswana) in ICT.

Each of the seven teachers were interviewed individually in private break-away rooms to ensure a safe, discrete and secure atmosphere. In an attempt to avoid researcher bias, two researchers were used to interview the teacher participants. The completed teacher consent forms gave consent for the interviews to be audio recorded. During the interview process, the teachers were made to feel comfortable and they were reminded verbally about the privacy of their information as well as their right not to answer particular questions and their right to exit the interview at any time (Alshenqeeti, 2014; Sutton & Austin, 2015). The data collectors used digital voice recorders to record each participant's interview. The recording was saved in an mp4 file format and downloaded onto a secured server located at the HSRC. A transcription

company identified by the HSRC's Tender and Contract Office was used to transcribe all audio files.

Even though the use of IDIs is such an invaluable method in qualitative studies, Boyce and Neale (2006) and Harrell and Bradley (2009) identified that interviews are prone to bias, especially when the researcher may want to ensure that responses from the participants have a specific slant or view that would guide the results of the research in a predetermined direction, and as such, all efforts must be taken to counter the possibility of researcher bias. In the context of the ILS intervention, to counter of the concern of researcher bias, two data collectors were used to interview the seven participants and the interview transcriptions of the audio files was prepared by an independent transcribing company that was nominated by the HSRC's Tender and Contract Office (Appendix O).

4.7 Data Collection

Kaurani and Marwah (2020, p. 61) described data collection as "the 'process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer queries, stated research questions, test hypotheses, and evaluate outcomes". Within a qualitative research context, qualitative researchers undertake their work in a natural setting to understand and interpret phenomena in terms of the meanings that people bring to it (Walliman, 2011). According to Halcomb (2016), multiple data collection instruments and methods can be used in qualitative research to gather data that capture the rich multiple realities present in the real-life context in which the research is being conducted. In qualitative research, data is chiefly obtained through interpersonal contact with the participant, usually in the form of an interview or when the researcher is in the close proximity to the participant, usually through observation (Lopez & Whitehead, 2013). Interviews, focus groups, and observations are some of the most common methods of data collection in qualitative research; however, Lopez and Whitehead (2013) encouraged creativity and the use of underutilised methods to gain an insight into the participants' world. In order to ensure that the data collection process was valid and trustworthy, a researcher from the HSRC's Education Unit, who was based in the North West province, volunteered to support and assist in the collection of the data.

Each of the three data collection instruments were administered twice during the study. The first administration was done at the end of Stage 1, after the teachers were exposed to and used the English version of the T-DL software. The second administration was at the end of Stage 2 when the teachers had been exposed to and used the Setswana version of the software.

4.7.1 Data collection

As the ILS intervention was unique and essentially breaking new ground within the South African educational context, the voices of the teacher participants were of utmost importance. It thus became imperative that the data collection instruments had to capture data that was both rich and deep. As such, it was vital that the instruments captured *what the teachers said*, *what the teachers did* and *how the teachers responded* as they engaged and used the software, which justified the design and structure of the three data collection instruments (Table 4.6).

Table 4.6: Design and description of the data collection instruments

Type	Description
Systematic Self-Observation (SSO)	SSO, suitable for investigating personal experiences, cognitive processes, emotions, motives, actions, omitted actions, and socially restricted activities.
Participant Observation (PO)	Watching people or groups in a specific real-life context performing real-life tasks.
In-Depth Interviews (IDI)	Adequate term for the range of ways people can supply you information.

The three data collection instruments were each administered twice during the data collection process. In Stage 1, data was collected after the teachers engaged and completed the various activities using the English version of the T-DL software. In Stage 2, the same three instruments were used to collect data as the teachers engaged and completed the various activities using the Setswana version of the T-DL software (Figure 4.9).

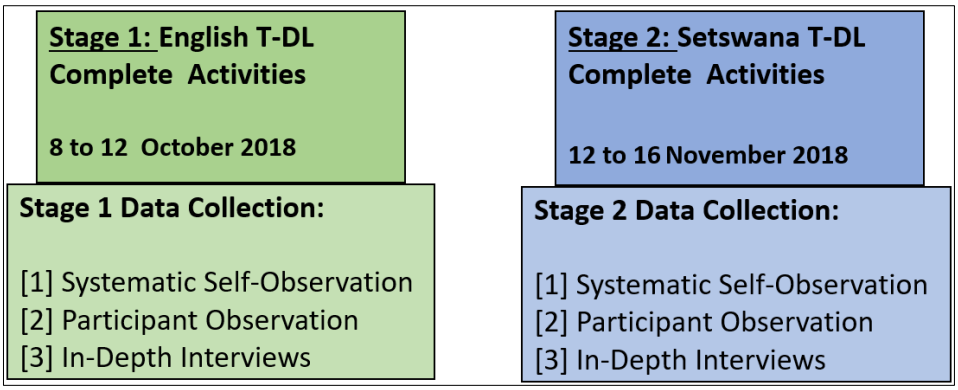

Figure 4.9: Stages of data collection

During the first stage of data collection, the teachers engaged and used the English T-DL software and then completed the predefined activities. This stage took place during the week of 8–12 October 2018 at the Brits Area Office ICT Centre, where each teacher was provided with their online credentials to access the English version of the software. At the end of this stage, the three data collection instruments were administered by two data collectors. On completion of Stage 1, the plan was for the second stage to commence. However due to unforeseen political events[7], the research team was forced to postpone Stage 2 of the ILS intervention to the second week of November. This stage of the ILS intervention took place from 12 to 16 November 2018 at the Brits Area Office. During this stage, the seven teachers were given user credentials to access the Setswana version of the T-DL software and completed the predefined activities.

During Stage 1 (English T-DL), all three instruments were administered and focused on the teachers' engagement and use of the English version of the software. The SSO instrument (Appendix F) and PO instrument (Appendix G) were completed simultaneously. Essentially, as the teachers completed the series of predefined activities and rated their user experience on the SSO instrument, they were observed by the data collectors, who recorded their observations onto the PO instrument. In order to ensure the consistency and richness of the observational notes made in the PO instrument, an observation framework consisting of four key aspects was

[7] During this period, the Madibeng area experienced severe service delivery protests that sparked violent community reactions. As such, schools and department offices were closed, and for safety reasons, the participants were asked not to attend.

introduced. The data collectors were requested to record their observation notes within the PO framework (Figure 4.10) using the four guiding aspects

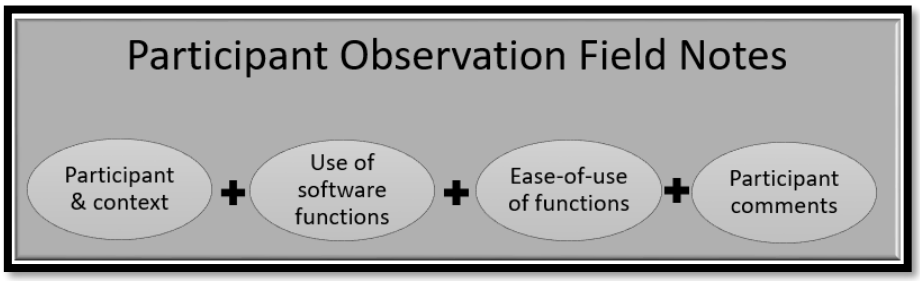

Figure 4.10: PO framework

The IDI instrument (Appendix H) was then used for the individual participant interviews that were conducted by the research team a day after the first two observation sessions (SSO and PO). On completion of the first data collection (English T-DL), the teachers were given access to the Setswana version of the software based on the assumption that Stage 2 would resume immediately. However, the second stage had to be postponed by a month, and as such, the teachers had access to the Setswana version for a month.

Stage 2 of the data collection process spanned the period of 12–16 November 2018. The process followed in this stage was exactly the same as Stage 1 (Figure 4.9). During Stage 2, the same three data collection instruments were used, which focused on the teachers' engagement and use of the Setswana version of the software. At the end of the two stages of data collection, a total of six data sets were collected, as reflected in Figure 4.11.

Stages 1 & 2: English and Setswana version of software
Stages 1 & 2 Data Sets: 6 Sets [1] Systematic Self-Observation (**1 set English + 1 set Setswana)** [2] Participant Observation (**1 set English + 1 set Setswana)** [3] In-Depth Interviews (**1 set English + 1 set Setswana**)

Figure 4.11: Total data sets collected

4.8 Data Preparation

According to Bhatia (2018), a researcher instinctively find patterns, connections, relationships, and ultimately, meaning when faced with data. McLellan, MacQueen,

and Neidig (2003) noted that the inappropriate or inadequate preparation of qualitative data can lead to a delay or negatively affect the analysis process. Kochanski (2010) further argued that in many research reports and conference papers, the process of preparing and presenting qualitative data is neglected and is treated cursorily since many assume that data in the form of words, observations and images does not deserve in-depth discussion as compared to figures, charts and statistics.

Bhatia (2018) provided a generic four stage framework for the preparation of qualitative data that highlights the following four broad stages that must be followed when preparing qualitative data:

1. **Getting to know your data**: Since most qualitative data is just words, it is imperative that the researcher should read the data multiple times to get familiar with the data and identify any emerging patterns.
2. **Linking the collected data to the research objectives**: It is vital that the researcher can to link the research objective and recognise the questions that can be answered through the collected data.
3. **Develop a framework**: This is done by attributing codes to the broad ideas, concepts, behaviours, or phrases that emerged from the collected data.
4. **Identify patterns and connections within the data**: The researcher can now attempt to look for patterns and themes from the coded data that can answer the research questions.

In this study, data collection was done using three distinct qualitative data collection approaches. As such, the data preparation process for each of the methods will be discussed individually. The starting point in the data preparation stage was the anonymisation of all the data sets, which was agreed upon when the teachers signed the consent forms.

4.8.1 Preparation of SSO data

The SSO data collection instrument comprised of four software functions, with each function comprising of a series of activities. The data collection process was conducted twice, first during the Stage 1 when the teachers used the English version of the software and then during Stage 2 when the teachers used the Setswana version of the software. During both the data collection stages, the participants completed a

series of predefined activities and then recorded their ease-of-use experience on a seven-point scale (Figure 4.12).

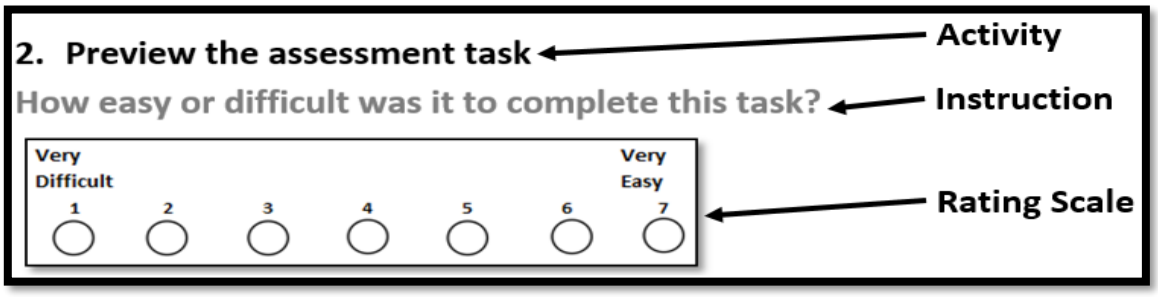

Figure 4.12: SSO rating scale

The rating scale used in the SSO instrument to describe the user experience ranged from the value 1 for *very difficult* to 7 for *very easy*. To simplify and streamline the analysis process, the following modifications were made to the System Usability Scale rating scale:

- Scale values 1, 2 and 3 were collapsed into the level description *difficult*
- Scale values 5, 6 and 7 were collapsed into the level description *easy*
- Scale value 4 was rated as *neutral*.

The decision to collapse the value scales was based on the rationale that the small number of participants (seven teachers) would make certain descriptions less impactful. Grondin and Blais (2010) and Jacoby and Mattel (1971) presented and supported this decision and argued that data categories can be collapsed either into dichotomous or trichotomous measures and that this would affect the reliability or validity of the research. Hence, the analysis of the data collected from the SSO process will be based on the three categories of user experience: *Difficult*, *easy* and *neutral*.

The preparation of the SSO data from both stages (English and Setswana) saw the capturing of the responses from the SSO instrument onto a MS Excel spreadsheet in the form of a frequency distribution, which will be discussed in greater detail in Chapter 5. The next step was to convert the frequency distribution into a column chart, which was used to describe the data. The use of a chart in a qualitative research is supported by Sloane (2009), who argued that the quantitative research domain has access to a large variety of visualisation instruments in the form of bar and column charts, scatter-plots, and pie charts to represent data, although many researchers are

unwilling to use visual instruments to represent qualitative data. In the context of this research, the representation of the qualitative or categorical data collected from the SSO instrument were done by using a frequency table or a frequency distribution, which allowed for the conversion of the frequencies into a series of column charts. The column charts represent each of the four software functions and the various activities. Jacelon and O'Dell (2005) and Sloane (2009) maintained that converting qualitative data into visually rich displays allows for greater analytical power and credibility of the research results.

4.8.2 Preparation of PO data

A substantial portion of PO data consists of in the field observations that the researcher makes in a field journal or data collection instrument. Most often, the data collected is textual, although it can also contain pictures, sketches and charts. According to Chu and Ilyas (2016, p. 1605), the cleaning of qualitative data essentially consists of "error detection and error repairing". Cleaning the data is important since 'dirty data' can result in inaccurate data, which ultimately will lead to inaccurate research findings and results. It is only when the data is cleaned that the transcription process can begin.

In the ILS intervention, the data collected with the PO instrument was done by two data collectors. Each data collectors made observation comments on the writing space provided on the PO instrument. All the completed PO instruments were collected and the instruments were cleaned, looking specifically for spelling and grammar errors first and then for misinterpretations. The cleaning of the PO data was done between the two data collectors because this made the process simpler as the data collectors could immediately clarify any error detected. After the data cleaning process, the observation comments were transcribed from the observer's handwritten observation notes directly into MS Word documents by the respective data collectors. The Word documents were categorised firstly into the appropriate data collection stages (English and Setswana) and then into the four functions of (1) navigation, (2) building assessment, (3) allocating assessment to a class and (4) downloading and printing the assessment task (Figure 4.13) within each stage. To ensure the accuracy of the transcription from the observation notes to the MS Word documents, a researcher from the HSRC volunteered to verify the accuracy in transcription. The files were at this point ready for reading and analysis.

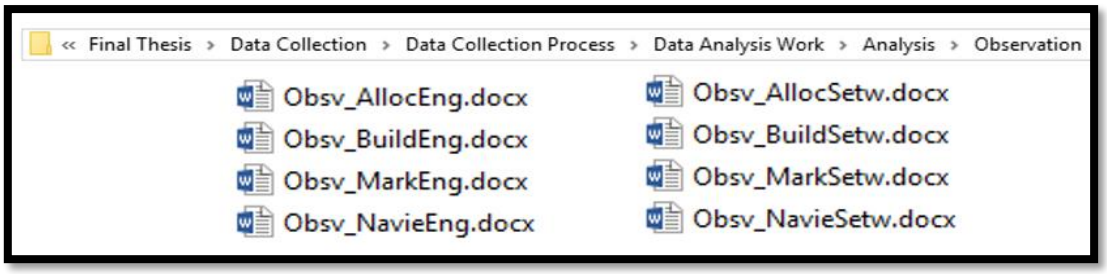

Figure 4.13: Observation transcription files

4.8.3 Preparation of IDI data

As stated earlier, all interviews were audio recorded and the audio files were saved in an mp4 file format. Upon completion of the interviews, each audio file was uploaded onto a secured external hard drive, after which the files were backed up onto a secured server at the HSRC offices in Pretoria. Each of the 14 audio files (seven English and seven Setswana) were allocated unique file names that included the initials of the participants' pseudonym and the interview stage as shown in Figure 4.14.

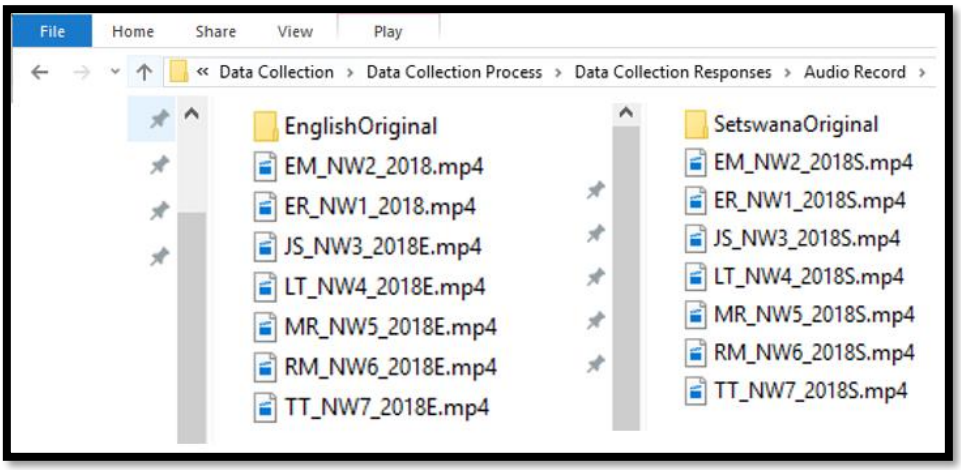

Figure 4.14: Interview audio files

The audio files were then transferred through Google Dropbox to a reputable transcription company that was identified by the HSRC's Tender and Contract Office. Part of the deliverables from the company included a transcription report, and this report explained the process and steps the company put in place to ensure the validity and accuracy of the transcription process. Extracts from the transcription report are quoted below and the entire report can be viewed in Appendix O.

These are some key aspects from the transcription report:

- “We also consulted dictionaries and at times specialists in the field. The teacher I know has taught for more than 40 years and was a principal for a number of years before going to the district office.”
- “I was granted access to the TARMII site (English and Setswana), this allowed me to get an idea of what TARMII was so that I can understand the interview questions as well as what the responses were.”
- “Another process of transcription is rewinding 3 to 5 times when the subject is not audible or says something that is not clear.”
- “Before each transcript is finalized, one has to re-listen to the audio again and perhaps one will find some parts of speech that were missed or correct any syntax issues that may have occurred during the typing.”

Upon completion, the transcription company submitted a copy of each participant’s interview transcripts for both data collection stages (English and Setswana) in a MS Word format as reflected in Figure 4.15.

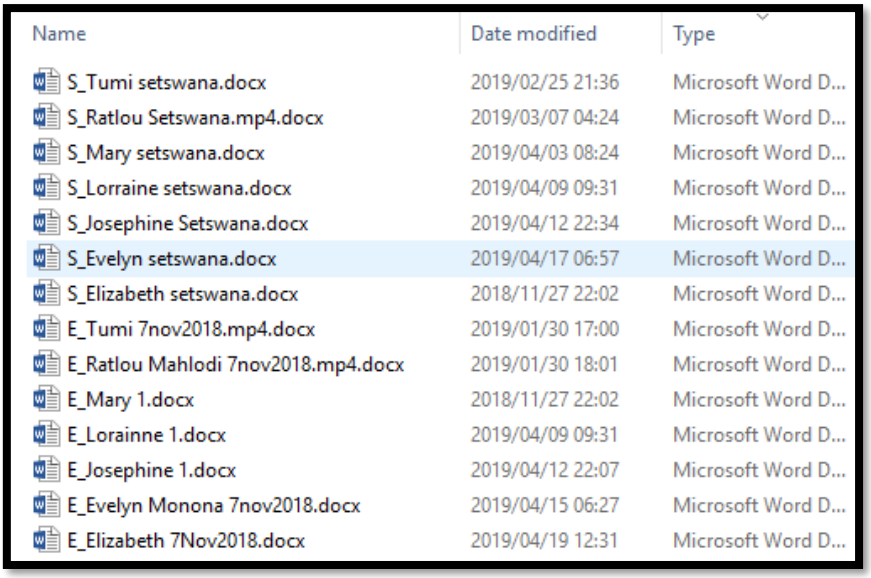

Figure 4.15: Interview transcription files

The documents were saved onto an external hard drive as well as the HSRC secured server. At this point the transcripts needed to be prepared for data analysis. Responses from the seven participants to the various interview questions from both phases of the interviews were clustered and saved in separate MS Word files (Figure 4.16) based on the question number. These files served as the main files for analysis purposes.

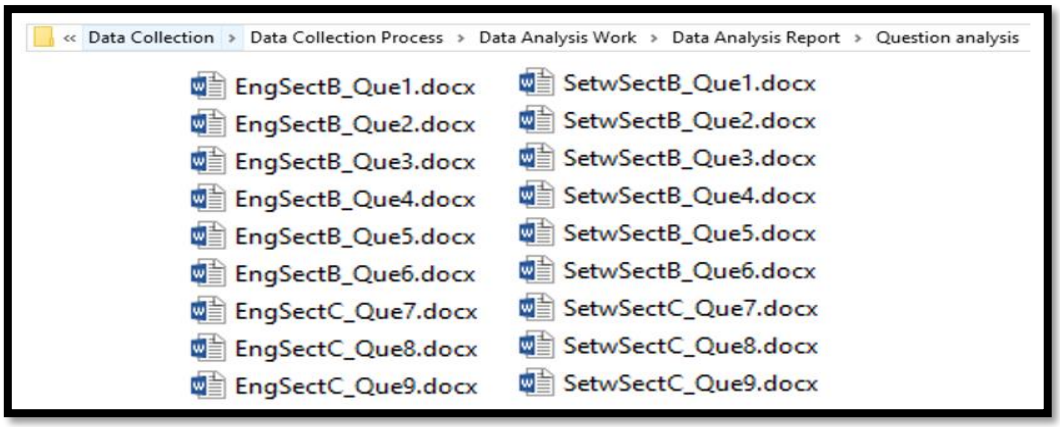

Figure 4.16: Composite transcription files per question

During the transcription of the audio files, the transcribing company identified parts of the audio as either “inaudible” or “not clear”. During the data cleaning process, the research team re-listened to those parts of the audio file in conjunction with the problem transcripts. Some of the issues identified by the transcriber were resolved, and those that were still not clear were left in an unresolved state.

4.9 Data Analysis Procedure

Rouse (2019, p. 1) described qualitative data in the following way:

> Information that cannot be counted, measured or easily expressed using numbers. It is collected from text, audio and images and shared through data visualisation tools, such as word clouds, concept maps, graph databases, timelines and infographics as well as narrative reports.

Due to the intricacies of social research, multiple data collection approaches are needed to capture the multiple realities so as to gain a deep understanding and appreciation of the human experience within a real-life context (Halcomb, 2016). Bhatterherjee (2012) stated that the analysis of qualitative data is greatly reliant on the researcher’s investigative and integrative skills as well as the researcher’s personal knowledge and understanding of the social context within which the data of the phenomenon under research was collected. Due to the unique context and investigative focus of the ILS intervention, it was necessary to adopt an analysis approach that would reveal the key features of the data to truly appreciate and understand the relationship between the teachers and their engagement in the use of the language-DL software. As such, this study adopted the thematic data analysis

technique to analyse two of the three data sets (PO and IDI), while simple frequencies was used to analyse the third data set (SSO).

The thematic data analysis technique was used to help identify the themes that were central to understanding and explaining the use of the T-DL software by the Setswana-speaking teachers. The use of thematic data analysis began with the search for repeated patterns within the IDI and PO data, with particular interest to identify similarities and differences within the data. These emerging themes were identified through careful reading and re-reading of the PO and IDI data (Pholotho & Mtsweni, 2016). The use of simple frequency analysis was important to analyse and interpret the SSO data. In order to determine patterns in the teacher user experience, it became necessary to find frequencies, magnitudes, structures, procedures, reasons, and consequences in relation to their use of the four functions of the software (Statistics Lumen Boundless, 2013).

4.9.1 Analysis of the SSO

This analysis was used for data collected from the SSO instrument. The responses of the teacher ease-of-use experience in relation to the activities in the SSO instrument was captured onto a MS Excel spreadsheet and then converted into a frequency distribution table as shown in the example in Table 4.7.

Table 4.7: Example of a frequency distribution table

Starting a class list	English Easy	Setswana Easy	No Difference	Total Participants
Open up the class list platform	2	2	3	7
Insert learner names	3	4	0	7
Insert learner parent details	2	4	1	7
Export the class list	3	4	0	7

From the example of the frequency distribution table (Table 4.7), a graphical output, in the form of a column chart was created, as shown as an example in Figure 4.17. The chart provides the following key pieces of information:

1. The software function such as *Starting a class list*
2. The various activities per software function such as *Open the class list platform*
3. The frequency of use of teachers, for example, *Per activity per the three levels*

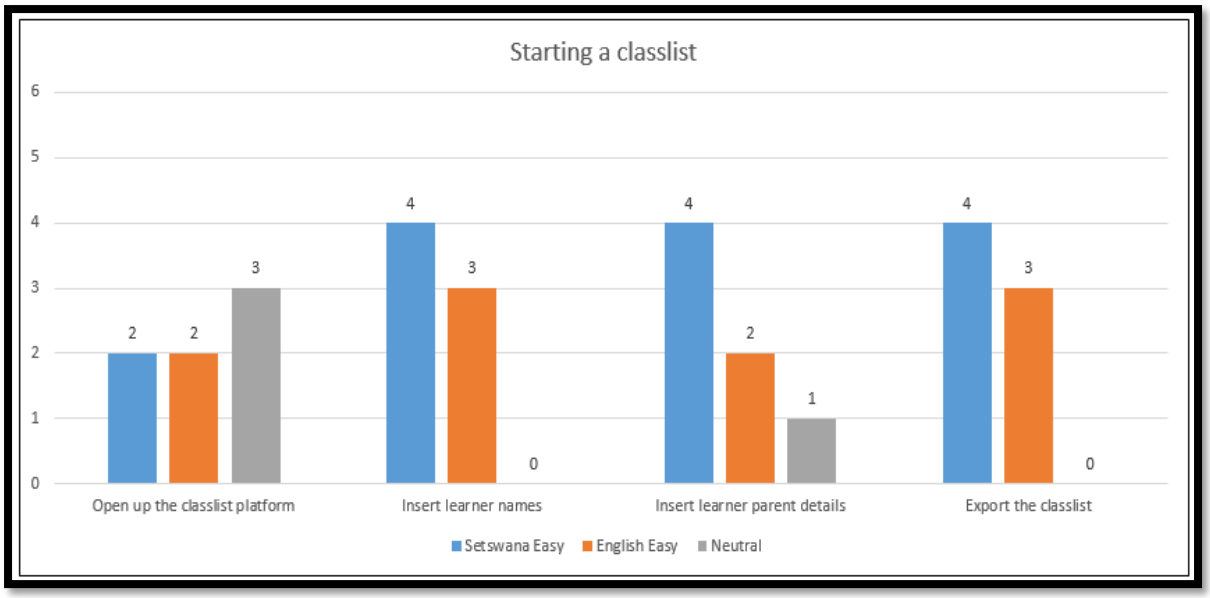

Figure 4.17: Example of a column chart

The following information can be read from the chart:

- **Column 1**, *Setswana Easy* (Blue): This column reflects the number of teachers who found using the Setswana version of the software easier when completing that specific activity.
- **Column 2,** *English Easy* (Orange): This column reflects the number of teachers who found using the English version of the software easier when completing that specific activity.
- **Column 3**, *Neutral* (Grey): This column reflects the number of teachers who found no difference between using the English and the Setswana version of the software when completing that specific activity.

In Chapter 5 only column charts will be used to present the results.

4.9.2 The process of thematic analysis

Thematic analysis is an approach used to interpret qualitative data, which includes data in the form of documents, interview transcripts and video and audio specimens. The researcher should carefully study the data in its specific format in an attempt to identify certain emerging concepts, trends, thoughts and patterns of meaning or expression. Using a thematic analysis approach is suggested when the researcher is trying to understand and delve into the participants attitudes, beliefs, expertise and perceptions of a certain phenomenon. Thematic analysis can adopt either an inductive

or deductive approach. An inductive approach involves using the data to determine the themes, while a deductive approach entails engaging the data with predetermined themes you presume to find within the data. According to Brough (2019), Braun and Clarke's process of thematic analysis proposed six stages to guide and assist in the analyses of qualitative data (Figure 4.18).

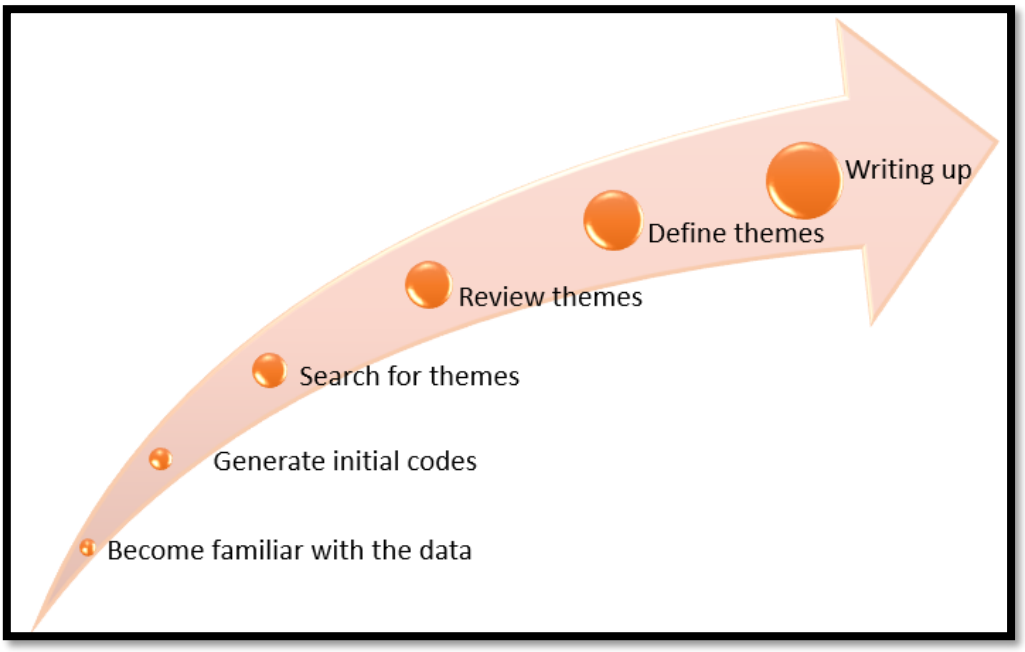

Figure 4.18: Stages of thematic analysis (Adapted from Brough, 2019)

1. Become familiar with the data
2. Generating initial codes
3. Search for themes
4. Review themes
5. Define themes
6. Writing up

Thematic analysis as described by Braun and Clarke's six stage approach were used to analyse the data collected from the PO and IDI data collection process of this study and will be discussed in context of this study in the next section.

4.9.2.1 Thematic analysis of the PO data

The data collected from the PO instrument was in the form of handwritten observational notes made by the data collectors as they observed the teachers

completing the various activities indicated in the SSO instrument. The observation notes were framed within these four key aspects of the PO framework:

1. **Participant and context:** Analysis of any qualitative data would be compromised if the participant and the context within which the participant exists is ignored. In the ILS intervention, the analysis of the PO data had to consider the teachers' ICT experience, age, experience, and their exposure to ICT resources while at the same time being cognisant of their respective working and living conditions.
2. **Use of software functions:** The teachers were observed as they completed the activities. The observation notes made by the researchers focused on how they interacted with the interface and accessed the functions.Analysis of the PO data required a focus on how the teachers interacted with and used the various functions of the T-DL software and then having to complete a set of activities.
3. **Ease of use of functions:** This aspect of the analysis was closely associated to the second aspect, use of software functions, in that the observation notes made by the researchers related to how easy or difficult the teachers experienced completing the various activities within the four functions.
4. **Participant comments:** During the PO data collection process, the teachers were expected to complete the activities; however, many of the teachers were asking questions, providing non-verbal cues like mumbling, or even body-language cues like shaking their head or tapping fingers. These 'side-comments' or actions were noted and then included in the analysis.

Subsequently the observation notes or data collected from the PO based on these four aspects of the framework was used in conjunction with Braun and Clarke's six-stage thematic analysis process as reflected in Figure 4.19.

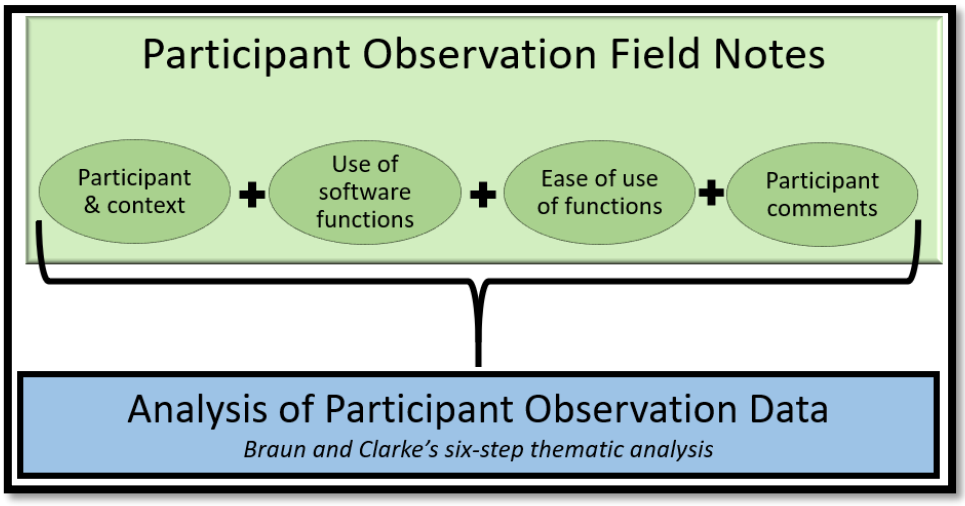

Figure 4.19: Analysis of PO data

Braun and Clarke's six-stage thematic analysis process (Figure 4.18) was used to guide the analysis of the PO notes derived from the PO data collection process with the aim of identifying emerging themes or repetitive patterns within the responses. The six steps as related to the PO data are discussed next.

Step 1: Become familiar with the data

In order to become familiar with the contents and focus of the PO data, a thorough reading of the researchers' observation notes was done in the context of the four aspects of the PO Framework (Figure 4.10 & 4.19).

Step 2: Generate initial codes

From the reading of the PO data, initial codes emerged that spoke to the observation notes. Table 4.8 reflects some of the codes that emerged.

Table 4.8: Initial codes from PO data

English	Indigenous	technical terms	racial
language	benefits	back-end	translation
ICT in education	colonists	digital divide	skills development
confidence	experience	resources	professional development
assessment	navigation	access	contextual
21st century	ICT exposure	language dominance	innovation

Step 3: Search for themes

Using the initial codes (Table 4.8) and supported by the observation notes, the search for relationships among the codes led to the development of some broad themes. These are the themes:

1. Use of English in ICT in South Africa
2. Translation into Indigenous languages
3. Indigenous languages in the 21st century
4. Teacher ICT skills
5. Affordances of ICT to the teacher: Assessment
6. African languages used in ICT
7. Software interface
8. Access to ICT resources and skills
9. Influence of digital divide on ICT use
10. ICT skills impact adoption of ICT

Step 4: Review themes

A deeper review of the broad themes identified in Step 3 saw the initial 10 themes being refined or discarded, resulting in the emergence of the final six themes. The rationale behind a smaller and more concise set of themes is to allow for an accurate representation of the data collected from the PO. These are the refined themes that supported the analysis of the PO data:

1. Dominance in the use of English in ICT
2. Translation of ICT resources into African languages
3. Indigenous language terminology development
4. ICT used for assessment
5. ICT skills and training
6. Indigenous GUI

Step 5: Define themes

In Step 5 the themes identified in Step 4 were further refined to ensure that the final themes support the understanding and analysis of the data collected from the PO instrument. There are the refined themes:

1. Teacher ICT skills
2. ICT used for assessment
3. Ease of navigating an Indigenous GUI

Step 6: Writing up

This is the write-up analysis of the collected data and are covered in detail in Chapter 5.

4.9.3 Thematic analysis of IDI data

As stated earlier, the IDI data from both the English and Setswana phases of the data collection was in the form of audio recordings that was transcribed into text files. The process of analysing the IDI data required a thorough and detailed reading and re-reading of the transcripts in an attempt to find emerging themes, repetitive patterns and linkages from within the transcribed responses (Boyce & Neale, 2006). The analysis of the IDI data was informed once again by Braun and Clarke's six-stage thematic analysis process (Figure 4.18), which are discussed below:

Step 1: Become familiar with the data

The transcribed audio files were subjected to three phases of initial probing: (1) The transcripts were read and then re-read, and this formed part of the data cleaning process; (2) the transcripts from each phase (English & Setswana) for each of the participants was then split and grouped as per the interview questions; and (3) the process of reading and then re-reading the responses per question was done to become familiar with the content and flow of the responses.

Step 2: Generate initial codes

At this point, the transcripts were grouped according to the IDI questions, and the readings followed at a question and response level and identified patterns from within the responses, which helped identify initial codes. Table 4.9 reflects some of the codes that were identified per question from Section B and Section C of the IDI instrument.

Table 4.9: Codes from IDIs

Question 1: Influence teaching practices			
repeat	enriched exercises	home language	ICT skills
convenience	feedback		
Question 2: T-DL software motivates			
assessing	simplify lesson	home language	language fluency
access anywhere	share ideas		
Question 3: Confidence using the T-DL software			
ICT literacy	ICT skills	support	training
translation			
Question 4: Confidence to build online assessment			
content	selection	skills	English makes it easy
user friendly	Setswana content	connectivity to access	
Question 5: Software offers problems/solutions			
class size	e-marking	code switching	translate
access to all	work anywhere	ICT skills	
Question 6: Influence assessment practices			
tests	remediation	instant feedback	reports
bigger item selection			
Question 7: Indigenous language use in ICT			
communication	terminology	local content	translation
dominant language			
Question 8: Barriers to Indigenous languages in ICT			
English opportunities	technical terms	code switching	employment
access to ICT	dominates software		
Question 9: Setswana ICT platforms			
technology	lack of terms	African languages intellectual	design and development
opportunities	develop words		

Step 3: Search for themes

At this stage, the codes developed (Table 4.9) were used to identify patterns and relationships, which led to the creation of 10 initial themes. These initial themes reflected areas of significance emanating from the IDI data. These were the broad themes:

1. ICT platform supports assessment
2. Barriers to the use of Indigenous languages on ICT platforms
3. Indigenous African language terminology
4. The effects of colonialism
5. Colonialism and the African person
6. ICT and its support to teaching and assessment
7. African languages and ICT
8. Importance of a GUI
9. Access to ICT
10. The digital divide

Step 4: Review themes

A deeper review of the themes defined in Step 3 saw the combining, refining and discarding of some of the initial themes as these themes had to be an accurate representation of the data collected from the IDI process. These were the refined themes:

1. Translation of ICT platforms
2. Indigenous terminology
3. Internalised colonialism
4. Effects of colonialism on teacher
5. Contextualised user-interface design
6. Access to ICT

Step 5: Define themes

In this stage, the themes identified in Step 4 were refined to ensure that the themes support the understanding and analysis of the data collected from the IDI instrument.

The aim of defining these themes and key aspects was to develop a general storyline of the IDI data. These are the themes:

1. African languages and software use
2. Confidence in building an online assessment
3. Indigenous African languages in ICT
4. Legacy of colonialism on ICT

Step 6: Writing up

This step was the write-up analysis of the collected data and are covered in detail in Chapter 5.

4.10 Triangulation of Data

The process of triangulation "involves the use of multiple and different methods, investigators, sources and theories to obtain corroborating evidence" (Anney, 2014, p, 226). Triangulation is one method for increasing the credibility and trustworthiness of the results of a study. Studies that use only one method of data collection is more likely to experience errors than studies that use multiple methods. The use of multiple methods allows for cross-data validity checks of the different types of collected data (Patton, 1999).

Anney (2014) and Korstjens and Moser (2018) identified three triangulation techniques: The first is investigator triangulation and uses multiple researchers; the second is data triangulation and uses different data sources or instruments to enhance the quality of the data collected; and the third is methodological triangulation and uses different research methods. According to Patton (1999), there is a recurring misconception around triangulation that different data sources or methodological approaches will essentially yield the same results, but in fact, triangulation has more to do with testing for consistency of results. Shenton (2004) and Weyers, Strydom, and Huisamen (2008) elaborated on this and maintained that the use of triangulation compensates for the individual limitations and benefits of various research methods or data. Thurmond (2001) and Weyers et al. (2008) identified these three broad advantages of using triangulation: Increased comprehensiveness and completeness; confirm trends and identify inconsistencies; and improves reliability and validity.

The data collected from the SSO instrument represented the teachers' rating of their ease-of-use experience using the T-DL software, the data collected through the PO instrument represented data reflecting the observation notes of the teachers as they used the T-DL software, and finally, the data from the IDI was collected during the teacher interview process. The analysis of the data from the three data sets saw the identification of key focus areas and themes. These focus areas and themes were then progressively merged to lead to the development of the final four themes as reflected in Figure 4.20.

SSO Focus	PO Themes	IDI Themes	Final Themes
Basic ICT skills	Teacher ICT skills		Proficiency in using a dual language software
Ease of navigation	Ease of navigating an Indigenous GUI	African language GUI	
Building an online assessment	ICT used for assessment	Creating an online assessment	Digital assessment
		Benefits of ICT for Indigenous African languages speakers	Indigenous African languages in ICT
		Dominance of the use of English in ICT	Legacy of colonialism on ICT

Figure 4.20: Development of final themes

The final themes:

- Theme 1: Proficiency in using a dual-language software
- Theme 2: Digital assessment
- Theme 3: Indigenous African languages in ICT
- Theme 4: Legacy of colonialism on ICT

The rationale behind the triangulation of data according to Weyers et al. (2008) is essentially to ensure the validation of data through cross corroboration of two or more data sources. In the context of the ILS intervention, the validation of the three sets of data served to support the discussion of the findings in Chapter 6. Figure 4.21 reflects how the data derived from the three data collection instruments fed into the four key

themes that were used to support and reinforce the discussion of the findings related to the teachers' experiences using the T-DL software as well as their attitude towards the use of Setswana as a language of the T-DL software. With this information, the four investigative questions and the main research question were answered.

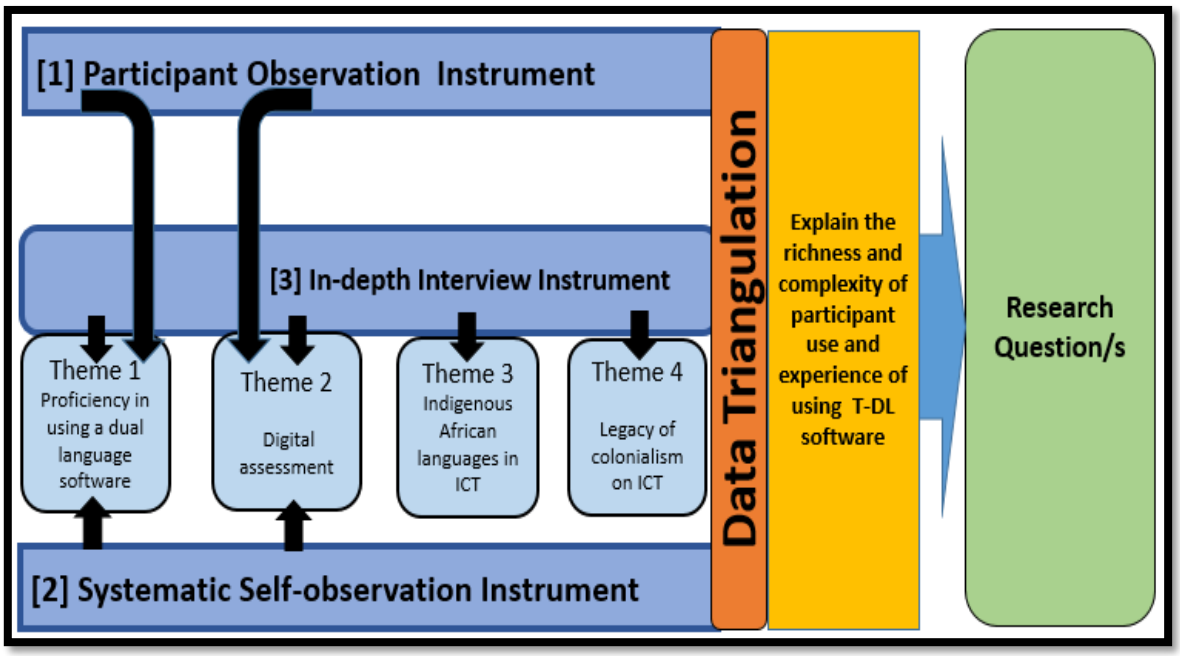

Figure 4.21: Triangulation of data

4.11 Trustworthiness

Evaluating the trustworthiness of research is essential if the results are to be implemented and incorporated into a real-life context (Seale & Silverman, 1997). An essential element that informs the trustworthiness of qualitative research is the veracity of the research. Trustworthiness in qualitative research consists of four key components: Credibility, transferability, dependability, and confirmability (Noble & Smith, 2015). These four components are unique to qualitative research (Krefting, 1991). Hammarberg, Kirkman, and De Lacey (2016) also argued that the evaluation of qualitative research cannot be based on the same criteria used to evaluate quantitative research. Trustworthiness in the context of qualitative research refers to the degree of confidence in the collection and interpretation of the data (Connelly, 2016; Seale & Silverman, 1997). Korstjens and Moser (2018) further defined trustworthiness as the degree of confidence in the methods used to collect the data and the process to interpret the data with the aim to ensure the quality of a study.

Lincoln and Guba (as cited in Connelly, 2016) and Korstjens and Moser (2018) identified the key criteria that support the trustworthiness of qualitative research as:

- **Credibility**: The confidence that can be placed in the truth of the research findings.
- **Transferability**: The degree to which the results of qualitative research can be transferred to other contexts or settings with other respondents.
- **Dependability**: The stability of the research findings over time.
- **Confirmability**: The degree to which the findings of the research study could be confirmed by other researchers.
- **Reflexivity**: The process of critical self-reflection about oneself as researcher (own biases, preferences, preconceptions) and the research relationship (relationship to the respondent).

4.11.1 Credibility

Positivist researchers place great emphasis on internal validity, in which they strive to ensure that their research measures or tests what is actually intended (Connelly, 2016). According to Shenton (2004), the equivalent concept in the qualitative domain is the concept of credibility, which attempts to understand how similar or consistent the findings are with reality. In order to strive for credibility of the research, a researcher can attempt to achieve the following criteria in the research:

- Using well-established research methods
- Adopting triangulation by using different data collection strategies
- Adopt strategies to ensure honest feedback from participants
- Random sampling of research participants
- Peer review of various aspects of the research project
- Collection of a detailed description of the phenomenon under investigation
- A detailed study of existing literature or evidence of previous research findings

As the ILS intervention was unique and breaking new ground within the South African educational context, it was imperative for the study to ensure a high level of credibility. As part of the design to strive for credibility, I attempted to meet some of the criteria identified. I decided to use IDIs and two forms of observation in this research, which would allow the voice of the teachers to be heard. To further ensure credibility, data

triangulation was used. This is supported by Korstjens and Moser (2018), who maintained that the use of different methods cooperatively compensates for their individual limitations and exploits their benefits.

The teachers who participated in this study were not compelled to participate and could withdraw at any time. This provision greatly contributed to the credibility of the ILS since the teachers had the right to quit at any time, meaning that there was a higher degree of probability that the teachers would give true responses. The random sampling of participants would have been the ideal sampling approach to support the credibility; however, as explained in Section 4.4.2, the use of purposive sampling was the only option because of the low penetration of ICT in schools in the Madibeng District. An important criteria to strive for research credibility was to ensure the minimisation of researcher bias. At all phases of the study, I engaged with and consulted with my supervisor, teachers, district officials, system designers, translators and senior researchers. All the criteria alluded to are essential for attaining credibility of the ILS intervention.

4.11.2 Transferability

As has been stated many times in this thesis, the ILS intervention was unique within the South African educational context, and as such, the study and the results should be informative and beneficial so that future studies on the localisation of computer software into an Indigenous language could be replicated not only in South Africa but anywhere in the world where the use and status of Indigenous languages need attention.

However, Shenton (2004) and Connelly (2016) both disputed this point and maintained that qualitative research is by nature very contextually applicable and thus it is a challenge to replicate a contextual phenomenon or specific human experiences. However, Anney (2014) and Gunawan (2015) argued that transferability is possible in qualitative research if the researcher employs purposeful sampling and includes a thick description of the study phenomenon to provide the audience with a proper understanding of the phenomenon so that it could be contextualised by those interested in replicating the study in their context. In the context of this research, transferability can pose a challenge because there are 11 official languages in South Africa and some of the Indigenous languages have multiple dialects. So to generalise

the research results would be inappropriate. However, I attempted to provide a detailed or thick description of the research so that if ever a similar research was to be attempted, the audience would have a detailed description of the research process.

4.11.3 Dependability

The issue of dependability in qualitative research rests on the assumption that if the research were repeated in the same context with the same methods and with the same teachers, similar results would be obtained (Connelly, 2016). Korstjens and Moser (2018) suggested that in order to address the issue of dependability within a research project, the researcher must ensure that a detailed audit trail is kept. This information would enable future researchers to repeat the work, if not necessarily to gain the same results. In relation to the ILS intervention, I attempted to report in the greatest detail all aspects of this project, from the pilot study and its findings to the sampling and a detailed description of the localisation of the software right to the methodology and the manner in which the data was collected as well as its capturing and analysis process. This depth and detail of the study would surely be sufficient for this study or a similar study to be repeated.

4.11.4 Confirmability

Confirmability refers to the degree to which the results of a research could be confirmed or corroborated by other researchers (Anney, 2014; Shenton, 2004). The gist of this concept is that the findings and its interpretation should be derived from the data and not based on the bias or attitude of the researcher. Krefting (1991) stated that reflexivity or the audit trail can be used to ensure the confirmability of the research. The audit trail is the most commonly used technique to establish confirmability, and Anney (2014) explained that the audit trail is a technique that a qualitative researcher adopts by detailing the process of data collection, data analysis, and interpretation of the data. Records are made of topics that the researcher may deem as being unique and interesting during the data collection. In relation to the ILS intervention, the detail and depth in which the study was described and explained greatly ensures that the study can be corroborated by other researchers.

4.12 Ethical Considerations and Bias

4.12.1 Ethical considerations

Research can take place at an individual, societal and global level, and as such, it is essential that research be morally and legally acceptable (Saunders et al., 2009). There are many facets when it comes to conducting research, from research methods, to data collection, to data analysis, and each process has its own unique ethical issues (Brevik, 2013).

Cohen et al. (2007) emphasised the dilemma faced by all researchers to find the middle ground between finding the truth and protecting the rights of the participants while seeking the truth. Saunders et al. (2009) took this point further by stating that many researchers in their haste to collect data neglect issues of ethical research practice. The data collected from research can only be considered valid if it is collected in an honest and ethical manner (Walliman, 2011). This point is reinforced by Creswell (2007), who stated that in order for data to be collected in an ethical manner, the researcher must ensure that the code of ethics is adhered to from the start of the research. Johnsson, Eriksson, Helgesson, and Hansson (2014) supported this point, contending that research must adhere to ethical guidelines and ethical codes to ensure that the research is always very respectful and honest when it comes to data collection and anonymisation, data analysis, and reporting and presenting results.

The ILS intervention was part of a larger study and ethical clearance was provided by the HSRC, and the National DBE and the North West Department of Education provided permission for the study to take place (Appendix N). I obtained research approval from the Ethics Committee in Education of the Faculty of Humanities of the University of the Witwatersrand (2018ECE017D; Appendix I). To respect the privacy of the teachers, all participants were given a pseudonym. I allocated pseudonyms instead of participant numbers to create and maintain some level of personal human experience by ensuring the participants were not just a number but was an entity with a name. During the course of segmenting the text in the data, labelling these segments with codes, and looking at frequencies, I attempted to act with honesty and integrity to ensure that I sustained a level of rigour to the research. The results were reported in a truthful manner and all attempts were made to not leave anything out, add anything or alter any aspect of the data.

4.12.2 Managing bias

Identifying, understanding and managing bias in research is vital when doing research. Bias can exist in all forms of research and across research designs and is virtually impossible to eradicate. Research bias can occur at each stage of the research process and research bias will eventually influence the validity and reliability of study results (Pannucci & Wilkins, 2010; Smith & Noble, 2014; Wa-Mbaleka, 2017). In qualitative research, the difficulty lays in ensuring real objectivity since the intrusion of the researcher's biases is inevitable (Shenton, 2004). Individual researchers bring to the research their experiences, ideas, preconceptions and personal philosophies, and if these are accommodated for in advance, it nullifies possible research bias.

In the ILS intervention, all attempts were taken to counter the issue of researcher bias and the following actions were taken to counter the issue of bias: The transcription of the interview data was done by a reputable external source; the triangulation of multiple data sources was used; and the findings were reviewed with peers through presenting at an international conference.

4.13 Summary

The research process used in this research study was based on a number of assumptions that all emanate from the research onion as proposed by Saunders et al. (2009). The research philosophy adopted in this research was interpretivism, which allowed for an ontologically subjective and socially constructed view of reality with rich descriptions of the social context and phenomena. The research approach used was inductive because themes and patterns emerged from the data collected and analysed from the various sources. In this study, I used a simple methodological qualitative research that took the form of a case study. This helped develop a richer, more contextualised, and more authentic interpretation of the phenomenon under study by virtue of its ability to capture a rich array of contextual data.

Due to the uniqueness of the ILS intervention, a pilot study was conducted in a context similar to the identified research environment. During the pilot study, the training programme as well as the various data collection instruments were tested. The findings from the pilot study then informed the modification of the research method and the data collection instruments. In terms of methodology, the research was

classified as a longitudinal study with seven teachers. The participants were selected using purposeful sampling. All participants attended a compulsory software training session that formed part of the research methodology.

The collection of data was done using three data collection instruments, the PO instrument, the SSO instrument and the IDI instrument. Each of these instruments were administered twice to each of the participants at the two stages of data collection (English T-DL stage and Setswana T-DL stage). All data collection instruments and transcripts were anonymised by allocating pseudonyms to all teachers. During the analysis of the various data sets, the IDI instrument and PO instrument were first coded and then refined into themes. The SSO data was analysed using frequencies and then converted into bar charts for easy interpretation. In an attempt to build in trustworthiness and to manage ethical conduct and bias, I included descriptions of the results by using triangulation (for credibility and confirmability), using rich, thick description and practising reflexivity for confirmability and to help manage bias. To add to the management of bias, I attempted to keep my identity separate from the research process and findings.

To ensure high ethical standards, I put the following actions into the place: Teachers completed consent forms that allowed them to withdraw at any point of the research; all data was anonymised; and as the researcher, I acted with honesty and integrity, reporting fully and comprehensively on the results.

CHAPTER 5
PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

To control a people, you must first control what they think about themselves and how they regard their history and culture. And when your conqueror makes you ashamed of your culture and your history, he needs no prison walls and no chains to hold you.

(John Henrik Clarke ,1991)

5.1 Introduction

Policy and practice decisions, especially those in education, are informed by data derived from both qualitative and quantitative research. The results from this type of research are useful as it often describes the real-life context within which policies and practice must be implemented (Anderson, 2004). As such, the ILS intervention adopted a qualitative research approach to investigate the influence that TARMII, a dual-language (T-DL) assessment software, would have on the user experience of the teachers and their attitude towards the use of Setswana, an Indigenous African language, in the field of ICT.

The purpose of this chapter is to present the data and the analysis of the data obtained from the ILS intervention. The research was conducted amongst seven Grade 3 teachers from the North West province in South Africa. As evident from the literature reviewed in Chapter 2, there is a dire lack of empirical research on the use of African languages in educational software within the South African context. As such, I hope that this research and the results derived from it will serve as an impetus for future research on the use of Indigenous African languages within the ICT space in South Africa and Africa at large.

My research was guided by the following main research question:

> How does the use of Setswana as the language of the TARMII dual-language online assessment software influence Setswana teachers' software experience and their attitude towards the use of African languages in ICT?

The data collection process (Section 4.7) occurred in two stages and used three data collection tools, as reflected in Figure 5.1. During the first stage, three sets of data were collected from the teachers as they engaged with and used the English version of the T-DL software. The second stage of data collection took place a month later and

saw the same three data collection tools being administered to the same teachers, as they engaged and used the Setswana version of the T-DL software.

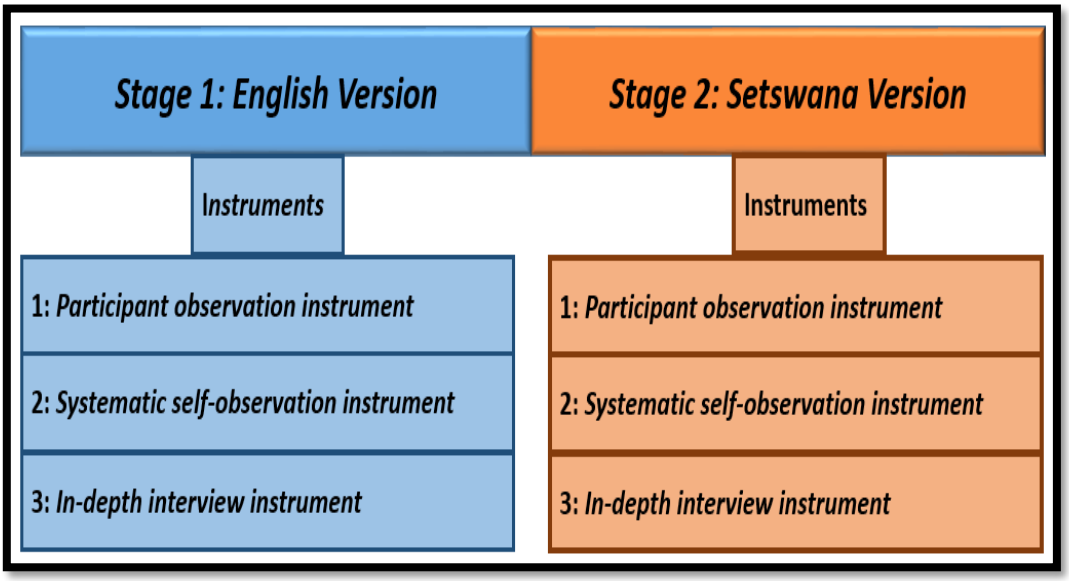

Figure 5.1: Data collection stages and instruments

5.2 Data Presentation

The data and the results presented in this thesis are unique because of the nature of this study as it focused on the use of an Indigenous African language in educational software within the South African educational context.

The data collected in this research will be presented in four sections, these include background information, the SSO data, the PO data and the IDI data.

Participants in this study were given pseudonyms in order to give them personality, in line with Lahman et al. (2015) rather than an impersonal label as Teacher 1 and Teacher 2 (Section 1.9). In the subsequent sections, pseudonyms will be used to elaborate on and present the findings.

5.3 Section A: Teachers Background Information

All seven teachers were female and were Setswana first language speakers. Four of the seven teachers fell in the 41–50 year age bracket, two in the 51–60 year age bracket, and just one in the 31–40 year age bracket.

Three of the seven teachers had between 21 and 30 years teaching experience, two had between 16 and 20 years teaching experience, and two teachers had between 1 and 9 years teaching experience.

With regards to their computer use at school (Table 5.1), four teachers indicated that they do not use a computer at school and three indicated that they use it between 1 and 3 hours daily at school. This low use of computers at primary school is related to the fact that access and use of computers is not seen as a priority for teachers in the Foundation Phase.

Table 5.1: Computer use at school

Hours computer use at school	n	%
not at all	4	57
1 to 3 hours	3	43
4 to 8 hours	0	0
9 to 11 hours	0	0
more than 11 hours	0	0
	7	100

Three teachers indicated that they do not use a computer at home, while another three indicated that they use it between 1 and 3 hours daily, and one teacher indicated that she uses a computer between 4 and 8 hours daily at home (Table 5.2).

Table 5.2: Computer use at home

Hours computer use at home	n	%
not at all	3	43
1 to 3 hours	3	43
4 to 8 hours	1	14
9 to 11 hours	0	0
more than 11 hours	0	0
	7	100

From Table 5.1 and Table 5.2 the overall use of computers by the teachers is fairly low, both at home and school. This factor will play an important role in their acceptance of and attitude to using computers for teaching.

Four of the seven teachers indicated that they had attended ICT training in the last five years and three indicated that they had not attended any ICT training. From those that attended training, two indicated that they had attended training in the MS Office suite

and three indicated that they had training in email and the internet, while only one teacher indicated that she had attended training in SA-SAMS (a school management software supplied to all South African schools by the DBE).

The teachers were asked about their choice of language use when it came to using social media platforms (Table 5.3). English was the preferred language of use on all three platforms (Email, SMS and WhatsApp) at 43%, however, some teachers (29%) indicated that they use Setswana to communicate across all three platforms.

Table 5.3: Preferred language for social media

Social media platform	Language used	n	%	
Email	English	3	43	
	Setswana	2	29	
	No response	2	29	100
SMS	English	2	29	
	Setswana	2	29	
	No response	3	43	100
WhatsApp	English	3	43	
	Setswana	2	29	
	No response	2	29	100

5.4 Section B: Systematic Self-Observation Data

This section presents the data collected from the SSO instrument. The data represents the teachers self-reporting experiences as they engaged and completed the various pre-set activities within each of the four software functions for both the English and the Setswana versions of the software.

During the two stages of data collection, each teacher had to rate their ease-of-use experience for every activity they completed when using the two versions of the T-DL software. The rating scale (Figure 5.2) consisted of a seven-level ease-of-use scale that was based on the System Usability Scale, as was discussed in Chapter 4 (Section 4.6.1).

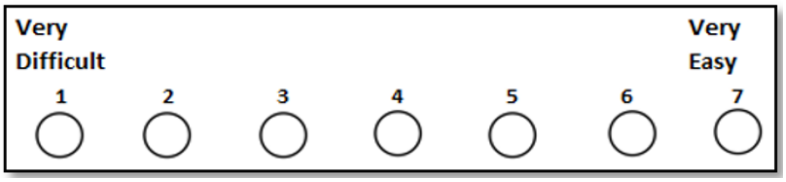

Figure 5.2: Rating scale

The rating scale ranged from a value of 1 (*very difficult*) to 7 (*very easy*). As the teachers completed an activity, they recorded their ease-of-use experience at the completion of the activity. Once they had completed all the activities in Stage 1 (English), they followed the same process using the same tool in Stage 2 (Setswana), which took place almost one month later due to reasons discussed in Chapter 4 (Section 4.7.1). At the end of the data collection process, the responses from each teacher were captured and summarised onto a frequency table on a MS Excel spreadsheet, as shown in Table 4.7. Each of the four software functions with its respective activities for both stages constituted a single table. A column chart, as exampled by Figure 4.17, was then generated from the frequency table. What follows is a presentation of the various findings that emerged from the data collected using the SSO instrument based on the completion and the ease-of-use experience rating of the various activities within the four functions as reflected in Figure 5.3

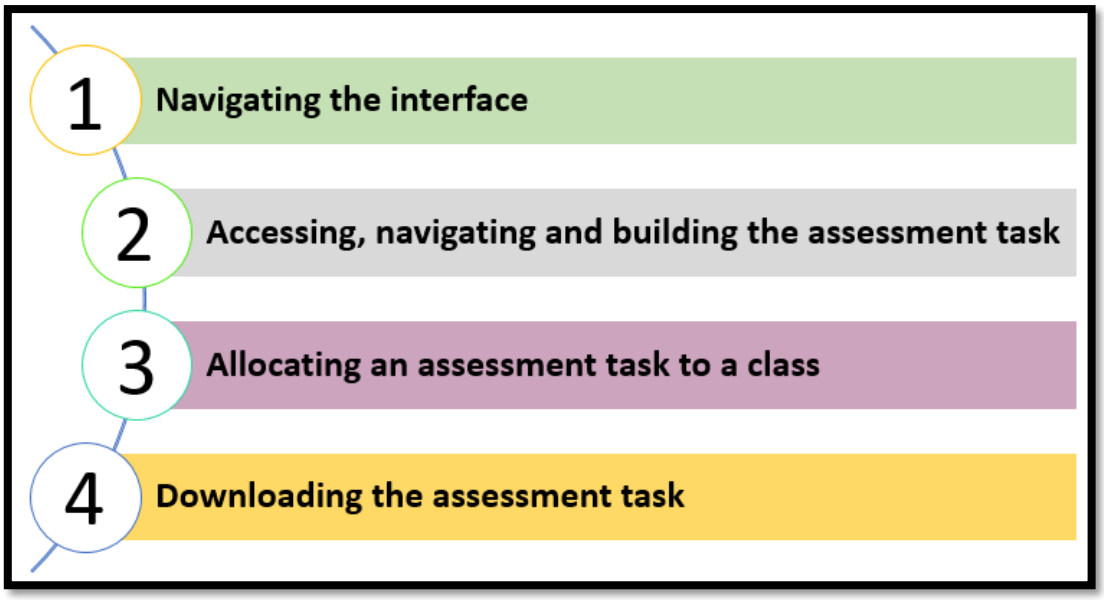

Figure 5.3: Functions of the T-DL software

5.4.1 Function 1: Navigating the interface

The purpose of this function was to determine how the teachers perceived the ease-of-use experience when navigating the T-DL software user interface. The ability for any user to navigate the software with ease is a critical aspect that many software designers agree either attracts or dissuades the user from using the software (Norman, 2013). This function consisted of seven activities that the teachers had to complete (Figure 5.4).

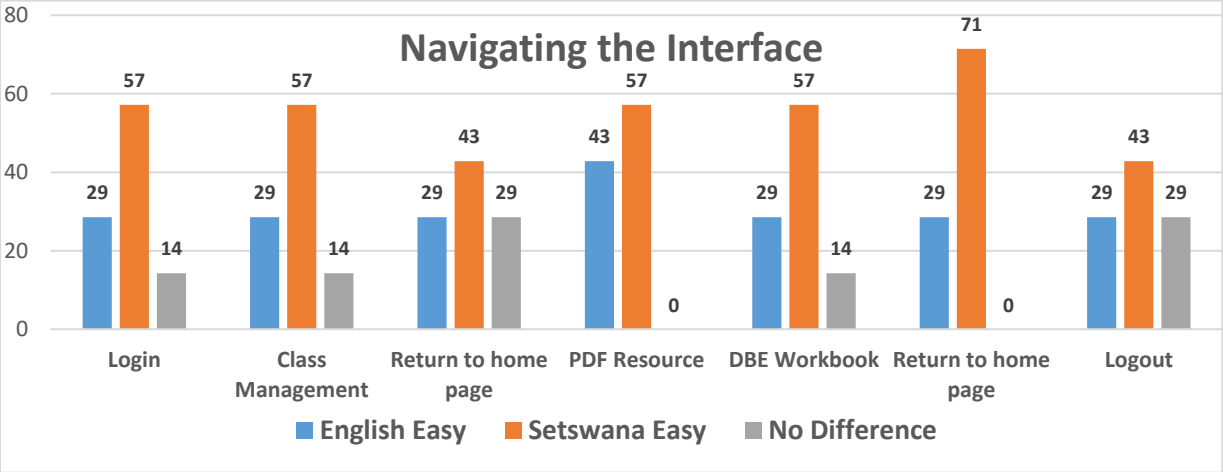

Figure 5.4: Navigating the interface

The data collected reflected how the teachers rated their ease-of-use experience as they engaged with the seven activities in both language versions of the software. The findings presented and discussed below must be viewed in conjunction with Figure 5.4.

5.4.1.1 Activity 1: Login to T-DL software

In this activity the teachers were required to access their T-DL online accounts by logging in with their usernames and passwords. From the total number of teachers, 57% indicated that they experienced this activity easier when they used the Setswana version of the software, 29% experienced the activity easier when using the English version, and 14% indicated that the ease of use of the Login process was the same in both versions.

5.4.1.2 Activity 2: Class management

In this activity the teachers were required to access the class management facility. They had to create a class list of by typing in the names and personal details of each learner and then register the class on the online T-DL platform. From the total number of teachers, 57% indicated that they experienced creating the class list activity easier when they used the Setswana version of the software, 29% experienced that the class list activity was easier using the English version, and 14% indicated that the ease of use of the Login process was the same in both versions.

5.4.1.3 Activity 3: Return to Home Page

Once the class list was completed, the teachers were required to return to the T-DL Home Page. From the total number of teachers, 43% experienced accessing the Home Page easier on the Setswana version, 29% experienced the activity to access the Home Page easier in the English version, and 29% indicated that they experienced no difference in the ease of use to access the Home Page in both versions.

5.4.1.4 Activity 4: PDF resource

In this activity, the teachers were required to access the PDF resource bank. This bank contains a series of PDF resources to support teachers. For this research, both English and Setswana resources were made available to the teachers. From the total number of teachers, 57% indicated that they experienced accessing the PDF resource activity easier when using the Setswana version and 43% experienced the activity easier when using the English version.

5.4.1.5 Activity 5: DBE workbook

In this activity, the teachers were required to access the DBE's official workbook. The workbook is vital to South African teachers as it provides a variety of activities and master copy sheets for teachers to use. From the total number of teachers, 57% experienced accessing the DBE workbook activity in the Setswana version easier, 29% experienced accessing the workbook activity in the English version easier, and 14% indicated that there was no difference in the ease of use to access the workbook in both versions.

5.4.1.6 Activity 6: Return to Home Page

The next activity required the teachers to return to the Home Page. From the total number of teachers, 71% experienced accessing the Home Page activity easier using the Setswana version and 29% experienced accessing the Home Page in the English version easier.

5.4.1.7 Activity 7: Logout

The final activity in this function required the teachers to logout from the T-DL online platform. From the total number of teachers, 43% experienced the logging out activity easier when using the Setswana version, 29% experienced the logout activity easier in the English version, and 29% indicated that they experienced no difference in the ease of use to logout from both versions.

5.4.2 Function 2: Accessing, navigating, and building the assessment task

The purpose of this function was to get the teachers to build an assessment task using the T-DL software test-builder and the item bank function. This function consisted of nine activities that the teachers had to complete to successfully build an assessment task (Figure 5.5).

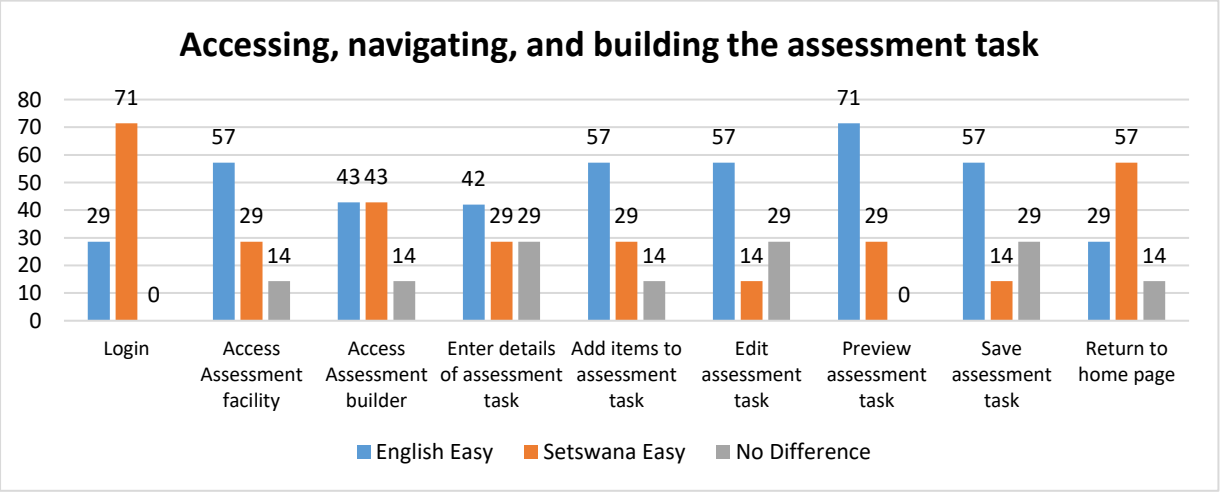

Figure 5.5: Accessing and building the assessment task

The data collected from these activities reflected how the teachers rated their ease-of-use experience as they engaged with the nine activities in both language versions of the software. The findings presented and discussed below must be viewed in conjunction with Figure 5.5.

5.4.2.1 Activity 1: Login

In order for the teachers to start using the assessment builder, they had to access their own T-DL online accounts by logging in with their usernames and passwords. From the total number of teachers, 71% indicated that they experienced this activity easier when they used the Setswana version of the software and 29% experienced the activity easier when using the English version.

5.4.2.2 Activity 2: Access assessment facility

In this activity the teachers were required to access the T-DL's assessment facility. This facility allows a user to create and populate the administration component of the assessment to be built, including date, grade and test instructions to the students. From the total number of teachers, 57% experienced accessing the assessment facility activity easier in the English version easier, 29% experienced accessing the assessment facility in the Setswana version easier, and 14% indicated that there was no difference in the ease of use to access the assessment facility in both versions.

5.4.2.3 Activity 3: Access assessment builder

Once the assessment facility was completed, the teachers needed to access the assessment builder. The assessment builder allows the teachers to start constructing the assessment framework. From the total number of teachers, 43% experienced this activity as easier in English, 43% experienced it as easier in Setswana, and 14% indicated that there was no difference in the ease-of-use to access the assessment builder in both versions.

Activity 4: Enter details of assessment task

In this activity, the teachers were required to enter the details of the assessment framework. This facility allows the teachers to create and populate the assessment framework for the assessment to be built, this includes number of items[8], maximum score, school term, assessment duration, spread of cognitive level and spread of question difficulty. From the total number of teachers, 42% experienced this activity easier when using the English version, 29% experienced using the assessment facility

[8] In the context of item banks, an item refers to a test question.

easier in the Setswana version, and 29% indicated that there was no difference in the ease of use to access the assessment details facility in both versions.

5.4.2.4 Activity 5: Add items to assessment task

In this activity, the teachers were required to select items from the item bank and then add these items to their assessment framework. From the total number of teachers, 57% experienced selecting items from the item bank and adding it to the assessment task easier when using the English version, 29% noted that the activity was easier when using the Setswana version, and 14% indicated that there was no difference in the ease of use to select and add items to the assessment framework in both versions.

5.4.2.5 Activity 6: Edit assessment task

Once the teachers have built their assessment task, they should be able to edit the assessment. This activity focused on viewing the teachers as they edited the assessment by adding or removing items or by changing the date and any other administrative assessment detail. From the total number of teachers, 57% experienced editing the assessment task easier when doing it in the English version, 14% experienced this activity easier in the Setswana version, and 29% indicated that there was no difference in the ease of use to edit the assessment task in both versions.

5.4.2.6 Activity 7: Preview assessment task

This activity allows the teachers to preview the assessment task using the T-DL preview facility. By previewing the assessment task, the teachers will be able to determine if any changes are required before the assessment task is saved. From the total number of teachers, 71% experienced previewing of the assessment task easier in the English version and 29% experienced this activity easier in the Setswana version.

5.4.2.7 Activity 8: Save the assessment task

This activity required the teachers to save or publish their assessment task onto the T-DL online platform. This activity is important since saving or publishing the assessment task allows the teacher, firstly, to allocate the task to a class so that the assessment can be taken online on any mobile device, and secondly, to save and

bank the assessment task to a national repository of ready-made assessments that could be shared among teachers in all nine province in South Africa once the T-DL software is rolled out nationally. From the total number of teachers, 57% experienced saving the assessment task easier in the English version, 14% experienced this activity easier in the Setswana version, and 29% indicated that there was no difference in the ease of use to save the assessment task in both versions.

5.4.2.8 Activity 9: Return to Home Page

Once the assessment task has been saved or published, the teachers were required to return to the Home Page. From the total number of teachers, 57% experienced accessing the Home Page easier when using the Setswana version, 29% experienced the activity to access the Home Page easier in the English version, and 14% indicated that they experienced no difference in the ease of use to access the Home Page in both versions.

5.4.3 Function 3: Allocating an assessment task to a class

One of the key functions of the T-DL software is its facility to allow students to write an assessment online on any smart mobile device. As such, it is imperative that the teacher is familiar with the steps to allocate an assessment task to the correct class or group of students. This function consisted of four activities that the teacher had to complete successfully to allocate an assessment task to a class (Figure 5.6)

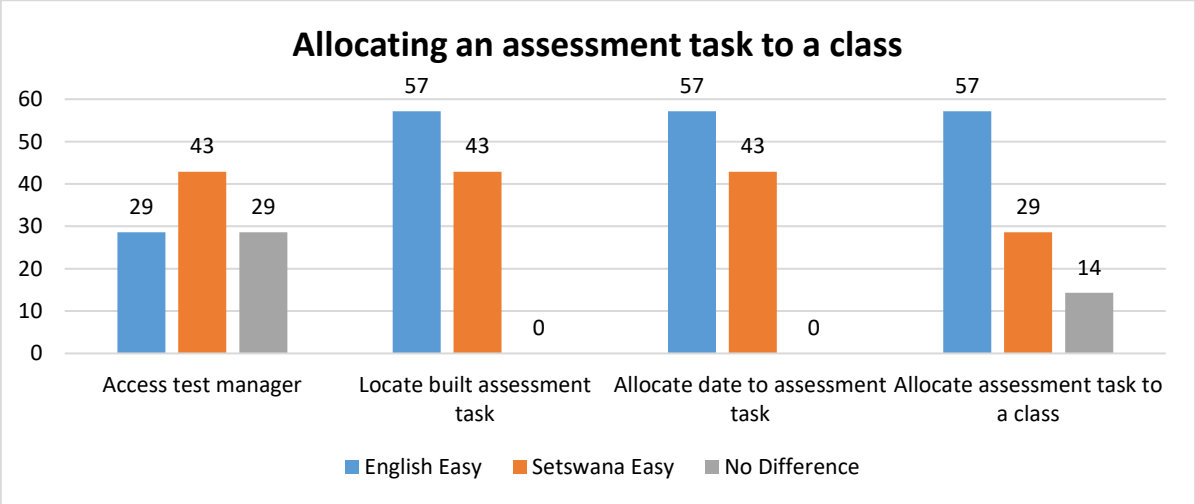

Figure 5.6: Allocating an assessment task to a class

The data collected reflected how the teachers rated their ease-of-use experience as they engaged in the four activities in both language versions of the software. The findings presented and discussed below must be viewed in conjunction with Figure 5.6.

5.4.3.1 Activity 1: Access test manager

In this activity, the teachers were required to navigate the T-DL software and access the test manager facility. The test manager allows for the management of all administrative aspects of managing the assessments. From the total number of teachers, 43% indicated that accessing the test manager was easier when using the Setswana version, 29% experienced this activity easier using the English version, and 29% indicated their experience in both versions was the same.

5.4.3.2 Activity 2: Locate built assessment task

This activity required the teachers to locate the assessment task they had just built within the test manager facility. This activity is important as it provides the teachers with the ability to mine the software to locate past assessment tasks. From the total number of teachers, 57% noted that their experience was easier when using the English version and 43% experienced this activity easier in the Setswana version.

5.4.3.3 Activity 3: Allocate date to assessment task

This activity allows the teachers to nominate a date and time when the assessment is released to students, who could then take the assessment online on any mobile device. This activity required the teachers to select from the calendar a date and time they would want the assessment to be released for students. From the total number of teachers, 57% indicated that they found the activity easier when using the English version and 43% experienced this activity easier in the Setswana version.

5.4.3.4 Activity 4: Allocate assessment task to a class

This activity allows the teachers to allocate an assessment task either to a single or to multiple classes. From the total number of teachers, 57% experienced the activity easier when using the English version, 29% experienced this activity easier in the Setswana version, and 14% indicated their experience in both versions was the same

5.4.4 Function 4: Downloading the assessment task

The purpose of this function was to allow teachers to download the assessment task that was auto-generated by the T-DL software as a PDF file output. This function consisted of six activities that the teacher had to complete in order to download an assessment (Figure 5.7).

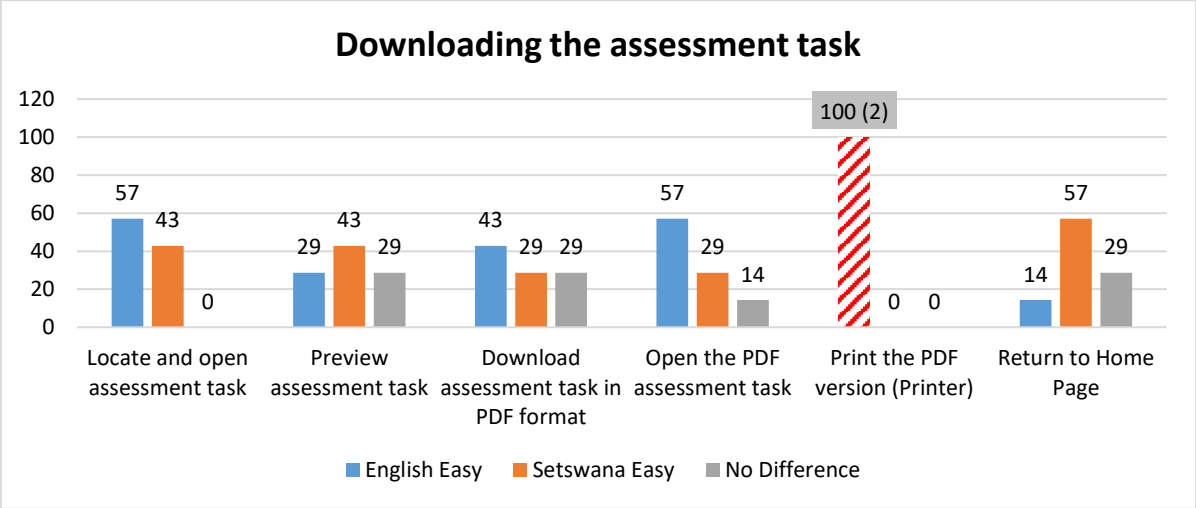

Figure 5.7: Downloading the assessment task

The data collected reflected how the teachers rated their ease-of-use experience as they engaged in the six activities in both language versions of the software. The findings presented and discussed below must be viewed in conjunction with Figure 5.7.

5.4.4.1 Activity 1: Locate and open assessment task

This activity required the teachers to locate the assessment task they had built and then open it in the T-DL test preview mode. From the total number of teachers, 57% experienced locating and opening easier while using the English version and 43% experienced the same activity easier when using the Setswana version.

5.4.4.2 Activity 2: Preview assessment task

This activity required the teachers to open the T-DL preview facility. Using this facility, they could view the assessment task prior to printing. From the total number of teachers, 43% experienced the activity easier on the Setswana version, 29% experienced this activity easier using the English version, and 29% indicated that they

experienced no difference in the ease of use to preview the assessment task in both versions.

5.4.4.3 Activity 3: Download assessment task in PDF format

This activity required the teachers to download the assessment task in a PDF file format. From the total number of teachers, 43% indicated that they experienced the activity easier when using the English version, 29% experienced this activity easier using the Setswana version, and 29% indicated that they experienced no difference in the ease of use to download the PDF file.

5.4.4.4 Activity 4: Open the PDF assessment task

This activity required the teachers to locate their downloaded PDF assessment file and to open the file using ADOBE reader. From the total number of teachers, 57% experienced the activity easier when using the English version, 29% experienced this activity easier in the Setswana version, and 14% indicated that they found no difference in the ease of use to open the PDF file.

5.4.4.5 Activity 5: Print the PDF version (printer)

This activity required the teachers to print the PDF version of their assessment task. However, due to logistics and issues of access at the Madibeng District offices, this activity was completed by only two teachers. For this activity the two teachers were given temporary access to the district office network printer. These teachers were then asked to complete this activity. Both the teachers indicated that it was easy following the print instructions on both the versions since the instructions of the printer software was still in English, hence the 100% response for the English version.

5.4.4.6 Activity 6: Return to Home Page

Once the assessment task was printed, or not printed in the case of the teachers who could not print, they were required to return to the T-DL Home Page. From the total number of teachers, 57% experienced accessing the Home Page activity easier in the Setswana version, 14% experienced accessing the Home Page easier in the English version, and 29% indicated that they experienced no difference in the ease of use to access the Home Page in both versions.

5.5 Section C: Participant Observation Data

An important aspect in the use and acceptance of any new software or online platform is the ability and need for the user to find the navigation of the interface easy. In the context of this study, this aspect was of great importance; hence it was important to observe and understand how the teachers interacted and experienced navigating the English and Setswana versions of the T-DL software. Data collected from the PO process comprised of the data collectors' observation notes as well as the general comments they made in relation to the teachers completing the series of activities within the four functions. The data presented in this section will be merged from both stages of the data collection (English and Setswana) and will cover the four software functions shown in Figure 5.3, which are:

- **Function 1**: Navigating the interface
- **Function 2**: Accessing, navigating, and building the assessment task
- **Function 3**: Allocating an assessment task to a class
- **Function 4**: Downloading and printing the assessment task

In this section, the PO data will be presented within the context of following themes:

- Teacher ICT skills
- ICT used for assessment
- Ease of navigating an Indigenous GUI

5.5.1 Theme 1: Teacher ICT skills

The data presented in this theme is derived from the data collectors' notes that were made on the observations and comments of the teachers as they completed the set of activities specified under Functions 1 and 4. Both these functions consisted of a series of activities that required the teachers to navigate through the T-DL software, and then to access the download and print facility of the software.

5.5.1.1 Function 1: Navigation of the software

The following findings were noted from the observation notes and comments as reflected in Table 5.4. Some of the teachers (Lydia, Thandi & Molly) found navigating the English version of the software simple. However, there were certain instances

where Thandi and Molly struggled with accessing the student assessment portal. Both these teachers requested assistance to locate the command buttons on the English GUI. Both Jose and Elize experienced problems working on the English GUI, which was assumed could have been attributed to their lack of basic computer skills; however, Jose and Elize seemed a bit more comfortable when using the Setswana GUI but their limited use and lack of ICT skills was noticeable even when using the Setswana version. The lack of ICT skills greatly increased the level of frustration among some teachers, especially Rebecca. While working on the English GUI, Rebecca became frustrated due to her lack of ICT skills. When she started working on the Setswana GUI, she still showed signs of frustration but later added that she would rather use the English version. Lydia was very comfortable using the English and Setswana versions and found navigation very simple. The general observations note that the teachers were fairly comfortable using the English and Setswana GUI and comment on their satisfaction with the level of translation.

Table 5.4: Observation notes for Theme 1: Function 1

Function & Teacher	Observation Notes
Function 1: Thandi	**English version**: She was confident using the version but experienced some difficulty working in management facility. I needed to intervene.
	Setswana version: She was confident navigating the interface, but experienced problems accessing the PDF and DBE resource facility. She eventually found the button with no help. She was happy with the interface translations.
Function 1: Rebecca	**English version**: She was initially slow grasping the navigation due to her lack of keyboard and mouse skills.
	Setswana version: Seemed a bit frustrated. She seemed to be very confused, and then she indicated that she preferred working on the English interface rather than the Setswana interface.
Function 1: Molly	**English version**: She had problems accessing the function. She managed to open the site easily but had problems logging in. She then asked for assistance.
	Setswana version: She seemed comfortable with it. She complimented the translation and said it made it easy for her to use and read the T-DL commands. She said she felt proud of seeing her language being used.
Function 1: Lydia	**English version**: Teacher is very computer literate and navigates easily in this version. Started to navigate other functions; I allowed her to do, but reminded her that she needed to access and rate her use while navigating the interface.
	Setswana version: She went through very easily. According to her, the translated commands were accurate and it explained what she had to do. She also volunteered to assist in future with translations. She also mentioned that she was very shocked and happy to see Setswana on the software. She never knew that Setswana can be used in computers
Function 1: Jose	**English version**: She initially seemed confused and minimised the T-DL browser window. She seemed stressed. I gave her some guidance. I reassured her that we all started where she is now. She is slow but doing the navigation.
	Setswana version: She asked about the term PDF and what was the plans we had to translate the terms. She worked easily in the Setswana but said that we

Function & Teacher	Observation Notes
	must be aware that in the North West province, there were regional differences of Setswana, and we must remember that when we translate.
Function 1: Evelyn	**English version**: She had initial problems using the version, but this was her browser issue. This was resolved. She is a confident user. She managed to access all functions easily in this version.
	Setswana version: She worked very easily through it. She said translation was very good and made it easy for her to read and follow. She queried why some terms were not translated.
Function 1: Elize	**English version**: Her computer skills are below par. She experienced it difficult to use external mouse on laptop. She seemed to be shaking, but she did not seem nervous. She was asking questions. She eventually found her way around and also found a shortcut, which I did not tell them about. She was impressed when I told her that I never realised it was there.
	Setswana version: She seemed more comfortable. She managed the activities without any assistance, even though she was slow. She said the level of translation made it easy. She asked why some terms were not translated.

5.5.1.2 Function 4: Downloading and printing the assessment task

The following findings were noted in relation to the teachers completing the various activities in this function from the observation notes and comments as reflected in Table 5.5. Thandi was the only teacher that seemed to be fully comfortable completing Function 4 activities on the English version. Rebecca worked slowly completing these activities and she requested assistance at certain times, but managed to complete her activities even though she seemed nervous. Both Molly and Evelyn showed signs of frustration when they were required to locate the command to open the PDF reader on the English GUI. The observations were that all the teachers worked a bit easier completing the activities in the Setswana version. Jose and Evelyn indicated that reading the Setswana commands made it a bit easier for them. However, it was observed that both Rebecca and Molly took time to read the Setswana commands and then process what they read before they activated the correct command button. According to Molly, she took long simply because she had to think first what the translated Setswana command requested, and so she thought about the command in English and then, using that frame of reference, she activated the Setswana comment. Molly and Jose commended the accuracy of the translation, which according to them made the navigation on the Setswana GUI easier.

The next activity in this function, required the teachers to print the PDF version of the assessment. Due to logistics and issues of access at the circuit office, access to the network printer was only granted to two teachers. Both Thandi and Jose, who were given access to the district's network printer, found the print options very easy. The

printer software still had the print options commands in English, so even though they attempted to print in Setswana, the printer interface was still in English.

Table 5.5: Observation notes for Theme 1: Function 4

Function & Teacher	Observation Notes
Function 4: Thandi	**English version**: Again, she seemed to work easily through the system. She did, however, have problems with the PDF reader.
	Setswana version: She found the activity easy but suggested that we should not try to translate PDF, it will never work in Setswana. The printing part was easy, but had to be assisted to insert the network password and user details.
Function 4: Rebecca	**English version**: She managed to download the assessment, but I had to assist her through the entire process. She seemed nervous.
	Setswana version: She said she felt better, but she said when she was working on the Setswana version, she had to think about the translated terms first. So in other words, thought in English and read the Setswana commands.
Function 4: Molly	**English version**: She had a problem downloading the PDF and became frustrated as she could not locate the PDF reader.
	Setswana version: She seemed to be comfortable with the commands and took time to read it first. She said she had to think about the term first before she performed the actions. She indicated that the commands in Setswana were well translated.
Function 4: Lydia	**English version**: She managed to access the download facility. She managed to download the PDF easily in both versions following the instructions.
	Setswana version: She worked easily in the Setswana but said that we must be aware that in the North West province, there were regional differences of Setswana, and we must remember that when we translate.
Function 4: Jose	**English version**: She managed to follow all commands to get to the stage of downloading the PDF.
	Setswana version: She said that the Setswana commands made it easier for her. She was happy with translation quality. Accessed the print facilities very easily.
Function 4: Evelyn	**English version & Setswana version**: This activity was a challenge to her in both the versions as she was not familiar with PDF type files. She requested assistance. She complimented the translation process.

5.5.2 Theme 2: ICT used for assessment

The data presented in this theme is derived from the data collectors' notes that were made on the observations and comments of the teachers as they completed the set of activities specified under Functions 2 and 3. Both these functions consisted of activities that would require the teacher to complete the entire cycle of preparing and building an assessment task and then allocating the assessment task to a specific class.

5.5.2.1 Function 2: Accessing, navigating, and building the assessment task

From the observation notes and comments as reflected in Table 5.6, the following findings were noted in relation to the teachers completing the various activities in this function. Thandi, Lydia, Molly and Evelyn found completing this activity on the English version fairly easy. They managed to access all the commands on the English version and build the assessment task. Although some of the teachers completed these activities very slowly, they still managed to complete the activity. During the observation it was noted that Jose and Rebecca were very confused and sometimes frustrated. The observations also noted that Rebecca, “sighed” a few times as she was completing the activities. On numerous occasions in this activity, Jose activated the wrong command buttons, and in some instances she self-rectified her error and at others requested intervention. As indicated, Evelyn managed to complete the activities, but was slow to build the assessment task and she also commented that the English items for Grade 3 would be too difficult for her Setswana-speaking students. While completing the activities, Elize continually commented that she was not comfortable using a laptop; however, she also showed signs of low computer skills and requested continuous assistance.

When working on the Setswana version, it was observed that Thandi, Evelyn, Molly and Lydia managed to access the assessment builder and open the relevant commands easily. They managed to follow all the required commands to build the assessment. However, it was observed that Lydia first read the commands very carefully before she activated the commands. Jose seemed confident and relaxed using the Setswana version, even though she worked very slowly on the software. Jose further commented that the items in the bank were to the level of her students at her school. Elize, who showed signs of nerves working on the English version, seemed a bit more relaxed with the Setswana version and commented that she found using the Setswana version easier as she could understand the commands; however, she was still very slow in engaging the software.

Table 5.6: Observation notes for Theme 2: Function 2

Function & Teacher	Observation Notes
Function 2: Thandi	**English version**: She managed to access the assessment facility easily but experienced problems adding items to the assessment task. Very slow working in the system, but she managed to complete all steps.

Function & Teacher	Observation Notes
	Setswana version: She was able to open the assessment builder and build an assessment without much problem. She questioned the translation of the interface command, “PDF Resource Bank”. She said that Setswana does not have those words and phrases.
Function 2: Rebecca	**English version**: She required assistance. She completed the tasks but was slow. I assume due to her lack of skills on keyboard and mouse. She seems very frustrated, and gave a ‘sigh’.
	Setswana version: She asked twice why we changed the software to Setswana. She seemed to work easily through the builder. She said that the translation was accurate. She said her preference would be the English interface over the Setswana interface. She also complimented the level of Setswana translation of the T-DL interface commands.
Function 2: Molly	**English version**: She had no problem building the assessment and add items but had a problem previewing print view of test. Her computer skills are advanced.
	Setswana version: She found it easy to build assessment and add items. She indicated that the Setswana commands were easy to read. She volunteered to assist in any future translation process.
Function 2: Lydia	**English version**: She navigated the system very easily but had a slight problem with working in the item bank. She seems a bit nervous using the mouse pad. I gave her a normal wire mouse, and she seems at ease now.
	Setswana version: She read the commands very easily and was able to do the action. She seems to take time to read the instructions first before she performs the action. She had a problem adding items to the test. She was happy with the translation and questioned why some terms were still in English. She identified an error, according to her, of one translation.
Function 2: Jose	**English version**: She had problems, and I needed to guide her. She seemed confused with the instructions and looked around. Three times she said that she does not use a computer often.
	Setswana version: She said that the Setswana items in the system were good for her students and at their level to understand. She was still slow/nervous using the Setswana version, but she completed her tasks slowly.
Function 2: Evelyn	**English version:** She found it easy. She discovered another route to access the item bank. She commented that her students will have a problem since the items are in English and English is not their first language.
	Setswana version: She said it was easy to use. She seemed to navigate easily without really doubting. She said she was proud to see the software online in her language, Setswana.
Function 2: Elize	**English version:** She was very slow and this was to do with her computer skills. She seemed nervous, and a number of times said she does not like working on a laptop.
	Setswana version: It seemed easier for her. She said she could understand the terms, but she was still slow using the software. She said she must practice more. But she commented that having it in Setswana makes it easier.

5.5.2.2 Function 4: Allocating an assessment task to a class

From the observation notes and comments as reflected in Table 5.7, the following findings were noted in relation to the teachers completing the various activities in this function. In using the English version, Thandi, Molly and Rebecca managed to allocate their respective assessments to the class using the assessment manager. Rebecca was a bit slow but she managed to complete this activity. Lydia managed to complete

this activity easily but requested clarification on the concept of a Teacher Dashboard and its purpose. At the start of the activity Jose seemed nervous, however, as she continued with the activity, she became more confident. Evelyn, on the other hand, requested assistance many times, and she commented that while she likes what the software offers teachers, she does not like working on computers. During the working session, Elize seemed very frustrated and asked to go to the ladies room. I could see the frustration, but she came back and worked slowly and the data collector helped her to complete the activity.

During the observation of teachers using the Setswana version, it was noted that Thandi and Molly found it easy to complete the activity. Rebecca, however, experienced a problem as she could not locate her class list, but she managed to resolve the issue and realised that she had saved it under a different name. Lydia found completing the activity easy and also commented that the translation of the term Teacher Dashboard to *Morutababa Karolwana* was fairly accurate. Both Elize and Evelyn worked very slowly to complete the activity. Evelyn took her time to read the commands and asked for assistance, while Elize, who worked slowly, commended the accuracy of the translations and commented that she found it easier working on the Setswana version; however, she indicated that she would still opt to use the English version. Lastly, Jose seemed to be confused working in the Setswana version. She did not seem to enjoy working in this version of the software and asked to go back to the English version that she said she found easier.

Table 5.7: Observation notes for Theme 2: Function 3

Function & Teacher	Observation Notes
Function 3: Thandi	**English version**: Without any instructions, she allocated the assessment task to a class. She seems very comfortable moving around the software.
	Setswana version: She commented on the high level of translation and her pride to see software in her language. She seems to move around the interface with ease.
Function 3: Rebecca	**English version**: She managed to complete the allocation of the assessment task to a class without any problems, but seemed doubtful as she navigated the interface.
	Setswana version: She found this function easy. She had a slight problem locating her class list but then realised that she saved it under a different name. She indicated that the translation was fairly accurate. She liked the way the commands guide her.
Function 3: Molly	**English version**: She found this function easy and managed to allocate a test to a class. However, she requested assistance to find her class, but it was just to confirm her action.

Function & Teacher	Observation Notes
	Setswana version: She seemed confident when she moved. She said that having it in Setswana would make teachers lives easier. She liked the translations done.
Function 3: Lydia	**English version**: She was comfortable doing this activity. She commented that some items in English would be tough for her Grade 3 students. She asked what the command "Teacher Dashboard" meant. She said it was the first time she came across this word in computers.
	Setswana version: She seemed very comfortable with navigation. She moved through very easily. She found some of the translations new and accessed all the functions easily, including "*Morutababa Karolwana*", which was the Setswana translation for "Teacher Dashboard". She said it will make it easy for other Setswana teachers.
Function 3: Jose	**English version**: She initially looked confused about what to do, but took time and then seem to follow the instructions easily. Then she looked confident completing the task.
	Setswana version: She started, seems hesitant, but queried why some terms were still in English and offered to help in the translation process. Did not seem to enjoy this version and asked if she could go back to the English version as it was easier for her.
Function 3: Evelyn	**English version**: She asked me seven times to assist her. She had a problem here. It seems the steps confused her.
	Setswana version: She did it on her own, but very slow. She said the commands were easy to understand and that the commands were well translated and it "said what it was supposed to have said".
Function 3: Elize	**English version**: She experienced this task a challenge, becoming frustrated. I decided to assist her. It was the computer skills that was her problem, but she was determined to learn.
	Setswana version: She said she liked it and that she experienced it easier to read and move around. She said that she that terms in Setswana makes it easier, but she also said she understands why some terms were not translated. She added that she would rather work in the English version, as it was easier to read.

5.5.3 Theme 3: Ease of navigating an Indigenous GUI

The data presented in this theme is derived from the data collectors' notes made on the observations and comments of the teachers as they completed all the activities within the four functions. In this theme, the focus was not on the functions of the software but rather on the observations and comments made on how the teachers reacted to the use of Setswana as the language of the software, as reflected in Table 5.8.

In general, all the teachers were pleased with the level and accuracy of the translation of most of the interface commands and content terms. Molly, Lydia and Jose felt comfortable working on the Setswana version and also reported that reading and activating the Setswana command buttons was easy. However, during the observation it was noted that some of the teachers took longer to engage and activate the commands on the Setswana version. They tended to look at the commands for a while,

and it was later determined through interaction with Thandi and Rebecca that they first tried to mentally visualise the English interface, and then based on that, they activated the commands on the Setswana version. During the observations, a few teachers mentioned their sense of pride to see Setswana being used in ICT and available on the internet.

While completing the various activities on the Setswana version, there were times that some of the teachers commented that they would rather use the English interface as the English commands were easier to follow; however, at no time did it seem that using Setswana impeded them from completing the activities.

An important comment noted during the PO data collection process was that even though the T-DL interface translations were of high quality, the different dialects in African languages must be considered because all African languages have multiple dialects and that African cultural taboos must be accommodated. This will be discussed further in Chapter 6.

Table 5.8: Observation notes for Theme 3: Functions 1, 2, 3 & 4

Function & Teacher	Observation Notes
Function 1: Thandi	She indicated her pleasure with the level of translations done on the interface and the accuracy of the translation. It said what needed to be done. She admitted that with some translations she had to first try to understand what it meant.
Function 1: Rebecca	However, she did indicate that she preferred working on the English interface as compared to the Setswana interface. She indicated that English was easier to understand on the software
Function 1: Molly	She complimented the translation and said it made it easy for her to use and read commands. She said she felt proud of seeing her language being used.
Function 1: Lydia	She went through very easily. According to her, the translated commands were accurate and it explained what she had to do. She also volunteered to assist in future with translations.
Function 1: Jose	She seemed comfortable (maybe she was more confident), but she did mention that she was happy with the Setswana commands. She seemed at ease using it.
Function 1: Evelyn	She worked very easily through it. She said translation was very good. Made it easy for her to read and follow. She queried why some terms were not translated.
Function 1: Elize	She seemed more comfortable. She managed the activities without any assistance. She said the level of translation made it easy. She asked why some terms were not translated.
Function 2: Jose	She said the items in the system were good for her students and at their level to understand. She also questioned non-translated terms, and I provided the same answer about Indigenous term development. She was still slow/nervous using the Setswana version, but she completed her tasks slowly.

Function & Teacher	Observation Notes
Function 2: Evelyn	She said it was easy to use. She seemed to navigate easily without really doubting. She said she was proud to see the software online in her language, Setswana.
Function 2: Elize	She said she found it easy to understand the terms, but she was still slow using the software. She said she must practice more.
Function 3: Molly	She said that it would make teachers lives easier and liked the translations done.
Function 3: Elize	She said she liked it and that she experienced it easier to read and move around. She said that she was used to Setswana and that terms in Setswana make it easier, but she also said she understands why some terms were not translated.
Function 4: Thandi	She said that there was an item (SW2017-289-3) within the bank that had a picture of a black cat on it, and black is not a good colour for them. As she brought up the issue of the black cat, she was asked further about the website, and she said that we also use black at the bottom and that is not good.
Function 4: Rebecca	She indicated that when she was working on the Setswana version, she had to think about the translated terms first.
Function 4: Jose	She said that using the Setswana commands made it easier for her. She was happy with translation quality.

5.6 Section D: In-Depth Interview Data

In this section, the data collected through the IDIs with the seven teachers will be presented within the ambit of the four themes identified during the coding process in Section 4.9.3. The themes are (1) African language GUI; (2) creating an online assessment; (3) benefits of ICT for Indigenous African language speakers; and (4) dominance of the use of English in ICT. Within each theme, specific focus areas were identified to help present a more succinct and richer description of the IDI data.

5.6.1 Theme 1: African language GUI T-DL

The ability and willingness of a teacher to use and integrate ICT is greatly influenced by their proficiency in using the computer software or digital resource. The data collected during the interviews attempted to define and understand the experience and confidence of the teachers as they navigated the user interface of the T-DL software. The responses in the form of quotations can be accessed in Appendix J.

5.6.1.1 Focus area 1: Ease of navigating the T-DL software

The final acceptance and use of any new software or online platform depend greatly on how easy a user finds navigating the software. The more user friendly the software, the more readily it will be accepted by users. Similarly, the ease with which the teachers navigated the Setswana version of the T-DL software would greatly influence

not only their acceptance and use of the software, but also their attitude towards the use of Setswana as a language of ICT.

As the findings from the PO showed, the teachers found navigating the Setswana version of the software fairly easy. The data from the interviews also showed that the teachers commented that the commands and the user interface was user friendly. Thandi (1.27) stated that the navigation of the interface was very easy and essentially the commands were self-explanatory. This was also supported by Molly (1.30), who noted that navigating in the software was “not difficult to learn”. As such, it shows that if the interface of a software is simple to read and navigate, then users will feel comfortable within the environment. However, there is also the question of acquired skills and whether possessing certain basic skills is essential? Elize (1.38) suggested that her typing experience and skills from decades ago greatly supported her working on the software. However, not all the teachers found engaging and navigating the Setswana version simple, and some teachers like Lydia (1.32) and Jose (1.34) noted that they lacked confidence working on the Setswana software, which they attributed to the lack of practice and access, indicating that as Foundation Phase teachers they do not have the same access to ICT resources as senior phase teachers at their schools. However, the review of literature (Section 2.9.2) showed that access and skills are not the only factors that contribute to ICT acceptance and use. The responses from the interviews also showed that most teachers were positive about their experience of engaging and navigating the Setswana version of the software. Molly made the following statement regarding her experience:

> Yes, it’s not difficult to access it. I found things easier since it is my language. I could know where to go. The buttons were easy to read and press. It’s something that’s easy to use, and the Tswana part that is a big thing. A big solution according to me. Now anyone can understand it. (1.31)

The acceptance and use of any software depends on the user feeling comfortable when engaging the software. Molly (1.31) noted that working on the Setswana version was made easier because it was in a language familiar to her, and since it was familiar, she suggested that anyone can now use the software. It is assumed that by anyone she meant any Setswana-speaking person. This notion was also supported by Elize, who reinforced the argument of language, when she stated that “it’s my first language.

The language I first experience as a child. So it was easy and, what you say … it was natural to me" (1.39.1).

From the voices of Molly and Elize it becomes apparent that providing access to software in Setswana made acceptance and use of the software easier. However, in order to ensure this is achieved, the quality of the Setswana translations must be acceptable. In order for a user to experience ease of navigation on a localised interface, the accuracy of translation of the interface commands are important. During the interview, Thandi (1.28) noted that the translation of the Setswana interface was accurate, and due to the accuracy, it was user friendly. This sentiment was echoed by Molly (1.31) and Lydia (1.33), who supported the accuracy of the translations and added that due to the accuracy of the translation, navigation and reading the command buttons on the interface was made so much easier. The use of Setswana on an educational software also brought with it a sense of security to the users, and Evelyn (1.37) said she felt "confident because it is my language", while Elize (1.39.1) noted that she felt natural using the Setswana version simply because "it is my first language, the language I first experienced as a child". This sense of comfort and security with the introduction of an innovation is critical to ensure acceptance and sustained use of the innovation.

However the interview data also presented responses from teachers that reflected a differing view of the experience and perception of teachers as they navigated the Setswana version of T-DL software. Jose noted the following:

> I was a bit slow because I have to read first. English is easier than … because it's an international language. So, I have to verify first Setswana. What does it mean like this? Yeah it takes a little time … more little time for me. (1.35)

Essentially what transpired when Jose was navigating the software was that when she saw the Setswana command, she first mentally translated the function to English and then, based on the mental translation, she navigated the software, and as such, she indicated that navigation took her a long time. This process of mental translation when using the Setswana version was not unique to Jose, and Evelyn also responded in the interview that she carried out a similar process. She noted that "I have to think first for this is. What is that … SAVE. Ok I have to go to SAVE. So I have to go first and think of it in English first, then translate it there" (1.51).

Another telling comment made by Jose (1.35) was the belief that English serves as an international language, and as such, is seen as the language of ICT. This view was also promoted partially by the fact that not all the interface commands and terms were translated because of the technical complexities of some terms. This could have supported the view held by Jose, which was also noted by Elize, that “there were some buttons that was still in English, not sure why it was like that” (1.39.2)”

5.6.1.2 Focus area 2: Confidence using the T-DL software

The interview data in this focus area looked at the confidence level of the teachers as they engaged and used both the English and the Setswana versions of the T-DL software. The data showed that all the teachers commented that they were confident using the English version of the software. According to Rebecca (1.42) and Elize (1.52), they had gained confidence using the English version of the software since, according to them, they learned things they did not know before, like building an assessment task and working on the software. Lydia (1.46) also commented that before she started working on the T-DL software, she was scared of computers but as she worked on the software she became more confident. These teachers alluded to an important concept in developing confident ICT users: With more use comes confidence. As such, exposure and use of ICT are essential factors for ICT acceptance by teachers.

Another key element that promotes the confidence in teachers to use ICT is acknowledging and accessing the educational benefits that ICT holds for teachers. In the context of the ILS intervention, the T-DL software, a unique assessment platform, was developed to simplify the assessment practices of South African teachers. According to Elize (1.52) and Thandi (1.40), their confidence in using the T-DL software grew as a result of the benefits the software held for them as teachers, since the software provides the opportunity to customize and modify assessment tasks at any given time using a wide array of curriculum aligned assessment items. The educational benefits that the T-DL software held for the teacher was also noted by Jose, who stated the following:

> I think it’s easy because you go through the content and you just choose what is suitable for your learners, then you pick what questions you want, and then

> you make the computer build your test. It makes this so easy for me now. I feel so sure now to use computers. (1.48*)*

In relation to the interview data collected from the teachers using the Setswana interface, it can be ascertained that four of the seven teachers indicated that they were confident using the Setswana version of the software. According to Thandi (1.41) and Molly (1.45), their confidence was high when they used the Setswana version because, firstly, the software was in a language they understood, and secondly, they felt relaxed using the software and as such could understand the functions of the software much better. Lydia (1.47) further commented that the Setswana commands were easy to follow, and as such, she found it easy to access and follow the instructions since it was in her first language. This was also supported by Evelyn who stated the following:

> I feel confident because it is my language. Remember it is my mother tongue, so when I see computers with my language, I know I can use it. It will make me want to learn more about computers. I can now teach my colleagues and learners. (1.51)

However, there were a few teachers, like Jose (1.49), who indicated that while she felt confident using the Setswana version and she was happy to see Setswana being used in ICT, she would still prefer English being used as the language of ICT; and Rebecca, who stated that “I am confident. At first I was doubtful but now I am confident. You know when I saw the Tswana computer, I was scared. I still think English is best” (1.43). So, while some of the teachers may have been positive about Setswana being used in ICT, they still felt that English was better suited for complex subjects like ICT.

5.6.2 Theme 2: Creating an online assessment.

Teaching in the 21st century requires a teacher who is competent and skilled in the use of technology. The availability of technology has created a context in which ICT can be used to enhance and support the teaching and assessment practices of the teacher. The T-DL software is a unique English and Setswana online assessment software aimed to assist teachers to simplify their assessment practices. However, in order for a teacher to benefit from the assessment capabilities of the software, it is important that they can use all the functions of the software effectively. The data in this

theme captures the interview responses of the teachers based on their experiences after building an assessment task using the T-DL software. The teacher responses for this theme can be accessed in Appendix K.

5.6.2.1 Focus area 1: Influence of T-DL software on assessment

The interview data in this focus area looked at how the teachers perceived the influence that the T-DL software (English and Setswana) had and can have on their assessment practices. According to Thandi (2.1), the software offered her as a teacher the opportunity to develop a test paper very quickly and then being able to save the test and use it again the following year. Jose, saw a similar benefit of the software as "it adds value to my teaching because it makes it easier. I am able to plan assessment activities in a short time. We don't have to take long to look for activities; they are incorporated in the TARMII" (2.9).

As these were Grade 3 teachers, the language of teaching and learning was Setswana, however, as per the South African curriculum, the Grade 3 students are introduced to English in the third term. As such, Molly (2.5) noted that as teachers working in disadvantaged and under-resourced schools, the T-DL software would greatly help them because it contains questions and PDF resources that they could access and use during their lessons.

Elize (2.13) further commented that the online facility of the software allows students to access the resources from anywhere and that the software can also be used by the students at home, either to take the test or to use the resources since many homes lack sufficient reading material. Furthermore, Lydia (2.8) noted that the T-DL software would greatly influence the assessment and support of students with learning barriers, as these students can now be assessed in Setswana rather than in English, since English is in itself a barrier to many Setswana and Indigenous African language speaking students. This was also alluded to by Thandi who stated that it "will be easier for the teacher, especially when you are using Setswana as a home language it's going to be easier for the teacher, as well as the learners to understand in their own language" (2.2). The interview data from this focus area shows that the T-DL software, both the English and Setswana version, carries with it a heap of benefits to both the teachers and the students.

5.6.2.2 Focus area 2: Motivation in using the T-DL software.

The acceptance of any ICT resource stems from the user identifying the value of using the software based on their context. As such, the user must first be motivated to accept the resource and then be motivated to use the resource. The interview data within this focus area looks at the responses provided by the teachers during the interview to define those factors that motivated them to accept and use the T-DL software.

The interview data indicated that the teachers identified a series of factors that motivated them to use the T-DL software. One of the main reasons is the heavy workload confronting many South African teachers. Both Thandi (2.15) and Molly (2.17) acknowledged that the greatest advantage of the T-DL software that motivated them was its machine marking capability, which would save them a great deal of time marking assessments. Elize commented that the T-DL software also allowed for the analysis of marks, and she stated that “you do a printout of the test, oral or classwork activity and then you give it to them. You sit down and analyse the marks or the performance” (2.25). Thus, the ability of the T-DL software to not only machine mark the assessments, but also to provide diagnostic analysis of student performance further motivated the teachers.

Another key factor that motivated the teachers lies at the core of the T-DL software: The inclusion of Setswana as a language of the GUI. Jose (2.22) noted that she was motivated to use the software since the software was in Setswana, and as such, it made it easier for her students to use, and the fact that the software was online will allow the parents to get involved with their child’s education, since many of them do not speak English at all. Thandi elaborated on this aspect and stated that having the software in Setswana will “simplify the lesson for me and my learners in terms of understanding, since the language that is spoken at the streets and at home. They understand better than English” (2.16).

Other teachers (Evelyn, 2.24 & Molly, 2.18) commented that the motivation for them to use the T-DL software rested on its ability to generate high-quality assessments in a short time in Setswana, a language of learning and teaching in the Foundation Phase. While Elize found that her motivating reason was not based on education but

rather personal, since “it can motivate me not to discard my mother tongue. *Ke skayi kgathologa wabona*”[9] (2.26).

5.6.3 Theme 3: Benefits of ICT for Indigenous African languages speakers

The introduction and use of ICT within the education context carries with it a number of benefits to the teacher. In the context of the ILS intervention, the introduction of an educational software in Setswana has provided the Setswana-speaking teachers the opportunity to benefit from the T-DL software, which according to Keegan (2008) and Osborn and Osborn (2010) is essential for Indigenous language speakers to also benefit from accessing ICT. The teacher responses for this theme can be accessed in Appendix L.

5.6.3.1 Focus area 1: Solutions offered by the use of the T-DL software

The collected interview data made it apparent that many of the teachers identified the value or solutions that the T-DL software offer them in their current context. Thandi’s (3.54) comment was focused on her large class size (52 students). According to her, the software would greatly support her assessment practices in that she would not have to spend too much time setting a quality assessment, since the T-DL software would set her assessment, and finally, the machine marking function of the software would save her time marking and give her time to engage and support her students. Then there were teachers who viewed the T-DL software as a way to cut down on the amount of paperwork expected from them. According to these teachers, assessments would be done by the students on the software and would, according to Elize (3.66), save paper. Evelyn also noted the following about using the software:

> It will make it easier because we are not going to write on paper. We are going straight to the computer, and at the same time, we are saving the school money but also getting our students used to life in the 21st century. That is good for them. (3.64)

Both Molly (3.58) and Jose (3.62) noted that for them the greatest benefit of the software was that it would help teachers to develop assessments since the item bank has quality items (questions) and all a teacher has to do is to select items based on

[9] Ke skayi kgathologa wabona: Setswana, translation, “I should not ignore it”

the term and the content area and then include it in the assessment. This will make it so much easier to set up an assessment. Rebecca (3.56) also stated that for her the benefit of being exposed to the T-DL software in Setswana is that it could motivate her school and teachers to purchase computers.

The interview data also showed that teachers (Thandi; 3.55) acknowledged that the use of the Setswana version of the software will help them to explain things more easily than when they use English. This point was reinforced by Elize, who stated that since "English is not their language, it's going to be difficult but when they see it in Setswana and I talk to then in Setswana because we do all our teaching in Setswana. It will become easier for my learners" (3.67). Evelyn highlighted the same benefits by making the following statement:

> It can create more solutions because my children….they will understand it in Setswana. English is not their language. I talk to them in Setswana. They will understand more than English. Also the teacher in Maboloka[10], who can't speak English, will now be able to use computers the same way a teacher in the city can. That's good. (3.65)

Jose (3.63) further noted that having the software in Setswana would benefit the teachers since they would be able to access content in Setswana and would not have to look for Setswana content. Lydia saw the bigger picture with the T-DL software; she saw it as a platform that would support collaboration among teachers and allow teachers to share assessments. She stated that "I see other assessments done in Tswana, then I can select the challenging ones and share from Brits to Mogwase[11]. It will help us" (3.61).

However there was also a concern from a teacher (Rebecca; 3.57) who, while appreciating the benefits that the T-DL software holds for teachers, cautioned that the software would be problematic in that in Setswana "they can't use all the big computer words". Hence she adopted the view that English is better suited to be used in complex fields like ICT.

[10]Maboloka is a village situated north east of Brits industrial area

[11] Mogwase is a town in the Bojanala District Municipality in the North West province and is close to Sun City and the Pilanesberg National Park

5.6.4 Theme 4: Dominance of English use in ICT

As stated in Chapter 2, Gudmundsdottir (2010) argued that the dominance and sustained penetration of English in ICT has resulted in language becoming the new factor that promotes the digital divide in developing countries. Ndebele (2014) contextualised this argument to South Africa and stated that in order to address the digital divide, access to ICT within the South African context has to be redefined with priority being given to Indigenous African languages. The interview data within this theme focused primarily on how the teachers viewed the use and place of Indigenous African languages in ICT, especially after they were exposed to and used the Setswana version of the T-DL software. The teacher responses for this theme can be accessed in Appendix M.

5.6.4.1 Focus area 1: Use of an African language in ICT

As indicated, the T-DL software is a unique technology introduced to Indigenous African language speaking teachers in South Africa through the ILS intervention. The interview data showed that the teachers were pleased with having an online educational software in Setswana. According to Thandi (4.68), having software in an Indigenous African language would allow more people to access and benefit from the information and knowledge stored within these ICT resources, especially those who live in rural areas and speak only an Indigenous language. Lydia (4.71) further added that the use of Setswana in ICT was beneficial as English is not the first language of her students and that engaging in English always poses a problem and threat to them. As a result, having technology like the T-DL software in Setswana at their disposal will benefit her students as they now will be able to access and use technology in a language that is natural to them.

Thandi emphasised that the fact that the T-DL software uses Setswana for its content and interface shows that any African language can be used in ICT. She expressed her feeling about seeing Setswana used in the T-DL software as follows:

> It's the first time to see something like that on any gadget … and digital gadget. I mean it says something. It makes me proud, you know. Always we think English is the only language that can be used. I am so happy. (4.77)

Elize (4.81) and Jose (4.73) added that having software like the T-DL software in Setswana would help them as teachers by making planning lessons and assessments easier for their students, since now they have items in Setswana. According to them, students as well as some teachers are not fluent in English and being forced to interact with English educational material are stressful to them. The issue of stress was further elaborated on by Evelyn (4.74), who maintained that if Setswana-speaking students are allowed to write tests and exams on an online platform like the T-DL software in Setswana, they will fair just as well as those students who take the same test or exam in English. The teachers acknowledged that having software in Setswana or any other African language is vitally important, not only for education but also for African society at large. Elize's closing comment in the interview brought to the fore the core reason behind the ILS intervention and why the need for localised software in African languages is so important:

> A child who is a teenager and then dropped out of school. His or her English can be poor, but if she gets something like this … the internet, ICT in the home language … they can be able to access. It is the duty of all parents to teach their children their home language. Even if those are attending English medium schools, otherwise our culture will die. (4.108)

5.6.4.2 Focus area 2: Barriers to the use of African languages in ICT

The data collected during the interviews and the comments made during the Participant Information sessions made it very clear that all the teachers were pleased and proud to see Setswana, an Indigenous African language, being used in an online educational software. However, the interview data also reflected concerns and doubts from the teachers when it came to the practicality of using Setswana or any other Indigenous African language in ICT resources. Rebecca raised a concern of whether Setswana or any other Indigenous African language has the necessary technical vocabulary to be used in complex fields like ICT. She made the following remark:

> Some of the words when we spell them in Setswana they are long but in English it is short. Sometimes we don't even have a word for that computer word. It's tough, so what is going to happen then? I think English is a better option for use in ICT. (4.69)

Jose (4.82) further commented that certain ICT terminologies, because of its technical complexity, exist only in English and cannot be translated into Setswana or any other African language. As a result, African languages lack the appropriate ICT terms and concepts, hence ICT resources will not be able to be localised to African languages. Rebecca (4.84) noted that many Africans have accepted the status quo that English will always be better suited to be used in academia and fields like ICT due to its dominance and widespread use, while African languages are seen as languages best suited for use at cultural and religious gatherings. This sentiment was reinforced by Thandi (4.77), who stated that almost everything in the digital world is communicated via English and that all their students think that if they use English, they are "cool".

Another problem identified by Molly, that was also examined in Chapter 2 through the work of Plonski et al. (2013), is the widely held perception that the use of a single colonial language unites the people while multiple African languages divide the people. According to Molly, the regional differences in Setswana, a single language, is very apparent within the Madibeng District, and she stated that the Setswana spoken in Rustenburg "is a little bit different than this one from Mmakau" [12] (Molly; 4.70). She argued that "you'd have to have five different or 10 different TARMII for all the teachers" (Molly; 4.80). Thus, the implications of Molly's comments are that due to the linguistic variations in a single language like Setswana, multiple versions of the T-DL software would be required for the district. The issue of linguistic variation and the justification of using a single ex-colonial language is supported by Evelyn who made the following comment:

> When I talk Setswana, she can't understand me. So, if I talk to him or her with English, then that person we can talk we can communicate. Also when I go for a job, they don't ask me in Tswana, they ask me in English since the person talking to me may be English speaking. (4.83)

5.6.4.3 Focus area 3: African languages used in ICT, a problem or solution?

The interview data collected attempted to understand whether teachers saw the introduction and use of African languages in ICT as creating more problems or providing solutions. It was noteworthy that some teachers (Thandi, 4.96; Rebecca,

[12] Mmakau is a village in Bojanala District Municipality and is located 40 kilometers from Pretoria

4.97) were happy using Setswana in ICT simply because it made things easier to understand, since it was their first language. However, Thandi (4.95), while acknowledging that Setswana-based ICT resources would be beneficial to many, indicated that she would rather use English ICT resources since in her words, “English is cool”. To try to understand this state of reasoning, it is important to look at the comment made by Rebecca, who explained why African language speaking individuals choose English over an African language:

> They know that when they go to interviews, it’s English. So it is better to keep on talking English. When they are doing Tswana, they go nowhere. Nowadays they must know ICT and in computers they only use English to type and to work, so there is no Setswana. Even with TARMII, will it be accepted by the Department? (4.98).

However, many teachers pointed to the solutions that ICT resources in African languages offer. According to Jose (4.104) and Molly (4.100), having ICT resources in Indigenous African languages would “allow people to express themselves in their own language, which would greatly help those who are not fluent in English”. Evelyn, (4.105) further commented that having computer software in an African language will ensure that people enjoy and love working on the software, since it is in their own language. However, the problem of regional language differences was again brought up by Jose (4.103), who provided a practical example. According to her, a rat is a rat in English, in Mahikeng[13] they call it *peba* and in Madibeng they call it *lekgotlo*, and as such, she stated that students from the same province (North West) but from different districts will still experience language as a barrier when accessing ICT. However, this time the barrier will not be a problem between English and Setswana, but between the different dialects found in the Setswana language. As such, Jose maintained that the T-DL software or any other software localised to accommodate an African language would create more problems if linguistic issues like dialects are not accommodated for. It is for this reason that she maintained that English is better suited for ICT in South Africa.

[13] Mahikeng: is the capital city of the North-West Province.

5.7 Summary

This chapter focused on the presentation and analysis of data collected from the SSO, PO and IDI instruments. The analysis of the collected data aimed to answer the main research question and its four supporting investigative questions. In summary, the data showed that two of the seven teachers lacked basic ICT skills, but it also showed that all the teachers found navigating both the English and Setswana interface easy. With regards to the Setswana interface, the teachers noted that the accuracy of the interface translations made the navigation easy. Some interface commands and buttons were not translated, which led one teacher to argue that Setswana or any other African language would not be suited for use in ICT.

The data further showed that teachers from rural areas of Madibeng found the standard of the Setswana items high for their students, while teachers from schools located closer to the urban centres found the items acceptable to the level of their students. The data also reflected that teachers who had more advanced ICT skills preferred the English version of the T-DL software, while those who were relatively new to computers preferred the Setswana version. Finally, the data showed that all the teachers, even those who indicated that they preferred the English version of the T-DL software over the Setswana version, said that they felt pride seeing an educational website using Setswana, their mother tongue, but insisted that any ICT resource localised to an African language must accommodate African cultural norms as well as being cognisant of regional dialects.

From the various data sets and their themes, these final four themes emerged (Figure 4.20):

1. Proficiency in using a dual-language GUI software
2. Digital assessment
3. Indigenous African languages in ICT
4. Legacy of colonialism on ICT

These final four themes will be used to further discuss the findings in Chapter 6.

CHAPTER 6
DISCUSSION AND SYNTHESIS OF RESULTS

'I'm not here to defend privilege, I'm here to spread it.'

(Hooley, 2015)

6.1 Introduction

This study was initiated because of the problem that most educational software and online resources available to the South African teacher are in English but most South African teachers are not fully proficient in English and rather use an Indigenous African language.

The ILS study was designed to investigate whether the localisation of an English online assessment software to include Setswana would influence the Setswana-speaking teachers' software experience and their attitude towards the use of Indigenous African languages in ICT. In this chapter, the results presented in Chapter 5 will be discussed within the context of the four themes (Figure 6.1) and supported by the relevant literature aspects (Chapter 2) within the aegis of the proposed conceptual framework (Chapter 3). The ILS intervention was guided and framed by the main research question.

6.2 Discussion of the Major Research Results

As explained in Chapter 5, the three data collection instruments (SSO, PO and IDI) were administered over two stages, with a one month gap between Stage 1 and Stage 2 (Figure 5.1). Four themes emerged from the analysis of the data (Figure 6.1), and these themes will be used to guide and frame the discussion component of this chapter.

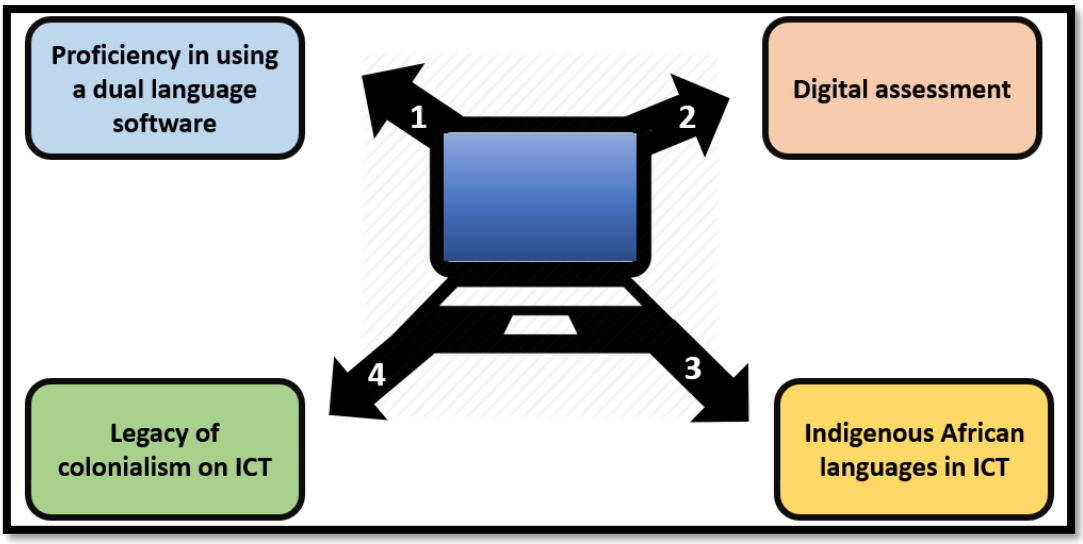

Figure 6.1: Emerged themes

- **Theme 1: Proficiency in using a dual-language software**: Under this theme the teachers' ease of use in navigating the T-DL software interface and their confidence in using the Setswana or English GUI are explored and discussed.
- **Theme 2: Digital assessment**: Within this theme the teachers' perception of the value of using the T-DL software or any other technology to support their teaching and assessment practices is explored and discussed.
- **Theme 3: Indigenous African Languages in ICT**: This theme is used to explore and discuss the teachers' attitude towards the introduction and use of Indigenous African languages in ICT.
- **Theme 4: Legacy of colonialism on ICT**: Under this theme the teachers' attitude and perception in relation to the use and status of English in ICT as a legacy of colonialism are explored and discussed.

6.3 Proficiency in Using a Dual-Language Software

In respect to the long-term aim of the ILS intervention and the T-DL software, the proficiency of teachers to effectively engage and use the software is essential. Thus, the conceptualisation and design of the T-DL software and its GUI had to be user friendly from both a technical and pedagogic perspective. The discussion of the results encapsulated in this theme will respond to the first investigative question, which asks:

What is the difference between the ease-of-use experience of the Setswana-speaking teachers when accessing and using the English version of the TARMII dual-language software and when accessing and using the Setswana version?

According to Basargekar and Singhavi (2017), for a user to effectively engage and use any computer software, the user must first understand and appreciate the purpose and benefits of the software and then be proficient in navigating the software environment and triggering the functions of the software. A user's proficiency in engaging any software is highly dependent on (1) the user's level of basic ICT skills, which includes keyboard and mouse skills and the navigation of the GUI, which essentially refers to the user being able to understand the purpose and use of icons, scroll bars and pop ups etc., dictating the level of ease with which the user can engage and use the software; and (2) their use of the various software specific functions, which allows the user to effectively interact with and use the software to its full capacity. This ultimately informs their confidence in using the software (Harerimana & Mtshali, 2019). The themes ultimately emerged from the data collected through the SSO, PO and IDI instruments.

6.3.1 Basic ICT skills

From the data pertaining to the teachers' background, it is important to note that most participating teachers indicated that they do not have the opportunity to access and use computers at school, while more indicated that they have the opportunity to access and use a computer at home. From the data collected through the SSO and PO instruments, it was noticed that most of the teachers had the basic ICT skills (mouse, keyboard and interface navigation), with the exception of two teachers who experienced problems using the computer mouse and keyboard. This finding was unexpected since the Madibeng education district office was supposed to have helped identify teachers who had the necessary basic ICT skills to participate in the ILS (See Section 4.4.2). However, this lack of basic ICT skills on the part of the two teachers did not hinder the progress of the data collection as they managed to complete the necessary activities even though it was done much slower than the rest of the teachers and with more one-on-one supervision. It was interesting to note that as the teachers engaged and completed the activities, they became more confident and proficient in

using the keyboard and mouse and also showed more confidence in accessing the different aspects of the T-DL software. This finding corroborates the ideas of Harerimana and Mtshali (2019) and Selinger (2001) who noted that the attainment of basic ICT skills is more effective when it is done in the context of everyday use of the software rather than training focused specifically on the attainment of specific ICT skills.

6.3.2 Interface navigation

The introduction of the T-DL software, as mentioned already, was ground-breaking in South Africa because there is currently no online educational software in an Indigenous African language available to teachers. The T-DL software gives the teacher the ability to select the language of the software interface. As alluded to by Keegan (2008), the navigation process within a localised software should be clear, logical and consistent while the purpose of the interface buttons and icons must be obvious, and only when this is achieved would the Indigenous language speaking user be willing to accept and use the software with ease and confidence.

The data collected to support the discussion around the teachers' ease of navigating the T-DL interface was based on the responses of the teachers' completion of the SSO instrument. Table 6.1 is a summary of the sections from Chapter 5 that looks at the teachers rating their ease of navigating and completing the various activities.

Table 6.1: T-DL teacher activities

	Activity	Total number of activities	Teacher ease-of-use experience		
			English	Setswana	No difference
1	**Navigating the Interface**	**7**	0	7	0
2	**Accessing, navigating, and building the assessment task**	**9**	7	2	0
3	**Allocating an assessment task to a class**	**4**	3	1	0
4	**Downloading the assessment task**	**6**	3	2	1
	TOTAL	***26***	***13***	***12***	***1***
	Percentage		***50%***	***46%***	***4%***

In the first activity, navigating the interface, it is apparent that all seven teachers found the seven activities easier when using the Setswana interface. However, in the

remaining three activities, more teachers indicated that they found the English interface easier to use. For instance, in the last two activities, even though most of the teachers found the English easier, some indicated that the Setswana version was easier. An observation that was derived from Table 6.1 is that the last three activities (Activity 2,3 & 4) were a bit more challenging and required the teachers to navigate a series of steps, while the first activity essentially required the teachers to do some simple straightforward activities by triggering commands. As such, this data shows that the teachers found the English version easier for those activities that required more intensive actions. This finding is somewhat inconsistent since the supplementary data showed that most of the teachers indicated that the translation of the interface commands, dropdowns, banners, and icons into Setswana were accurate and simple to follow. So even though more teachers found the English version easier for the last three activities, the findings derived greatly support the findings of Ndebele (2014) who suggested that the translation of software into an African language must be linguistically accurate and culturally sensitive for the African language speaking population to accept the technology. This finding further confirms Osborn and Osborn's (2010) statement that the process of translation in the localisation of software into an Indigenous African language is central to the success and acceptance of African languages into the digital age. This finding is also supported by the results obtained by Phaahla (2015, p. 185), who found during the ATM study, that the translation of terms or phrases that will appear on the GUI must be accurate otherwise Indigenous language speakers will "abort and interrupt" their use of the ICT resource.

An unanticipated finding noted during the PO process was two teachers who later acknowledged that while navigating the Setswana interface, they read the Setswana interface command, then mentally translated it into English, and then triggered the correct Setswana icon. This ability to language-switch or code-switch is common to many South African Indigenous language speakers who can speak multiple languages. The finding is consistent with the finding made by Bodomo (1996), who noted that Indigenous African societies in South Africa are highly multilingual, giving them the ability to switch between their Indigenous language and English without much effort. The finding is further corroborated by Keegan (2008, p. 5), who noted that within a localisation project in New Zealand "the interface in te reo Māori was used

significantly in the Indigenous language" even though most of New Zealand's Indigenous population speak English fluently.

This finding is important in the field of software localisation within the South Africa context showing that it is vital that software developers or organisations considering localising software must ensure that any software localised to the South African context must be multilingual to accommodate code switching between the various languages of South Africa. The design and development of the TARMII software platform accommodated a multilingual interface by ensuring the T-DL platform have the capability to accommodate the 11 official South African languages (Figure 1.5). Having this capability within the software is important, because, according to Thapa and Sæbø (2014), the design of any ICT resource must be cognisant and consistent with the social, political, economic and cultural context within which the ICT resource will function.

6.3.3 Terminology translation

The localisation of software is constituted of different activities, and the translation of the resource files is a central activity. The translation of the T-DL software, as discussed in detail in Section 1.3.1, comprised of a series of pre- and post-translation activities during which a total of 22 English terms and phrases or 15% were not translated due to their technical intricacies. The results from the data showed that two teachers responded negatively to the untranslated terms and phrases because they said that the fact that some terms were not translated proved that English was a better and only option for use in the T-DL software, arguing that Setswana or any other African language cannot be used in technical fields like ICT. According to these teachers, using English is more beneficial since it is more advanced and offers more for personal and professional advancement.

These findings are in agreement with the findings of Seti et al. (2015, p. 18), who noted that speakers of Indigenous African languages were inclined to view English with higher esteem since they felt that a "good command of English, will also open the doors to job mobility and economic prosperity". Seti et al. (2015) further reiterated that the English language is central to all practices related to the global economy, the information society and the development of ICT.

In contrast to these findings, is the finding that noted that a number of the participating teachers volunteered to help translate the 15 % of the untranslated terms and phrases into Setswana, while some teachers also volunteered to help translate the existing Setswana terms into the different dialects that would accommodate the subtle differences in the way Setswana was spoken in the different regions in the North West province. This willingness by the teachers to become involved in the translation process further supports the ideas of Finlayson and Madiba (2002) and Osborn and Osborn (2010), who suggested that for African languages to be used in ICT resources, there needs to be a concerted effort to develop appropriate and resilient African language terminologies in the field of ICT. This process of development does not need just technical experts or linguists, but according to Alberts (2006), the person or end user for whom the software is meant should be actively involved in the process of translation as well as terminology development, which will ensure that language does not play a role in restricting entry into the digital environment (Njoh, 2018).

6.3.4 Cultural and contextual appropriateness

Overall, the teachers were pleased with the T-DL software in Setswana. However, the results from this study showed that the process of software localisation should not focus purely on the process of translating the original language of the interface into the target language, but that equal attention must be given to factors of context and culture. This was evident from three findings or comments. The first was that some teachers cautioned that the level of Setswana test items in the bank was too high for students from that district, while a single teacher indicated that she was happy with the level of the Setswana items for her students. This incongruity between the teachers could be as a result of the geographical position of the schools that these teachers come from, in that some of the teachers were from schools that were rural and some came from schools that were closer to the Brits urban area centre. Secondly, cognisance had to be given to the issue of language dialects, especially in African languages. This will be discussed in more detail later in the chapter. Thirdly, the issue of cultural beliefs must be taken into consideration.

The teachers noted that one of the Setswana items in the bank used a picture of a black cat, and according to the teachers, a black cat is something that is seen by some Tswana’s as a bad omen, and as such, should be avoided. Furthermore, the same

teacher also remarked that the T-DL software's website footer[14] was black and suggested that a neutral colour should be used. These results are corroborated by the findings by Khan (2014), who stated that most interventions in Africa have failed simply because the design and developers did not consider contextual and cultural factors. Bamgbose (2011) and Prah (2007) also explained that for any ICT resource to be accepted and adopted by a society, cultural and linguistic factors must be accommodated. South Africa is a multicultural society, and as such, the issue of accommodating the different cultures and languages becomes an even greater challenge. Therefore, the design and cultural sensitivity of computer programs and online software are important. According to Dia (2014), by ensuring this, access and acceptance of the ICT resources will grow exponentially. The argument around contextual and cultural accommodation is supported by Jandrić and Kuzmanić (2015) and Ndebele (2014), who suggested that it is only when the ICT resource meets the needs of the local context and its people, that the resource will achieve its true potential and the people realise its affordance. Osborn and Osborn (2010) maintained that the process of software accommodation or localisation can be a monumental task that requires the input from translators and technical experts. Equally important, Keniston (1997) suggested that the process of software localisation can be made simpler if the key players in localisation (linguists, translators, culturalists and technologists) are involved at the initial stages of the conceptualising and design of the software.

To summarise the results in response to the first investigative question, teachers found completing the straight forward navigation activities easier with the T-DL Setswana, while they found the complex activities like building an assessment task and task editing easier when using the T-DL English. A possible explanation for these results may be that the number of actions required to trigger the easier activities was fewer and the translated commands were easier to follow, while the more complex activities required multiple commands to be triggered to complete the activity and the translated commands were not straight forward translations but were new term developments that occurred during the localisation process.

[14] A footer is a section of content at the very bottom of a webpage.

6.4 Digital Assessment

At the centre of the T-DL software design is its ability and functionality to support and assist teachers to build high-quality assessment tasks using pre-set test items and then to allocate these assessment tasks to students who can complete these tasks online on any device. The discussion around the results captured in this theme will answer the second investigative question:

> How do the English and Setswana TARMII dual-language software support Setswana-speaking teachers' assessment practices?

Although most teachers tend to rely on traditional teaching methodologies, the introduction of ICT has opened a world of possibilities to replace or enhance traditional styles. The use of technology in education has given teachers the ability to reach a greater number of students more efficiently. The array of advanced technological functionality available to the teacher can greatly help and support teachers to monitor, provide feedback and support individual students (Neumann, Anthony, Erazo, & Neumann, 2019).

The design and development of the T-DL software attempted to include many technological innovations that would support assessment in the 21st century. The various functions, as shown in Figure 6.2, were available to the seven teachers in both the English and Setswana versions of the software.

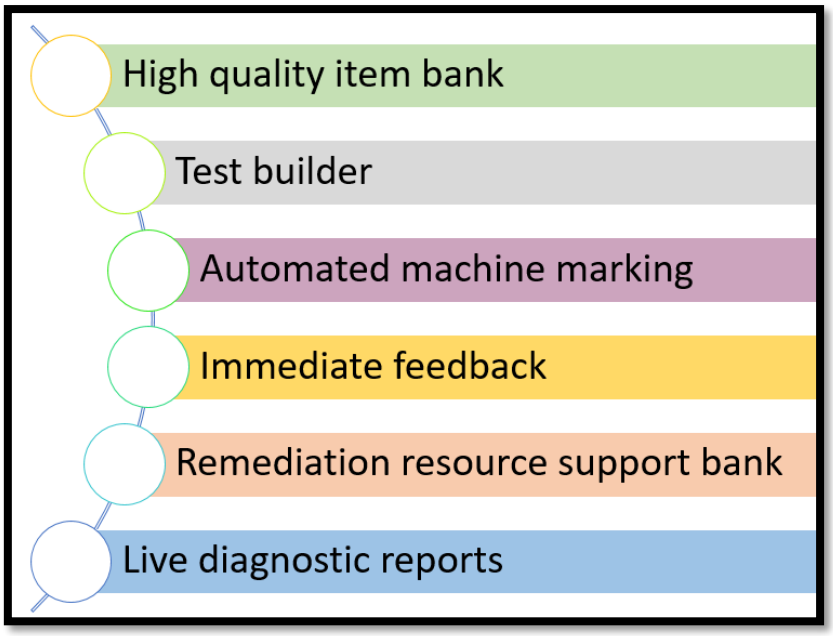

Figure 6.2: T-DL software e-assessment functionality

The results show that the teachers were generally content with the T-DL software, especially the assessment functions (Figure 6.2). The data shows that the teachers saw the software as something that will greatly minimise their workload because the T-DL software provides the teachers with the function to set and mark a test, provides diagnostic feedback and also suggests remediation support resources. This finding is in line with the findings of Sahito and Vaisanen (2017) and Thorsteinsson and Niculescu (2012), who stated that for an ICT resource to be accepted and used by teachers, the resource must minimise the workload or provide an innovative alternative to complete a traditional task. Furthermore, the finding also supports Neumann et al.'s (2019, p. 9) suggestion that the use of technology for assessment should "simplify test administration, to automate test scoring, to create reports that make use of new measures of learning …, to aid in the interpretation of results".

The emphasis of the ILS intervention was to investigate how Setswana-speaking teachers reacted to the Setswana version of the T-DL software, with focus on the Setswana GUI. An unanticipated finding was when the teachers commented during the interview process that the availability of English resources was "great", but they were concerned with the lack of quality Setswana items. The findings showed that the teachers were happy with the Setswana items, but felt that there should be more Setswana items and that the items should be at the level of their learners. This finding is supported by the work of Keegan (2008, p. 8), who suggested that to ensure that

Indigenous users engage with the localised software, it is necessary that “an Indigenous language version of the interface should focus on highlighting and directing clients to Indigenous language content”. While Lieberman (2003) stated that as long as there is a lack of digital content in Indigenous languages, Indigenous language speakers will perceive Indigenous languages as having a lower status and significance and thus opt for the dominant ex-colonial language, like English. Adegoju (2013) also argued that as long as information exists in a language unfamiliar with the Indigenous population, they will not be able to access it and benefit from it.

6.4.1 Assessment builder

As stated, the assessment build function is central to the T-DL software. From the interview data, it becomes clear that the teachers were generally pleased with the way the assessment build function worked. They indicated that the steps were simple to follow. However, a comment made by two teachers during the interview, stating that they found the English interface of the assessment builder easier to engage with and use than the Setswana version. According to these teachers, the steps that had to be followed to build an assessment task in the Setswana version was not clear. However, on further enquiry there are two reasons why they felt that the Setswana version was difficult to follow. According to the first teacher, the steps in the Setswana version was easy to understand in Setswana, but to her the steps were not sequential or logical; hence the steps to build the assessment task did not make sense. The second teacher reported that the translation of some of the commands into Setswana was not accurate, and as such, this teacher mentally translated the Setswana commands into English and then triggered the Setswana commands or icons. Both these teachers reported that they would rather use the English version of the software, which they said would make their work easier.

These two results bring to the fore the argument put forward by Doherty (2016), who emphasised the need for a very high standard of translation and stated that if the process of translating ICT terminologies is not accurate, it will result in users not being confident in using the software, which ultimately would result in them accepting and using an English version of the software. As such, Doherty (2016) insisted that when it comes to software translations, it is necessary to include expert linguists and software specialists. However, Keet and Barbour (2016) rejected Doherty’s (2016)

argument and argued that for the successful translation of ICT terminology into an African language, expert linguists and ICT specialists should not work in isolation, but should consult with the target end-users of the software, the speakers of the Indigenous African language.

To summarise the results in response to the second investigative question, the results from the data show that the teachers were pleased with what the T-DL software (English and Setswana) offered them because it minimises their workload and provides real-time student feedback with diagnostic reports. The teachers, however, commented that the T-DL software lacked sufficient Setswana assessment items. It must be noted that the sample was fairly small, and as such, the result that they were happy with the software minimising their workload is not transferable to similar contexts in South Africa. The result that the software lacked Setswana test items can be because the T-DL software was initially developed as an English-based software.

6.5 Indigenous African Languages in ICT

The unique nature and contribution of the ILS intervention lay in its use of Setswana, an Indigenous African language, as a language for online educational software. Currently, great emphasis is being placed globally on empowering Indigenous languages because of the increased concern around the neglect and rapid extinction of Indigenous languages. The discussion of the results captured in this theme will attempt to answer the third investigative question:

> How does exposure to the TARMII dual-language online assessment software influence the attitudes of Setswana-speaking teachers towards the use of Indigenous African languages in ICT?

6.5.1 Empowering African languages

The review of literature further showed that African languages are greatly underrepresented in all key sectors of South African society, and subsequently, African languages occupy a lower status than English, and in some instances, Afrikaans.

From the data it became apparent that the teachers felt a sense of pride when they were introduced to and started using the Setswana version of the T-DL software.

Some of the teachers indicated that they did not expect to see an African language being used in computer software. Prior studies conducted by Adera et al. (2014) and Lieberman (2007) supported this finding and stated that providing Indigenous populations access to and use of digital resources in their mother tongue will bring about a sense of respect and pride in their language, which would eventually lead to the Indigenous language being viewed as a language of status and as an equal to the dominant ex-colonial languages. However, a concerning trend also emerged from the data. While the teachers felt pride seeing Setswana being used in an online education platform, a general perception emerged among most of the teachers that Setswana and Indigenous African languages did not have the necessary capacity or terminology to be used in ICT or any other technical field. Therefore, there is a perception that African languages occupy a lower status than and are inferior to English. This scepticism is built on the notion that since English already has a strong foundation of terms and phrases that are used in ICT and as such, it would be difficult to translate those terms into Setswana (Prah, 2007).

The results also showed that one teacher viewed Indigenous African languages as best suited for use at social gatherings and church services. This is the same teacher who at the start of the ILS intervention said that even though she was proud to see Setswana being used in software, she would still use English as she felt that English is better suited for use in specialist subjects. This result was reinforced by the findings of Yu and Dumisa (2015), who stated that many Africans equated English with education and intelligence and equated Indigenous African languages with culture and religion. This result can also be explained through the concept of the static maintenance syndrome that Alexander (2010) proposed to explain the differentiated view Africans held about the place and role of Indigenous African languages. This perception that Setswana or any other African language does not have the power or capacity to be used in specialist subjects is a clear sign that Indigenous African language speakers do not believe their language has an intellectual capacity. This was evident from a teacher's statement that "everything is English. When you go to work and at school you are being taught in English. English is for the big difficult subjects". Hence, it is critical to empower Indigenous African languages through modernisation and intellectualisation in South Africa. Prah (2007) explained that language empowerment is when an African society in their attempt to achieve modernity ensures

that the language of literacy and education is an Indigenous language. Khumalo (2017) expanded on the concept of language empowerment by linking it to the concept of language intellectualisation, which essentially is a process of ensuring that an Indigenous language has the necessary terminology to be used with scientific rigour and precision in any field, which will negate the perception that Indigenous African languages lack technical terminology and are therefore unintellectual languages (Ndebele, 2014). According to Phaahla (2014), the use of Indigenous African languages in ICT is in line with the key proposal made at the 2003 *Conference on Open Access to Knowledge in the Sciences and Humanities*, which motivated global members to exploit the opportunities and affordances offered by ICT to develop software to advance languages other than English.

6.5.2 African languages in ICT promotes access

The promotion and use of Indigenous African languages in ICT would greatly ensure equitable access to ICT resources and digital information for all. The concept of access to ICT resources has traditionally been viewed from the perspective of the digital divide (Section 2.11). Results from the data show that the teachers were overall happy with the introduction and use of Setswana in the T-DL software and that the teachers supported this feeling by suggesting that access to software in their Indigenous language would ensure teachers and students who are not fluent in English will greatly benefit from accessing educational software in a language natural to them

As such, the concept of the digital divide, as explained in the various bodies of literature (Bagchi, 2005; Naidoo & Raju, 2012; Sein & Furuholt, 2012), can no longer be viewed purely from the perspective of physical access to ICT resources as emerging literature (Fuchs & Horak, 2008; Hsieh et al., 2008; Sikhakhane et al., 2005; Wong et al., 2010) has identified language as a key factor in promoting and sustaining the digital divide. This result is further supported by Anthony and Padmanabhan (2010), who found that to address the digital divide, most developing countries are placing too much emphasis on addressing issues of physical access to ICT resources and are neglecting the role of language and culture in promoting the digital divide. Etoundi et al. (2016) urged for the inclusion of African languages and cultures within the ICT space, since it is only when African languages are accommodated in the digital

space that the acceptance and use of ICT will be widespread across the African continent.

6.5.3 African languages in ICT, a problem or solution

The results of this study show that most of the teachers were positive about the inclusion of Setswana in the T-DL software as well as the accuracy of the translations of the terminologies. The teachers further acknowledged that having the T-DL software and its functionality available in Setswana provided them with a series of innovative solutions that would ease their assessment workload (Figure 6.2). This finding is in line with Venkatesh and Sykes's (2013) comment that the acceptance and use of any ICT solution by an Indigenous population will only be successful if the issues of linguistic and cultural appropriateness are addressed.

So while acknowledging the value of using Setswana in the T-DL software, the results also pointed to an area of concern raised by some of the teachers. Their concern emanated from the fact that most Indigenous African languages have multiple dialects and whether the T-DL software would be able to accommodate these subtle differences within a single African language. This problem was discussed in Section 5.6.4.3 where an example of dialect difference was shown: The Setswana word for rat is is *peba* in Mahikeng, which is about 250 km away from Madibeng, where the Setswana word for rat is *lekgotlo*.

According to the teachers, these subtle regional differences in the Setswana language can impede the acceptance and use of the T-DL software or any other software localised to an African language. Ouane and Glanz (2010, p. 62) challenged the notion that differences in dialects can pose a problem and stated that differences in dialects should not impede communication since "people speaking different speech varieties sufficiently understand each other and can communicate without difficulty since they are speaking dialects of the same language". However, Mtsatse and Combrinck (2018) maintained that the differences in dialects, even though subtle, cannot be ignored when translating any resource. They noted that when dialect differences were not considered and a standard or neutral translation was provided, the teacher and students developed negative attitudes towards the standard translation version since they felt that the translation was not culturally and linguistically suited for their context.

An additional finding that was not anticipated but that emerged from this study was the benefit the Setswana version of the T-DL software held for students with learning difficulties. The data showed that a few of the teachers noted their pleasure of having the T-DL software in Setswana. According to these teachers, working with Grade 3 students that have learning problems is a challenge, and trying to address their learning problems using English ICT resources simply amplifies the students' problems. However, the Setswana version of the software and Grade 3 content will make providing learning support to these learners so much easier for the teachers. This finding is supported by Adera et al. (2014), who stated that having content in an Indigenous language will greatly develop the confidence and pride in using the Indigenous language in educational subjects, while El-Koumy (2016) noted that to address and resolve learning problems among students in a foreign language would simply exacerbate the problem since the issue of decoding and comprehension will be greatly compromised. Ivancevic-Otanjac (2016, p. 463) furthered this argument, stating that if the issue of language is no longer a barrier to the African student, the teacher simply has to "address the weakness areas of students with disabilities and difficulties by making instructional and content modifications".

The results also showed that the teachers felt that the Setswana version of the T-DL software empowered the Setswana-speaking teacher. During an interview, a teacher commented that "the teacher in Lebotloane, who can't speak English will now be able to use computers the same way a teacher in the city can, that's good".

To summarise the results in response to the third investigative question, the results from the data shows that the teachers were generally very positive towards using African languages in ICT and felt that introducing and using African languages in ICT will empower and raise the status of African languages. However, they also cautioned against neglecting African dialects and insisted that dialects must be accommodated in software localisation. This result may be explained by the fact that the teachers themselves realised that Setswana and other African languages have been greatly neglected not only in ICT but in other main sectors as well and that even though they may prefer using English, seeing Setswana being used in ICT will benefit other users who may not be fluent in English.

6.6 Legacy of Colonialism in ICT

Colonialism and its legacy have without a doubt affected and still affect aspects of South African society. The dominance and imposition of English over South Africa's Indigenous languages are just one of the legacies of colonialism. This situation has resulted in the vast majority of South Africans being excluded from active participation in key areas of society because of language. One such area is ICT. The potential benefits that ICT holds have greatly been diminished because language serves as a barrier to access. The discussion of the results captured in this theme will attempt to answer the fourth investigative question:

> What is the relationship between Setswana-speaking teachers' view of the use of English in the TARMII dual-language software and the use of Setswana?

6.6.1 Status of English

The English language has had a great impact on the linguistic structure of many nations and has influenced how individuals perceive the role of English in their personal and professional lives. The results of this study clearly showed the distinct view that the teachers held concerning the role and position of English. Firstly, the results showed that some of the teachers perceived English as a superior language to Setswana and other African languages. This is seen in their comments that fluency in English is essential for success in the employment sector and that those fluent in English will have better opportunities when seeking employment and during job interviews. This result is supported by David and Okazaki's (2006) findings that in the American Filipino community, fluency in English is a sign of higher intelligence and being able to speak English is a necessity for a Filipino to secure employment and to progress socially. A similar finding was noted by Adegoju (2013), who commented that within the African context, many Africans viewed fluency in English as a way to develop and progress professionally. However, Adegoju (2013) cautioned that the drive to empower English in African countries can result in those Africans who are not fluent in English becoming non-active and non-effective participants in African society. According to Ndebele (2014) and Phaahla (2010), this perception that proficiency in English equates to economic prosperity and a higher social standing is common in a

post-1994 South Africa, which is a result of the Indigenous population believing that their language is inferior to English (Gupta-basu, 1999).

6.6.2 Colonial mentality and the use of Setswana in the GUI

The results of this study show that some teachers believed that Setswana and African languages have no power, and thus, will never be able to develop and advance in the digital age, implying that African languages have no purpose or future in the 21st century and going forward. This finding supports what Bamgbose (2011) and Němeček (2010) alluded to in their work, in which they stated that the first suggestion of the demise of a language occurs when the speakers of the language see no value or future in the language, which is evident in this finding. Kaschula and Maseko (2014) stated that it is important that African languages become globally relevant, which can only be achieved when they can be used in specialist subjects and domains. As such, it is not surprising that we see the ascendency of English at the expense of Setswana, simply because the Setswana teachers found English more attractive and saw a future for English in the field of ICT over Setswana. Fuchs and Horak (2008) alluded to this when they stated that the African population will adopt the use of English over their African language when they see no value or power in their Indigenous language.

This marginalisation of Indigenous African languages does not only impact the status of African languages, which was evident from the results of this study, but also, according to Gudhlanga and Makaudze (2012) and Ndimande-Hlongwa and Ndebele (2017), creates an environment in which Africans view themselves as being inadequate and inferior to those who speak English. This condition or feeling of inadequacy and inferiority is described by Van Der Westhuizen et al. (2017) as another legacy of colonisation. The colonisation of the African mind still exists in South Africa in 2020. The existence of the colonial mindset or the colonised mind was evident in this study where the results showed that some teachers believed that English should be used in official and academic contexts, while Setswana should be used for prayer and social gatherings.

Various study findings have shown that the low status and use of African languages is largely due to negative attitudes that African language speakers have towards their language, as they feel African languages are inferior and lack the capacity and intellect to be used in fields like ICT, law, medicine and education (Léglise & Migge, 2007;

Shakib, 2011; Tshotsho, 2013). This finding was supported by results from the ILS intervention, where some teachers commented that because 15% of the terms (22 terms) were not translated on the T-DL software, it was sufficient proof that Setswana could never be used in ICT and that it supported their argument why English was still the best and only option. However, this argument can be challenged based on the evidence from the web-review process (Section 2.10), where it was noted that the multilingual Physical Science website (Thunderbolt Kids) still had certain non-translated terms in English even though it was available in four official languages of South Africa and has been active since being published in 2008.

6.6.3 Addressing the language issue in a post-1994 South Africa

Post-1994 South Africa saw the introduction of a plethora of acts and policies to rewrite the injustices of the past. Politicians, sociologists and academics all agreed that achieving equity in education and language was central to South Africa's development. Fast forward to 2018, the ILS intervention produced an interesting finding during the T-DL software training phase: When introduced to the software, the seven participating teachers remarked that they were very shocked and happy to see their language (Setswana) being used on the internet and in computer software. A teacher commented that she never knew that Setswana could be used in computers and always thought that computers only worked with English.

In 1996, the Language Plan Task Group published a report called *Towards a National Language Plan for South Africa* and the report clearly stated that it was necessary to "promote the use of indigenous languages in new domains" (LangTag, 1996, p. 4). In 2003, the South African Department of Arts and Culture produced the *National Language Policy Framework*, in which it is clearly stated that "this Policy Framework also takes into account that we are faced with the challenge of globalisation and that our Indigenous languages should be part of the rapidly expanding technological environment" (Department of Arts and Culture, 2003, p. 3). In 2004, the South African Department of Education published the *White Paper on e-Education*, which stated the following

> The Department of Education, in collaboration with the Department of Arts and Culture, will promote the adaptation and development of local content into Indigenous languages. While there is a large amount of curriculum

> material and resources available on the internet, this online content must be evaluated for educational relevance before adaptation and possible translation into Indigenous languages. (Department of Education, 2004, p. 26)

So almost 24 years since the publication of the LangTag report and 16 years since the *White Paper on e-Education*, where it was explicitly stated that to "promote the use of languages" and that "online content must be evaluated for educational relevance before adaptation and possible translation into Indigenous languages", not much has been done to empower and intellectualise African languages so that it could be used in the field of ICT. As long as South Africa lacks the will to implement policy, English will continue to dominate the ICT environment and end-users will have no option but to use English computer interfaces, which ultimately will result in them viewing English as a superior language that is better suited for use in ICT and other important subjects.

To summarise the results in response to the fourth investigative question, the teachers were generally happy to see Setswana being used in computer software and they felt it would help those who cannot speak English fluently. However, the teachers still felt that English was a better language for use in ICT because they believe that English gave them more power and opportunity. A possible explanation for these results may be that the teachers felt that using English in software would benefit some Indigenous speakers, while they felt that having computer software in an Indigenous African language would benefit many more people. They related it to the T-DL software and said that teachers in other parts of the North West province would enjoy working with the Setswana version.

6.7 Summary

Overall, the results from the ILS intervention indicates that the teachers were generally satisfied with engaging and using both language versions of the T-DL software. All the teachers indicated that they were happy and proud to see Setswana being used in the T-DL online software. The comparison of the rating of the teachers ease of use between the English and the Setswana version of the T-DL software indicated that there was just a 4% difference in favour of the English version being easier to use (Table 6.1). However, even those teachers who indicated that they were pleased and proud to see Setswana being used in the T-DL software felt, like all the other teachers,

that currently Setswana or any other African language does not have the capacity or intellectual facility to be used in ICT. As such, they felt that that English was the best and most appropriate language to be used in ICT within the South African education system.

This rather inconsistent result can be explained by looking at the conceptual framework adopted for the ILS intervention (Chapter 3). Traditionally the TAM focused on the aspects of perceived usefulness and perceived ease of use, which essentially explains how the user's perception of the new technology influences their acceptance of the technology. However, within the context of the ILS study, the adopted conceptual framework had to accommodate the perceived usefulness and perceived ease of use while at the same time accomodating the context (language) in which the technology was going to be used.

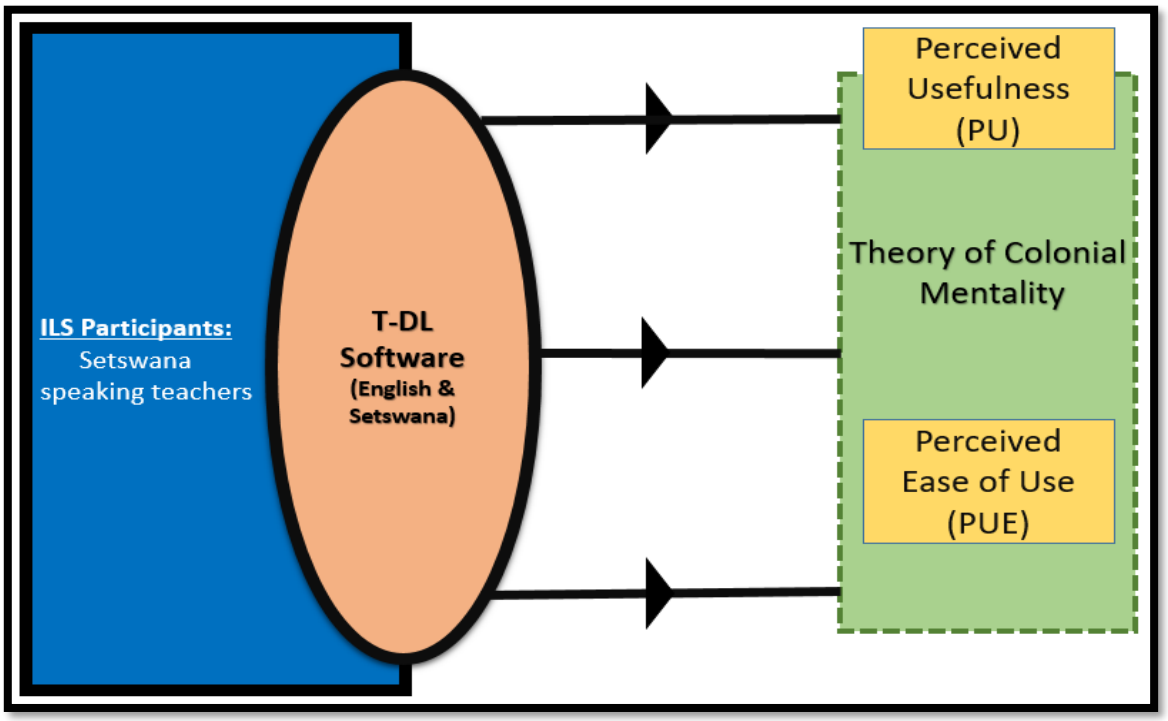

Figure 6.3: Technology acceptance of the ILS teachers

In the context of the ILS intervention as summarised in Figure 6.3, seven first language Setswana-speaking teachers were introduced to the T-DL software. As with the normal TAM model, these teachers would have seen its *perceived usefulness* as well as its *perceived ease of use*. However, as the results show, the teachers had never before experienced, seen or even used educational software in Setswana or any African langaguge. As such, the data collected from these teachers had to be explained within

a framwork that would capture this unique situation and essentially capture a snapshot of a specific period in time when they were exposed to and expected to use such a piece of software. As such the results show that although they were “happy” and “proud” to see the Setswana version of the T-DL software, their perceived usefulness and perceived ease of use was eventually influenced by their fixed belief that English was a stronger and more advanced language as compared to Setswana, this mental state of the teachers is best explained through the theory of colonial mentality.

Thus the conceptual framework adopted in the ILS intervention greatly supported and unlocked the various strands of data collected during the two data collection phases of the ILS intervention. So while the T-DL software is a unique piece of technology within the South African educational context, and while the teachers may have felt pride in using this technology in their mother tongue and saw its benefits, the legacy of colonialism ensured that these teachers viewed the use of their Indigenous language in this technology as being sub-standard and inferior to English. Future software can be developed in Indigenous African languages, but that does not guarantee that African languages will be accepted as an equal to English or any other ex-colonial language, it thus becomes imperative that every effort must be made to address the colonial mentality that exists among so many, it is only when this is achieved that true development can begin.

CHAPTER 7
CONCLUSIONS AND IMPLICATIONS

The language they were forbidden to speak
is the same language that saved this nation.

(Lowe 2008)

7.1 Introduction

In this final chapter, the results from the ILS intervention are briefly summarised with reference to the main research question. A summary of the study process that speaks to the review of the literature and the conceptual framework is summarised in Section 7.2, and the success of the study in answering the main research question is appraised with a summary of the findings in Section 7.3. Next is a review of the contributions made by this study in Section 7.4, specifically concerning its theoretical and practical contributions. Section 7.5 presents a personal reflection based on my experience conducting the study, and this leads to a review of the limitations of the study in Section 7.6, which is followed by suggestions for future research in Section 7.7 and by concluding remarks in Section 7.8.

7.2 Summary of the Study Process

The ILS intervention was positioned in the area of software localisation, and more specifically, the localisation of educational assessment online software into Setswana, a South African Indigenous African language. The purpose of the ILS intervention was to determine whether the localisation of an English language online assessment software to include Setswana would influence the Setswana-speaking teachers' software experience and attitude towards the use of Indigenous African languages in ICT. A pilot study was conducted on a small scale to evaluate the feasibility, duration and adverse conditions that could impact the software training and the data collection instruments to inform and improve the study design of the full-scale ILS intervention. The study adopted an inductive approach, and Table 7.1 presents an overview of the main chapters.

Table 7.1: ILS overview

Chapter 2	Chapter 3	Chapter 5	Chapter 6
Due to the limited body of literature in the field of software localisation within the African and South African context, it was necessary to extend the expansive review of literature to areas that were deemed important in the use of Indigenous African languages in ICT. The areas included African languages, digital divide, Africanisation, technology adaptation, ICT affordances, and technology acceptance.	The culmination of the review of literature saw the development of a conceptual framework that was a fusion of the TAM and the theory of colonial mentality. This framework were aptly suited to explain the collected data, ranging from ICT user experience rating to participant responses dealing with the attitude towards Indigenous African languages in ICT.	This chapter saw the various sets of data collected from the two data collection stages being analysed within an integrative analysis process that led to the presentation of the data in the form of frequency tables, charts and narrative or textual reports.	In this chapter, the significance of the findings were discussed and interpreted within the context of the existing body of literature and the research problem under investigation. New insights emanating from the findings in relation to the research problem were explained.

Seven Setswana-speaking teachers based at three primary schools in the Madibeng District of the North West province were purposively selected to participate in the study. All the teachers attended a compulsory software training session. Three data collection instruments were administered to the seven teachers. The data collection took place in two stages. During the first stage, the teachers engaged and used the English version of the T-DL software, and during the second stage, they engaged and used the Setswana version of the software. During each stage, the same three data collection instruments were administered. Analysis of the data collected from the SSO instrument and the PO instrument provided insight into the ease-of-use experience of the teachers and also allowed for the comparison of the ease-of-use experience of the teachers as they used the two language versions of the T-DL software. The data collected from the IDI instrument allowed for a broader view of how teachers perceived the role of ICT in teaching and assessment as well as their attitude towards the introduction and use of African languages in ICT.

7.3 Summary of the Study Findings

The introduction and access to an online educational software in an Indigenous African language, Setswana, is without a doubt an innovative step within South Africa's ICT and educational environment. This study was both unique and ground breaking in that it provides Indigenous African language speaking teachers' access to a truly South African online software in their first language. To capture the complexity and richness of the engagement and rejoinder of the Setswana teachers as they used the T-DL

software, the ILS study was designed around the main research question and supported by four investigative questions (Table 7.2).

Table 7.2: Research question and investigative questions

Main Research Question			
How does the use of Setswana as the language of the TARMII dual-language online assessment software influence Setswana teachers' software experience and their attitude towards the use of African languages in ICT?			
Investigative Questions			
1	**2**	**3**	**4**
What is the difference between the ease-of-use experience of the Setswana-speaking teachers when accessing and using the English version of the TARMII dual-language software and when accessing and using the Setswana version?	How do the English and Setswana TARMII dual-language software support Setswana-speaking teachers' assessment practices?	How does exposure to the TARMII dual-language online assessment software influence the attitudes of Setswana-speaking teachers towards the use of Indigenous African languages in ICT?	What is the relationship between Setswana-speaking teachers' view of the use of English in the TARMII dual-language software and the use of Setswana?

In order to answer the main research question, the ILS intervention offered three major findings that are also significant in the context for any future projects dealing with the localisation of software into an African or any Indigenous language. The first finding showed that the teachers appreciated working on the Setswana interface and indicated that they felt a sense of pride and elation. The finding also noted that the teachers found using the English version of the software easier when they were required to complete complex assessment activities, while they found the Setswana version easier when completing the more simple activities that involved interface navigation. The implication of this finding could be directly related to the issue of terminology development. As stated in Chapter 6, certain terms that did not have an equivalent in Setswana went through the process of language development. This was done by the Setswana translator and approved by the moderators, and as such these terms were unfamiliar to the teachers. Hence these terms were more difficult to understand and contextualise within the T-DL assessment activity functionality. Therefore, they found the English version easier when building an online assessment task.

The second finding was that while all teachers were satisfied with the level and accuracy of the translations into Setswana, some were not confident that Setswana could be used in ICT as there were some terms and phrases that still appeared in English on the Setswana version of the software. As a result, the teachers adopted

the attitude that since certain terms and phrases could not be translated into Setswana, English in their view, were the superior and more appropriate language to be used in ICT. They believed Setswana lacked the intellectual capacity to be used in ICT. An implication of this finding could relate directly to David and Okazaki's (2006) state of colonial mentality, in that the state of colonial mentality of the teachers typically shows that after decades of physical colonial rule, the teachers who were part of the ILS intervention believed that English was better suited to be used in ICT as they felt English was a superior language to Setswana.

The third finding of this study suggests that while term and phrase translation is important, equal attention must be given to the culture and context within which the software would be functioning. This was noted by a teacher who raised her concern pertaining to colour and animals. The implication of this finding could mean that any future localisation project should consider involving the potential end user from the early stages of software conceptualisation and design to work alongside the linguists and software developers.

It has become very clear through the triangulation of the data that a number of the teachers found working on certain functions easier when using the Setswana version and rated their ease-of-use experience with the Setswana version higher than with the English version. The same teachers who professed their pride in seeing Setswana being used in ICT during the interviews but ended by acknowledging that they would prefer using English in ICT since to them English offered more opportunities for development. Their comments suggested that English is a more intelligent language. Thus their perceived usefulness and perceived ease of use of the T-DL software was greatly influenced by the view that English was a better-suited language for technical and complex fields like ICT, supporting the role that the influence of colonial mentality had among these teachers concerning the acceptance of technology.

7.4 Contribution

The ILS intervention is a predominately technology-driven study, and because of its focus, will contribute greatly to the existing body of knowledge at a theoretical and a practical level.

7.4.1 Theoretical contribution

The use of ICT in education is expanding at an incredible rate; however, the integration and use of ICT for educational purposes in developing countries are greatly below par compared to developed countries. To allow developing countries, which most often speak Indigenous languages, to benefit from ICT, it is essential that the ICT resources are made available to the developing world in their respective languages. The strength behind this study is its contribution to the current body of knowledge concerning the field of localising software into Indigenous languages and the development of a framework that will support the use of Indigenous languages in ICT. The search for relevant bodies of literature about the use of African languages on ICT platforms produced a dearth of information, and as such, this study through its literature and findings will greatly add to the small but existing body of knowledge in this field. Furthermore, the conceptual framework developed in the ILS intervention provides future localisation researchers with a framework that would allow them to account for and accommodate legacies of the colonial period within the ambit of technology acceptance.

7.4.2 Practical contribution

At a practical level, the ILS intervention provides software developers and translators various levels of engagements and insights.

It offers software developers the following insights and guidance when localising software:

- The expectations and demands that must be met to conceptualise and design a multilingual software
- The need to include a wide array of key role players to localise software
- The need to focus on context and culture when localising any software platform

It offers translators the following insights and guidance when translating software for localisation:

- The need to include a wide array of key role players when translating terms and phrases that will be used with a digital platform
- The importance of terminology development

7.5 Personal Reflection

It was during the early parts of 2015, while I was working at the HSRC on the third version of the TARMII educational software, an online software for the support of assessment practices of the South African teacher, that I had the idea for my PhD. The eventual rollout of the software promised to provide access to an online platform to every South African teacher that would simplify and streamline their assessment practices. As I sat and contemplated the possible path for my PhD, I was listening to the Redemption Song by Bob Marley, and these lyrics would eventually underpin my PhD and my PhD journey:

We are going to emancipate ourselves from mental slavery because while others might free the body, none but ourselves can free the mind.

These lyrics were part of a speech delivered by Marcus Garvey in Nova Scotia in October 1937. Looking to further understand the song and the speech, I found an unorthodox academic paper written by Hooley (2015), who used the Redemption Song to critically discuss issues around self-actualisation, social justice and social transformation. In his paper Hooley (2015, p. 1) defined the concept of mental slavery as “the link between how people think about themselves and political change”. Getting back to my PhD and hoping to find a niche for my study, I extracted the findings from both the TARMII 1.0 and TARMII 2.0 research reports. In the 2013 TARMII 2.0 report, a side note cited two participants who expressed their nervousness and unease of engaging and using the TARMII 2.0 software because of their lack of fluency in English, the default interface language of the software.

The aim and promise of the third version of the software were to make the life of every South African teacher easier. However, if the software were still going to be developed using traditional Western software design principles with English as its default language, would the software serve “every South African teacher” since most South African teachers speak an Indigenous African language. If this status quo in the design of educational software remained, would it not imply that every Indigenous African language speaking teacher was compelled to accept, access and use digital software and information in English. This led me to another declaration made by Marcus Garvey in his speech: ‘The man who is not able to develop and use his mind is bound to be the slave of the other man who uses his mind ….’ (Hooley, 2015).

It was at this point that the words of Marcus Garvey, Hooley (2015), the lyrics of the Redemption Song and the TARMII 3.0 technology merged and allowed me to see my niche and identify a problem that needed to be addressed, which led to the localising of the TARMII 3.0 software to include Setswana, an Indigenous African language, and to the birth of the TARMII dual-language (T DL) software. Those lyrics by Bob Marley that served as the stimulus for my journey are fittingly the words I used to start this story in Chapter 1 and to end my journey here. This real-life problem guided and grounded my PhD, so that the findings are pertinent not only within a South African education and social context but also in a global context where most of the world's Indigenous languages are being marginalised in the digital space.The completion of this study was a journey. A journey on which there were many detours and unexpected stops. Although the study evolved with every word written, every thought and every piece of data collected, I essentially stayed the long road. Initially, my vision for the study was to include a larger number of teachers spanning more provinces and more languages, but due to circumstances beyond my control, I was forced to work in a single province with a small number of teachers. I learned on this journey not to take anything for granted and to be prepared for anything. As such, it became passion to constantly challenge whatever hurdles this study threw my way, from power outages to service delivery protests.

For me, the greatest challenge and what I initially perceived to be a weakness was my inability to speak an Indigenous African language, since my study focused on the use of Setswana in the field of ICT. However, as I immersed myself into the study, I realised that what I perceived as a weakness were a strength because my position allowed me to engage the literature, the participants, and the data from a neutral, non-biased standpoint, which added legitimacy to the study and its results.

My readings of various literature sources and engagements with linguists and teachers gave me a solid grounding to understand the depth and implications of the study, while my passion for technology in education was at times thrown on its head as I interacted with teachers teaching in the most demanding contexts in the North West province. As such, many a time I became a sceptic and questioned the feasibility of introducing ICT to the South African teacher, and just like Larry Cuban (2001) in his book *Oversold and Underused: Computers in the Classroom*, I questioned whether the introduction of T-DL to an Indigenous African language speaking teacher would

actually add value to the teachers' everyday work. But I was constantly reminded of John Dewey, an educational reformer, who said, "If we teach today as we taught yesterday, we rob our children of tomorrow" (GoodReads, 2013).

7.6 Limitations of the Study

According to Kinloch (2020), scientific research is an imperfect practice since the focus is to investigate research questions in areas that are both known and unknown, and this carries with it a high probability of human error, hindrances in data collection, and bias on the part of the researcher or participant. As such it is important to acknowledge and discuss the limitations that were present in the study. Acknowledgement of the limitations within the study is beneficial since it allows for future research with a similar focus to be enhanced, while allowing the readers to gain an understanding of the study's framework and value. By presenting the limitations of the study, the researcher is not admitting to bad planning or incoherent thought but is rather informing future researchers of the challenges and pitfalls in the research process so that similar challenges can be addressed (Price & Murnan, 2004). The limitations of this study is essentially a learning curve for researchers and software developers interested in localising computer software into an Indigenous African language or any other Indigenous language. The findings in this study are subject to the following limitations:

- **The sample:** Even though Kakulu (2014) advocated for the use of small samples when studying a new phenomenon, I still feel that a key limitation of the ILS intervention was the small sample size, which essentially resulted in the use of just one Indigenous language (Setswana). If a larger sample size was used, the study could have included a second or third Indigenous African language, which would have allowed for a deeper set of data to be collected from different language groups situated in different geographical locations in South Africa.
- **Lack of previous empirical studies:** Due to the scope of this study, the availability of relevant prior research was very limited at both a national and international level. As stated in Chapter 2, the few pieces of African research in the field of software localisation were from a more theoretical standpoint rather than pure empirical research. Hence the use of prior studies to support the theoretical foundations of the ILS study was limited.

- **Data collection period**: The data collection took place over two stages (English and Setswana) with a month in between the two stages. The initial plan was to conduct both stages consecutively. However, due to violent service delivery protests in the Madibeng area, the second stage took place a month later. The one month break between the stages was too long, and as such, some of the teachers lost interest in the software while others used the English version extensively, which was not ideal for the second data collection stage.
- **Data collection instruments:** Although the teachers were willing to engage in English during the data collection, a serious limitation in the data collection process was the language medium used during the data collection, especially the interviews. In retrospect, it would have been opportune and justified if I had translated all three data collection instruments into Setswana.

7.7 Future Research

This study has resulted in the emergence of additional questions in need of further investigation. These are the questions that the study raised:

- It would be interesting to conduct a cross-national study involving additional Indigenous languages across multiple provinces using the T-DL online software.
- Further work needs to be done to investigate the influence that the involvement of Indigenous language speaking teachers as consultants and designers can have on the process of localising educational software.
- Further research might explore the perceptions around the use of dialects in an African language in the field of ICT.
- Further research can explore how colonial mentality influences the intellectualisation of African languages, especially in the field of ICT.
- Another possible area of future research would be to investigate how the introduction of online educational software influences the attitude of students towards African languages in ICT.

7.8 Concluding Remarks

The need and drive to promote the use and status of Indigenous African languages has been emphasised through various acts and polices from the dawn of South

Africa's democracy; however, the implementation of these policies has not been effective. The explosion of ICT and the benefits that ICT holds for humanity cannot be denied, and in the same way, humanity cannot be denied the right to benefit from accessing and using ICT. However, the virtual colonisation of the digital world through the dominance of English has resulted in a situation that has seen the vast majority of South Africa's population being unable to access and use ICT resources simply because of their lack of proficiency in the dominant language, English. If we are to ensure that all South Africans can access and benefit from ICT, we must ensure that all South Africans can access and engage with ICT in a language that everyone feels comfortable using. Hence, the end argument put forward is not the purging of the use of English in ICT in South Africa, but rather the inclusion of Indigenous African languages alongside English as default languages used in the field of ICT so that technological resources and digital information accommodate all languages and all peoples of South Africa.

> Some promoters within the coalition seek profit from selling equipment and software in the school market. Others seek a swift solution to thorny problems that historically have crippled education. Still, others see an electronic revolution in classroom teaching practices. And some promoters, committed to social justice, want to ensure that poor and minority children will not be left behind in the rush for technological expertise. (Larry Cuban, 2001)

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APPENDIX A: LANGUAGE WEB CONTENT

Web page results: Afrikaans



Basiese strukture by diere

DID YOU KNOW?
Diere word geklassifiseer in diegene met 'n ruggraat (ruggraat) en diere sonder. Diere met 'n ruggraat word ***gewerweldes*** genoem en dié sonder ruggraat word ***ongewerweldes*** genoem .

Kom ons kyk na die liggaamsdele van diere van naderby.

Soos plante, het diere ook 'n basiese struktuur. Die basiese struktuur van 'n dier is:

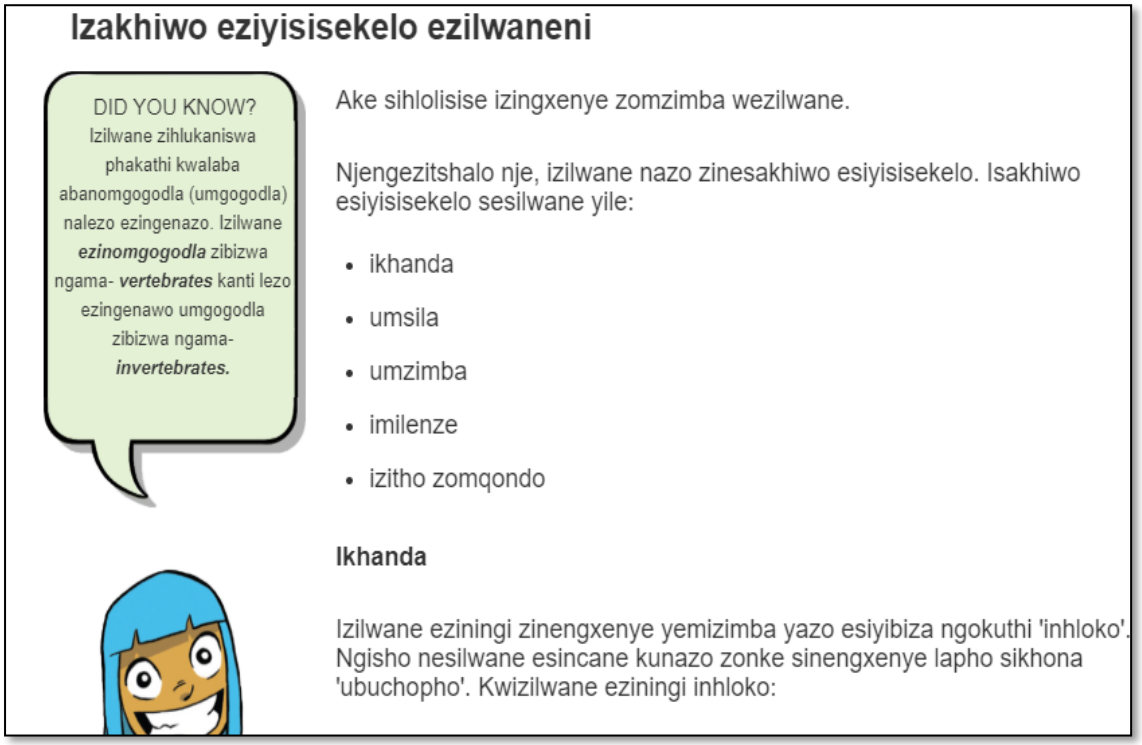
- kop
- stert
- liggaam
- ledemate
- sintuigorgane

Kop

Die meeste diere het 'n deel van hul liggaam wat ons 'hoof' noem. Selfs die kleinste dier het 'n deel waar dit 'brein' is. By die meeste diere het die kop:

- skuur (of breinagtige struktuur) - hoe klein ook al

Web page results: isiZulu



Izakhiwo eziyisisekelo ezilwaneni

DID YOU KNOW?
Izilwane zihlukaniswa phakathi kwalaba abanomgogodla (umgogodla) nalezo ezingenazo. Izilwane ***ezinomgogodla*** zibizwa ngama- ***vertebrates*** kanti lezo ezingenawo umgogodla zibizwa ngama- ***invertebrates.***

Ake sihlolisise izingxenye zomzimba wezilwane.

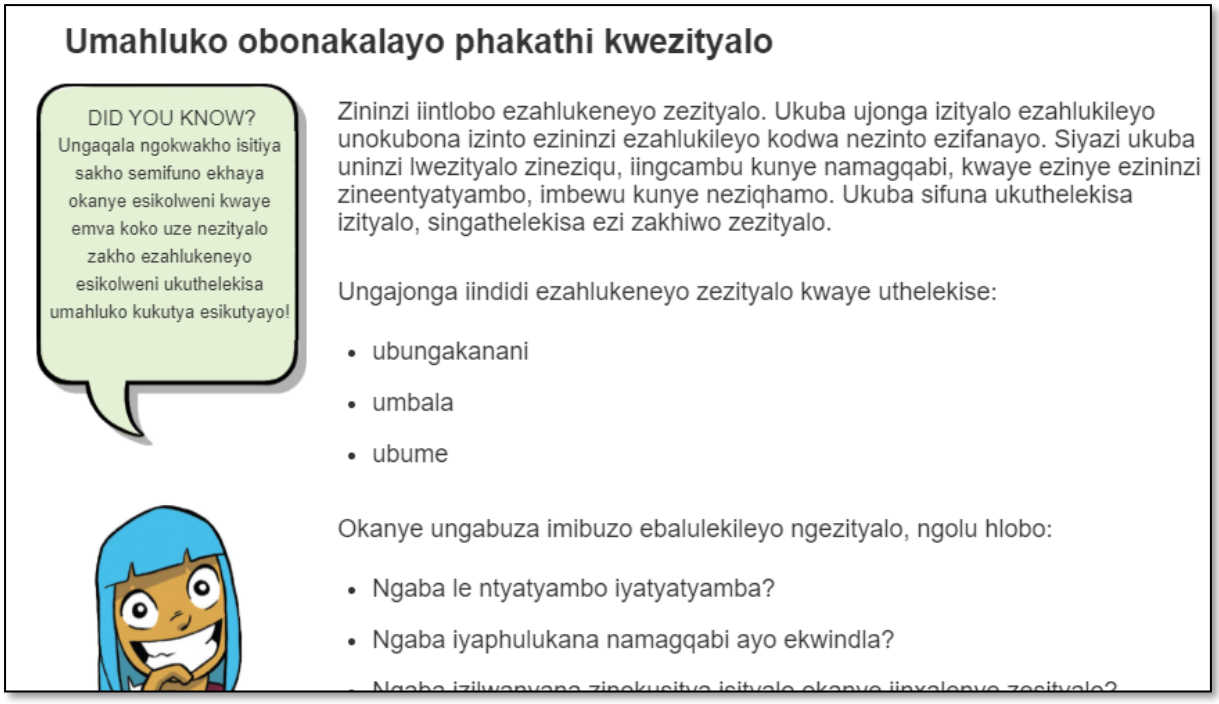
Njengezitshalo nje, izilwane nazo zinesakhiwo esiyisisekelo. Isakhiwo esiyisisekelo sesilwane yile:

- ikhanda
- umsila
- umzimba
- imilenze
- izitho zomqondo

Ikhanda

Izilwane eziningi zinengxenye yemizimba yazo esiyibiza ngokuthi 'inhloko'. Ngisho nesilwane esincane kunazo zonke sinengxenye lapho sikhona 'ubuchopho'. Kwizilwane eziningi inhloko:

Web page results: isiXhosa



Umahluko obonakalayo phakathi kwezityalo

DID YOU KNOW?
Ungaqala ngokwakho isitiya sakho semifuno ekhaya okanye esikolweni kwaye emva koko uze nezityalo zakho ezahlukeneyo esikolweni ukuthelekisa umahluko kukutya esikutyayo!

Zininzi iintlobo ezahlukeneyo zezityalo. Ukuba ujonga izityalo ezahlukileyo unokubona izinto ezininzi ezahlukileyo kodwa nezinto ezifanayo. Siyazi ukuba uninzi lwezityalo zineziqu, iingcambu kunye namagqabi, kwaye ezinye ezininzi zineentyatyambo, imbewu kunye neziqhamo. Ukuba sifuna ukuthelekisa izityalo, singathelekisa ezi zakhiwo zezityalo.

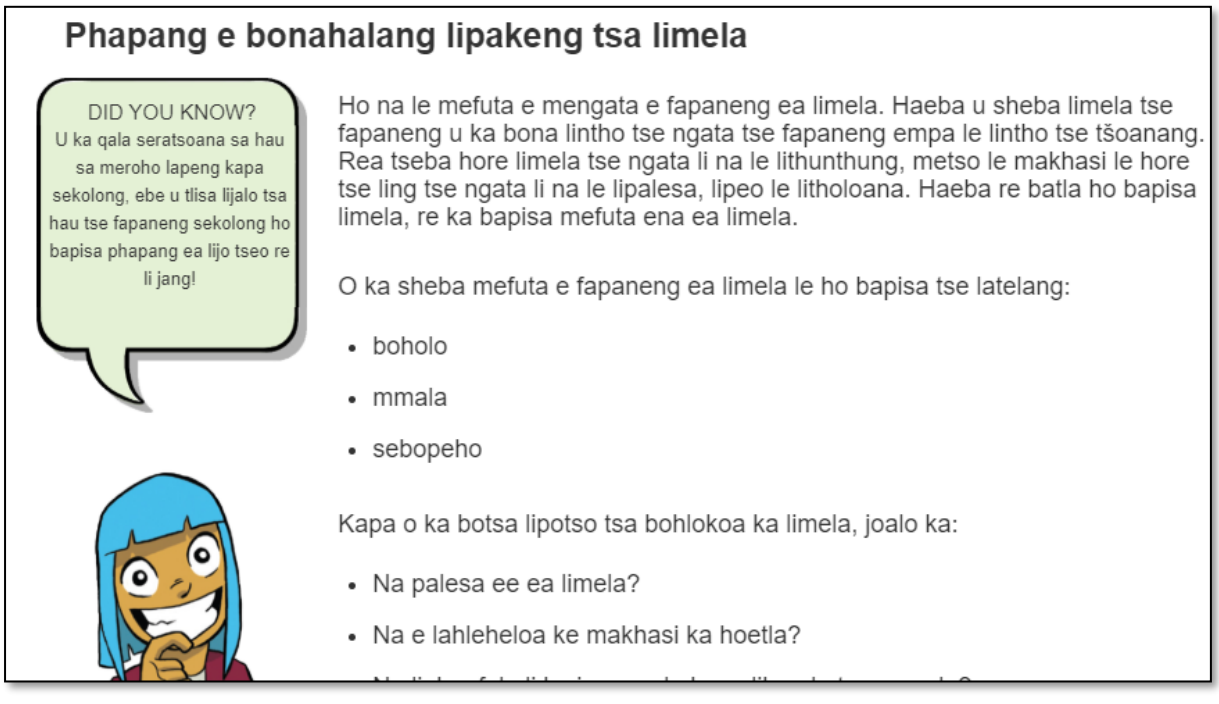
Ungajonga iindidi ezahlukeneyo zezityalo kwaye uthelekise:

- ubungakanani
- umbala
- ubume

Okanye ungabuza imibuzo ebalulekileyo ngezityalo, ngolu hlobo:

- Ngaba le ntyatyambo iyatyatyamba?
- Ngaba iyaphulukana namagqabi ayo ekwindla?

Web page results: Sesotho



Phapang e bonahalang lipakeng tsa limela

DID YOU KNOW?
U ka qala seratsoana sa hau sa meroho lapeng kapa sekolong, ebe u tlisa lijalo tsa hau tse fapaneng sekolong ho bapisa phapang ea lijo tseo re li jang!

Ho na le mefuta e mengata e fapaneng ea limela. Haeba u sheba limela tse fapaneng u ka bona lintho tse ngata tse fapaneng empa le lintho tse tšoanang. Rea tseba hore limela tse ngata li na le lithunthung, metso le makhasi le hore tse ling tse ngata li na le lipalesa, lipeo le litholoana. Haeba re batla ho bapisa limela, re ka bapisa mefuta ena ea limela.

O ka sheba mefuta e fapaneng ea limela le ho bapisa tse latelang:

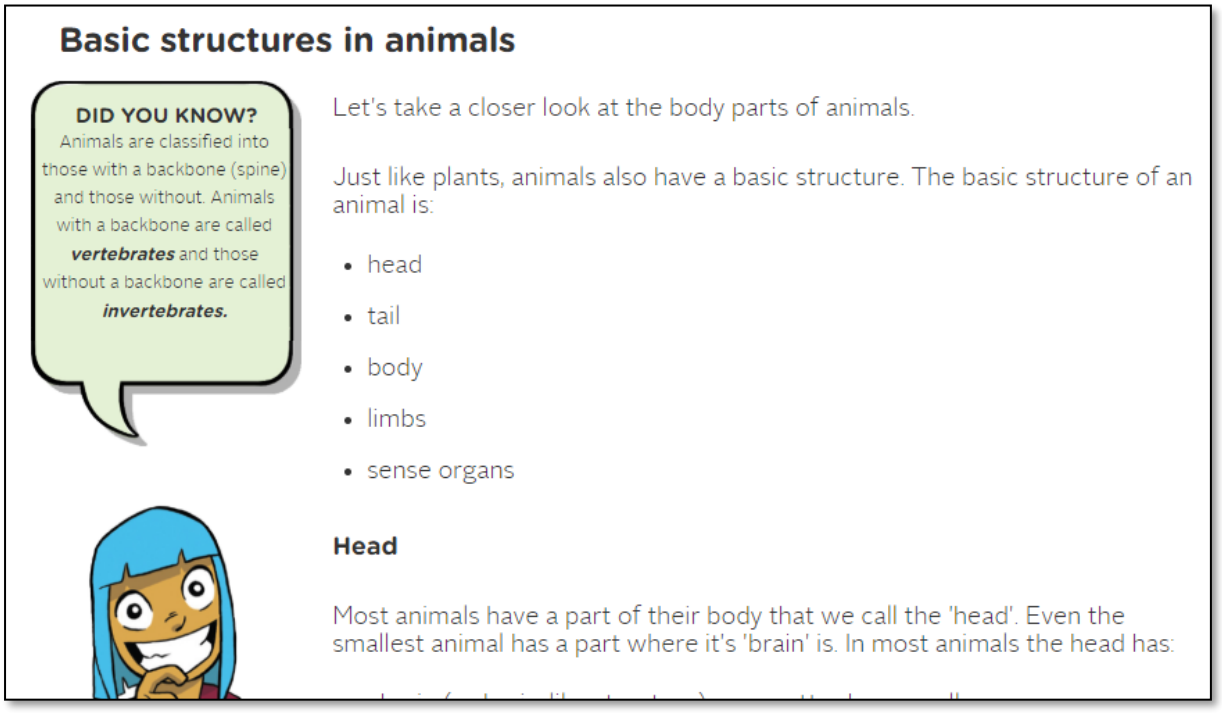
- boholo
- mmala
- sebopeho

Kapa o ka botsa lipotso tsa bohlokoa ka limela, joalo ka:

- Na palesa ee ea limela?
- Na e lahleheloa ke makhasi ka hoetla?

APPENDIX B: LANGUAGE WEB CONTENT 2

Web page results: Setswana



Basic structures in animals

DID YOU KNOW?
Animals are classified into those with a backbone (spine) and those without. Animals with a backbone are called ***vertebrates*** and those without a backbone are called ***invertebrates.***

Let's take a closer look at the body parts of animals.

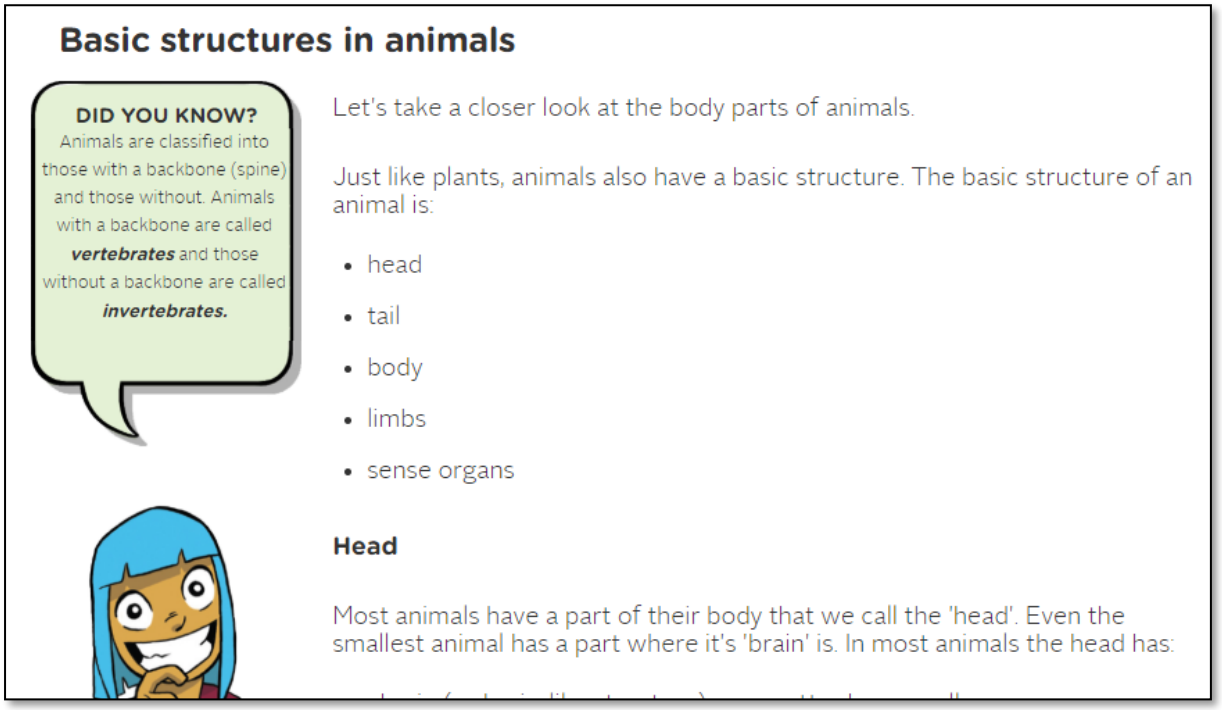
Just like plants, animals also have a basic structure. The basic structure of an animal is:

- head
- tail
- body
- limbs
- sense organs

Head

Most animals have a part of their body that we call the 'head'. Even the smallest animal has a part where it's 'brain' is. In most animals the head has:

Web page results: Northern Sotho



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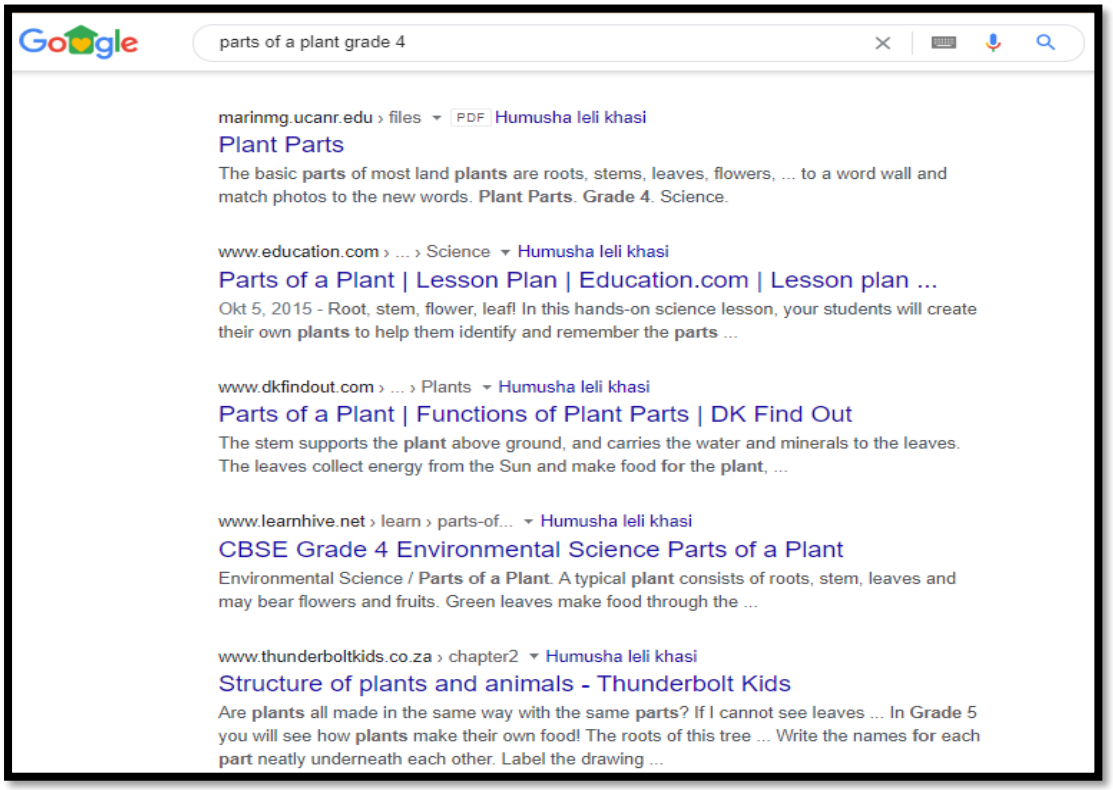
Head

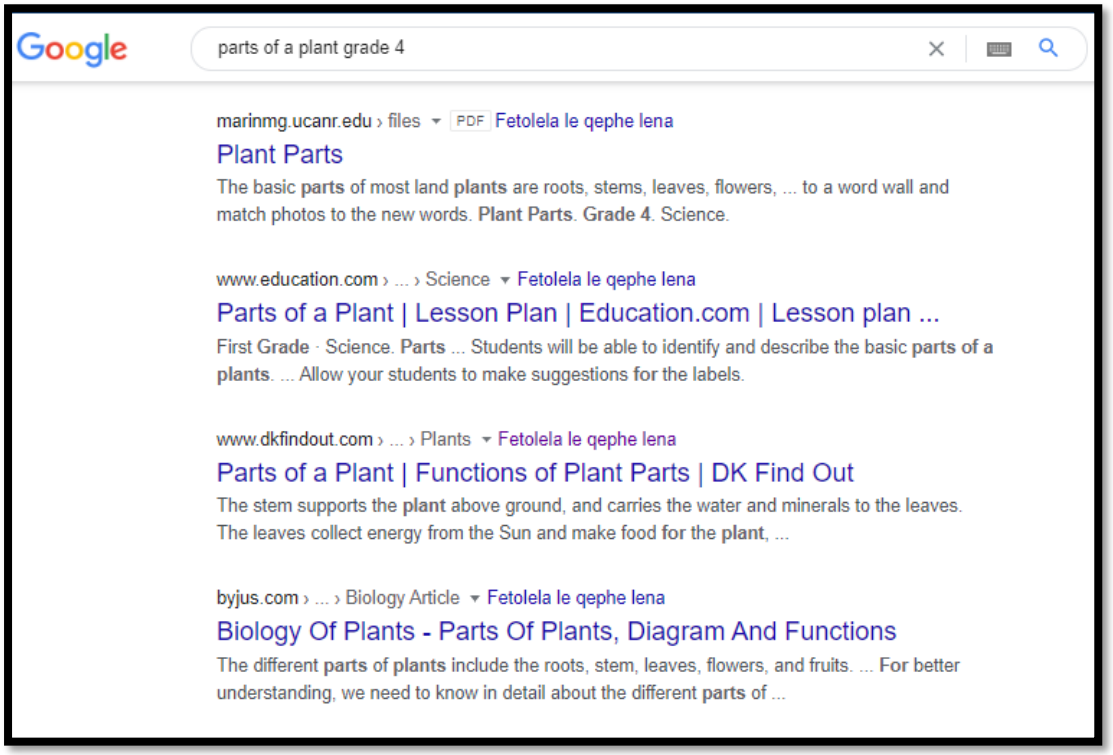
Most animals have a part of their body that we call the 'head'. Even the smallest animal has a part where it's 'brain' is. In most animals the head has:

APPENDIX C: LANGUAGE WEB SEARCH RESULTS

Google search results description: isiZulu



Google search results description: Sesotho



APPENDIX D: SPECIALIST TERMINOLOGY

Web page results



Waterlilies and reeds growing in water.

ACTIVITY: Ukuqhathanisa izitshalo



IMIYALELO:

1. Sebenza nomngani.
2. Qhathanisa izitshalo ezimbili (iminduze yamanzi nezinhlanga) usebenzisa izakhiwo zezitshalo.
3. Lapho abantu beqhathanisa izinto ezahlukahlukene besebenzisa iqoqo lezinto (njengezakhiwo zezitshalo esizisebenzisayo), bavame ukusebenzisa itafula ukubhala phansi imibono yabo.

APPENDIX E: REQUEST FOR DATA COLLECTOR

Human Sciences Research Council

Pretorius Street

Pretoria

14th August 2018

To whom it may concern

Dear Mrs M Clarke

Re: Data collection in the North West Province

I am currently busy with my PhD degree through the School of Education at the University of the Witwatersrand. I am presently at the planning stage for data collection. Due to the sensitivity of the data collection process, I would like to request your assistance in the collection of the data. There will be a total of three data collection instruments that will be administered. You will be expected to assist with observations and interviews. Currently there are seven participants and the data collection will take place over two weeks:

Week 1: 8th to 12th October 2018

Week 2: 12th to 16th November 2018

The data collection will be conducted at the Brits APO office.

I would greatly appreciate it if you could let me know if you would be interested in being part of the data collection team. Please send me your response as soon as possible.

Kind regards



M.Moodley (Mr)

082 450 3185

maglin4@gmail.com

APPENDIX F: DATA COLLECTION INSTRUMENT SSO

SSO Instrument

TEACHER: SYSTEMATIC SELF-OBSERVATION

Unique Teacher Code:

Name of Teacher: _____ (optional to fill in)
School: _____
Date of SSO: __/__/___

SSO- SHEET

The SSO process will be based on four (4) aspects of the use of the TARMII software. These will include:

1. **Navigating the interface**
2. **Accessing, navigating and building the assessment task**
3. **Allocating an assessment task to a class**
4. **Marking the assessment task**

You will be asked to perform a series of actions within each function. You will then be required to record your Ease-of-Use Experience (EoUE) onto the rating scale provided.

Navigating the interface

1. **Open the TARMII application.**

2. **Log in with your user name and password.**
How easy or difficult was it to complete this task?

Very Difficult						Very Easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. **Open the class management facility.**
How easy or difficult was it to complete this task?

Very Difficult						Very Easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. **Go back to the Home Page.**
How easy or difficult was it to complete this task?

Very Difficult						Very Easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. **Open up the PDF resource bank**
How easy or difficult was it to complete this task?

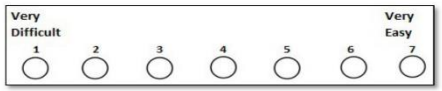
Very Difficult						Very Easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. **Open up the DBE Official Workbook facility**
How easy or difficult was it to complete this task?

Very Difficult						Very Easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

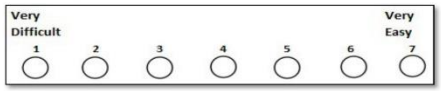
7. Go back to Home Page

How easy or difficult was it to complete this task?



8. Log Out from the TARMII platform

How easy or difficult was it to complete this task?

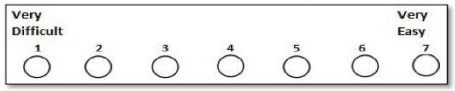


General Comments

Accessing, navigating and building the assessment task

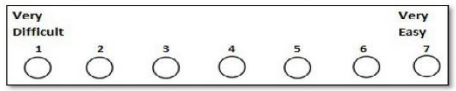
1. Log onto the TARMII platform

How easy or difficult was it to complete this task?



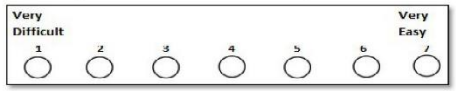
2. Open up the Assessment facility

How easy or difficult was it to complete this task?



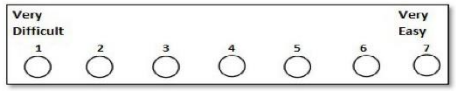
3. Open up the Build Assessment function

How easy or difficult was it to complete this task?



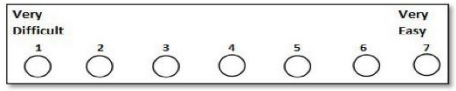
4. Enter all the details of your assessment task

How easy or difficult was it to complete this task?



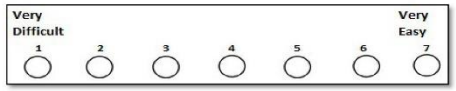
5. Now add the required items into your task

How easy or difficult was it to complete this task?



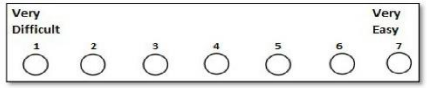
6. Remove one item from your assessment task

How easy or difficult was it to complete this task?



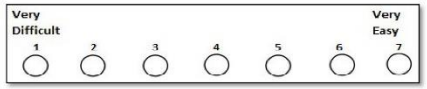
7. Save your assessment task build

How easy or difficult was it to complete this task?



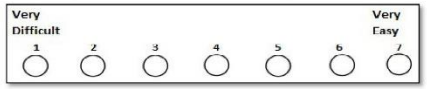
8. Preview your built assessment task

How easy or difficult was it to complete this task?



9. Return to Home Page

How easy or difficult was it to complete this task?

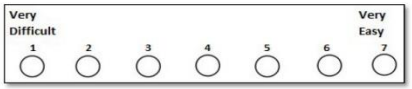


General Comments

Allocating an assessment task to a class

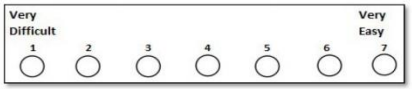
1. Open Test Manager

How easy or difficult was it to complete this task?



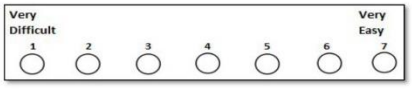
2. Locate and add your built assessment task to your class

How easy or difficult was it to complete this task?



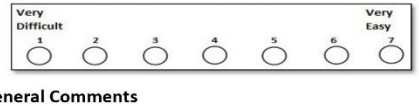
3. Allocate a date on which your assessment task must be taken

How easy or difficult was it to complete this task?



4. Allocate the assessment task to your class

How easy or difficult was it to complete this task?



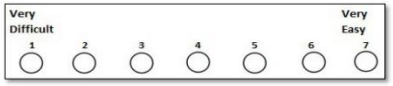
General Comments

Prepare for learners to take the test

Downloading the assessment task

1. Open the assessment task you want to download

How easy or difficult was it to complete this task?



2. Preview the assessment task

How easy or difficult was it to complete this task?



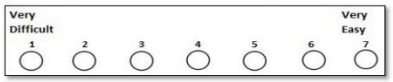
3. Download the assessment task as a PDF

How easy or difficult was it to complete this task?



4. Open the PDF assessmet task

How easy or difficult was it to complete this task?



5. Send the PDF assessment task to the printer

How easy or difficult was it to complete this task?



6. Return to Home Page

How easy or difficult was it to complete this task?



General Comments

THE END

APPENDIX G: DATA COLLECTION INSTRUMENT PO

PO Instrument

PARTICIPANT OBSERVATION

Unique Teacher Code:

Name of Teacher: _____ (optional to fill in)
School: _____
Date of observation: __/__/____

OBSERVATION SHEET

The observation will focus on the four (4) user functions of the T-DL software.
These will include:

1. **Navigating the interface**
2. **Accessing, navigating and building the assessment task**
3. **Allocating an assessment task to a class**
4. **Marking the assessment task**

Each user will be asked to perform a series of actions within each function.
The user will then be observed as they complete each task.
The researcher(s) will observe the user performimg the SSO tasks and will record the observation. As you make your observational notes, please keep the following aspects in mind.

1. Navigating the interface

General Task Observation Comments

2. Accessing, navigating and building the assessment task

General Task Observation Comments

3. Allocating an assessment task to a class

General Observation Comments

Prepare for learners to take the test

4. Downloading the assessment task

General Task Observation Comments

THE END

APPENDIX H: DATA COLLECTION INSTRUMENT IDI

IDI Instrument

TEACHER INTERVIEW

Unique Teacher Code: _____

Name of Teacher: _____(optional to fill in)
School: _____
Date of interview: ___/___/____
Audio file name: _____

This interview will be audio recorded

Section A: Subject biographical information

1. What is the GENDER of the subject?

Male		Female	

2. What is the subject's language options?

First Language		Second Language	

3. What is the AGE of the subject?

21 to 30yrs		31 to 40yrs		41to 50yrs		51 to 60yrs		61 yrs and older	

4. How many years has the subject been teaching?

0 to 5yrs		6 to 10yrs		11 to 15yrs		16 to 20yrs		21 to 30yrs		31 yrs and more	

5. How many hours a day does the subject work on a computer at school?

Not at all		1 to 3 hours		4 to 8 hours		9 to 11 hours		More than 11 hours	

6. How many hours a day does the subject work on a computer at home?

Not at all		1 to 3 hours		4 to 8 hours		9 to 11 hours		More than 11 hours	

7. Has the subject attended any ICT training in the last 5 years

Yes		No	

8. If YES, what type of training did the subject attend?

MS Office		SA SAMS	
Email		Other ELearning applications	
Internet		TARMII	

9. What language does the subject use on the following platforms when messaging?

Email	
SMS	
WhatsApp	

SECTION B-Using the TARMII software

1. Do you think using the TARMII software influences your teaching practices? ***Please elaborate***?
2. Do you think use of the TARMII software motivates you as a teacher in class? ***Please elaborate***?
3. Do you feel confident or doubtful when navigating through the various functions of the TARMII software? ***Please elaborate?***
4. Do you feel confident or doubtful to build an assessment task using the TARMII software? ***Please elaborate?***
5. Do you feel using the TARMII software offers you more problems or solutions? ***Please elaborate?***
6. Do you feel the TARMII software can influence the way you assess? ***Please elaborate?***

SECTION C-Indigenous African Languages in ICT

7. Do you think indigenous African languages (Setswana) can be used in ICT and technology at large? ***Please elaborate?***
8. What factors do you think can pose as barriers for indigenous African languages (Setswana) to be used in ICT?
9. Do you think using Setswana in ICT platforms and resources will make it easier for Setswana speakers to use? ***Please elaborate?***

THE END

APPENDIX I: UNIVERSITY ETHICS APPROVAL LETTER

Wits School of Education

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

27 St Andrews Road, Parktown, Johannesburg, 2193 • Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3221 • Fax: +27 11 717-3009 • E-mail: enquiries@educ.wits.ac.za • Website: www.wits.ac.za

11 September 2018

Student Number: 1483688

Protocol Number: 2018ECE017D

Dear Meganathan Moodley

Application for Ethics Clearance: Doctor of Philosophy

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate, has considered your application for ethics clearance for your proposal entitled:

Localisation of an assessment software to Setswana, a South African indigenous language for Foundation Phase teachers

The committee recently met and I am pleased to inform you that **clearance was granted**. Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely,

M Mabeta

Wits School of Education
011 717-3416

cc Supervisor – Dr Reuben Dlamini

APPENDIX J: AFRICAN LANGUAGE GRAPHICAL USER INTERFACE T-DL

Theme 1:

Focus area 1: Ease of navigating the T-DL software

Theme 1: Focus Area 1

Speaker & Stage	Quote	Quote Number
Thandi/English	"It's quite easy like I said, it speaks for itself".	1.27
Thandi/Setswana	"I think they are easy, because the Setswana…I'm Setswana speaking person, it explains itself. The translation is good, that's what I can say, it explains itself, its easy, its user friendly"	1.28
Rebecca/English	"I know how to use the TARMII. To log in using my username, registering learners and subjects."	1.29
Molly/English	"Just relaxed", "It was not difficult for me to learn."	1.30
Molly/Setswana	"Yes, it was. It's not difficult to access it. I found things easier since it is my language. I could know where to go. The buttons were easy to read and press, it's something that's easy to use and the Tswana part that is a big thing, a big solution according to me. Now anyone can understand it	1.31
Lydia/English	"Not confident, but I'm getting there, but I think as time goes on I will be confident… with practice."	1.32
Lydia/Setswana	"It was just easy for me as time goes on it was enjoyable."	1.33
Jose/English	"I am struggling a bit, because it's my first time. I have not been in TARMII." "It's only for this period from last week then today."	1.34
Jose/Setswana	"I was a bit slow because I have to read first. English is easier than… because it's an international language. So, I have to verify first Setswana. What does it mean like this? Yeah it takes a little time… more little time for me."	1.35
Evelyn/English	"I was not clear enough…..I remind what I've done last time."	1.36
Evelyn/Setswana	, "I feel confident because it is my language."	1.37
Elize/English	"It's easy. I don't know maybe it's because I've done typing since 1981."	1.38
Elize/Setswana	"Because it's the… it's my first language. The language I first experience as a child. So it was easy and, what you say… it was natural to me.	1.39.1
Elize/Setswana	But there were some buttons that was still in English, not sure why it was like that.	1.39.2
Evelyn/Setswana	"I have to think first for this is. What is that- SAVE. Ok I have to go to SAVE. So I have to go first and think of it in English first..then translate it there…"	1.51

Focus area 2: Confidence using the T-DL software

Theme 1: Focus Area 2

Speaker & Stage	Quote	Quote Number
Thandi/English	"I'm confident about it because like I said, it's a wide range to choose from".	1.40
Thandi/Setswana	"I was going to understand things much easier with the language".	1.41
Rebecca/English	I thought I did not know how to work the computer. But now I feel confident using the TARMII, I feel so nice. I have learnt so much.	1.42
Rebecca/Setswana	"I am confident. At first I was doubtful but now I am confident. You know when I saw the Tswana computer, I was scared. I still think English is best."	1.43
Molly/English	"it was not difficult".	1.44
Molly/Setswana	"I feel relaxed using it."	1.45
Lydia/English	"First I was not sure, but now it is easy, but first I was scared." "its step by step to follow, TARMII makes it easy."	1.46
Lydia/Setswana	"The commands were just easy, Setswana words were easy. "It was just easy to access it. It is so easy to read the instructions."	1.47
Jose/English	No, I think it's easy because you go through the content and you just choose what is suitable for your learners, then you pick what questions you want and then you make the computer build your test, it makes this so easy for me now, I feel so sure now to use computers.	1.48
Jose/Setswana	"It is easy with the Tswana, but I like English, will be easier to use, for me that is."	1.49
Evelyn/English	"I feel scary because if you don't know the computer…you will feel scary, but if you know then you'll be confident."	1.50
Evelyn/Setswana	I feel confident because it is my language. Remember it is my mother tongue, so when I see computers with my language, I know I can use it. It also will make me want to learn more about computers. I can now also teach my colleagues and my learners. This is great.	1.51
Elize/English	"I feel comfortable because everything is there and then if I don't want to put in an item, I can easily delete it."	1.52
Elize/Setswana	"I thought about the English version, I then used it in the Tswana version."	1.53

APPENDIX K: CREATING AN ONLINE ASSESSMENT

Theme 2:

Focus area 1: Influence of T-DL software on assessment

Theme 2: Focus Area 1

Speaker & Stage	Quote	Quote Number
Thandi/English	"I can do this question paper for this term, even next year I'm still going to select the same questions from that part that we did last year".	2.1
Thandi/Setswana	"Will be easier for the teacher especially when you are using Setswana as a home language it's going to be easier for the teacher as well as the learners to understand in their own language."	2.2
Rebecca/English	"Because it is easy to use to record the learners,"	2.3
Rebecca/Setswana	"It will save time because now we are writing, we are using other people to type for us, pay money,"	2.4
Molly/English	"I no longer search around textbooks, searching for questions, which one is suitable. Those levels you just read and select from TARMII."	2.5
Molly/Setswana	"I think assessment will be so much easier now, I don't have to search for things for my children to test. TARMII has it all, and its is Setswana, we don't have that before. The questions are nice, because when I look at it, we can see it has drawings, the activity they have drawings, so simple to use."	2.6
Lydia/English	"Just making it easy for me to enhance teaching and learning and enrichment for my learners."	2.7
Lydia/Setswana	"So, at least those who have learning barriers will be able to have something also."	2.8
Jose/English	"it adds value to my teaching because it makes it easier, I am able to plan assessment activities in a short time. We don't have to take long to look for activities; they are incorporated in the TARMII."	2.9
Jose/Setswana	"I'll be able to plan my activities in a short space of time. It is easily accessible."	2.10
Evelyn/English	"It's positive because it allows the teachers to do the work easily and helps making recording the assessment of the learners quicker. Yes, it will improve my teaching. You are going to struggle first."	2.11
Evelyn/Setswana	"It can influence my teaching because Setswana I will understand the language correctly and better not like English. Yeah if they give me the one that I'm going to communicate with it, I'm going to do my work with it."	2.12
Elize/English	"At home they don't have English readers, I can give them as the homework, and they can practice at home".	2.13
Elize/Setswana	"Since all the subjects are taught in my home language which is Setswana and only English as the first additional."	2.14

Focus area 2: Motivation in using the T-DL software.

Theme 2: Focus Area 2

Speaker & Stage	Quote	Quote Number
Thandi/English	"Yes, a lot. I mean this TARMII it works itself out, it marks itself. You don't… you don't even get tired".	2.15
Thandi/Setswana	"It's gonna simplify the lesson for me and my learners in terms of understanding since the language that is spoken at the streets and at home, they "understand better than English".	2.16
Molly/English	"Cause it makes it easier. You have to just log in and do your selection and mark your tests."	2.17
Molly/Setswana	"It's the language of learning and teaching in the foundation phase."	2.18
Lydia/English	"At least I will have knowledge of the computer now and it can reduce my work as a teacher also at home."	2.19
Lydia/Setswana	"I will be able….knowing more on IT and prepare…"	2.20
Jose/English	"It is so easy to plan your activities in time. Yeah."	2.21
Jose/Setswana	"I like it in my language, it is easier for the kids, they will find it easier as well, their parents can also read it easier now, since most don't speak English well or even at all."	2.22
Evelyn/English	"I know something about the software, not only TARMII but other softwares…Microsoft Office Word. I will like to use it. I will learn from it each and every day."	2.23
Evelyn/Setswana	"It motivates me because it make my work easier and I can see there how to do assessments and record marks."	2.24
Elize/English	"You're picking up items, especially when you're teaching….you do a printout of the test, oral or classwork activity and then you give it to them. You sit down and analyse the marks or the performance."	2.25
Elize/Setswana	"Yes it can motivate me not to discard my mother tongue, Ke skayi kgathologa wabona."	2.26

APPENDIX L: BENEFITS OF ICT FOR INDIGENOUS AFRICAN LANGUAGES SPEAKERS

Theme 3:

Focus area 1: Solutions offered by the use T-DL software

Theme 3: Focus Area 1

Speaker & Stage	Quote	Quote Number
Thandi/English	"I've got 52 kids in class, it saves me time because everything is already marked, teach things again".	3.54
Thandi/Setswana	"Things are going to be more easily explained than when I have to explain in English and put back into Setswana". "Things are goin' to be more easily explained."	3.55
Rebecca/English	"They can go right to the computers, doing their work there." ,"Maybe it will motivate schools to buy computers" and "can even motivate educators to have their own laptops maybe even work from home".	3.56
Rebecca/Setswana	"I think it will be a problem with the Setswana, they can't use all the big computer words, I favour English	3.57
Molly/English	"As I said, I think everything is available. You just select your own items and use it for assessment."	3.58
Molly/Setswana	"it's something that's easy to use." , "the Tswana part that is a big thing, a big solution according to me. Now anyone can understand it."	3.59
Lydia/English	"it's providing more solutions because it reduces more work that we are having now."	3.60
Lydia/Setswana	"I see other assessments done in Tswana, then I can select the challenging ones, share from Brits to Mogwase, will help us."	3.61
Jose/English	"I get everything I need to do my assessment. I don't struggle."	3.62
Jose/Setswana	"you don't have to go and page in the books to look for Setswana activities, so it's easier for us to get the activities timeously from TARMII."	3.63
Evelyn/English	"It will make it easier because we are not going to write on paper. We are going straight to the computer and at the same time we are saving the school money but also getting our learners used to life in the 21st century. That is good for them."	3.64
Evelyn/Setswana	"it can create more solutions because my children….they will understand it in Setswana". "English is not their language, I talk to them in Setswana, they will understand English, also the teacher in Maboloko, who can't speak English will now be able to use computers the same way a teacher in the city can, that's good"	3.65
Elize/English	"we don't have to write on the paper setting the test, we will select the questions and then everything will be on the computer now, no more papers."	3.66
Elize/Setswana	"English is not their language, it's going to be difficult but when they see it in Setswana and I talk to then in Setswana because we do all our teaching in Setswana, it will become easier for my learners."	3.67

APPENDIX M: DOMINANCE OF ENGLISH USE IN ICT

Theme 4:

Focus area 1: Use of African language in ICT.

Focus area 2: Barriers to the use of African languages in ICT

Theme 4: Focus Area 1 & 2

Speaker & Stage	Quote	Quote Number
Thandi/English	it's the first time to see something like that on any gadget….and digital gadget. I mean it says something, it makes me proud you know, always we think English is the only language that can be used, I am so happy".	4.77
Rebecca/English	"Because some of the words cannot be translated in Setswana." "In English, the Setswana will sometimes, will find it difficult to get them in English."	4.78
Rebecca/Setswana	"When you go, maybe you visit different places, you talk English not Tswana."	4.79
Molly/English	"I think it that of language, some words….the pronunciation again. We don't pronounce the same way." "you'd have to have different what…5 different or 10 different TARMII for all the teachers?"	4.80
Molly/Setswana	"some people prefer English as a language of instruction, English some say you can easily communicate with."	4.81
Jose/English	"the terms…like the words they use in computer programmes. We may not have those words in Tswana. That is a big issue."	4.82
Evelyn/Setswana	"Everything is English when you go to work and at school you are being taught in English. English is for the big difficult subjects " When I talk Setswana she can't understand me. So, if I talk to him or her with English, then that person we can talk we can communicate, also when I go for a job, they don't ask me in Tswana, they ask me in English since the person talking to me maybe English speaking.	4.83
Rebecca/Setswana	"No, As I say, most people use communication in English and we used to use Tswana at church, but not in computers", "Most of the time interview is in English or Afrikaans."	4.84
Evelyn/English	"On it the poems of Setswana, I realise there are no more. So it is bad luck because you need those poems to teach learners about it."	4.85

Focus area 3: African language in ICT, problem or solution?

Theme 4: Focus Area 3

Speaker & Stage	Quote	Quote Number
Thandi/English	"Yes definitely. Setswana would be easier for everyone ", "English is cool".	4.95
Thandi/Setswana	"they'll be able to understand most of the things easier because it's the language that they are speaking, they are using every day".	4.96
Rebecca/English	"Yes, because it's my language," , "but I like to communicate with English because it's more easy."	4.97
Rebecca/Setswana	"The Setswana people, yes they will be happy because some of the people don't understand English." "Some are not proud because they know that when they go to interviews, it's English, so it is better to keep on talking English. When they are doing Tswana, they go nowhere, nowadays they must know ICT and in computers they only use English to type and to work, so there is no Setswana, even with TARMII, will it be accepted by the department?"	4.98
Molly/English	"I think English would be much easier. For me and the children…and the learners."	4.99
Molly/Setswana	, "Yes I think so. Because we still have people who cant' even read or English or so. So, there are…they can do Setswana."	4.100
Lydia/English	"yes, they will participate, yeah, I think they will do."	4.101
Lydia/Setswana	"the questions are easy for the learners compared to the ones we are using on NECT1."	4.102
Jose/English	"a rat is a rat in English, in Mahikeng they call it "peba" but in our place we call it "lekgotlo" "It won't be easy for all of us because our learners won't be understanding that is spoken in Mahikeng."	4.103
Jose/Setswana	"Because every nation will be able to express themselves with their own language and it will help those who are not good in English." "Yes, yes, English it's just straightforward."	4.104
Evelyn/English	"they will enjoy it. It's their own language, so they will… they will love the software because it is on their own language." "the other people they don't know English, they didn't go to school."	4.105
Evelyn/Setswana	"they've never gone to school but they know their language, So it it in their own language, then they will use it easily."	4.106

Cont….Theme 4: Focus Area 3

[1] The National Education Collaboration Trust is an organisation dedicated to achieve South Africa's national goals for basic education.

Theme 4: Focus Area 3

Speaker & Stage	Quote	Quote Number
Elize/English	"Even if I would do that in Setswana, but I will have to sit down and analyse what it says."	4.107
Elize/Setswana	"Very proud! Very proud!" "a child who is a teenager and then dropped out of school. His or her English can be poor, but if she gets something like this….the internet, ICT in the home language… they can be able to access." "it is the duty of all parents to teach their children their home language. Even if those are attending English medium schools, otherwise our culture will die."	4.108

APPENDIX N: DEPARTMENT APPROVAL

North West TARMII study approval

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Private Bag X895, Pretoria, 0001, Sol Plaatje House, 222 Struben Street, Pretoria, 0002, South Africa
Tel.: (012) 357 3000, Fax: (012) 323 0601, www.education.gov.za

Ref no: P-0082/18-26/10/2018
Enquiries: Dr RR Poliah
Tel: 012 357 3983
Email: Poliah.r@dbe.gov.za

Ms SM Semaswe
Acting HOD: Education
North West
Private Bag X2044
MMABATHO
2735

By fax: 018 388 3430

Dear Ms Semaswe

POSTPONEMENT OF THE TEACHER ASSESSMENT FOR MONITORING AND IMPROVING INSTRUCTION IN THE FOUNDATION PHASE (TARMII) 3 PILOT STUDY TO MARCH 2018

The Department of Basic Education (DBE) in collaboration with the Human Science Research Council (HSRC) and the United States Agency for International Development (USAID) have been developing a computer based repository of test items that will assist teachers in the development of assessment tasks. This project which is managed by the HSRC was initially planned to be piloted in September 2017 in the North West Province but has been rescheduled to March 2018, due to problems experienced with the versioning of the test items.

A letter was sent to the province in May 2017 requesting the pilot to be conducted in September 2017 (Annexure A).The criteria for the implementation of the revised TARMII 3 pilot study have changed since the initial letter that was sent to the province. The pilot study will take place in schools that have English as the home language for Grade 3 learners, internet connectivity and sufficient number of devices to ensure online test taking by the learners.

The TARMII 3 pilot study will be conducted in 10 sampled schools in the province. The list of sampled schools is attached. The schools have been selected in conjunction with the Provincial Assessment Co-ordinator in the province.

The HSRC will be in contact with the Provincial Assessment Coordinator for further logistical arrangements regarding the pilot study.

We apologise for the postponement of the project but we are convince that this project will assist teachers in alleviating the assessment workload and contribute to improved assessment practices.

Yours sincerely

MR/HM MWELI
DIRECTOR-GENERAL
DATE: 21/01/2018

APPENDIX O: TRANSCRIPTION REPORT

Interview transcription process



MOSEKOLA SOLUTIONS ...beyond boundaries

Author: F. Mhlanga		Approver: A. Mathibela	
Doc: QF-024	Effective: 09/11/2019	Rev: 002	Page 1 of 1

Transcription process

Dear Mr Moodley

The transcription process is not complicated really but it does take long.

To process the files into text one needs to have a reliable computer and a word processor as well as an audio player. In general then I had to confirm with the client whether to use real names or general titles for the subjects in the interview. In order to ensure accuracy we did research on the internet to ensure acronyms are correct. It usually takes around 1 hour to type 10 minutes if an audio is clear without background noises. At times it can even be 15 minutes that is typed in an hour.

We also consult dictionaries and at times specialists in the field. For the subject at hand if needed I would have had to consult a teacher. The teacher I know for example has taught for more than 40 years and was a principal for a number of years before going to the district office. For the Information Technology and Accounting/Auditing/Business Process industry I don't consult much as these are my specialist areas. Unless it is very complicated, I will then consult a sub-specialist in the industry.

I was granted access to the TARMII site (English and Setswana), this allowed me get an idea of what TARMII was so that I can understand the questions as well as what the responses were.

Another process of transcription is rewinding 3 to 5 times when the subject is not audible or says something that is not clear. This then satisfies the transcriptionist that he subject is not clear and "indistinct" can be put on the transcript as that part of speech is audible but not clear what is said. In other instances "inaudible" is used if the responses are done using hand or head gestures. At times the subject will have answered but the interviewer will indicate the answer as "yes" "no" or "unsure" from observing these gestures.

Finally, before each transcript is finalized, one has to relisten to the audio again and perhaps one will find some parts of speech that were missed or correct any syntax issues that may have occurred during the typing. This process will take roughly the same amount of time as the audio as this can be done without really stopping/pausing the audio. Once complete the files are sent back to the client.

I trust this covers your enquiry.

TARMII *3.0* [TARMII Dual-language]

A TOOL FOR ENHANCING ASSESSMENT AND LEARNING IN FOUNDATION SESSION



TRAINING GUIDELINES- 2018

Trainer : _____

Province: _____

Circuit: _____

The aim of the master training session is to prepare officials from the department of education to conduct training of the TARMII 3.0 software with teachers. The various training modules are divided into SESSION. A SESSION is not equivalent to time. Depending on the ability and size of the training group, certain SESSION may take a longer period to complete. It is important that as a trainer, the practical activities within a SESSION are repeated by teachers to ensure mastery of the skill.

INTRODUCTION

SESSION 1:	Gaining access to TARMII
SESSION 2:	Teacher Registration process
SESSION 3:	TARMII Home page: Navigation
SESSION 4:	Create class list (Learner)
SESSION 5:	Create Assessment
SESSION 6:	Manage Tests (part 1)
SESSION 7:	Learner and Parent Registration
SESSION 8:	Manage Tests (part 2)
SESSION 9:	View Reports
SESSION 10:	Access and use resource

Introduction and Background

1 What is TARMII?

2. Focus of TARMII

3. Different versions of TARMII

4. The different users on TARMII, Registration levels

SESSION 1: Gaining access to TARMII 3.0

SESSION OBJECTIVE: The teacher should be able to access the web-based version of the TARMII 3.0 application.

The TARMII 3.0 application can be accessed using any browser, Internet Explorer, Google Chrome, Mozilla Firefox, Opera and Lynx using the ***Uniform Resource Locator (URL)***:
http://tarmii3.upfronthosting.co.za/



SESSION 2: Teacher Registration process

SESSION OBJECTIVE: The teacher will be able to register online as a user.

PRACTICAL APPROACH: Teacher must:

➔Step 1: Identify the three levels of user registration.

➔Step 2: Teacher must complete the TEACHER REGISTRATION process.

➔Step 3: Identify a mandatory field and ensure that each mandatory field is completed.

➔Step 4: Use the province download facility.

➔Step 5: Select the school from the auto-name facility

➔Step 6: Receive One-Time-Pin (OTP) and activate account

SESSION 3: TARMII 3.0 Home page: Navigation

SESSION OBJECTIVE: The teacher will be able to LOGIN as a teacher and then navigate and access the different functions on the webpage.

PRACTICAL APPROACH: Teacher must:

➔ Step 1: LOGIN with registered details.

➔Step 2: Identify and use Header TABS [***Home, About, LogOut***] to navigate the webpage.

➔Step 3: LogOut as user

➔Step 4: Login as user

➔Step 5: Navigate to different functions (Assessment, Learners, Reports…etc.) and then return to Home page using either Bar Menu or Tab

➔Step 6: Access and Navigate the bottom information menu

SESSION 4: Create class list

SESSION OBJECTIVE: The teacher should be able to create a class list either by **importing** or using the **manual entering** process.

PRACTICAL APPROACH: Teacher must:

➔Step 1: Identify the icon to develop and populate a class list.

➔Step 2: Add a class list: enter "class list title" + Add Class List

IMPORT CLASS LIST- Excel

➔Step 3: Identify the Import List button Import list

➔Step 4: Identify and open import "Help" file.

➔Step 5: This process will be explained to the teachers since we will not be able to access and download their SA SAMS class list.

APPENDIX Q: LANGUAGE EDITING CERTIFICATE

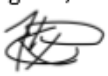
WORDPLAY EDITING
Copy Editor and Proofreader
Email: karien.hurter@gmail.com
Tel: 071 104 9484
Website: http://wordplayediting.net/

24 August 2020

To Whom It May Concern:

This letter is to confirm that the dissertation *Localising an online computer software to include Setswana, an Indigenous African language, for the South African teacher* by Meganathan Moodley was edited by a professional language practitioner.

Regards,



Karien Hurter