Investigating the difference in comprehension between Sesotho and English subtitles: The case of full and keyword subtitles

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ABSTRACT

Research on the benefits of subtitles for learning was pioneered by Price (1983). Her study found that captions, also known as intralingual subtitles, which were primarily intended for the deaf and hearing-impaired viewers, facilitate language acquisition for viewers who were not hearing-impaired. Since this ground-breaking study, researchers have investigated the use of different types of subtitles in different educational contexts. The use of subtitles in the classroom may be particularly useful in the multilingual classrooms, where they can be used to facilitate comprehension of content.

In the present study the impact of subtitles on comprehension when learning content of a specific subject was explored. The aim of this study was two-fold. First it aimed to find out how the language and style of subtitling affected comprehension. The empirical component of the study examined how Sesotho L1 and English L2 subtitles impacted the Sesotho L1 participants' comprehension of the academic content presented in the videos. The participants each watched five videos, each presented in one of the five modes: full subtitles English (FSE), full subtitles Sesotho (FSS), keyword subtitles English (KSE), keyword subtitles Sesotho (KSS) and no subtitles (NS). The comprehension of the content was assessed by using a comprehension test at the end of viewing each video.

Second, it used the SMI iViewX RED500 eye tracker to examine how the extent of subtitle reading affects comprehension. The participants' eye movements were monitored as they viewed the experimental videos. The study considered eye-tracking measures such as the Reading Index for Dynamic Texts (RIDT) and Unique Fixation per Mean Word (UFMW).

Other issues to consider when studying subtitles include how task effort and attitude towards subtitles affect participants' performance. These two factors were not the main aims of the study, but they are included in the study because they could potentially affect comprehension and the reading of the subtitles. Through self-report questionnaires, the participants were asked to rate their perceived task effort experienced while viewing the videos and their attitudes towards subtitles in general and in the educational context.

The data was analysed using the mixed-effects model. With regard to language, no significant effect was found in the differences for the performance between the presentation modes, thus the hypothesis that subtitle language would have an impact on comprehension was refuted. In terms of subtitle style, no practical effect on comprehension was found, therefore refuting the hypothesis that subtitle style would have an effect on comprehension. Despite this, the participants' experience provides interesting insights into the study. The participants found FSE to be most helpful and KSS to be the least helpful, regardless of this, the negative correlation found between

comprehension and subtitle helpfulness for the KSS was found to be practically visible. In contrast, the content was found to be most difficult when presented with KSS and least difficult when presented with FSE. This is consistent with the responses in the attitudinal questionnaire where participants indicated that they would recommend FSE for use in the educational context. This could be attributed to the fact that the majority of the participants were familiar with English subtitles in general television viewing. Another possible explanation is that the participants perceive English as "the language of education", i.e. they are so accustomed to English being the dominant language of education in South Africa (particularly at university), that they see the FSE as the "normal" or "ordinary" subtitles to use.

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CHAPTER 1: INTRODUCTION

1.1   Introduction

This chapter serves to provide context for the use of subtitles in the South African educational domain. The aim of this study was to determine how the subtitle style and language would influence comprehension of Sesotho university students watching a video of a university lecture with L1 and L2, full and keyword subtitles. The content in the video was presented in English, which is the primary language of education in multilingual South Africa, despite policies allowing learners to learn in their mother tongue.

Firstly, this chapter focuses on the issue of language in the multilingual classroom settings in South Africa. Secondly, the chapter discusses African languages in general and in education. Thirdly, the chapter focuses on the language abilities of students in higher education. Fourthly, subtitles as intervention tools in education and the guiding learning theories are discussed. Fifthly, the research problem, objectives, hypotheses, and methods of this study are discussed. Lastly, a chapter breakdown is provided.

1.2   Contextualisation

1.2.1   Languages in education in South Africa

South Africa is a multilingual country with 25 spoken indigenous languages, of which 11 are official languages. Prior to democracy, only English and Afrikaans were awarded official status, and were used as mediums of instruction in schools. This changed with the constitution of the democratic South Africa that was published in 1996, which allowed the country's indigenous languages to be used as languages of learning and teaching. According to Section (29:2), "everyone has the right to receive education in the official language or languages of their choice in public educational institutions where that education is reasonably practical". In line with the Constitution, policies in education promote multilingualism and access to education in the mother tongue (Language in Education Policy, 1997; National Language Policy for Higher Education, 2002).

These constitutional goals however have not been fully implemented as noted by Beukes (2009). Likewise, the Ministerial Advisory Panel on the Development of African Languages in Higher Education (2015) reported that "little progress has been made in exploring and exploiting the potential of African languages in facilitating access and success in higher education institutions". This means that learners are still exposed to learning in English or

Afrikaans instead of their mother tongue, and thus are deprived of the benefits of mother-tongue instruction.

In higher education specifically, it is speculated that the slow implementation may be due to the fact that African languages still need to be developed to be scientific and academic languages, as stated in the National Language Policy for Higher Education (2002:10). However, language attitudes of the role players, including policy-makers, educators, parents and learners are also key to implementation of language policies. The importance of attitudes and the impact they have on policy implementation are illustrated by Lewis' (1981:262) assertion that,

> [a]ny policy for language, especially in the system of education, has to take into account the attitudes of those likely to be affected. In the long run, no policy will succeed which does not do one of three things: conform to the expressed attitudes of those involved; persuade those who express negative attitudes about the rightness of the policy; or seek to remove the causes of the disagreement. In any case knowledge about attitudes is fundamental to the formulation of policy as well as to success in its implementation.

The next section focuses on attitudes of role players in education in South Africa in order to find explanations for the slow implementation of the language policies.

1.2.2 Attitudes towards African languages

Bamgbose (2011:2) asserts that multilingualism tends to be perceived negatively as it is viewed as a barrier to communication and associated with high costs. In contrast with a single language spoken by the majority, multilingualism can be considered to be a barrier in communication because there may be no shared language (Bamgbose, 2011:2). Bamgbose (2011:2) posits that African languages can express scientific and academic concepts, despite the widespread perception that they cannot. He holds the view that "the trite linguistic truism that there is no concept that cannot be expressed in any language provided the need to do so arises holds good today as before" (Bamgbose, 2011:3). According to Bamgbose (2011:3), this means that African languages can be used in domains they have never been used in before, such as education, provided language development is undertaken.

1.2.2.1 Attitudes towards African languages in education

Beukes (2009:46) found that African parents have the perception that because their children speak African languages, it is imperative that they learn English and be taught in English. Thus, multilingualism in education is not an option for the parents, as English is perceived as the dominant language in education these days. In addition, parents prefer English because

it is associated with greater global economic opportunities (Mkhize & Balfour, 2014:135). It is likely that learners hold the same viewpoint as the parents.

African students in South African universities indicated preference for English as a language of learning and teaching (LoLT) (Dalvit & De Klerk, 2005; Bangeni & Kapp, 2007; Hilton, 2010). In Dalvit and De Klerk (2005), participants explained that introducing isiXhosa to the university context would influence the level of education negatively. In recent years, students' attitudes have changed to embracing African language as an additional LoLT (Dalvit *et al.*, 2011; Khetoa & Motsei, 2021). However, some research indicates that English is perceived by many university students as the preferred language (Gordon & Harvey, 2019).

1.3 Language abilities of learners in higher education

Despite the fact that parents and learners prefer English as the LoLT, a significant number of learners enter university with English skills that are below the expected level after high school. However, students seem to be oblivious to the low levels of their proficiency in the preferred language. In their study, Coetzee-Van Rooy and Verhoef (2000:181) found that their participants' perceptions of their English reading skills were incorrect. The participants were confident about their English reading skills, however their test results showed poor performance. Coetzee-Van Rooy and Verhoef (2000:181) suggest the discrepancy between perceptions and test results may be explained by the participants' reasons for learning a new language. Their reasons are, among others, to communicate with fellow South Africans. The researchers, therefore, concluded that the participants would not be academically proficient since the purpose of learning the language was for interpersonal communication.

Van Rensburg and Weideman (2002:152) noted similar findings in their study. They conducted the ELSA Plus test (English Language Skills Assessment for the tertiary environment), on 1000 first-year students at the University of Pretoria, and found that more than 25% of the participants presented with proficiency levels below Grade 10 level. This means that the low English proficiencies may negatively affect students' academic performance, as language is considered to be one of the most important factors influencing students' academic performance by the Council on Higher Education (CHE, 2010:182).

According to the Language Policy for Higher Education (Department of Higher Education, 2002:4-5),

> Language has been and continues to be a barrier to access and success in higher education; both in the sense that African and other languages have not been developed as

academic/scientific languages and in so far as the majority of students entering higher education are not fully proficient in English and Afrikaans.

This is supported by Van Dyk and Weideman's (2004:1) assertion that, "low academic language proficiency levels have indeed been mooted as one of the primary causes of the lack of academic success experienced by many students at South African universities". In order to support students who may experience language as a barrier, The Language Policy for Higher Education of 2002 requires the higher education institutions (HEIs) to develop initiatives for promoting that promote multilingualism (Department of Higher Education, 2002:15).

1.4   Subtitling as intervention

One initiative that may be considered is the translation of learning and teaching support material such as study guides, lecture slides and class videos. This is discussed in more detail in Chapter 2. One form of translation, which may be beneficial is audiovisual translation (AVT), more specifically subtitling. Subtitling can be defined as,

> a way of translating what is being said in an audiovisual text, with two characteristic features. First, there is a change of medium, from the oral to the written form. Second, the oral message of the source audiovisual text is also present in the translated product. (Bartrina, 2009:230)

The aim of the written message is to help the viewer comprehend and appreciate the message of the audiovisual text (Bogucki, 2004:82). Since the written message is presented with the oral message, it is important that the two messages are in synchrony in order for the viewers to follow (Diaz Cintas & Remael, 2007:9). The requirement for synchrony has implications for the rate at which the subtitles are presented. The presentation rate is guided by the "six-second rule" (Diaz Cintas & Remael, 2007:96) according to which a viewer can read text presented over two subtitle lines, with each line containing a maximum of 37 characters, in six seconds. The subtitles in this study were created according to these guidelines and are discussed in Chapter 3.

1.4.1   Subtitling in the multilingual classroom

In South Africa, AVT is commonly used in media and the entertainment industry, but it can be extended to not so familiar contexts like the classroom as a possible solution for challenges in communication in a multilingual environment (Gambier, 2006:258). Globally, subtitling is a popular form of AVT in educational contexts and there is a growing interest in studying this in

a multilingual South Africa. When used in the multilingual educational context, subtitling is to be used to translate audiovisual teaching materials (such as recorded lessons, tutorials or any other multimedia teaching and learning support material from the LoLT), which in most HEIs is presented in English as an additional language (EAL), into the learners' first or strongest language(s).

1.4.2 Learning theories guiding subtitles in education

However beneficial the use of subtitles in education may be, research has found conflicting views based on educational theories, some supporting this intervention and others not. One theory used to argue for the use of subtitles in education is the dual coding theory, which suggests that "a combination of imagery and verbal information improves information processing" (Sydorenko, 2010:50). Another theory used is the information delivery hypothesis, which explains the inclusion of subtitles in audiovisual material in education. This hypothesis suggests that students learn more when they receive information through more paths. On the other hand, the reality of conflicting theories, such as dual channel and limited capacity assumptions, has to be considered in studies concerning subtitles. These suggest that learning is reduced when content is presented in more than one channel due to the redundancy effect.

In light of the conflicting views on subtitles in education, this study sought to examine whether full and keyword subtitles result in increased learning. This was assessed through comprehension tests. Since subtitles can only be useful if they are read, the study also sought to investigate the extent to which the subtitles were read and how this has contributed to comprehension. For this purpose, eye movements of participants during the video viewing were recorded using an eye tracker. A comparison was made between the eye movement data and the comprehension scores for the viewing of the different experiment conditions. Findings may be used to guide educators when using subtitles in the translation of learning and support material.

1.5 Central problem statement

The use of subtitles in education is primarily reported in contexts where it is used as a language learning tool to facilitate the learning of English as an additional or foreign (see Section 2.4 for an overview of the effects of subtitles on learning). Majority of the research conducted in this context makes use of content from the entertainment domain with English subtitles. This study investigated the influence of subtitles on learning academic content. In light of the difficulties faced by non-native English speakers learning in English as an additional

language, and in view of the merits of mother tongue instruction, this study evaluated whether subtitle language and style could improve comprehension. The subtitle languages used in the study are English and Sesotho, and the subtitle styles are full subtitles and keyword subtitles (Section 2.2 describes the various subtitle styles). The study postulates that the Sesotho L1 viewers' comprehension will differ when they are presented with both full and keyword subtitles in Sesotho L1 and English L2. Additionally, the study suggests that there will be further differences between the levels of comprehension for Sesotho full and keyword subtitles, as well as for English full and keyword subtitles. It also postulates that the extent to which the subtitles are read will influence comprehension.

1.6   Research question

In order to determine the effects of subtitles styles on comprehension, this study seeks to answer the following primary questions:

The primary research questions

- To what extent does the language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos?

- How does the extent of subtitle reading (RIDT and UFMW) influence Sesotho L1 participants' comprehension of content presented through the different languages and styles of subtitle presentation?

In order to answer the main question, the following secondary questions were explored:

(1)   What effect does the style of English L2 subtitles (full subtitles (FSE) and keyword subtitles (KSE)) have on comprehension?

(2)   What effect does the style of Sesotho L1 subtitles (full subtitles (FSS) and keyword subtitles (KSS)) have on comprehension?

(3)   Which style and language of subtitles result in better comprehension?

(4)   What effect does the extent of reading of the English subtitles (full subtitles (FSE) and keyword subtitles (KSE)) have on comprehension?

(5)   What effect does the extent of reading of the Sesotho L1 subtitles (full subtitles (FSE) and keyword subtitles (KSE)) have on comprehension?

1.7 Research objectives

In order to answer the research question the primary aims of the study were as follows: (1) To compare the effect of full subtitles and keyword subtitles in English to the effect of full subtitles and keyword subtitles in Sesotho on comprehension of Sesotho L1 users; (2) to determine the difference in effect of full subtitles and keyword subtitles in English on comprehension of Sesotho L1 users; (3) to determine the difference in effect of full subtitles and keyword subtitles in Sesotho on comprehension of Sesotho L1 users; (4) to determine which style of subtitles results in better comprehension; and (5) to determine the effect of the degree of subtitle reading, of the different language and styles of subtitle presentation, on comprehension of Sesotho L1 users.

1.8 Hypotheses

For the research questions stated above to be answered, the following hypotheses were set for this study:

Hypotheses regarding the primary research questions

1. Regarding subtitle language and style

- With regard to both full and keyword subtitles, the Sesotho subtitles will result in improved comprehension due to the benefit of content being presented in the participants' home language which is perceived to be their strongest language.

- For both English and Sesotho, the keyword subtitles will result in improved comprehension due to participants having less content to read and thus experiencing a lower cognitive load than that anticipated for full subtitles.

2. Regarding the extent of subtitle reading (RIDT)

- A higher RIDT score, indicating the greater degree to which the subtitles were read, will result in improved comprehension.

Hypotheses regarding the secondary questions

(1) There are differences in comprehension scores and these are attributed to the English subtitle style.

(2) There are differences in comprehension scores and these are attributed to the Sesotho subtitle style.

(3)   Sesotho keyword subtitles will result in better comprehension.

(4)   There are differences in comprehension scores and these are attributed to the extent of reading of the English subtitles.

(5)   There are differences in comprehension scores and these are attributed to the extent of reading of the Sesotho L1 subtitles.

1.9   Methodology

In order to achieve the aims outlined above, the study comprised a literature review and an empirical study.

1.9.1   Literature review

The literature review in Chapter 2 focused on literature on the following concepts:

- Language situation in education in South Africa

- Theories of learning

- Research of subtitling in education

- Different types and styles of subtitles

- The use of eye-tracking technology with specific focus on subtitle reading

The aim of the literature review was to contextualise the current study against the existing knowledge and research in the field. Furthermore, the literature review aimed to gain insight on how previous studies were conducted which guided the design of this study.

1.9.2   Empirical study

The aim of the study is to investigate whether the different subtitle styles (full and keyword subtitles), presented in English and Sesotho, had an impact on comprehension of Sesotho L1 students, while their eye movements were monitored using the SMI iViewX RED500 eye tracker in order to measure the extent to which they read the subtitles. The participants were each shown five videos of a university lecture of a first-year Psychology module (PSYC 111) presented in English. Each video was presented with different subtitle conditions: full subtitles in English, full subtitles in Sesotho, keyword subtitles in English, keyword subtitles in Sesotho and no subtitles.

Every viewing of the video was followed by the comprehension test completion phase. The comprehension test sought to find out how each subtitle condition could have influenced the participants' comprehension of the content.

The study consisted of an additional empirical component of completing two questionnaires. The one questionnaire was a self-report whereby the participants reported their perceptions of the instruments and the content, plus their perceived effort in completing the tasks of the experiment. The second questionnaire included questions of attitude where the participants indicated their attitudes towards subtitles in general and their use in the educational context.

1.9.3 Ethics

This study involved student participants, therefore the researcher applied for ethical clearance from the Ethics Committee for Language Matters at the NWU, under an existing project titled: Investigation of mediated communication in terms of the means of production and the impact of end users. Ethics clearance was granted: NWU-00425-15-A8. See Appendix H.

Before recruiting participants, additional permission to involve students in the study was sought from the North-West University's Research Data Gatekeeper Committee (RDGC). Both the gatekeeper committee and ethics committee were satisfied that the data and personal details of the participants would be treated anonymously, thereby abiding by the requirements of the Protection of Personal Information Act (PoPI). Anonymity in this case refers to using participant numbers instead of names.

In addition, the researcher sought permission from the Academic Literacy Programme Leaders to access the students' records for their TALL scores. Additional permission to recruit participants during contact sessions and on the modules' sites on the North-West University's Learning Management System was sought from the Programme Leaders and lecturers of the Academic Literacy and Communication modules.

Before participation, participants were reminded about the general aims of the study and that their participation was voluntary, meaning that they were free to leave the experiment should they choose to do so. Furthermore, it was explained that the participation in the experiment would not affect their academic performance or marks.

Information about the eye tracker and its basic function was provided without making reference to subtitles or subtitle reading. Furthermore, the participants were informed that their comprehension would be tested, without the details that the comprehension of the Sesotho

and English subtitles will be compared. These details were concealed as they could influence the behaviour of the participants and result in biased participation.

The researcher also ensured that the welfare of participants was safeguarded by including breaks in between sessions and providing the participants with some water.

Since the participants included in the study were 18 years and above, they were requested to give consent to participate in the study by signing an informed consent form giving the researcher permission to:

- record their viewing of the videos using the eye tracker, and

- anonymously report all data in the current study and in any future report or publication.

1.10 Chapter division

Chapter 1: Introduction and contextualisation

This chapter includes the introduction and contextualisation of this study and the researcher's reason for the particular topic.

Chapter 2: Review of the literature

This chapter discusses relevant literature on subtitling, reading and the use of eye-tracking technology to study different aspects of reading. Focus is placed on the reading of English and African languages, and on research conducted on subtitle reading. A gap in the literature is identified, thus prompting the need for further research.

Chapter 3: Methodology

This chapter discusses the methods used in this study to collect data. It includes details on the preparation, experiment design, research instruments and data analysis techniques.

Chapter 4: Presentation and analysis of the results

This chapter analyses the data collected for the static text reading and the subtitle reading of the three video clips.

Chapter 5: Conclusion

In this chapter the results of the data analyses are interpreted. Conclusions and the implications for future research are included.

CHAPTER 2: SUBTITLING IN EDUCATION

2.1   Introduction

The previous chapter provided a brief overview of the aspects in the current South African language landscape which have a direct influence on the language situation of students at South African higher education institutions. The chapter identified the use of subtitles as a tool to support students who may be at risk due to the language barrier. Subtitles in general are a means of bridging the language gap for viewers of any audiovisual material. Although they are predominantly used in the entertainment industry, extensive research has shown that they may be of use in the educational context. This chapter intends to review the relevant literature, discussing subtitles in education. Before delving into the review, it is important to clarify what subtitling is. This will be followed by a discussion of how it has been used in educational contexts with specific focus on the theoretical basis and how they can be used to benefit students.

2.2   Definition of subtitling

Subtitling is one of the strategies available for providing viewers experiencing a language barrier or those with a hearing impairment with access to content in the soundtrack of audiovisual material. Audiovisual products are polysemiotic texts, conveying meaning through multiple channels: the verbal auditory channel, the non-verbal auditory channel, the verbal visual channel and the non-verbal visual channel (Gambier, 2006:260). Figure 2-1 (adapted from Gambier, 2006; Diaz Cintas & Remael, 2007) illustrates the four channels as well as examples of items they consist of.

	Auditory channel	Visual channel
Verbal	Dialogue, monologue, commentary and songs	On screen written text such as subtitles, street names, credit titles, letters etc.
Non-verbal	Instrumental music, sound effects and paralinguistic elements such as pauses, tone, pitch, volume etc.	On-screen images of actors including their facial expressions, body language, movements, costume etc. and factors such as lighting, colours, framing etc.

Figure 2-1:   Components of audiovisual texts

As shown in Figure 2-1, subtitling is placed in the verbal visual channel. Diaz Cintas and Remael (2007:8) define subtitling as:

> a translation practice that consists of presenting a written text, generally on the lower part of the screen, that endeavours to recount the original dialogue of the speakers, as well as the discursive elements that appear in the image (letters, inserts, graffiti, inscriptions, placards and the like), and information that is contained in the soundtrack (songs, voices off).

This recount of the original dialogue can be presented in a variety of ways in terms of the language used and how the subtitles are edited. For the purpose of this study, classification in terms of language will be referred to as subtitle type and classification according to the editing will be referred to as subtitle style.

2.2.1   Types of subtitles

Three types of subtitles have been identified by Diaz Cintas and Remael (2007:13-18), using language as criteria: intralingual, interlingual and bilingual subtitles. This section will discuss the three types but only intralingual and interlingual subtitles are relevant to this study.

2.2.1.1 Intralingual subtitles defined

In intralingual subtitling the language of the on-screen text is the same as the language of the original dialogue heard in the audio track (referred to as the source language). These subtitles are also referred to as captions or as same language subtitles. Translation in this type of subtitle takes place from one mode to another within the same language. Intralingual subtitles are primarily intended for the deaf and hard of hearing, but they do benefit the hearing, especially for second language users and immigrants (Diaz Cintas & Remael, 2007:15). According to the authors these subtitles may also benefit users who speak a different dialect of the source language (Diaz Cintas & Remael, 2007:17), for example American English and South African English. In addition, Diaz Cintas and Remael (2007:17) explain that intralingual subtitles are beneficial to unlock accents in the utterances of either foreign or native speakers of the source language.

2.2.1.2 Interlingual subtitles defined

On the other hand, in interlingual subtitling, translation is from a source language of the source text to a target language in the on-screen text (Diaz Cintas & Remael, 2007:17). Similar to intralingual subtitles, translating here occurs between modes (from oral to written). However, with regard to language, interlingual subtitles entail translating between languages. These subtitles may be classified as standard subtitles and reversed subtitles (d'Ydewalle & De Bruycker, 2007; Perego *et al.*, 2016). Standard subtitles consist of a translation of the audio soundtrack, which is in the viewer's additional language or a foreign language they do not understand, into subtitles in their home language. Reverse subtitles, on the other hand, are a translation of the audio soundtrack in the viewer's home language into subtitles in an additional language (d'Ydewalle & De Bruycker, 2007; Perego *et al.*, 2016). Standard subtitling provides viewers of a language community different from the one of the original audio track with access to the audio tracks of the materials viewed. Reverse subtitling is mainly intended for the teaching of the additional language (Diaz Cintas & Cruz, 2008).

2.2.1.3 Bilingual subtitles defined

The final type of subtitles is the bilingual subtitles in which subtitles are simultaneously presented in two different languages (Liao *et al.*, 2020:70). According to Liao *et al.* (2020:70) these subtitles are believed to have the potential to deliver the benefits of both intralingual and interlingual subtitles. In order to prevent excessive pollution of the image, common practice is to use two lines only, with a different language on each line (Diaz Cintas & Remael, 2007:18).

2.2.2   Subtitle style

Apart from language, subtitles may further be classified in terms of how they are edited and presented. In order to distinguish this from the language classifications mentioned above, this will be referred to as styles of subtitles. The styles of subtitles that are commonly used in educational contexts include, but are not limited to, full subtitles, key word subtitles, full subtitles with keywords highlighted and glossed keyword subtitles.

Full subtitles

Full subtitles are subtitles where the dialogue is captured verbatim. Guillory (1998:93) describes them as subtitles containing 100% of the utterance in the audiovisual text.

Keyword subtitles

Keyword subtitles, in turn, include only the words which are important for understanding the meaning of the audio message (Montero Perez *et al.*, 2013:27; Montero Perez *et al.*, 2014a:123, Bensalem, 2016:454). Keywords are determined in different ways. In some studies, keywords include specific word classes such as verbs and nouns only; whilst in other instances they may be made up of a certain percentage of the full script, which in research ranges from 14%-50% (Guillory, 1998:93; Baltova, 1999; Montero Perez *et al.*, 2013:27; Bensalem, 2016:456).

Full subtitles with keywords highlighted

Montero Perez *et al.* (2014a:123), in their study on how captioning types impacted on L2 learners' vocabulary acquisition and comprehension of L2 video, created full subtitles with keywords highlighted. In order to create these subtitles, they selected target words that would be unfamiliar to the participants in a subtitle, and highlighted them.

Glossed keyword subtitles

In the study, investigating the effects of enhancing videos, Montero Perez *et al.* (2018:8) created glossed keyword captions which are defined as intralingual keyword subtitles where "each keyword is linked to its corresponding L1 context-bound translation". To view the translation of a keyword, users need to tap the space bar, which will cause the video to pause so that the translation can be displayed on the screen (Montero Perez *et al.*, 2018:8). For instance, an "account" in general can refer to a narrative that describes an event, but in the banking context, it refers to a type of financial property owned by an individual. If "account" appears in the source text (ST) as a keyword and the context in which it is used in the ST is banking, then the glossary entry in the target language will be an equivalent of the term as used in the banking context.

2.3   Subtitles and theories of learning

When designing educational interventions using subtitled material it is important to consider learning theories and how they support and guide the use of subtitling in education. These theories include dual coding theory (Clark & Paivio, 1991; Paivio & Clark, 2006; Sydorenko, 2010; Paivio, 2014), the information delivery hypothesis (Mayer, 2009) and the cognitive theory of multimedia learning (Mayer, 2005; 2009; 2021). This section will discuss these theories and consider their implications for subtitling in education.

2.3.1   Dual coding theory

Dual coding theory states that humans process information through two channels: the verbal and the non-verbal (Paivio, 2014:142). Clark and Paivio (1991:3) explain that the verbal channel deals with all linguistic material, while the non-verbal deals with non-linguistic items. The two channels are connected to each other and they are able to "function independently or cooperatively to mediate non-verbal and verbal behaviour" (Paivio & Clark, 2006:3). According to this theory, presenting information through both imagery and verbal representations improves the processing of the information (Sydorenko, 2010:50). For subtitling in education this means that subtitling could be a viable tool to use in educational videos, as the educational content is presented in both the auditory and visual channels, which may result in improved processing of information. In other words, the fact that learners would hear the information as spoken by the lecturer, while also seeing the information in written format in subtitles, could help the learners process the information better. This was confirmed in the Linebarger *et al.* (2010:161) study, which found that participants who viewed the video with captions scored higher in word recognition and comprehension.

2.3.2   Information delivery hypothesis

Another theory that supports the benefits of using subtitles in education is the information delivery hypothesis. The focus of this theory is the modes though which information is presented and not the channels through which the information is processed. The theory holds the belief that modality through which information is presented does not matter (Mayer, 2009:203). According to Mayer (2009:205),

> the premise underlying the information-delivery hypothesis is that learners need to receive verbal and visual information (i.e., words and pictures); obviously pictures are presented visually, but the modality of the words does not matter because they have the same informational value when expressed as speech as when expressed as printed text. Therefore, the information-delivery hypothesis predicts that learners who receive a

multimedia lesson with words presented as on-screen text will perform the same on retention
and transfer as learners who receive the identical lesson with words presented as narration.

According to this theory, effective learning requires the presentation of information through
both verbal and visual channels, and the modality of presenting words does not matter. The
presentation of words is not limited to a single modality, which allows for subtitles to be used.
Subtitles therefore provide learners with the opportunity to access the same information
through more than one path; the lecturer's speech, which is auditory and through writing
(subtitles), which is visual.

2.3.3   Cognitive theory of multimedia learning

According to the two theories discussed thus far, information in audiovisual texts is processed
through two channels or modalities. Likewise, the cognitive theory of multimedia learning also
suggests that information is processed through the visual/pictorial channel and the
auditory/verbal channel in the human brain (Mayer, 2009:57). This theory which aims to
understand "how to use words and pictures to improve human learning" (Mayer, 2005:32), is
based on the assertion that "people learn more deeply from words and pictures than from
words alone" (Mayer, 2014:55). Mayer (2009:57) continues to explain that pictures are
processed in the visual channel and speech text is processed in the auditory channel. Printed
words on the other hand are processed in both channels, first in the visual channel and then
in the auditory/verbal channel, as can be seen in Figure 2-2.
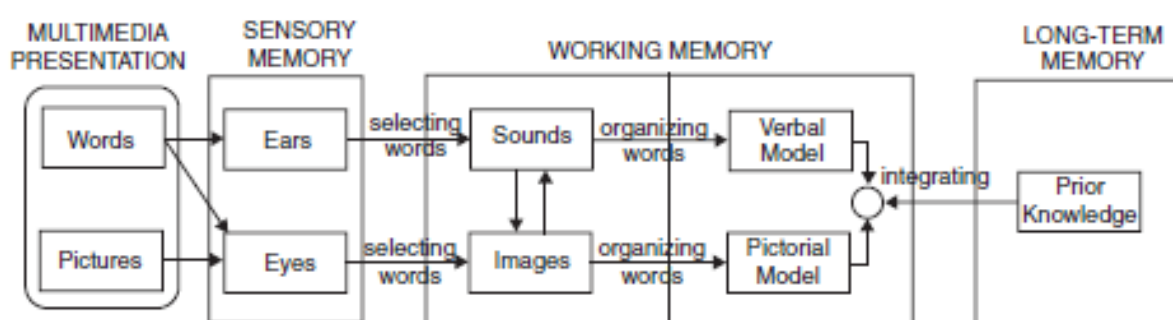
Figure 2-2:   *Cognitive theory of multimedia (Mayer, 2005:37)*

Figure 2-2 also illustrates how humans process information in a multimedia text. Words and
pictures are presented in the multimedia text. The learners access these items through their
ears and eyes. According to Mayer (2021:231), "The sensory input in sensory memory decays
rapidly, but can be transferred to working memory by paying attention (represented by the
selecting arrows)". This means by focusing and paying attention to certain sounds and images,
they are selected to be held in the working memory where they are processed. According to

Mayer (2009:62), the arrows from sound to images indicate a "mental conversion of a sound (such as the spoken word "cat") into a visual image (such as an image of a cat) – that is, when you hear the word "cat" you might also form a mental image of a cat". Mayer (2021:231) further explains that in the working memory, which has limited capacity, the sounds are organised into the verbal model and the images are processed into the pictorial model. The final phase of information processing involves learners integrating the verbal and pictorial models with each other, as well as with their relevant prior knowledge, which is stored in the long-term memory (Mayer, 2021:231).

According to the cognitive theory of multimedia learning (Mayer, 2009:61), in order for the process illustrated in Figure 2-1 to result in meaningful learning, the design of multimedia messages needs to take into consideration the following factors: (1) channels available for processing information, (2) humans' capacity to process information, and (3) learner engagement with the information. Based on these considerations, the theory rests on three assumptions, namely the dual-channel assumption, the limited capacity assumption and the active processing assumption.

2.3.3.1 The dual-channel assumption

The dual-channel assumption proposes that the human system for processing information is made up of two channels; the auditory/verbal and the visual/pictorial (Mayer, 2005:33). Mayer (2005:33-34) explains that information presented to the eye, which includes images and on-screen text, is processed in the visual channel; information presented to the ear, which includes dialogue, narration and other sounds, is processed in the auditory channel. Mayer (2009:64) later distinguishes between the two channels in terms of presentation mode and sensory modalities. With regard to the presentation mode, the focus is on whether the information presented is verbal (speech or written text) or non-verbal (images, videos or background sounds). On the other hand, the focus of the sensory modality is whether presented stimulus is processed through the eyes (including images, written text and videos) or ears (such as speech text and background sounds).

In the context of subtitled audiovisual material, this means that the subtitles provide an additional channel through which information can be processed. However, since videos or films contain a lot of information in the visual channel, the addition of subtitles may result in the channel being overloaded since that is also where the images on the screen are processed. Similarly, the addition of subtitles may result in the verbal channel being overloaded as it processes both the dialogue and the subtitles. In order to prevent verbal

content competing with pictures in terms of their processing, the cognitive load theory recommends presenting verbal content through speech text only (Mayer, 2009:124).

2.3.3.2 The limited capacity assumption

The limited capacity assumption states that the brain has a limited capacity for processing information, meaning that each channel can process a limited amount of information at a time (Mayer, 2005:35). This means that presenting a lot of visual content at a time may result in an overload of the visual-pictorial channel; equally so, presenting a lot of auditory content at a time may result in an overload in the auditory-verbal channel (Mayer, 2002:60). As a result of this limited capacity, Mayer (2005:36) asserts that we have to decide which "pieces of incoming information to pay attention to, the degree to which we should build connections between selected pieces of information and our existing knowledge". With regard to subtitling this means that subtitlers need to remember that the brain has to process the same information in two channels: verbal-auditory (the lecturer's speech), and the visual channel (subtitles). It is therefore important that they carefully consider the amount of information included in the subtitles in order to minimise overload. This is important as both channels may be overloaded, since subtitles are processed in both channels, with the spoken words in the verbal channel, and the images in the visual channel.

2.3.3.3 The active processing assumption

The third assumption, the active processing assumption, assumes that humans actively process information in order to make sense of their experiences (Mayer, 2005:36). The cognitive processing involves paying attention to incoming information, organising it and integrating it with prior knowledge. For subtitled audiovisual material it means that the viewers actively select the information that will assist in making sense of their experience. This means that if the auditory information is not sufficient to provide meaning, the learner may select information for clarity from the subtitles presented in the visual/pictorial channel. Once again, this emphasises the importance of careful consideration when creating subtitles.

The purpose of subtitles in the educational context is to assist learners to acquire and understand knowledge. The theories discussed demonstrate the possible effect of subtitles in the learning process. From the theories it is evident that learners can benefit from more than one source of information. In addition, the theories also demonstrate possible overload that may result due to learners being exposed to information through multiple channels. This has implications for the inclusion of subtitles in educational material, they may be beneficial and at

the same time they may result in overload. Therefore, subtitles must be thoughtfully into educational materials if they are to benefit learning and improve comprehension.

2.4 The effects of subtitles on learning

A number of studies (Kothari *et al.*, 2002; Kothari *et al.*, 2004; Koolstra *et al.*, 2004; Ayonghe, 2009; Mahlasela, 2012; Kruger 2013; Kruger *et al.*, 2014; Kruger & Steyn, 2014) have been conducted investigating the usefulness of subtitling in education. Subtitled videos are especially beneficial for learners for whom English is an additional language. Subtitles assist these learners to: "overcome common issues such as content that is spoken very quickly, accented English, mumbling or background noise. Captions also assist students to clarify full names and technical terminology and allow them to watch videos in sound-sensitive environments like offices and libraries" (Kent *et al.*, 2018:158)

Some researchers have focused on the effects of subtitles on literacy and language learning (Kothari *et al.*, 2002; Kothari *et al.*, 2004; Koolstra *et al.*, 2004; Ayonghe, 2009). Other researchers have focused on the effects of subtitles on learning of a specific subject (Mahlasela, 2012; Kruger 2013; Kruger *et al.*, 2014; Kruger & Steyn, 2014). While distinct, these categories overlap in that they all include an inherent element of comprehension that is key to learning in general.

2.4.1 The effects of subtitling on language learning

Studies on subtitling in the education domain focus mainly on language learning. These studies focus, amongst others topics, on learning to read, vocabulary acquisition and comprehension (Markham,1989; Garza, 1991; Koolstra & Beentjes, 1999; Linebarger, 2001; Kothari *et al.,* 2002; De Bruycker & d'Ydewalle, 2003; Kothari *et al.* 2004; Yuksel & Tanriverdi, 2009; Linebarger *et al.* 2010; Sydorenko's, 2010; Hayati and Mohmedi, 2011; Hwang & Huang, 2011; Latifi *et al.*, 2011; Montero Perez *et al.*, 2014a). These studies mainly make use of videos available in the entertainment domain such as film and music.

In terms of learning to read, Linebarger (2001:289) states that the presence of subtitles in audiovisual products may assist "children to establish a connection between the spoken and the printed word by placing words in a familiar context using a familiar medium". From this it can be deduced that subtitles can contribute to the process of learning to read, as De Bruycker and d'Ydewalle (2003:672) put it "[i]f subtitles are effectively processed (and read), subtitling may be considered a teaching tool for children who are in the process of learning to read, or for people who are experiencing reading difficulties". A number of studies have been conducted to investigate this idea. The studies discussed below looked at educational benefits

of subtitles used in a social context, and demonstrate Caimi's (2006:89) statement that "the importance of the educational dimension is evident when we consider the function that subtitled multimedia products have in our societies".

Kothari *et al.* (2002) conducted a study investigating the effects of songs with same language subtitles (SLS) on the reading skills of primary school children and found that subtitles contribute to improved syllable and word recognition and reading. Similar to Kothari *et al.* (2002), Linebarger *et al.* (2010), found that watching subtitled videos resulted in improved reading skills in young children who were still learning to read. This study used videos of children's programmes whilst the Kothari *et al.* (2002) study used music videos. In a later study, Kothari *et al.* (2004) focused on the benefits of subtitles for the literacy of hearing adults. They found that the literacy of those who watched subtitled Bollywood music videos on a regular basis increased at a greater pace when compared to that of adults who watched the subtitled videos on rare occasions or did not watch them at all.

The process of learning to read implies vocabulary acquisition. Although subtitles are mainly consumed by users who do not know the language of the audio, they are of benefit even to first language speakers. This is demonstrated by findings of a study by Koolstra *et al.* (2002:340-341) which demonstrates that intralingual subtitles provide "vocabulary acquisition in the viewer's own language" for first language users.

Other studies (Koolstra & Beentjes, 1999; Yuksel & Tanriverdi, 2009; Sydorenko's, 2010; Montero Perez *et al.*, 2014a), have demonstrated that interlingual subtitles also contribute to vocabulary learning. The Montero Perez *et al.* (2014a) study is particularly relevant to the current study as it investigated the effect of different styles of subtitles on vocabulary acquisition. The participants were divided into six groups and the groups were randomly assigned to the experiment conditions of no captions, full captions, keyword captions and full captions with highlighted keywords. The findings demonstrate that the groups exposed to captions (full captioning, keyword captioning, and full captioning with highlighted keywords) performed equally well on word form recognition and significantly outscored the no captions group (control group). However, captions with keywords (keyword captions and full captions with highlighted keywords) were the most beneficial for word meaning recognition.

The findings of the studies discussed above show that subtitles contribute to language learning and thus confirm the benefit of dual-channel input. According to the dual coding theory, presenting information in two modes, auditory and written, results in improved processing and therefore facilitates learning.

Another area of research interest for subtitles in education is the impact of subtitles on comprehension. A number of studies have been conducted to investigate the benefits of subtitles for comprehension (Markham, 1989; Garza, 1991; Hayati & Mohmedi, 2011; Hwang & Huang, 2011; Latifi *et al.*, 2011; Lacroix, 2012; Mahlasela, 2012; Kruger, 2013; Kruger *et al.*, 2014; Kruger & Steyn, 2014). Some have found that indeed subtitles do contribute to increased comprehension of video content, whereas others found that they have no effect in terms of comprehension.

Several studies have found a positive correlation between subtitles and comprehension, including studies by Markham (1989), Garza (1991), Hayati & Mohmedi (2011) and Hwang and Huang (2011). The sample of all these studies were university students who were mainly EAL speakers, except for the Garza study (1991) which included a group made up of English native speakers. The participants in all studies watched video materials with and without subtitles. The subtitles in the studies included intralingual and interlingual subtitles. In the Markham (1989) and Garza (1991) studies on the one hand, all groups were exposed to videos with and without subtitles. In the Hayati and Mohmedi (2011) and Hwang and Huang (2011) studies, on the other hand, each group was exposed to only one of the treatment conditions: video with subtitles or video with no subtitles. After watching the videos, the participants' comprehension of the content was measured through multiple-choice questions. The findings of all four studies demonstrated that the addition of subtitles to video material resulted in better comprehension of the video content.

Other studies, however have not conclusively found that the presence of subtitles facilitates comprehension of content (Latifi *et al.*, 2011; Lacroix, 2012; Mahlasela, 2012; Kruger, 2013; Kruger *et al.*, 2014; Kruger & Steyn, 2014). In contrast to the studies discussed in the previous paragraph, these studies focused on content learning rather than language learning. In addition, they used educational videos instead of those from the entertainment domain, which are typically used in language learning studies.

2.4.2 The effects of subtitling on content learning

Other studies of subtitling in education focused on the effects of subtitles on content learning. In these studies, researchers investigate if subtitles make content more comprehensible to learners. This section will discuss studies that focused on the effect of subtitles on content learning.

Mahlasela (2012) investigated the use of mother-tongue (L1) subtitling in enhancing comprehension of physical science content of Sesotho-speaking learners taught in EAL in a

South African school context. He found that Sesotho subtitles did indeed improve the recall component of comprehension of physical science (Mahlasela, 2012:78).

Similarly, Kruger *et al.* (2014) conducted an eye-tracking study, which, amongst others, aimed to investigate the effect of subtitle language comprehension of an academic lecture at university. The participants were 68 Sesotho native-language speakers whose LoLT was English as second language. The participants were randomly assigned to three groups: 1) a group that watched a video of a recorded Psychology lecture taught in English without subtitles (Group E); 2) a group that watched a video of the same lecture with English subtitles (Group EE); and 3) a group that watched a video of the same lecture with Sesotho subtitles (Group ES). The findings from the study demonstrated that there was no statistically significant difference in the performance of the groups in the comprehension tests. They also investigated the effect of the subtitles over a long term by letting the participants complete a second comprehension test. The results of the test indicated that the performance of all groups in the study deteriorated, however, Group ES performed better than the others, suggesting potential benefits of L1 subtitles for information retention due to "L1 cognitive priming" (Kruger *et al.*, 2014:12). This cannot be said with certainty as they found that L1 subtitles were read to a lesser extent than the L2 (English) subtitles.

In another study, Kruger and Steyn (2014) investigated the influence of subtitle reading on performance. The participants were 36 Sesotho native language speakers, who were first-year students majoring in Psychology. The participants were randomly assigned into a test group and a control group. The test group watched video recordings of a lecture presented in English with English subtitles and the control group watched the same video recordings without subtitles. The participants completed a comprehension test on the content of all the videos, after watching all six videos. The results from this study showed no statistically significant differences between the two groups in terms of the participants' performance in the comprehension test. This could be interpreted to mean that the subtitles did not influence comprehension, however, in the test group those participants who read the subtitles more performed better than those who read the subtitles to a lesser extent (Kruger & Steyn, 2014:118). This shows that in order for the subtitles to have any positive impact, the reading has to be more than just superficial.

Due to the inconclusive findings on the effect of subtitles on comprehension, more research is needed in this area. Most research in subtitling in education to date has used full subtitles either in the same or different language as the audio track. Therefore, the current study seeks to explore the aspects of style and language. Subtitle style refers to how subtitles are edited and presented. In recent research in subtitles in education, the following styles have been

investigated: full subtitles, keyword subtitles, partial and synchronised subtitles, and full subtitles with highlighted keywords (Guillory, 1998; Baltova, 1999; Kikuchi, 2003; Rooney, 2011; Mahlasela, 2012; Kruger, 2013; Montero Perez *et al.*, 2013; Kruger *et al.*, 2014; Montero Perez *et al.*, 2014; Behroozizad & Majidi, 2015; Bensalem, 2016). Full subtitles and keyword subtitles are the most popular styles in this area of research. The current study will focus on these two styles.

Just as research found the use of full subtitles to be beneficial for vocabulary learning and retention, some research focusing on the effect of keyword subtitles on vocabulary learning and retention also found that participants who viewed video material with keyword subtitles performed significantly better than the participants who viewed such material with no subtitles (Baltova, 1999). In another study focusing on the effect of keyword subtitles on comprehension, Guillory (1998), one of the pioneers of research on alternative styles of subtitling in the educational context, compared the effect of French second language subtitles on French second-language learning. The intralingual subtitles in the study were presented in the following conditions: keyword subtitles, full subtitles and no subtitles. She investigated the extent to which keywords facilitated comprehension. The participants were beginner learners of French as a foreign language. They were required to watch an authentic video and complete a comprehension test at the end of the video. Her findings were that the subtitles contributed positively to comprehension but there was no significant difference between the effect of keyword subtitles and full subtitles. The keyword group did, however, outperform the no-subtitles group. Other researchers have also found that keyword subtitles facilitate comprehension of content (Rooney, 2011; Behroozizad & Majidi, 2015).

Guillory (1998:95) asserts that keyword subtitles have an additional benefit of accessing the same support as with full subtitles without being subjected to having too much text to read. This will allow the learners an opportunity to access the information in another path as well as the auditory channel, thereby enhancing the processing of information. Although the same applies to full subtitles, Guillory (1998:97) posits that "With smaller amounts of text in the visual channel, learners are less likely to encounter overload to multichannel processing and more likely to achieve fuller comprehension of the information coming through the auditory channel". This means that keyword subtitles, which contain "smaller amounts of text", are a useful tool in the educational context.

Educational videos generally include slides and diagrams, which require learners to pay more attention to the visuals in the video. The presence of subtitles may result in competition for attention in the visual channel, which may impede understanding. In this context, keyword subtitles are the more suitable option since they contain less text to process, resulting in less

overload, which allows the learners to benefit from using subtitles. This may be beneficial for learners learning in a language other than their home language, as it is the case for the majority of learners in South Africa.

Although some studies have found keyword subtitles to be beneficial (Guillory, 1998; Rooney, 2011; Behroozizad & Majidi, 2015), others have found no significant difference between the effect of keyword subtitles and no subtitles on comprehension (Kikuchi, 2003; Montero Perez *et al.*, 2013; Montero Perez *et al.*, 2014; Bensalem, 2016). The study of Montero Perez *et al.* (2014), for example, compared the effect of three subtitle styles on comprehension: full, keyword subtitles and full subtitles with highlighted keywords. Their research investigated whether the style of subtitles had an effect on the French L2 learners' comprehension of content. The findings were that the subtitle style had no significant effect on the comprehension test scores. However, the researchers believe that there is a need for further research to investigate the benefits of keyword subtitles, and the current study aims to contribute to this.

In the studies mentioned above, the languages used in the audio speech and the subtitles were the same, in other words the subtitles were intralingual. Further research on the impact of interlingual keyword subtitles is needed. Numerous studies have investigated the benefits of interlingual full subtitles, where the language of the audio speech is different from the language of the subtitles (Linebarger *et al.* 2010; Sydorenko's, 2010; Hayati and Mohmedi, 2011; Hwang & Huang, 2011; Latifi *et al.*, 2011; Lacroix, 2012; Montero Perez *et al.*, 2014a). In South Africa there has been research using interlingual subtitles, including Sesotho L1 subtitles. Mahlasela (2012) investigated the use of mother-tongue (L1) subtitling in enhancing comprehension of physical science content of learners taught in EAL. He found that Sesotho subtitles did indeed improve the recall component of comprehension of physical science (Mahlasela, 2012:78). In another study focusing on interlingual subtitles, Kruger *et al.* (2014) investigated, amongst others, the effect of subtitle language on comprehension. They found that even though Sesotho L1 subtitles do not have a significant effect on comprehension, it may have benefits in the long term for information retention. The studies reviewed here demonstrate inconclusive findings in terms of (1) the impact of subtitles on comprehension and (2) the effectiveness of interlingual subtitles. Since the South African research on the use of subtitles (intralingual and interlingual) in education focused on the use of full subtitles, there is room for further research focusing on keyword subtitles.

The use of L1 subtitles is particularly important as these subtitles provide the learners taught in EAL the opportunity to access content in an additional path using a language they understand better. This would give the learners the same advantage as mother-tongue

education, which promotes "acquisition of knowledge and understanding" (Stoop, 2017:2). These observations are further corroborated in Chürr's (2013:7) assertions that the use of the mother tongue facilitates expression and reception and also promotes optimal learning. The L1 subtitles could thus assist learners to overcome the limitations posed by language in a multilingual classroom. Two matters need to be kept in mind, however, when using subtitles in an educational context. Firstly, despite the benefit of subtitles, they may result in increased cognitive load as found in Kruger (2013:48). This is a result of learners having to concentrate more as they simultaneously process information from the subtitles, the lecturer's speech and other onscreen content (including slides and the lecturer's non-verbal communication). Kruger's study (2013) used full subtitles, and it is anticipated that since keyword subtitles are shorter and give learners less to read, they do not place such a heavy burden on cognitive load. Therefore, alternative styles of presenting subtitles need to be explored in order to determine the benefit of subtitles in the educational setting, seeing as only one style has been used to date in the South African context. In this regard, the current study intends to explore the use of a particular subtitle style, L1 keyword subtitles, in order to determine whether subtitle style contributes to enhanced comprehension, as an aspect of learning. Sesotho is the L1 that will be explored. In order to comment on Sesotho L1 subtitles, the effect of EAL subtitles will also be investigated in order to draw a comparison between the two.

Another matter to be considered is that although there are benefits to L1 learning, South African students have accessed and interacted with educational content in EAL for most of their primary and all of their secondary education. However, it has been found that they are not proficient in the LoLT. Considering this background, one would assume that the participants would make use of the L1 subtitles presented. However, research has shown the opposite, with participants avoiding to read the Sesotho subtitles (Kruger *et al.*, 2014:8). Thus an assumption cannot be made that there will be automatic inclination for students to meaningfully interact with the Sesotho L1 subtitles. This has implications for the comprehension and reading of L1 subtitles.

As seen in the literature review, different research has reached different conclusions regarding the value of subtitles in education. Two different areas of subtitle research in education were covered in the section; language learning and content learning. Gains were seen in the language learning area, where vocabulary acquisition and literacy showed to have benefited the most. The results for the benefits of interlingual subtitles in education were inconclusive but some suggested some potential benefits, such as long-term retention of content. In addition, the literature demonstrated that full subtitles are beneficial despite their potential to pose an overload for viewers. Studies on keyword subtitles, which are thought to alleviate the

potential overload of full subtitles, have generated conflicting findings. In some studies, keywords were found to be beneficial for comprehension, whilst in others they did not have any significant effect. As seen in the review, one of the aims of educational subtitles research is to investigate the effects of subtitles in comprehension. Therefore, the next section focuses on comprehension, how it is defined and how it can be assessed.

2.5 Comprehension defined

The presence of subtitles on audiovisual material is intended to enhance the comprehension of the viewer. This section briefly focuses on defining this concept and discusses how it can be assessed in the classroom.

Duke and Carlisle (2011:200) define comprehension as "the act of constructing meaning with oral or written text". The authors explain that meaning is constructed mentally through factors that have an effect on each other such as text, the listener or reader and the context of the communication process. This means that if, for example, the reader has prior knowledge about content of the text, the text will be easier to understand.

Comprehension can be assessed in various ways. Assessment design is commonly guided by Bloom's taxonomy which provides a useful framework, which includes comprehension, for categorising test questions (Jaiswal, 2019:11). Jaiswal (2019:12) further explains that the framework includes measurable verbs that describe what students need to do in order to demonstrate learning. Among the activities used to measure students' learning is recall.. Carlisle (1999:11) identifies recall measurement as a common method for assessing comprehension in the classroom. Comprehension tests typically include the following types of recall: recognition, cued recall, and free recall. These types of recall may include questions described as typical questions for assessing comprehension of a text such as true/false, multiple choice, cloze and open-ended questions (Cain & Oakhill, 2006:701-705).

Recognition recall entails presenting participants with options from which they are to select the correct option. The questions used include true/false and multiple-choice questions. In true/false questions, participants are presented with a sentence and they have to indicate whether the sentence is true or false (Cain & Oakhill, 2006:702). The authors assert that these forms of assessment pose low processing demands on the participants, as no complex verbal response is required. They are good for assessing the memory element of comprehension but fall short in terms of inference making, which is another comprehension indicator. Multiple choice is also a form of assessment which does not require a complex verbal response,

however, it poses a higher processing demand because a participant has to compare responses in a set of options and choose the correct one (Cain & Oakhill, 2006:703).

Cued recall on the other hand involves providing the participants with a cue to remind them of the answers to the questions asked. Cloze tasks are included in this type of recall as they consist of a sentence where a single word is omitted and the participant has to either fill in the word or select the appropriate word from a list (Cain & Oakhill, 2006:701).

Free recall involves the participant receiving no cues to assist them to remember the answer to the questions. The questions include open-ended questions such as asking for explanation of concepts or to motivate their responses. Through this form of assessment, the participants' memory and understanding are tested (Cain & Oakhill, 2006:703-704).

Viewing subtitled audiovisual material implies listening and reading comprehension. Listening comprehension therefore involves making meaning of an oral text, the speech and all other sounds available in the context of audiovisual material. Reading comprehension on the other hand, involves constructing meaning of written texts, which include subtitles.

Reading comprehension may be influenced by additional factors including reading speed and identification of words (Cutting & Scarborough, 2006:280; Perfetti, 2007:357). These two factors influence each other as demonstrated by Cutting and Scarborough's (2006:280) assertion that reading speed may be slowed down by poor word recognition (identification), ultimately leading to reduced reading comprehension. Word identification includes the "spelling, pronunciation and meaning" of a word (Perfetti, 2007:364). Perfetti explains that word identification may be impeded by confusion emanating from words sharing spelling or pronunciations (homographs and homonyms). In addition to these, Pollatsek *et al.* (2003:63) identify frequency and length of the word as hindrances to word recognition.

These aspects are very important for research on subtitled audiovisual content. A participant may not recognise a word, which has a homonym, in the audio track and this may be resolved by the spelling in the subtitle. However, with words pronounced the same and spelled the same, but with a number of different meanings, the subtitle may not resolve this issue. This may prove to be problematic for the viewer since the reading of subtitles is different from the reading of normal static texts, in that the viewers do not have access to opportunities that readers of static texts have to confirm the meaning of the ambiguous word. The tests used in this study include recognition, cued and free recall. Their design will be discussed in detail in Chapter 3.

2.6 Reading subtitles

Research shows that the reading of subtitles is automatic and effortless (d'Ydewalle *et al.*, 1991; d'Ydewalle, 2002:60; d'Ydewalle & De Bruycker, 2007:2004). Before discussing the reading of subtitles, it is important to define reading, to distinguish between reading of static texts and dynamic texts, and to discuss reading proficiency as a factor that may have an impact on subtitle reading.

2.6.1 Reading defined

According to Day (2020:2) "reading comprises a number of interactive processes between reader and the text during which the reader uses his or her knowledge to build, to create and to construct meaning". Day explains that the interaction between the reader and the text involves the reader making meaning from information in the text and from prior knowledge. Processes involved in reading include, amongst others, word recognition, creating an understanding of what the text is about, making inferences about the text and making decisions regarding how attention is directed (Day, 2020:2). The aspect of knowledge is not limited to the knowledge of the language but also includes matters such as content knowledge, knowledge of the genre and general knowledge. Day (2020:2) asserts that "readers use all these knowledges to build, to create, to construct meaning, and all readers all have different knowledge". Since people have different "knowledges" it means that they have different reading abilities and attach different meanings to different texts. Similarly, the reader-response theory holds that reading is an active process in which readers create and develop meaning (Khatib, 2011: 151).

The discussion above applies to the reading of both static texts and dynamic or moving texts. However, these two texts differ greatly. Static texts are printed texts, which include texts such as books, journals, magazines and newspapers. Dynamic texts include onscreen texts such as subtitles. As a result of these differences in the nature of the texts, static texts and subtitles are read differently.

2.6.2 Subtitle reading vs static text reading

One distinction between subtitle reading and static text reading is that readers of subtitles do not have less control over the reading process. For example, readers of static texts can determine the rate at which they will read the text; this is, however, not possible for viewers reading subtitles as subtitles stay on the screen for a set time which is determined by the subtitle creator. Apart from instances where the viewer has facilities to rewind the film, a viewer of audiovisual content often does not have the opportunity to reread subtitles to confirm

information once they go off screen. This has an implication for comprehension as viewers cannot 1) scan the text for information, and 2) read and reread at their own pace when they encounter a term they do not recognise.

Another distinguishing element of subtitles is that they are read in the presence of other sources of audiovisual information, which have to be processed simultaneously with the subtitles (Gambier, 2006:260). This means that the reader cannot focus on the subtitles only to create meaning but they have to integrate the other onscreen content such as speech, music, background sounds, on screen images, actors etc. One may argue that due to these conditions, reading subtitles places a demand on the viewer, and that the viewer may choose to avoid the subtitles completely. This is supported by McConkie and Yang's (2003:421) assertion that "People clearly can exercise a great degree of cognitive control over their eye behaviour when they wish to." However, the authors continue to explain that research has found that "the sudden onset of a stimulus object can draw observers' eyes even when they are trying to avoid directing their gaze to the object" (McConkie & Yang, 2003:421). This concurs with the assertions that reading of subtitles is an "effortless and automatic" exercise (d'Ydewalle *et al.*, 1991 d'Ydewalle, 2002:60; d'Ydewalle & De Bruycker, 2007:2004).

An important aspect of reading, which this study seeks to investigate, is comprehension. Pretorius and Machet (2004:45) state the following regarding the ability to read: "[t]he ability to read refers to more than just being able to recognise letters and decode words; it includes the ability to construct meaning from the written word and familiarity with the various forms and functions of written texts".

Research investigating the effect of subtitles on comprehension, cannot assume that by virtue of subtitles being available on screen and them being automatically processed, as mentioned in McConkie and Yang (2003), they will contribute to comprehension. It is important to determine whether subtitles are read and the extent to which they are read, as Kruger and Steyn (2014:116-117) assert we can only understand the role of subtitles in learning when "we consider the correlation between comprehension and the degree to which participants actually read the subtitles". Whether subtitles are read or not will be influenced by among other factors the viewers' reading proficiency.

2.6.3 Reading proficiency and subtitle reading

Matjila and Pretorius (2004:5-6) discuss the development of reading in English across all levels of education in South Africa. The current discussion will focus on the post-school phase as this phase includes higher education (HE), which is the focus of this study. In the post-

school phase reading is done for personal, professional and study purposes, with proficient English readers expected to read an estimated 350 words per minute (Matjila & Pretorius, 2004:6). Reading is the more effective source through which complex topics are accessed when compared to listening.

For the purposes of the current study, it would be useful to know the expected reading abilities for Sesotho as well. However, reading in African languages cannot be reported to the same degree as reading in English due to lack of research regarding reading in African languages, a concern raised by a number of researchers (Matjila & Pretorius, 2004:17; Pretorius & Mampuru, 2007:39; Makalela & Fakude, 2014:71). From the few studies available, some have found South African primary school learners to have reading proficiencies in their mother tongue and the LoLT that are 3-4 years lower than expected (Pretorius & Mampuru, 2007; Makalela, 2012; Phokungwana, 2012; Makalela & Fakude, 2014).

With regard to both English and African languages, Matjila and Pretorius (2004:17) found that most learners enter high school at Grade 8 lacking reading skills. According to the authors, catch-up in developing reading skills will be difficult if the skills are not established by the time a learner leaves primary school (Pretorius & Mampuru, 2007:54). This may mean that some of these learners will go through high school and enter higher education without having fully developed their reading skills.

This backlog in reading proficiencies of static texts, in both the African languages and English, may pose a challenge for subtitle reading. The fleeting nature of subtitles and their temporal constraints require the viewer to keep up with the subtitles, to be able to process and interpret them while reading, and at the same time interpret the additional audio and visual clues presented with subtitles. This means viewers should have good reading proficiency in order to adequately read and consequently benefit from subtitles. Hefer (2013:365) found that Sesotho L1 speakers spent more time reading Sesotho subtitles than the L2 English subtitles. The participants are said to have experienced the Sesotho subtitles as foreign and lacked the required skills for processing the subtitles together with other stimuli from the visual channel (Hefer, 2013:365). This could explain the finding by Kruger *et al.* (2014) that participants avoided reading the Sesotho L1 subtitles.

The challenges pertaining to reading proficiency and the reading of Sesotho subtitles, discussed in the previous paragraphs, do not mean that the use of subtitles should be abandoned. On the contrary, it means that more research is required in the use of subtitles as an educational tool so as to benefit South African students. Alternative styles of subtitling may be explored to find the one that will be most beneficial in the South African context.

Given the aforementioned challenges, it is important for subtitling studies in South Africa to determine to what extent the subtitles presented are read. This can be done by utilising eye tracking, a popular tool in the study of reading and subtitle reading to investigate these matters, used in international studies (Rayner & Pollatsek, 2006; d'Ydewalle & De Bruycker, 2007; Romero-Fresco, 2009; Perego, *et al.*, 2010; Kruger & Steyn, 2014) and also in South African studies (e.g. Hefer, 2013; Kruger, 2013; Kruger *et al.*, 2014; Matthew, 2019).

2.7 Eye tracking as a tool to study subtitle reading

Eye tracking is a popular tool to study reading and subtitle reading. This technology records the eye movements of participants during reading, thereby enabling researchers to discover more about reading processes. Through eye tracking, researchers are able to see whether the subtitles were read and the extent to which they were read.

2.7.1 Definition of eye tracking

According to Doherty and Kruger (2018:47), "eye tracking is the study of eye movements using a device that tracks one's gaze and response to the given stimuli". In addition, SensoMotoric Instruments (SMI) (2009:14) explains that the stimuli may be "visual, auditory, cognitive, or vestibular stimulus". This technology is used in research in various fields of study, such as marketing, neurology and psychology (SMI, 2009:14). According to Doherty and Kruger (2018:47-48), eye tracking was introduced to research on subtitles in the 1980s in studies conducted by d'Ydewalle and colleagues. These studies focused on subtitle processing and reception.

2.7.2 Eye tracking as a tool to study subtitle reading

Eye tracking is a valuable tool in subtitling research as it gives researchers "unprecedented access into the eyes, and arguably the minds, of the viewers" (Doherty & Kruger, 2018:47). Thus, through eye-tracking, data researchers are able to make some deductions about the impact of subtitles on the viewers and their processing of the subtitles. The fact that viewers look at subtitles does not mean that they have read them or read them well. Therefore, it is important to investigate the extent of subtitle reading, as Kruger and Steyn (2014) suggest, as this is an important consideration for understanding how subtitles affect comprehension. Two reading indices are available in this regard: the Reading Index for Dynamic Texts (RIDT), developed by Kruger and Steyn (2014) and the Unique Fixations per Mean Word (UFMW), by Matthew (2019). Before delving into the details regarding the reading indices, it is necessary to provide a brief explanation of terminology used in the calculation of the abovementioned formulae, namely fixation, saccade and regression.

Fixations

Fixations are described as the state where eye movement stops for a certain period of time, it may be on a particular word or area in a text, in order to process it (Perego, 2008:35; Holmqvist *et al.,* 2011:21). Holmqvist *et al.* (2011:22-23) further explain that fixations are made up of three micro-movements: tremor, micro-saccades and drifts. Tremors are minute movements whose role is unknown; the authors assume tremors may just be muscle control movements. Drifts are the movements that take the eye's focus away from the area it is fixating on, and the micro-saccades counter this movement by returning the eye's attention to the area of fixation (Holmqvist *et al.*, 2011:23*)*.

According to Holmqvist *et al.* (2011:23), the duration of fixations can be anything from 35 ms and longer. Rayner and Pollatsek (2006:215) assert that fixation duration is linked to text processing, meaning that readers fixate for longer when they encounter a difficult text. Longer fixations may occur as a result of the reader encountering less frequent words, words containing spelling errors, more ambiguous words, words that are inappropriate for the context and words located in places that require more processing (McConkie & Yang, 2003:413; Morris & William, 2003:236). Hefer (2011:19) asserts that the issue of text difficulty is particularly significant in subtitling where the need to minimise distractions from other sign systems is essential, so as to allow the viewer time to process other visual signs.

Saccades

In between fixations, the eye rapidly moves from point to point on the image, from word to word in this case, and these movements are known as saccades (Holmqvist *et al.*, 2011:23). Rayner and Pollatsek (2006:614) assert that vision is suppressed during the saccades, therefore the content of the text is only processed during the fixation. The function of the saccades is to bring the segments of the texts into foveal vision for processing (Rayner & Pollatsek, 2006:614). Saccade sizes vary from one letter space to over 20 letters space. When readers encounter texts that are difficult, they make shorter saccades.

Regression

Sometimes it may be necessary for the eye to move backwards in a text in order to process something that was perhaps unclear or not understood. This backward saccade is known as regression (Holmqvist *et al.*, 2011:263). The authors further explain that regressions in a text may be within a word, identified as "in-word regression" (Holmqvist *et al.*, 2011:263-264). Alternatively, the regressions may be between words and they are identified as "between-word regression". The "in-word" regressions consist of small backward saccades within one word, whilst the "between-word" are comprised of backward saccades within a sentence to a word

that was fixated previously (Holmqvist *et al.*, 2011:263-264). Regressions can be short, not moving back too far from the currently fixated word, while others are longer. According to Rayner and Pollatsek (2006:615), the short regressions indicate difficulties in word recognition, while the longer regressions indicate difficulties in comprehension.

The following discussion demonstrates how these concepts form part of the reading measurement formulae, the RIDT and the UFMW.

Reading Index for Dynamic Texts (RIDT)

The RIDT is a subtitle reading formula developed by Kruger and Steyn (2014) aimed at measuring the extent to which a subtitle is read. The formula takes into account various eye movement measures and generates a reading score. This score is an indication of the extent to which a particular participant read a particular subtitle (Kruger & Steyn, 2014:110). The *p* in the formula stands for participant, the *s* for subtitle and the *v* for video.

$$\text{RIDT}_{vps} = \frac{\text{number of unique fixations for } p \text{ in } s}{\text{number of standard words in } s}$$
$$\times \frac{\text{average forward saccade length for } p \text{ in } s}{\text{standard word length for } v}$$

Figure 2-3:   *RIDT formula (Kruger & Steyn, 2014:110)*

The formula does not include "refixations and regressions where no new information is likely to be processed" (Kruger & Steyn, 2014:110). The authors acknowledge that these two measures may indicate that viewers experienced difficulty in processing the word, but assert that this is more relevant for static texts than dynamic texts. They argue that the brevity of the subtitle duration on screen generally allows for the subtitle to be read once. Therefore, the regressions in subtitle reading do not play the same role as for reading static texts.

Unique Fixations per Mean Word (UFMW)

Matthew (2019) found the exclusion of regressions in the RIDT formula to be problematic. He found that the RIDT penalised participants' regression movements strictly: the backward saccades cancelled the forward saccades, and thus resulted in an RIDT score of zero in some cases (Matthew, 2019:88). A score of zero means that the subtitles were not read, and this is not a true reflection of the reading process. Consequently, Matthew (2019) adapted the RIDT to accommodate regressions and the result was the Unique Fixations per Mean Word (UFMW) formula.

In this formula, regressions are allowed and form part of the measurement of the extent of reading as they are not penalised but are included in the number of unique fixations. The UFMW is calculated by way of the following equation:

$$UFMW = Fixations\ without\ refixations/mean\ words$$

Figure 2-4: **UFMW formula (Matthew, 2019:88)**

Both the RIDT and UFMW do not provide a reference point, but for the RIDT it is generally understood that a score closer to 1 may be regarded as an indication of full processing: a high RIDT score demonstrates more extensive subtitle reading, whilst a low score demonstrates that subtitles were read to a lesser extent (Kruger *et al.*, 2014:6). Since the UFMW formula is an adaptation of the RIDT formula it can be deduced that a higher UFMW score may be regarded as an indication of more thorough processing.

2.7.3   Factors that impact eye movements (eye movements explained)

As indicated in the previous section, text difficulty has an influence on the eye movements of the reader. According to Rayner and Pollatsek (2006:621), "the ease or difficulty associated with understanding a word during reading clearly affects how long readers fixate on that word". The authors identify several factors that can influence how difficult it is to process words, which are discussed below.

According to Rayner and Pollatsek (2006:621), the most common measurement of word difficulty is word frequency. The implication of word frequency and word difficulty for reading and the reading process would be that when a reader encounters less frequent words they take longer to process those words, which is demonstrated by more, longer fixations. Rayner and Pollatsek (2006:622) further explain that the fixation durations decrease when words, both high and low frequency, are repeated.

Other factors that can affect the ease of processing a word are age-of-acquisition and word familiarity, both of which are linked to word frequency (Rayner & Pollatsek, 2006:622). The authors explain the age at which words are acquired has an influence on the time it takes to process the words. They assert that words acquired earlier in life become familiar over time and may be frequently used, which consequently has an impact on how long it takes to process them. However, they point out that age-of-acquisition may be problematic in part because it is influenced by other variables such as concreteness of the word and the frequency of its use in speech (Rayner & Pollatsek, 2006:622). This has a bearing on subtitle creation; the subtitler

would have to take care not to use difficult and unfamiliar words when reducing the text in order to give viewers sufficient time to (1) process the subtitle text, and (2) watch and listen while reading the subtitles. The careful selection of words will prevent viewers spending too much time fixating on one word and not allocating enough time to read the rest of the subtitle and to view the images on the screen.

Another measure for text difficulty is the predictability of words based on the context in which they are used. Rayner and Pollatsek (2006:623) assert that the context around the words facilitate or hinder word recognition. Furthermore, research has found that the time spent on words that are predictable based on context is less than that spent on words that are not predictable. From this it can be deduced that the use of more predictable words would result in shorter fixations and less regressions on that word.

Linked to predictability is the factor of transitional probability, which is the order in which specific words are typically followed by certain words (Rayner & Pollatsek, 2006:623). The effect of transitional probability is demonstrated in a study by McDonald and Shillcock (2003), where they analysed the eye movements of L1 English speakers to determine how the degree of collocations measured by transition probabilities affected the processing of words. They found that the fixations were shorter for words whose collocations had high transitional probability. This means the words in the text normally collocate with each other in the conventional usage in the language.

Context is also important for resolving issues around ambiguity, where a word may have multiple meanings. According to Rayner and Pollatsek (2006:623), the correct meaning of an ambiguous word may be found in the context. The authors further assert that the search for meaning, however, implies longer fixations and more regressions (Rayner & Pollatsek, 2006:623). In other words, uncertainty regarding the meaning of a word will lead to the reader taking longer to process the word and also to go back into the text more often to find meaning.

More and longer fixations on subtitles imply that viewers will have less time to process other signs available in the visual and audio channels of the audiovisual product (Hefer, 2011:26). A balance between time spent on reading subtitles and time for processing information from the other channels needs to be created in order for the viewers to pay attention to other images on the screen and the audio track. Based on the discussion in this section the balance may be achieved by reducing the number of difficult, ambiguous and unfamiliar words within the constraints posed on the creation of subtitles. Another possible solution that this study seeks to explore, is to reduce the amount of words in the subtitles through keyword subtitling. In this

way, it is anticipated that the viewer will spend less time on the subtitles and have time to attend to other stimuli in the video.

2.8   Conclusion

This chapter focused on the issues that are relevant for a study on subtitles in education. The chapter started off with defining subtitles and classifying them according to types and styles. The subtitle type includes the classification of subtitles according to language, such as intralingual and interlingual. On the other hand, subtitle style refers to how the subtitles are edited and presented; these include full subtitles, keyword subtitles, full subtitles with keywords highlighted and glossed keyword subtitles. This study focuses on how full and keyword subtitles, in English and Sesotho, influence comprehension of educational content.

Research in the field of subtitling includes research on subtitles used in entertainment and in education. Research on subtitles in the entertainment industry dominates the discipline. This research, however, does include an educational element where researchers have looked into how subtitles in television programmes, films and song impact on learning. Findings from existing subtitle research indicate that subtitles have a positive effect on factors such as literacy, language learning and comprehension of the content.

Furthermore, the chapter focused on theories of learning. These theories have a common thread that cuts through most of them, namely that humans process audiovisual stimuli through the verbal and non-verbal channels. The availability of the two channels may be beneficial for subtitles in that the same information may be processed through different channels; on the other hand, the presence of subtitles and other images on the screen may result in an overload in the non-verbal channel, thus hampering learning or comprehension. The chapter discussed how each theory affects the inclusion of subtitles in educational material. The keyword subtitle style is considered to be a potential solution for the element of overload and was investigated in this study.

Finally, the chapter discussed eye–tracking technology as a popular tool used in subtitling and subtitle reading research. Through this technology, researchers are able to document and study participants' eye movements and to determine if they have read the subtitles and to what extent. Researchers are then able to make more inferences about the benefits of subtitling for comprehension by comparing the comprehension data with the eye-tracking data. The eye-tracking measures that were elementary for this study were the RIDT and UFMW, which are formulae that calculate the degree to which subtitles are read. The chapter explained the eye-tracking measures included in the calculation of these formulae. These formulae are relevant

to the current study as it seeks to understand how the extent of subtitle reading impacts on comprehension.

In the next chapter the set-up of the experiments and the data collection process are discussed in detail.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The previous chapter illustrated the situation in South African HEIs where many EAL students are taught in English, the LoLT. The chapter established that interlingual subtitles may be beneficial in the development of support material for students. Various styles of interlingual subtitles were explored, such as full subtitles, keyword subtitles, full subtitles with keywords highlighted and glossed keyword subtitles and their benefits. To date, the full subtitle style has been the focus of South African studies. In these studies, the videos consisted of English audio and full interlingual subtitles presented in African languages, Sesotho or Afrikaans. The current study focuses on exploring the possible benefits of a different style of subtitling: keyword subtitles. Keyword subtitles provide participants with less words to read, thus it was anticipated that the subtitles will reduce the cognitive demand placed on the participants. In other words, it was expected that the participants, because they had more time for reading and less text to read, would read the keyword subtitles to a greater extent than the full subtitles; and furthermore, that the more the subtitles are read the more beneficial they will be for improved comprehension.

The aim of this study is to examine the impact of subtitle styles on the comprehension of Sesotho L1 participants when viewing recorded educational materials. The research questions of this study sought to determine effects of subtitle styles, as well as the effects of the extent to which the subtitles are read, on comprehension. The subtitle conditions used in this study include full subtitles English (FSE), full subtitles Sesotho (FSS), keyword subtitles English (KSE), keyword subtitles Sesotho (KSS) and no subtitles (NS). Various tools, such as comprehension tests, a self-report task-load questionnaire, a perception questionnaire and eye tracking were used to answer the research questions. These tools will be discussed in this chapter.

This chapter also describes the methods employed in order to determine whether the outcomes supported the hypotheses of this study, which are as follows:

- With regard to both full and keyword subtitles, the Sesotho subtitles will result in improved comprehension as compared to any type of subtitle in English, due to the benefit of content being presented in participants' home language.

- For both English and Sesotho, the keyword subtitles will result in improved comprehension due to participants having less content to read and thus the subtitles might not increase cognitive load as much as full subtitles; and

- A higher RIDT score, indicating a greater degree to which subtitles were read, will result in improved comprehension.

The chapter starts off by describing the experiment setup, including the setting and participants. The chapter then continues to describe the materials used and how they were prepared for the study. The selection of the videos and the creation of the subtitles in the different styles are also discussed. In addition, the procedure of developing the comprehension tests and the questionnaires is described. Furthermore, an outline of eye-tracking technology, which was used to determine the degree to which subtitles were read, is provided. Following this, an explanation of how the relevant data was collected and analysed is provided.

3.2 Setting

The study was conducted at the Vanderbijlpark Campus of the North-West University (NWU). The NWU is made up of three campuses situated in Potchefstroom, Mahikeng and Vanderbijlpark. The NWU has a multilingual student and staff population, with English, Setswana, Sesotho and Afrikaans as the official languages. These languages are widely spoken in Potchefstroom and Mahikeng, which are towns in the North-West province where the most widely spoken languages are Setswana (63.4%), Afrikaans (9.0%), Sesotho (5.8%), isiXhosa (5.5%) and English (3.5%) (Census 2011: Table 2.6).

Vanderbijlpark, on the other hand, is a town in Gauteng province, which has different language dynamics. The predominant languages for Gauteng are identified as the following: Zulu (19.8%), Afrikaans (12.4%), Sesotho (11.6%) and English (13.3%) (Census 2011: Table 2.6). The statistics indicate that Sesotho is spoken in the two provinces where the campuses are situated, however, it is more dominant in Gauteng. Furthermore, the Vanderbijlpark campus, whose official languages include Sesotho, is situated in the Vaal Triangle region of Gauteng, where Sesotho is one of the dominant languages. It can therefore be expected that Sesotho would be amongst the dominant home languages for the students at the Vanderbijlpark campus as reflected in the campus profile: Sesotho (28%), English (18%), IsiZulu (12%) and Afrikaans (10%) (Coetzee-Van Rooy, 2019). This dominance meant that the Vanderbijlpark campus would have a greater Sesotho student population to recruit participants from than the other two campuses.

3.3 Participants

3.3.1 Participant sampling

In this study, two non-probability sampling methods, which include purposive and quota sampling were used. Students eligible for participation were Sesotho First Language (L1) speakers who completed Sesotho as First Language or First Additional Language in Grade 12. Sesotho as a school subject was a requirement because some of the material in the study was presented in Sesotho, and therefore the participants needed to have developed language abilities in Sesotho in order to engage with the materials in this study. Inability to do so would skew the findings for the study.

Another inclusion criterion was the field of study. The materials used in this study were from the field of Psychology. In order to avoid prior knowledge influencing the performance in the comprehension tests and therefore skewing the findings of the study, participants could be from any field of study except Psychology. Students who are or were registered for a Psychology module in their current or previous studies were therefore excluded from participating.

The last inclusion criterion was the year of study. Participants had to be first-year students only, since the materials used in the study are intended for first-year students.

3.3.1.1 Recruitment of participants

A total of 38 participants were recruited through advertisements distributed on campus (See Appendix A) and brief presentations in classes. The researcher received permission to recruit from Academic Literacy (ALDE) and Communication (ICOM) classes at NWU, Vanderbijlpark Campus. These classes were identified as they had high numbers of students. The researcher targeted the ALDE education and IT groups as they provided the researcher a high likelihood of reaching students who are not enrolled for Psychology modules.

According to the regulations set forth by the Ethics Committee for Language Matters (Humanities), the researcher was not allowed to recruit participants herself. Instead, third-party recruiters assisted and the process for recruitment was planned as follows: the researcher would go to the identified classes and give a brief overview/explanation of the study, after which the third party recruiter would invite the students to participate. The physical recruitment in classes did not go as planned as the third party recruiters were not available to go to every class due to their own work and study commitments. To compensate for this a YouTube video was created with the researcher giving a brief description of the project. The

video ends with a third party recruiter inviting participants to sign up (See Appendix B). This video was posted on the ALDE and ICOM eFundi sites. The researcher also made arrangements to visit some classes to play the video for the students.

In the video and the recruitment letter, the potential participants were informed that the study was about the use of audiovisual material in education with the aim of determining how these materials contribute to learning. In the video, the finer details regarding the nature of the study were kept minimal in order to "avoid conscious reactivity of participants that would make these data worthless" as warned by Bröder (1998:806). For example, the term "subtitles" was omitted in the description and title of the project because it could bias participants' viewing behaviour by drawing their attention to the subtitle area instead of allowing for natural/preferential viewing and reading; instead, the term "audiovisual material" was used, which includes videos and other materials without being overly specific. The researcher defended this approach in the ethics application, and the Ethics Committee for Language Matters (Humanities) was satisfied that it was necessary to conceal some detail in the general description.

3.3.2 Academic literacy as a grouping variable

The 38 participants were randomly allocated to five groups. The groups had unequal number of participants as demonstrated in Table 3-1. The inequality is a result of problems that were encountered while the experiments were being conducted such as participants dropping out of the experiments.

All the groups were exposed to the same experimental videos, each in a different subtitle condition. The videos are recordings of lectures presented in a module at university. The fact that the videos consist of academic content meant there was a possibility that the results of the study could be influenced by the academic literacy levels of the participants instead of the video conditions. The researcher therefore had to make provision for the issue of the participants' academic literacy levels. The researcher aimed to have a representative sample in terms of academic literacy levels in the groups, i.e., the groups were to include students with abilities in the lower levels, intermediate levels and higher levels. Academic literacy (specifically the results from the TALL (Test of Academic Literacy Levels) was thus used as a grouping variable in order to achieve a representative sample so as to be able to generalise the results to the sample and to attribute the results to the video conditions. The number of participants on each of these levels is demonstrated in the Table 3-1.

Table 3-1: ***The number of participants per level included in each group***

Participant Group	Academic literacy level	Number of participants
A (7 participants)	Lower	3
	Intermediate	2
	Higher	2
B (9 participants)	Lower	5
	Intermediate	3
	Higher	1
C (7 participants)	Lower	3
	Intermediate	2
	Higher	2
D (7 participants)	Lower	4
	Intermediate	3
	Higher	0
E (8 participants)	Lower	4
	Intermediate	2
	Higher	0
	TALL scores are not available for participants who did not take the test.	2

3.3.2.1   Academic literacy defined

Academic literacy should not be mistaken for language proficiency; it involves much more as demonstrated by Weideman's definition. According to Weideman (2007:x-xi), academic literacy includes the ability to understand academic vocabulary, understand and make meaning of content, interpret meaning of content, make inferences from and apply information contained in academic texts. Participants in the study were expected to engage with the content presented in the videos and demonstrate understanding, which was tested through comprehension tests. The academic literacy test results were important for this study as they were the only available indicators of the participants' academic ability. The results enabled the

researcher to ensure that the experiment groups were balanced in terms of the academic literacy levels of the participants.

3.3.2.2 How is academic literacy tested?

Students come to higher education institutions with different levels of academic literacy. Higher education institutions have had to develop tests to assess the academic literacy of students (Van Dyk & Weideman, 2004:14). These tests are considered to be indicators of the students' ability to access and interact with academic material. One such test that is locally developed for use by multilingual institutions, is the Test for Academic Literacy Levels (TALL) (Le, Du Plessis & Weideman, 2011:116). According to the authors, the TALL is used for student placement and planning intervention programmes in order to prepare students for undergraduate studies (Le *et al.,* 2011:116-117).

The TALL is available in English with the TAG being the Afrikaans equivalent. However, there are initiatives focusing on the translation of the test into African languages including Sesotho. Butler (2017) at the NWU Vanderbijlpark campus undertook an initiative to translate the TALL into Sesotho. The initiative emanated from evidence that students from various institutions were prepared to use learning support material presented in African languages (Butler, 2017:15). The use of African languages in higher education therefore required reliable tests to assess students' academic literacy in African languages, hence the translation of the TALL.

3.3.2.3 Access to participants' TALL results

All first-year students at the NWU write the TALL at the beginning of the academic year. Students at the Vanderbijlpark campus are requested to complete both the English and Sesotho versions of the test, with the completion of the Sesotho test being optional. Since the current study investigated the impact of Sesotho subtitles on participants' comprehension of content, both Sesotho and English academic literacy levels were important. Permission to access the TALL results was requested from the students and formed part of the ethics application for this study. The English TALL were requested from the subject chair for Academic Literacy on the Vanderbijlpark campus, who is the custodian of the TALL tests. The Sesotho TALL results, which are part of a study by Prof Gustav Butler, were requested from him. The TALL results in this study were used for grouping purposes only, which is outside the original purpose of the TALL results.

The original aim was to use the Sesotho TALL scores as the grouping variable, however, since the Sesotho version is not compulsory, 50% of the participants did not write the Sesotho TALL.

The researcher therefore used the English TALL scores to allocate participants to groups, ensuring that all groups included the different levels of academic literacy.

3.4 Materials used

3.4.1 Research instruments

The following types of materials were used for this study: subtitled video clips, comprehension tests and a self-report questionnaire.

3.4.2 Subtitled video clips

The primary materials used in this study were recorded English lectures from a first-year Psychology module (PSYC121) on the Vanderbijlpark Campus of the NWU, which were readily available from the resources of the School of Languages. These videos had been used in previous studies on subtitles in education (Kruger *et al.*, 2014; Kruger & Steyn, 2014). Using the same videos in the same context as previous studies means partial replication and thus the researcher will be able to compare the findings of the current study to those of previous studies.

The videos were selected because they are general introductory lessons on subject-specific content aimed at first-year students. Since the videos are introductory lessons, they were appropriate for this study as the study investigated comprehension of new content, for which participants were not required to have prior knowledge in order to understand. The topics of the video clips include compliance, attraction, aggression, social psychology and community psychology. All videos are presented by the same lecturer presenting the class, and include PowerPoint slides shown to students in the actual class. The videos had been subtitled into English and Sesotho for the previous studies (Kruger *et al.*, 2014; Kruger & Steyn, 2014), by the researchers with the help of Sesotho mother-tongue speaking colleagues in the School of Languages of the NWU. For the current study, both the English and Sesotho subtitles were checked for quality by the researcher. For the English subtitles, this involved correcting spelling and punctuation. The Sesotho subtitles involved more in-depth revision, as it involved using different translation procedures for translating subject-specific terminology. This will be discussed in more detail in the section dealing with subtitle creation.

The selected videos were each approximately 30 minutes long and they were cut into five video clips of between 8 and 12 minutes. Seeing that the participants were required to watch five videos in different experiment conditions, the researcher had to take into consideration the issue of attrition (participants dropping out of and not completing the study) which is

common in experimental studies (Orero *et al.*, 2018:111). Orero *et al.* (2018:111) cite issues such as "duration and complexity of the task", loss of motivation or engagement, and fatigue as factors that may lead to participants exiting the study. The videos were thus shortened in order to mitigate the identified factors related to attrition rates.

Two factors were considered in the determination of where to cut the videos. The first factor was identification of sections which addressed a topic in full, allowing the researcher to adequately cut the video without omitting relevant information. The second consideration was creating video clips that were independent of each other so as to ensure that the content of each clip would be comprehensible without the participants having to refer to the other video clips. Having a series of independent video clips would allow for the presentation of the videos in any sequence, meaning that they will not need to be viewed in a specific order. The resulting video clips were further cut to exclude any material that was not relevant for the content such as greetings and administrative arrangements.

The videos all have an English audio track with subtitles created in either English or Sesotho. Each of the video clips was prepared in five conditions: no subtitles (NS), full subtitles English (FSE), full subtitles Sesotho (FSS), keyword subtitles English (KSE) and keyword subtitles Sesotho (KSS). The participants were allocated to five groups (A to E) where the experiment conditions of each video were set as illustrated in Table 3-2. Each group viewed each individual video clip in a specific condition that was randomly allocated, meaning that each group viewed the video clips in five different experiment conditions. Furthermore, the order of presentation was randomised for each participant in order to reduce the order effect, which involves participants responding in a particular manner in an experiment due to the order in which the experiment materials were presented. This means that each participant was exposed to all five experiment conditions, and no participants viewed the clips in the same order. The viewing of each video clip in different conditions would support the researcher by attributing the possible differences in performance to the experiment conditions. The videos in the different subtitle conditions can be found in Appendix C.

Table 3-2: ***Video conditions per group***

Participant Group	Video	Subtitle condition
A	1	NS
	2	FSS
	3	KSS
	4	FSE
	5	KSE
B	1	FSS
	2	KSS
	3	FSE
	4	KSE
	5	NS
C	1	KSS
	2	FSE
	3	KSE
	4	NS
	5	FSS
D	1	FSE
	2	KSE
	3	NS
	4	FSS
	5	KSS
E	1	KSE
	2	NS
	3	FSS
	4	KSS
	5	FSE

A pre-video was created and shown to the participants prior to the experimental videos. This is common practice in subtitling and eye-tracking studies. The purpose of the pre-video was to acquaint the participants with the medium and the reading of subtitles, specifically Sesotho subtitled videos. Sesotho subtitles were most likely to be new to the participants as South African television programmes contain mainly English subtitles. Since familiarity with subtitles has an impact on subtitle processing (Gerber-Morón *et al.,* 2018:2), it can be anticipated that having to suddenly read unfamiliar Sesotho subtitles on screen could affect the manner in which the participants process the subtitles. The pre-video containing full Sesotho subtitles was thus presented to mitigate for the possible effects of Sesotho subtitles on how they are processed during the experiment. This short pre-video was also created from the available

PSYC121 videos, but did not contain the same content as any of the five video clips used in the study. The participants did not complete comprehension tests or a questionnaire for the pre-video, as it served a different purpose from the other videos in the experiment.

3.4.2.1 Video complexity as an indicator of video comparability

After the experiment videos were created, the full transcripts were tested for complexity in order to determine whether they were comparable. The videos had to be comparable in terms of complexity and the level of language used, in order to ensure that participants' performance was not influenced by differences in levels of difficulty. In order to do that the full subtitle scripts, which are close to being the full transcript of the audio track, were used to compare the complexity of the subtitles.

The full subtitle scripts of the videos were analysed for readability and complexity using the following readability tests, which are freely available online: Coh-Metrix, Lexile and Flesch-Kincaid. Various text features account for text readability and difficulty such as text length, grammatical characteristics, cohesion, text abstractness, word concreteness, syntactic simplicity and narrativity (Green *et al.,* 2010; Graesser, McNamara & Kulikowich, 2011). In order to ensure comparability of the subtitle texts and to ensure that the videos are comparable in their level of complexity, the texts were analysed for these features through the Flesch-Kincaid, Coh-Metrix and Lexile indices. These measures help determine each text's level of difficulty and matches it against the reader's ability. The scores and comments from the test results were used to compare the levels of complexity of the videos and thus also the suitability and comparability of the videos for the experiment. Since the participants were first-year students, and since the videos are recorded lectures from a first-year module, it was anticipated that the complexity level of the videos would not exceed a Grade 12 reading level. The scores are demonstrated in Tables 3-3-3-4, and 3-5.

The results of the Flesch-Kincaid analysis are demonstrated in Table 3-3. According to this analysis, the texts across all five videos were easy to read with the highest grade level being Grade 6.

Table 3-3: *Flesch-Kincaid reading ease scores*

Video	Topic	Duration	Number of Words	Flesch-Kincaid Reading Ease	Flesch-Kincaid Grade Level
1	Compliance	00:08:56	1109	89.9	3
2	Attraction	00:12:30	1410	82.1	4
3	Aggression	00:09:23	994	72.6	6
4	Social Psychology	00:10:57	1080	78.4	4
5	Community Psychology	00:09:08	898	62.3	6

Further analysis was done using the Coh-Metrix measures, which analyse the ease or difficulty of texts on five different dimensions: narrativity, syntactic simplicity, word concreteness, referential cohesion, and deep cohesion. For a given text, each of these dimensions is given an "ease score compared to thousands of other texts" (Nelson, Perfetti, Liben, & Liben, 2012:15).

Table 3-4: *Coh-Metrix measures*

Video	Topic	Duration	Number of Words	Narrativity %	Syntactic simplicity %	Word concreteness %	Referential Cohesion %	Deep Cohesion %
1	Compliance	00:08:56	1109	89	82	34	27	89
2	Attraction	00:12:30	1410	86	73	2	34	59
3	Aggression	00:09:23	996	62	68	5	33	52
4	Social Psychology	00:10:57	1080	69	90	5	20	39
5	Community Psychology	00:09:08	898	58	75	5	20	44

The results of the Coh-Metrix analysis of the texts is demonstrated in Table 3-4 above. The narrativity dimension demonstrates the extent to which a text is story-like and contains familiar words and oral language (Graesser *et al.,* 2011:228). The authors (Graesser *et al.,* 2011:230) explain that syntactic simplicity describes the simplicity level of the sentence structures, with a low value indicating an easier to process text. Since texts are transcripts of speech text, the high percentages for narrativity and syntactic simplicity are understandable. In terms of the degree of narrativity, the scores range from fairly high to very high (58%-89%) meaning that all texts were relatively easy to read and understand. A similar variation was found in terms of syntactic simplicity which ranged from 68%–90%.

In terms of word concreteness, the authors (Graesser *et al*., 2011:230) explain that text with words that "are concrete, are meaningful, and evoke mental images - as opposed to being abstract" will have higher scores. Table 3-3 indicates low levels of concreteness, from 2% to 34 %, meaning that the texts were more abstract and this is understandable as the content of the videos deals with concepts in psychology.

Referential cohesion, in turn, refers to the degree to which terms and concepts are connected with each other throughout the text (Graesser *et al.,* 2011:230). The authors further explain that science texts have a higher referential cohesion than social studies and arts texts. This explains the lower referential cohesion for the texts in the current study, which range from 20% to 34%. This low referential cohesion measures mean that for all subtitles the connections between sentences were low, requiring the reader to infer the relationship between the sentences thus making them difficult to read.

With regard to deep (or causal) cohesion, on the other hand, "scores are higher to the extent that clauses and sentences in the text are linked with causal and intentional (goal-oriented) connectives" (Graesser *et al*., 2011:230). High scores for deep cohesion are therefore beneficial in making texts, particularly those with difficult topics, easier to understand. The deep cohesion scores for the texts ranged from 39% to 89%, as indicated in Table 3-3, meaning that some consisted of connectives, making them easier to understand, whilst others with lower scores did not have this support, making these videos possibly difficult to understand.

 Although there is a large difference in terms of deep cohesion, the other categories do not display such great variation. The texts, and by implication the videos, can therefore be considered to be comparable.

A third and final analysis was done using the Lexile Analyzer, which measures the syntactic and semantic complexity of the text by analysing its characteristics, such as sentence length and word frequency (https://lexile.com/). The result is a Lexile measure, which indicates the text complexity, together with details of the word count, mean sentence length and mean log frequency. Table 3-4 illustrates scores from the Lexile analysis of the videos.

Table 3-5: **Lexile measures**

Video		Duration	Number of Words	Lexile Measure	Lexile grade equivalent	Mean Sentence length	Mean Log Word Frequency
1	Compliance	00:08:56	1109	500-600L	3	7.63	3.81
2	Attraction	00:12:30	1410	400-500L	2	7.44	3.78
3	Aggression	00:09:23	996	600-700L	3	9.03	3.56
4	Social Psychology	00:10:57	1080	500-600L	3	8.15	3.53
5	Community Psychology	00:09:08	898	500-600L	3	7.55	3.58

According to the Lexile measures as presented in Table 3-5 the videos were comparable in the sense that not much variation was found between the videos in terms of the Lexile measure, grade equivalent, mean sentence length and mean log word frequency. The Lexile analysis indicated the mean sentence length to be ranging from 7.44 to 9.03.

The mean log frequency calculates the frequency of a word in a corpus of 600 million words (Lennon & Burdick, 2004:3). The authors (Lennon & Burdick, 2004:3) further explain that the measurement is "used to determine the semantic difficulty of a text" with a lower measure indicating the use of less frequent words. The mean log frequencies ranged from 3.53 to 3.81 demonstrating lower frequencies, which may result in difficulty in reading, this can be expected as the texts contain Psychology terminology.

According to the results of the above analysis, the subtitles may generally be described as texts containing shorter sentences with words of lower frequencies. The Lexile measures ranged from 400L–700L for which the grade equivalents are Grade 2 and Grade 3 respectively. According to these measures the texts' complexity was comparable in that, according to the analysis, the texts were appropriate for the lower grades and may be considered to be suitable for first-year students.

The discussion above reflects on the different types of analyses done with the intention of determining the comparability of the videos. From all the tests done it can be seen that the videos are relatively easy, with the highest grade being Grade 6 for the Flesch Kincaid and Grade 3 for the Lexile. These grades are lower than the grade of the participants, which is anticipated to be at Grade 12 since they have passed Grade 12. A factor that may contribute to the lower grades is the fact that subtitles are actually a transcription of speech and consideration should thus be given to the difference between oral texts and written texts. Furthermore, it should be taken into consideration that the texts are from videos of an introductory module intended for first-year students, thus the use of language will be simple in order to be appropriate for the intended audience. Even though the analyses indicate easy texts, it is important to note that some learners

leave high school with under-developed reading skills as discussed in the previous chapter. Under-developed reading skills were related to the findings by Hefer (2013:171) that the Sesotho L1 participants spent more time reading subtitles compared to their English L1 counterparts. These Sesotho L1 participants also exhibited slower reading of Sesotho subtitles compared to their reading of the English subtitles; the Afrikaans L1 participants, on the other hand, demonstrated no difference in the reading of Afrikaans and English subtitles (Hefer, 2013:171). This finding further confirms that indeed some participants enter HE with under-developed reading skills. Based on this finding it may be expected that some of the participants of the current study may exhibit a similar under-development in their reading skills, therefore making it important that the subtitles are easy to read so that all participants may have an equal opportunity at reading them. The reading of the subtitles is an important consideration if their impact is to be examined.

3.4.2.2 Subtitle creation

The English subtitles used in the Kruger *et al.* (2014) study were translated into Sesotho for the purpose of that study. The current study made use of these same subtitles, but with some modification and additional editing. Both the English and Sesotho subtitles were edited for spelling and grammar for the current study. With regard to the Sesotho subtitles; it was evident that the lack of terminology in African languages in South Africa poses difficulty for translators. For example, the two English terms 'like' and 'love' have the same equivalent in Sesotho – 'rata'. Translation becomes problematic when such concepts are not used in general terms but are used as two distinct concepts in a specific context such as Psychology. In such instances and in instances where terms are not yet lexicalised in Sesotho, the revision included translation using the transference procedure, which involves transferring the source language terms as they are into the target text.

The lack of subject-specific terminology in Sesotho also resulted in some terms being translated differently in different instances. For example, 'social identity theory' was initially translated as 'teori ya ho itemoha' **(back translation: identity theory)** in one instance and in another 'social identity' is translated as 'kamano le batho' **(back translation: association with people)**. In instances where terms are not lexicalised in Sesotho, the revision included translation using the transference procedure, which involves transferring the source language terms as they are into the target text. The revision of the original subtitles was done with the assistance of Sesotho lecturers and a Language Practice lecturer who is a Sesotho L1 speaker.

With regard to the technical aspect of creating the subtitles the researcher did a quality check of the original subtitles following recommendations by Díaz Cintas and Remael (2007:96) as guidelines. An important aspect in subtitle creation is the reading ability of the viewers. It is

important for all stakeholders that accessing subtitled AVT content does not become a reading exercise, resulting in viewers not getting information from other channels available such as the on-screen visuals and the audio content. This consideration is particularly important for subtitling educational content, where the aim is for subtitles to contribute to the learning process. The subtitles thus had to meet the basic recommendations by Díaz Cintas and Remael (2007:96) which include maximum lines and character count. The quality check confirmed that all subtitles adhered to the 'six-second' rule and consisted of a maximum of two lines, and each line of 37 characters, which included punctuation and spelling.

The original subtitles were edited, in terms of quality control for translation, using Aegisub, a free online subtitling software, which is available on http://www.aegisub.org/.This was performed in the subtitling programme itself: the presentation speed for each video was set in the file settings. Once the subtitles were finalised, the subtitle file was embedded on the videos using Format Factory, a video editing software available online. The subtitle was saved in SubRip (.srt) format since it was one of the formats suitable for Format Factory. The process of embedding the subtitles involved uploading the video and subtitles into Format Factory and deciding on the required settings for finalisation. The subtitle font size was set in a proportional size to the rest of the screen, and the colour was set as white with a black border. Once the settings were set, the conversion was completed.

3.4.2.3   Selection of keywords

The current study makes use of subtitles used in previous studies which are full subtitles containing a near verbatim rendering of the audio track. However, there is a big difference from previous studies in that the current study also investigates the use of keyword subtitles as opposed to full subtitles. Considering spatial and temporal constraints and the needs of the audience, subtitling seeks to strike the balance between reading time, the transfer of the message and synchronicity (Ghia, 2012:163). Ghia (2012:163) further explains that this may be achieved by using among others the translation strategy of reduction, which "involves the deletion of linguistic material in the shift from ST to TT", and that this deleted item can be accessed from the other channels of information.

There are different approaches to the deletion of items. Kovačič (1994, cited in Ghia (2012:163)) distinguishes between total and partial reduction and explains that partial reduction is "achieved through condensation strategies and is mainly a syntactic phenomenon". Total reduction, in turn "consists of the deletion of linguistic information which is generally deemed as not necessary for general comprehension and easily retrievable from context (e.g. repetitions, address terms and

phatic markers)" Kovačič (1994, cited in Ghia (2012:163). In order to produce a subtitle file for the current study that only contained keywords, a strategy of total reduction was applied.

A second approach was followed by Guilloroy (1988). In her study, Guilloroy (1988) requested lecturers of French to watch the videos and read the subtitle files (Guilloroy, 1988). They were then asked to underline the words they deemed as important for understanding the content. The researchers then selected the words that made up 50% or more of the underlined words as keyword subtitles. Behroozizad and Majidi (2015) used the route used by Guilloroy (1988). They asked five experienced teachers from two institutions to watch the films and underline the words on the subtitle script that were important for understanding the content. The researchers used 80% of the keywords selected by all five teachers for the final keyword subtitles.

Park (2004) on the other hand, got students to identify lexical words in the video used and these were subtitled. The subtitles were piloted and in the feedback the participants indicated that the subtitles contained too many words and they would have preferred them to contain the difficult words only. Following this feedback, Park (2004) then requested another set of participants to create subtitles for the videos, and from this he was able to identify difficult words from the words the participants got wrong or missed. These were included as the keywords in the study.

In their study, Montero Perez *et al.* (2014b) selected keywords by firstly identifying 140 possible target words and asking students, whose profile was similar to that of the targeted participants, to identify words they knew and did not know on that list. Twenty of those were unknown to 70% of the students and these were retained as the target words. A further prior knowledge test of the 20 words was conducted, and the students identified three words they were familiar with. These three were also removed from the list, and the keywords were created from the remaining 17 target words.

The current study followed the same route as Guilloroy (1998) in determining the keywords, given the time constraints and availability of participants. The researcher consulted a Psychology lecturer who teaches the PSYC 121 module with the aim of requesting him to assist with the identification of the keywords. His expertise on the module content and experience with students put him in a favourable position to know what is important to keep and what could be omitted. The researcher explained the study to the Psychology lecturer and specified the focus on the use of keyword subtitles to facilitate learning. With this background of what the study sought to investigate and how the subtitles were to be used in the study, the lecturer agreed to assist with identifying the keywords. He received the video clips and the subtitle files and subsequently identified the keywords. Since the Psychology lecturer does not know Sesotho, the keywords selected were for the English subtitles only. A summary of the number of words in the keywords

selected per video is included in Table 3-6 below The researcher used the English keywords received from the lecturer to identify the Sesotho keywords in the Sesotho subtitle files.

Table 3-6:   *The number of words per keyword subtitles for each video*

	Number of words in the full subtitles	Number of words in the keyword subtitles	Percentage of words keywords constitute
Video 1	1440	226	6%
Video 2	1508	264	6%
Video 3	1410	241	6%
Video 4	1467	279	5%
Video 5	1425	167	9%

3.4.3 Comprehension tests

Each video clip had to be accompanied by a comprehension test. The videos have comprehension tests which were used in the previous study (Kruger *et al.,* 2013), which the researcher had access to. Since the current study used clips cut from the original videos and not the full videos, the researcher had to carefully consider which questions from the original comprehension tests could be retained. Furthermore, additional comprehension questions had to be developed so that the comprehension tests for the final clips would have sufficient questions. More questions were developed by using recent examination papers and the study unit outcomes outlined for each video. The original tests together with PSYC 121 examination papers and module outcomes were used to compile tests for the videos used in this study.

The Psychology lecturer was consulted and requested to check the comprehension tests for accuracy and consistency in terms of level of difficulty. His opinion and input as an expert on the module content were important. The lecturer considered the comprehension tests and confirmed that they were appropriate and relevant to test comprehension for the selected clips. After initial approval by the lecturer, the comprehension tests were pilot-tested with a small group of participants at the Potchefstroom campus of the NWU. This group consisted of first-year non-Psychology students, similar to those who would participate in the main study on the Vanderbijlpark Campus of the NWU, apart from the fact that they did not have to be mother-tongue speakers of Sesotho. Students from the Potchefstroom campus were used so as not to deplete the numbers of students on the Vanderbijlpark Campus who qualify to participate and who may want to participate in the main study. Including Potchefstroom campus students helped increase the pool of participants, which contributed to validating the research findings. The

intention of the comprehension pilot was to check if the level of difficulty of the questions was appropriate for the intended participants. Questions with performance lower than 30% correct answers and higher than 90% correct answers would be deemed too difficult or too easy, and would be altered or discarded from the test. However, the timing of the pilot turned out to be problematic – the participants who signed up could not complete viewing and answering the comprehension tests, which means the full pilot of these comprehension tests could not be completed in the intended manner. To make up for this in the limited time available for the researcher to finalise the comprehension tests and to ensure validity of the test items, other means were devised to ensure that the comprehension tests were appropriate.

The researcher sought the assistance of Academic Literacy (ALDE) lecturers who have experience and skill in setting up comprehension tests. A team of the lecturers with combined work experience of more than 40 years were asked to watch the videos and look at the comprehension tests to identify whether they were appropriate or not, and thus helped with selecting the final questions for each test.

At the initial meeting with the team, they indicated that the questions only tested the lower element of comprehension, which is memory and not the 'understand (comprehension)' category of Bloom's Revised Taxonomy. The team made recommendations to assist the researcher to revise the questions in a suitable manner. The revised questions included activities such as participants paraphrasing the information in their own words, classifying items, comparing and contrasting concepts and explaining concepts.

The researcher revised the questions, taking into consideration the concerns of the ALDE team that random guesswork may be used to answer the multiple-choice questions and the true/false questions. Some of these questions were retained as the researcher took into consideration the fact that the participants were exposed to the content once and did not have the opportunity to revisit the content. However, they were adapted to request students to include a reason for the answer selected in order to ensure that not only memory was tested. This does not eliminate guesswork, however, by asking participants to justify their responses allows them to demonstrate an element of understanding which is relevant for the level of first years according to Bloom's Revised Taxonomy.

Due to time constraints and unavailability of the ALDE team, the revised questions were submitted to one senior ALDE lecturer who approved the final tests and they were finalised. An example taken from the Video 5 comprehension test demonstrates how the true/false questions were revised following the intervention of the ALDE team:

Original question:

Read each statement and decide whether it is true or false.

8) Community psychology focuses on people on an individual basis.

Final question:

2) Indicate whether the following statement is True or False and explain the reason for your answer.

Community psychology focuses on people on an individual basis.

The purpose of the comprehension tests was to examine whether the different types of subtitle conditions influenced the participants' understanding of the content in the clips. According to Carlisle (1999:11) recall measurement is a common method for assessing comprehension in the classroom. Carlisle (1999:12) further explains that comprehension depends on long-term memory and working memory processing information presented. In order for the comprehension tests in the current study to assess comprehension holistically, they were designed to include the following types of recall: recognition, cued recall, and free recall. These types of recall may include questions described as typical questions for assessing comprehension of a text such as true/false, multiple choice, cloze and open-ended questions (Cain & Oakhill, 2006:701-705).

Recognition recall entails presenting participants with options from which they are to select the correct option. The questions used include true/false and multiple-choice questions. In true/false questions, participants are presented with a sentence and they have to indicate whether the sentence is true or false (Cain & Oakhill, 2006:702). The authors affirm the input of the ALDE lecturers by asserting that these forms of assessment pose low processing demands on the participants, as no complex verbal response is required. They are good for assessing the memory element of comprehension but fall short in terms of inference making, which is another comprehension indicator. Multiple choice is also a form of assessment which does not require a complex verbal response, however, it poses a higher processing demand because a participant has to compare responses in a set of options and choose the correct one (Cain & Oakhill, 2006:703).

Cued recall on the other hand involves providing the participants with a cue to remind them of the answers to the questions asked. Cloze tasks are included in this type of recall as they consist of a sentence where a single word is omitted and the participant has to either fill in the word or select the appropriate word from a choice (Cain & Oakhill, 2006:701).

The last type of questions used in the study falls under free recall, which involves the participant receiving no cues to assist them to remember the answer to the questions. They are open-ended questions such as asking for explanation of concepts or to motivate their responses. Through this form of assessment, the participants' memory and understanding are tested (Cain & Oakhill, 2006:703-704). These different levels of comprehension are important to test as they reflect the level of understanding appropriate for first-year students, who are advanced learners.

The different comprehension tests for the different videos all counted a total of 10 marks, with each test consisting of different types of questions as outlined in Table 3-7 below.

Table 3-7:   Types of questions asked per video

	Recognition	Cued recall	Free recall
Video 1	2	1	2
Video 2	2	1	3
Video 3	1	3	3
Video 4	2	2	3
Video 5	1	3	3

The comprehension tests were presented in one language only, English. The researcher had considered presenting them in Sesotho as well since Sesotho subtitles were used. The decision to present the comprehension tests in English only was based on the reality that students at HEIs are mainly assessed in the LoLT (English) only. At the NWU some assessments are bilingual, with English and Afrikaans, however this combination would not be suitable for the participants in the current study and the introduction of Sesotho tests could have been a source of frustration as they would be unfamiliar to the participants and could be a potential confounding variable. The comprehension tests for all videos can be found in Appendix D.

3.4.4   Questionnaire

The study included three types of questionnaires, a biographical information questionnaire, a cognitive demand self-report questionnaire and a questionnaire on the participants' experience with subtitles in general and their perceptions of subtitles in the educational settings. The biographical questionnaire was included in the consent form and asked identifying particulars of the participants, which were used to describe the participant population in the study (See the biographical details section of the consent form, Appendix E).

Participants were also requested to respond to a self-report task load questionnaire after completing the comprehension test at the end of each video. The task load questionnaire was employed to measure the participants' perceptions of their experiences during the viewing of the respective videos. The questionnaire focused on the level of difficulty of the content and language of the videos, subtitle reading and preferences of subtitle styles and language. The responses of the participants in these questionnaires provide an indication of how much effort was involved in the viewing of each video/topic and possibly the extent of concentration difficulty experienced during viewing. The questions in the questionnaire were adapted from previous studies; this will be discussed later in this section.

Even though studies mentioned in the previous chapter have been shown to have benefits, subtitle research cannot overlook the issue of cognitive load that subtitles place on viewers. Analysing cognitive load does not form part of the core focus of the current study, however, it is important to acknowledge that it is pertinent in the educational context where participants have to demonstrate an understanding of the educational content presented. The ideal situation would be for subtitles to place as little as possible cognitive demand on participants, however, this may not be possible for the current study. Considering Kruger's (2013:37) assertion that the presence of unfamiliar or unexpected material on the screen seems to result in higher cognitive load, it may be expected that the use of the unfamiliar Sesotho as well as keyword subtitles will result in high cognitive load. The findings that regarding the participants' perception regarding the usefulness of the subtitles confirm this in that the Sesotho subtitles were considered to be the least helpful (refer to the discussion in Section 4.5.1.3.2).

Previous studies have found varying findings in this regard. Diao, Chandler and Sweller (2007:251) found that subtitles presented with auditory content lead to cognitive load, which in turn interferes with learning. Kruger (2013:49) found that subtitles may lead to increased cognitive load. On the contrary, Kruger *et al.* (2013:65) and Kruger *et al.* (2014:9) found no statistical significance in difference between the levels of cognitive load reported by participants who viewed videos with subtitles and that of the participants who viewed the videos without subtitles. The subtitles did not increase cognitive load as anticipated.

The studies by Kruger (2013), Kruger *et al.* (2013) and Kruger *et al.* (2014) investigated full subtitles only. A recent study by Matthew (2019), investigated verbatim and edited subtitles. Matthew (2019:50) describes verbatim subtitles as full subtitles, which although synchronised with the dialogue did not conform to the general subtitle conventions. On the other hand, the edited subtitles are full subtitles but were edited in accordance to the subtitle standards (Matthew, 2019:50). This study found that there was no difference in the cognitive load participants experienced when exposed to the material with subtitles and material without subtitles (Matthew,

2019). When comparing the verbatim and edited subtitles, Matthew (2019:94) found that edited subtitles were more likely to be read than verbatim subtitles. Matthew further found that the participants experienced less cognitive load when processing edited subtitles compared to verbatim subtitles. From these findings it is evident that there is a need to continue to explore the cognitive load participants experience due to the inclusion of subtitles; although cognitive load could not be measured directly in the current study, insights were gathered by including the questionnaire on self-perceived cognitive load.

The current study explored the use of keyword subtitles, and anticipated that participants would report low levels of self-perceived cognitive load, as they would be having less content to read, which would place less demand on them. This is however, contrary to Moran's (2012:197) assertion that removing function words from the subtitle text may place more cognitive demand on the participant as "it is more cognitively taxing to process and comprehend a grammatically incomplete sentence with fewer words than it is a grammatically complete one with more words". This means that there is a possibility that the participants may experience the reading of keyword subtitles to be demanding. Considering the two contradicting points of view, it was essential for the study to include the self-report questionnaire so as to determine the level of demand as experienced by the participants. The participants' response to the questionnaire would therefore provide insight into how content was perceived as well as perceptions of the subtitle reading experience for both subtitle styles used in the experiment, the full and keyword subtitles.

The self-perception questionnaire was completed after each comprehension test (thus five times in total, one for each video viewed). It focused on the total viewing experience and included questions pertaining to participants' perceptions regarding their experience of the content of the video and their subtitle reading experience.

The task load questionnaire was created by adapting the Leppink *et al.* (2013) and Leppink and van den Heuvel's (2015) questionnaires for measuring cognitive load. Leppink *et al.* (2013) developed an instrument for measuring cognitive load. The instrument, a ten-item questionnaire, used a ten-point scale to rate the demand of the task as perceived by the participants. The questions included the difficulty of the content, the clarity of instructions in the activity, and the effect of the activity on the understanding of the topic. The topic covered in their study was statistics but the authors clarified that statistics could be replaced by the domain in which data is collected (Leppink *et al*, 2013:8). Due to debates regarding the measurement of cognitive load, Leppink and van den Heuvel (2015) modified the Leppink *et al.* (2013) questionnaire to include only eight questions focusing on the difficulty of content, terminology, and instruction language used in the activity. Instead of questions regarding the impact of the activity on comprehension, the Leppink and Van den Heuvel (2015) questionnaire included the perceived mental effort used

to complete the activity. The current study's questionnaire consisted of nine questions, which were mainly based on both questionnaires. The questionnaire retained the Leppink *et al.* (2013) question regarding the impact of the activity on comprehension, which was excluded in the Leppink and Van den Heuvel (2015) questionnaire. The questions in the current questionnaire focused on the difficulty of the content, terminology and language used in the videos, the impact of the subtitles on comprehension, and the perceived mental effort used to complete the activity.

The participants responded to this nine-item questionnaire at the end of each video viewed, by rating their perception of their experience of viewing the videos in the experiment on a ten-point scale. Similar to the Leppink and Van den Heuvel (2015) questionnaires discussed above, the responses ranged from 1 ("not at all") to 10 ("is completely the case"). Throughout the questionnaire the response options were presented in a consistent manner, with the negative response on the left-hand side, and the positive response on the right-hand side, with average or neutral responses in the middle. This was done based on the recommendation by Dörnyei and Taguchi (2009:32) so as to reduce possible cognitive effort and distraction involved in the process with participants internally rating and then marking the chosen option on the questionnaire. The task load questionnaire can be found in Appendix F.

The last questionnaire was completed only once, after the fifth video was viewed, and focused on the participants' general experience of subtitling and perceptions of subtitling in education (See Appendix G). The questionnaire contained questions that measured the participants' perceptions of the helpfulness of subtitles in education, their preference for subtitle type, and which subtitles they would recommend to others. In addition, the questionnaire focused on the participants' exposure to subtitled television programmes in general. The participants indicated how often they watched TV, if the TV programmes they watched contained subtitles and the language of the subtitles.

3.5   Eye tracking

In addition to questionnaires, the current study used an eye tracker, a popular tool in subtitling studies. Eye-tracking data, which demonstrates how subtitles are read, can corroborate or contradict the questionnaire responses. In the current study, eye tracking proved to be a useful tool to provide the researcher with information about the viewing behaviour of participants when reading the different styles of subtitles (full subtitles and keyword subtitles) in the two languages, English and Sesotho.

3.5.1   Eye-tracking system: iViewX^{TM} RED

The SMI iViewX RED500 eye tracker was used to monitor participants' eye movement whilst watching the video clips. The RED500 is a remote eye-tracking device that is table-mounted. The setup of the device consists of the iViewX workstation, a stimulus screen and the eye-tracking module. The eye-tracking module is located at the bottom of the stimulus screen and uses infrared LEDs to illuminate the eyes (SMI, 2011:168).

Figure 3-1:   SMI's iViewX™ RED500 eye-tracking system

This eye-tracking system works with a built-in camera which views and records the eye behaviour of the participants. According to SMI (2011:166) it has a sampling rate of 500 Hz, meaning that it takes 500 photographs of the eye per second, calculating the pupil position and size, and relative head movement. The RED500 allows for the measuring of participants' eye movements without any physical contact. Given this non-intrusive nature of the device, experiments take place under relatively natural viewing conditions. However, the participants were required to sit as still as possible for the duration of the experiment as movements would influence the data collection.

In eye-tracking studies, mascara can be mistaken for the pupil, thus leading to the camera jumping from pupil to the dark lashes, resulting in inaccurate calibration. To avoid this issue, participants wearing eye make-up were requested to remove it. Eye-makeup remover pads and a mirror were provided for participants who put on mascara and they removed the makeup themselves. The reflection caused by eye glasses can also lead to inaccurate calibration. Four participants who signed up for the study wore glasses and two unfortunately had to exit the study due to calibration difficulties. Participants were excluded if their eye tracking ratio was less than 85%.

3.5.2   SMI Experiment Center™ 3.5

The experiment was set up and run from SMI's Experiment Center 3.5, a component which is specific to SMI iViewX™ software. In preparation for the experiment, the relevant stimuli were selected and inserted into Experiment Center 3.5. A calibration element is always automatically inserted as the first 'stimulus' participants see. The process of calibration ensures that the participants' eye behaviour is recorded accurately by the system. This is important as people have different eye shapes with varying eyeball radii (Holmqvist *et al.,* 2011:128), which affect where they focus when viewing an object. Calibration therefore ensures accurate recording of the place that participants viewed the screen whilst the stimulus is presented.

During calibration participants are shown a dot that moves across the screen. Holmqvist *et al.* (2011:128) explain that the calibration area has predefined points, commonly 2, 5, 9, 13, or 16, which cover the area where the experiment stimuli will be presented. The participants are requested to follow it with their eyes without moving their heads. When the dot stops the participants have to focus their eyes on the centre of the dot until it moves again. This process continues until all points presented are fixated. All the while the system observes the participants' pupil position at each point in order to select the correct pupil reflections for all points fixated (Holmqvist *et al.,* 2011:129). In order to ensure accuracy a predetermined deviation value should not be exceeded (Holmqvist *et al.,* 2011:128). According to the authors (2011:133), some systems calculate an "accuracy value of the average deviation between markers and gaze position". A maximum deviation of 0.5° is recommended (Holmqvist *et al.,* 2011:133). The authors recommend that recalibration be conducted should the validation value exceed the required accuracy value.

Once calibration is successful, the recording may start. The remaining stimuli that follow calibration were sorted according to the order in which they will be presented. For the current study the order was the calibration, pre-video, and lastly the five primary videos.
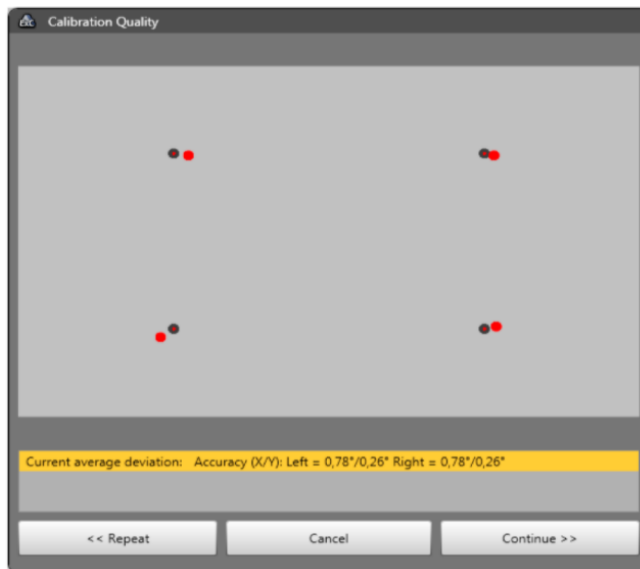
Figure 3-2:   *Screenshots of calibration process (from Saiz Manzanares et al., 2020:6)*

3.5.3   SMI BeGaze™ 3.5

All data was captured and recorded in real-time, and analysed using SMI BeGaze™ 3.5, which is also an element specific to SMI iViewX™. It is used for behavioural and gaze analysis of eye-tracking data (SMI, 2009b:2). It automatically groups data based on individual experiments and participants.

Eye-tracking data was recorded for the viewing of the entire screen, but only the viewing data for the subtitle area at the bottom of the screen was considered for analysis: each individual subtitle was marked as an area of interest (AOI) and data was analysed in terms of these AOIs.

During data analysis, recordings were grouped and presented according to each AOI. The AOIs were marked after the data had been collected using AOI editor in BeGaze™. They were marked with the intention of ensuring that the retrieval of the recording of eye-tracking data focuses specifically on the AOIs (in terms of time spent in the AOI, number of fixations, fixation duration, etc.). Once AOIs are marked, BeGaze automatically clusters the eye-tracking data per AOI. The data may be viewed in BeGaze itself (scan paths, etc.), however for the purpose of the current study, the data was exported from BeGaze in Excel format for statistical analysis.

3.5.4   Eye-tracking measures

Although eye-tracking systems record and allow for the investigation of many measures of eye movement, only a specific aggregated measure was used in the current study, namely the Reading Index for Dynamic Texts (RIDT). RIDT is a score "of the degree to which a particular

subtitle was read by a particular participant" (Kruger & Steyn, 2014:110) and is determined through the following formula:

$$\text{RIDT}_{vps} = \frac{\text{number of unique fixations for } p \text{ in } s}{\text{number of standard words in } s} \times \frac{\text{average forward saccade length for } p \text{ in } s}{\text{standard word length for } v}$$

Figure 3-3: **RIDT formula (Kruger and Steyn, 2014:110)**

The RIDT score indicates the extent to which a subtitle was read by each participant, thus allowing for conclusions to be made regarding the effect of the subtitle reading on comprehension. As Kruger and Steyn (2014:116-117) assert, we can only understand the role of subtitles in learning when "we consider the correlation between comprehension and the degree to which participants actually read the subtitles". The RIDT score is interpreted on a scale, with a very low score depicting that subtitles were read to a lesser degree and a high score depicting more extensive reading (Kruger *et al.*, 2014:6).

However, the RIDT formula may be problematic, as Matthew (2019) discovered in his study. Some participants in his study had a RIDT score of zero for some of the subtitles. This meant that the subtitles were not read. However, the fixations counts were higher than zero, indicating that the subtitles were read. Upon closer investigation of the RIDT formula, Matthew (2019) found that when the participants rescanned a subtitle (regressed), the formula detracted these from the number of fixations. This means that for those subtitles with zero fixations, the participants possibly made numerous regressions. For Matthew (2019:46), multiple regressions were inevitable since the language of the audio and the subtitles (English) is an additional language for the participants in his study. As discussed in the previous chapter, many South African students access education through EAL, however, many enter higher education with poor proficiency in English. Due to this and the lack of reading skill development, there was a possibility that the participants would need to reread some of the subtitles in order to understand and confirm information. In order to avoid a false representation of how the subtitles were processed, Matthew (2019) adapted the RIDT formula in order to accommodate the multiple regressions, which the RIDT penalised. The regressions did not detract from the unique fixations. This resulted in a new formula called the Unique Fixations per Mean Word (UFMW).

The UFMW score was calculated for each subtitle by dividing the number of unique fixations for those subtitles (i.e. fixations without refixations) by the mean number of words (number of words of subtitle divided by the average word length of subtitles in the video) (see Equation 1).

Equation 1: UFMW= Fixations without Refixations / Mean Words (Matthew, 2019:47)

The current study shares similarities with Matthew's study with regard to the population and their context. The participants in both studies are non-native speakers of English, who are students at the NWU, Vanderbijlpark campus. Furthermore, videos of recorded academic lectures were used and the videos have an English audio track and English subtitles. What is different, however, is that the current study also includes Sesotho subtitles and had a different focus than Matthew's study. The current study seeks to investigate the effect of L1 subtitles, both full and keyword, on comprehension. The inclusion of L1 subtitles emanates from the findings of some research that L1 subtitles may contribute positively to comprehension (Mahlasela, 2012). The investigation of L1 subtitles will make a contribution to the ongoing discussions about the benefits of mother-tongue education. In order to determine whether subtitles contribute to comprehension it is essential to determine if and to what extent the subtitles are read. The use of the eye-tracking technology makes this possible through the reading indices such as RIDT and UFMW.

The current study therefore set out to determine the extent of subtitle reading by calculating the RIDT as well as the UFMW values for all videos viewed with subtitles. Even though found to be flawed, calculation of the RIDT would enable the researcher to compare the findings of the current study to those of previous studies that used the RIDT formula to calculate the degree of subtitle reading (Kruger & Steyn, 2013; Kruger *et al.*, 2014). In addition to RIDT, the modified UFMW was also calculated since multiple regressions were anticipated in the current study, given the similarities to the study by Matthew (2019). Apart from reading in English, regressions were also anticipated for the Sesotho subtitles since students (1) are not used to Sesotho subtitles and may have never been exposed to them before, given the subtitling culture in South Africa, which provides mostly English-only subtitles on public television; and (2) have primarily received education through English, which is the main LoLT in South Africa. To conclude, eye tracking was therefore used in the current study to gain insight into the extent to which subtitles were processed in order to draw conclusions regarding the effect of subtitles on comprehension.

3.6   Data collection procedure

The experiment took place in the eye-tracking laboratory of the NWU Vanderbijlpark Campus. All materials were issued to participants individually, and participants completed the experiment activities individually, as the eye-tracking lab could only accommodate one participant at a time. Each participant was required to attend two sessions – participants were requested to book the two separate sessions on days and at times that suited them. The experiment was split into two sessions to avoid the participants sitting in the experiment for too long and becoming fatigued. In the first session information regarding the study was provided and the participants were orientated

about eye tracking and the setup in the laboratory. They were given the details of what the experiments entailed, namely that they would watch five Psychology videos, which were each approximately ten minutes long. They were also told that after each video they would complete a comprehension test and a self-report questionnaire about the video they had just viewed. They were given an opportunity to ask questions of clarity and to make the final decision to continue with the study. This was followed by giving written consent, completing the consent form and the viewing two of the videos. In the second session the participants viewed the last three videos, completed the comprehension tests and filled out the questionnaires. The duration of each session was approximately 1 hour and 15 minutes.

Once the experiment started, participants were requested to sit still until the end. This required that they be seated in a comfortable position. They were seated on a stable chair, which had no wheels, thus assisting the participants to limit unintentional movements. Any movements would affect the participant's placement and therefore the accuracy of the eye tracker's calibration of the participant's eye movements. The chair was positioned 700 mm away from the stimulus screen which displayed the experiment videos. The height of the chair was adjusted accordingly, so as to ensure clear visibility of the participants' eyes and correct placement in the eye image frame on the researcher's monitor. The system indicated the type of adjustment that had to be done for the correct seating of the participants in front of the stimulus screen.

The experiment started with the calibration of the participants' eyes. At the start of this process a black dot with a white centre appeared on the screen. At the click of a button the dot moved across the screen and the participants were requested to follow it with their eyes, without moving their heads. When the dot stopped participants had to focus on the dot's white centre and only start to move their eyes when the dot moved again. This continued until nine points were fixated. In order to ensure accuracy, four validation points were given. A maximum deviation or error of 0.5° on the horizontal and vertical axis was calculated by the system. In the event that the maximum deviation was exceeded, a subsequent calibration was performed. This continued until calibration was successful.

After calibration, the first session of the experiment started with a two-minute pre-video, which was followed by two subtitled video clips. The pre-video served the purpose of preparing participants for the experiment by helping them to get acquainted with the equipment to be used and the reading of subtitles. The five primary videos were between 8–10 minutes long. Each video viewing was followed by a comprehension test and the self-report questionnaire on task load. The participants were not limited in terms of time to complete the comprehension test and questionnaire for each video. After completing a task (video, comprehension test, questionnaire),

a short break was provided before moving to the next video. Water was available in case the participants needed to refresh.

All videos were viewed, and all comprehension questions and questionnaires were completed on the computer screen, while the eye movements of the participants were recorded by the eye tracker. In order to complete the comprehension test, participants had to type their responses, meaning that they would have to move their head as they look down to write the answers. These movements could result in possible change in the participants' placement, therefore making it necessary to perform calibrations again prior to moving on to the next video to ensure that the system would continue to measure the eye movements accurately.

Depending on the availability of the participants, the second session was held either on the same day as the first session or on a different day, and participants proceeded in a similar manner to view the last three videos (each video was followed by the completion of the comprehension test and filling out of the self-report questionnaires as in the first session). After the final video was viewed, the researcher expressed her gratitude to the participants and presented them with a flash drive as a token of appreciation.

The presentation of the videos was counterbalanced and randomised, meaning that the participants viewed the videos in a different order. This was in an attempt to reduce the order effects, which can be caused by a number of factors. These factors include participants getting tired during the experiment (fatigue); improved performance due to participants getting familiar with the experiment environment; improved performance for certain videos based on their order of presentation; and external conditions such as heating, lighting or sitting arrangements. By randomising and counterbalancing the order of video presentation, the researcher tried to ensure that the language and style of the subtitles can be recognised as cause for any differences in performance.

3.7   Data analysis

This section discusses the methods of data analyses used for the different components of the study. The main data comprises the data collected for subtitle reading (eye-tracking data and comprehension tests), since this is the main focus of the current study. Other data includes the biographical and self-report questionnaires.

Analyses of the data were conducted using mixed models with the comprehension scores, subtitle reading data (UFMW, RIDT scores) and the self-report questionnaire responses as dependent variables. The independent variable was the subtitle condition (the language and style). Mixed models, also referred to as mixed-effect models, are defined as "models which incorporate both

fixed and random effects" (Baayen, 2008:242). Fixed effects are those factors that are repeatable such as the treatment factor (the subtitle conditions in this study), and random effects are those factors that are not repeatable and are randomly sampled from a population such as the participants (Baayen, 2008:241-242). In the current study the fixed effects are the different subtitle conditions for the videos, and the random effects are the participants and items (the videos). Winter (2013:24) explains that random effects have an influence on the variation of data (for example, individual differences such as each participant having different levels of understanding for each video, levels of exhaustion), affect all responses from the same participant. In addition to participants, the video is the other random effect that may have an effect on the data, since participants viewed different video clips in varying sequences.

Considering the various factors mentioned, mixed models are ideal for analysing data in experimental studies such as the current study in that "they take the full data into account" (Winter, 2013:26). This is important as both random and fixed effects in experimental research influence the data. Using mixed models will allow the analysis to account for the effect of participants and the video; and the subtitle conditions on the variation of data. Another advantage is that mixed models "do not require that all measurements should be present for all subjects. One does not have to discard all measurements related to one subject if one value is missing" (Levishna, 2015:193). This is particularly relevant for studies that use participants such as the current study which have challenges of incomplete datasets due to various reasons such as (1) participants possibly choosing to withdraw from the experiment for their own reasons, (2) participants may skip a section in the comprehension test or questionnaire, and/or (3) particularly in eye-tracking study, the researcher may terminate the experiment or discard certain data due to challenges with calibrations.

3.7.1 Participant demographics

The participants' demographics were collected for the sole purpose of describing the participant population, therefore demographic data were not analysed for answering the research questions.

3.7.2 Comprehension tests

Participants' answers to the comprehension questionnaires were recorded and tabulated. A maximum mark allocation of either 1 or 2 (depending on the maximum mark allocation for the individual questions) was awarded for correct answers and a score of 0 was awarded to questions answered incorrectly. From there totals and percentages were calculated for individuals. The means for the comprehension scores for each video and the subtitle condition were calculated. These were compared and effect sizes were used to determine if any practically significant differences were found for the different conditions.

3.7.3 Subtitle reading

Data was automatically recorded in real time via the SMI iViewX™ RED system. The data was viewed and analysed in BeGaze 3.5, and was exported to Excel and SPSS afterwards for further analysis. Since the study focused on the reading of subtitles, the subtitles were considered and marked as areas of interest and all data pertaining to them was recorded and measured.

The eye tracker calculates a vast amount of data. For this study the focus is on the extent to which the subtitles were read, and this was determined through the RIDT and UFMW measures. In order to calculate these measures, the following metrics were exported from BeGaze 3.5: fixation count and saccade length. The study used the RIDT and UFMW measures to investigate how the viewing behaviour of participants differed when reading subtitles presented in the different languages and styles; discussion of the individual eye-tracking measures will not be presented. The means for the reading measures per subtitle condition were calculated. They were compared and the differences were also analysed in terms of effect sizes in order to determine the level of practical significance of possible differences observed for the different conditions.

3.7.4 Questionnaire

The analysis of the questionnaire data entailed reducing the nine questions in Section A to two factors through exploratory factor analysis (EFA). EFA entails grouping questionnaire questions that have commonalities and reducing them to a number of factors that capture the essence of these questions (Cohen, Manion & Morrison, 2018:818). The resultant factors were assessed for validity and reliability, after which comparisons of the means could be performed. These differences in means were further analysed to determine if there were any practically significant differences for the differences in the means using the effect sizes. In addition, questionnaire data from Section B of the questionnaire was analysed by means of calculating frequencies. Furthermore, correlations were drawn between participants' responses and the comprehension tests scores as well as the eye-tracking data for subtitle reading and questionnaire data.

3.8 Conclusion

To summarise, the data collected in order to answer the research questions included the following: comprehension tests, subtitle reading data for the different subtitle styles (full subtitles English, keyword subtitles English, full subtitles Sesotho and keyword subtitles Sesotho), task load questionnaire data and perception questionnaire data. In order to ensure the validity of the data, different measures were taken to account for every possible confounding variable. This was done though the exclusion criteria for selecting participants, randomisation of experiment materials, the design of the questionnaire and the design of the data collection procedure. These

considerations were put in place so that the researcher could state with confidence that the outcomes of the study were not influenced by how the data was collected. The findings of the study therefore reflect a trustworthy answer to the research questions.

This chapter discussed the research methodology, which included descriptions of the setting and participants, instrument design, and an overview of how data was collect and analysed. The next chapter discusses the findings of the analyses that were conducted using data from comprehension test scores, the degree of subtitle reading scores and the task load questionnaire.

CHAPTER 4: ANALYSIS AND INTERPRETATION OF DATA

4.1   Introduction

This chapter presents the results of the analyses and the interpretation of the data collected in this study in order to determine what effect subtitle styles have on comprehension. The two primary questions this study seeks to investigate are (1) the extent to which the language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos; and (2) the influence, which the degree of subtitle reading has on the participants' comprehension of the content in the videos. In order to answer these two questions, the participants participated in an experiment and responded to questionnaires. From the experiment and questionnaire, the following sets of data were collected and analysed: comprehension data, subtitle reading data and questionnaire data.

The questionnaire data included biographical details of the participants which enabled the researcher to determine if the participants met the inclusion criteria for the study. The information included age, gender, hometown, language profiles of the participants, Sesotho symbols in Grade 12 and current fields of study.

Those who met the inclusion criteria participated in the experiment, which involved each participant watching five different videos with five different subtitle conditions, with their eye movements recorded by an eye tracker. The eye tracker would assist in determining the extent to which the participants processed the subtitles. At the end of each video the participants completed a comprehension test which was followed by a self-reported mental effort questionnaire. The questionnaire was used in order to gain more clarity on factors that may have influenced comprehension (i.e., possible confounding variables), with specific focus on the participants' viewing experience of each of the videos. A second questionnaire, which focused on the participants' experience of subtitling in general and their perceptions of the use of subtitles in education was completed at the end of the fifth video. The questionnaire was used in order to gain more clarity on factors that may have influenced comprehension (i.e., possible confounding variables), such as the participants' viewing experience and perceptions regarding the use of subtitles. Therefore, for each participant there were five sets of comprehension scores, eye-tracking data (also called "subtitle reading data"), questionnaire responses for each of the five videos that were viewed, and a final set of questionnaire responses after having viewed all five videos (after concluding participation as a whole).

The comprehension data is analysed in order to explain the possible effect of full and keyword subtitles in English and Sesotho on the comprehension of the videos as viewed by Sesotho L1

participants, and to compare the effect of the types of subtitles on the participants' comprehension. This will answer the first primary research question which seeks to find out to what extent do the language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos.

The subtitle reading data is analysed in order to see how the reading of the subtitles presented in different languages and styles impacted on the participants' comprehension. This will answer primary research question 2, which focuses on how the extent of subtitle reading influences Sesotho L1 participants' comprehension of content presented through the different languages and styles of subtitle presentation. The findings from the questionnaire data will provide more clarity to the findings of both primary research questions.

Analyses of the data were conducted using mixed models with the comprehension scores, subtitle reading data (UFMW, RIDT scores) and the self-report and perception questionnaire responses as dependent variables. In this study a large dependency in the data was caused by the same person viewing the five different videos with five different comprehension tests and five different eye tracking sets of data. As a result, comparative analyses were conducted using the mixed models method with the data from the comprehension tests, the eye tracker and the two self-report questionnaire factors as dependent variables. The first level of dependency is the subject, which for this study was the participant. The other level which was taken into account, is the review number, the sequence in which the videos were viewed. For all of these analyses the video and subtitle types and the interaction between the two were treated as fixed effects. Statistical significance will be indicated by p-values < 0.05.

The data analysis and interpretation will be discussed in three main sections. In Section 4.2 a description of the participants will be provided using the biographical information provided in the questionnaire. Following this, Section 4.3 presents the data analysis and interpretation of the subtitle reading data. Section 4.4 will discuss the questionnaire data analysis and interpretation. This will be followed by the discussion of the correlations found in the data in Section 4.5. Finally, Section 4.6 concludes the chapter by way of a summary of the findings.

4.2   Participant biographical information

4.2.1   Age and gender

A total of 38 students participated in the study, of which 55.3% (n = 21) were females and 44.7% (n = 17) were males. The age of the participants ranged from 18–32 years. The mean age was 20.47 (standard deviation=2.797), and 50% (n = 19) of the sample was 19 years and younger. This was to be expected as the participants were required to be first-year students.

4.2.2 Place of origin

The participants were from Gauteng, 71.1% (n = 27), and the Free State, 28.9% (n = 11); which are the provinces with the most mother-tongue speakers of Sesotho. This was to be expected because the university campus where data was collected is located on the border of Gauteng and Free State provinces. The participants identified different towns in the two provinces from where they originated, and the highest percentage of students, 42.1% (n = 16), came from Vanderbijlpark where the university campus is situated.

4.2.3 Participants' language profiles

Language was an inclusion criterion for participation in this study; the participants had to be Sesotho mother-tongue speakers. Sesotho is one of the official languages in South Africa and according to the Census 2011 report, it is the fourth dominant language in Gauteng, being the home language of 11.6% of the province's population. In Vanderbijlpark, Sesotho is the second most dominant languages with 20% of the population identifying it as their first language. Due to the dominance of Sesotho in Vanderbijlpark, it was selected as the language to be used in creating the subtitles and consequently as the language of the participants.

In order to ensure that the appropriate participants are included in the study, the biographical questionnaire used gathered the participants' language background. For this purpose, the questionnaire contained a list including all the eleven official languages of South Africa from which the participants were required to indicate their mother tongue and home language.

The two concepts (mother tongue and home language) are used to refer to languages used in the home domain. The questionnaire used both mother tongue and home language since different understanding of these terms may exist due to multilingualism within families. The idea of the different understanding of the terms is demonstrated by Calteaux's (1996:48) assertion that "within the inter-ethnic marriages in urban areas, the home language may be that of the father or mother, although the mother's language often seems to be chosen as it is she who spends the most time with the children". According to Banda (2000:59) "the concept of 'mother tongue' is increasingly becoming fuzzy and untenable" due to changes in the language and in the socio-political contexts of post-apartheid South Africa. As a result, participants may find it difficult to respond to questions pertaining to their mother tongue or home language, as Winkler (1997:29) found. In response to this 'problem' Coetzee van Rooy (2012:89) defined home language for the participants as the language used in the home most of the time. Taking into consideration the problems associated with the notions of mother tongue or home language, both terms were used to mean the same thing in the current study. This approach accommodated participants from

multilingual families, who may identify the language of one parent as the mother tongue and the language of the other parent as the home language (the language used at home).

In addition to home language/mother tongue the participants were requested to identify the language they used the most in the social domain. This would give a picture of the language used outside the home. The participants identified their language use as presented in Table 4-1 below.

Table 4-1:   ***Participants' language profile indicating mother tongue, home language and languages used in the social domain***

	Mother tongue		Home Language		Language used in Social domain	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
English	0	0	0	0	26	68,4
IsiZulu	4	10,5	0	0	1	2,6
Sepedi	1	2,6	0	0	0	0
Sesotho	31	81,6	37	97,4	11	28,9
Setswana	2	5,3	0	0	0	0
Siswati	0	0	1	2,6	0	0
Total	38	100,0	38	100,0	38	100,0

The majority of the participants, 81.6% (n= 31) indicated Sesotho as their mother tongue and 97.4% (n = 37) indicated Sesotho as the language used at home, as depicted in Table 4-1. Table 4-1 clearly demonstrates the different understanding of the terms mother tongue and home language and this may be due to the presence of more than one language in the home domain, with 18,4% of the participants selecting isiZulu, Sepedi and Setswana as the mother tongue; and 2.6% selecting Siswati as the home language. The participants who selected other languages as the mother tongue selected Sesotho as the home language, and those who selected another language as home language selected Sesotho as the mother tongue. This demonstrates that irrespective of terminology used, all 38 participants were Sesotho mother-tongue speakers and therefore met the requirements to be included in the study. With regard to the social domain, English was indicated as the language used by most participants, 68.4% (n = 26) in the social domain, with 28.9% (n = 11) of participants using Sesotho in this domain.

The findings that the majority of the participants identified Sesotho as either the mother tongue or the home language were to be expected, given that participants were from geographical areas where the main language spoken is Sesotho. It was interesting to find that the majority of participants use English in the social domain.

It was important for this study that the participants could also read Sesotho as they would be exposed to educational videos containing Sesotho subtitles. Since being a mother tongue speaker of a language does not necessarily imply the ability to read the language; having completed Sesotho as a school subject in Grade 12 was regarded as an indicator of the ability to read Sesotho. This was therefore another inclusion criterion, participants who did not meet this criterion were excluded. As a general indication of their ability in Sesotho, the participants were required to indicate the symbol they achieved for Sesotho in Grade 12 by selecting from six categories: 30%–39%; 40%–49%; 50%–59%; 60%–69%; 70%–79%; and 80% or higher. All participants indicated symbols 60% and higher as indicated in the chart below.

Symbols achieved for Sesotho in Grade 12

7,9
34,2
57,9

■ 60%-69% ■ 70%-79% ■ 80% or higher
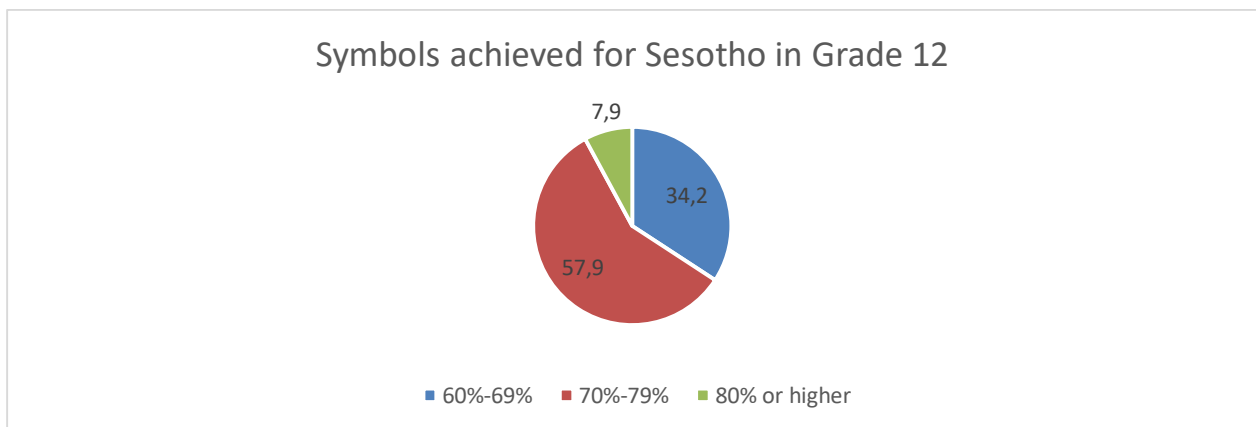
Figure 4-1: ***The participants' Sesotho Grade 12 symbols***

4.2.4 Prior exposure to learning content

An additional inclusion criterion for the study was that participants should not be registered for a psychology module in their current study or have taken a psychology module in previous studies. This criterion was included so as to exclude, as much as possible, the influence of previous knowledge on the comprehension of the content used in the experiment materials. In order to ensure that participants were not registered for a psychology module, the participant biographical questionnaire included a question regarding the field of study with specific reference to registration for psychology. The students who met the criterion were allowed to participate. The participants came from different fields of study as illustrated in Figure 4-2.

Percentage of participants per discipline

13,2 | 23,7 | 23,7 | 39,5

BA ■ BCom ■ BEd ■ BSc
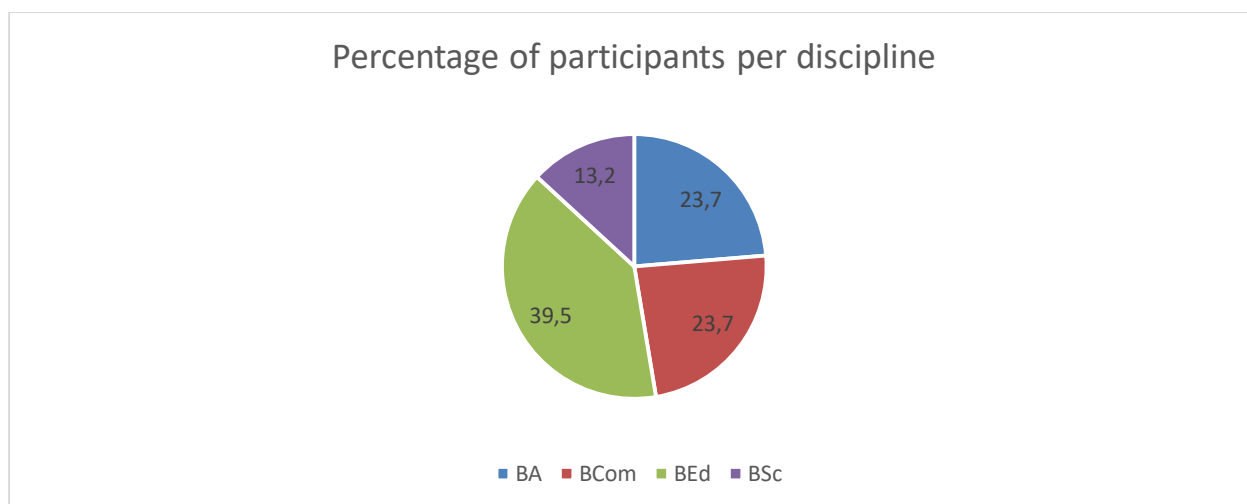
Figure 4-2: ***Distribution of disciplines of study among the participants***

The highest number of participants, 39.5% (n = 15), were enrolled for a Bachelors in Education, followed by Bachelor of Arts and Bachelor of Commerce with nine participants each (23.7%). The least number of participants were enrolled for Bachelor of Science at 13.2% (n = 5). The higher numbers from the education field could be expected as they have the biggest classes on the Vanderbijlpark Campus of the NWU and the recruitment was done in the academic literacy (ALDE) classes for education. Some disciplines such as BEd, include psychology as an elective module, but the participants in this study specifically indicated in the questionnaire that they did not have psychology as a module.

4.2.5 Conclusion on participant biographical information

The abovementioned data was reported in order to provide a description of the participants. This brief description demonstrates that the participants fully meet the inclusion criteria of the study and are thus relevant to answer the research questions Furthermore, it is anticipated that their demographics would not confound the data collected from them.

4.3 The impact of subtitles on comprehension

The two primary questions this study seeks to investigate are (1) the extent to which the language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos; and (2) the influence which the degree of subtitle reading has on the participants' comprehension of the content in the videos. In order to answer these questions, the participants were requested to watch five videos with different subtitle conditions, and at the end of each video, they completed comprehension tests. The comprehension questions assessed the participants' comprehension of the content of the videos. The aim was to determine the impact the subtitle language and style had on the participants' comprehension of the content. The

sections below will provide an overview of participants' comprehension scores for the different subtitle conditions.

4.3.1 Performance in the comprehension test

Short comprehension tests consisting of six to seven questions were completed at the end of each video, and the comprehension test for each video was scored out of ten. The data was analysed using a mixed effect model in order to identify the differences in the comprehension test scores. The study seeks to explain these differences in terms of the video condition, meaning that conclusions potentially may be made regarding the effect of the video condition by identifying which subtitle condition achieved the highest mean score. It is anticipated that the participants will score the highest in the comprehension test for the videos containing the Sesotho keyword subtitles.

In order to see what inferences could be made regarding which subtitle condition and comprehension in the current study, the analysis compared the participants' comprehension test score means for all of the videos (regardless of condition), the video conditions and the interaction between the two. The results of this analysis indicate the statistical significance of the effect of the differences in the comprehension scores. The only statistically significant effect was found in the differences of comprehension scores for videos, with $p < 0,0001$, discussed in more detail below. The difference in the comprehension means with regard to the video conditions, on the other hand, demonstrated a significance level of $p=0,570$, meaning that subtitle conditions do not have a statistically significant influence on comprehension. Similarly, the interaction between the video and the video condition did not demonstrate a statistically significant influence on comprehension with $p=0,321$. Based on this finding it could not be concluded that the different subtitle conditions have an impact on comprehension.

Analysis of variance was calculated for the data; the standard error is an indication of the variance within the data. The estimate for residual was 2,820843 and the standard deviation was 0,366009. The estimate for the participant was 0,776926 and the standard deviation was 0,355473.

Lack of statistical significance, does not mean the end for the research data being analysed. Field (2009:56) asserts that the importance of research findings should not be limited to their statistical significance, but that the magnitude of the difference between data should be considered through the effect sizes. The following sections discuss the individual means for the comprehension tests and their effect sizes, which indicate practical significance. The comparison of the comprehension test score means for the videos will be discussed first, followed by the means of the subtitle conditions, which will enable the researcher to answer the research questions in more detail.

4.3.1.1 Comparisons of the comprehension test means for videos

As previously mentioned, a statistically significant difference was found in the differences of comprehension scores for all the videos, regardless of condition (p=0,000). The maximum score for all five tests was 10. As a second step, effect sizes where calculated based on the differences in the mean comprehension scores for all the videos that were viewed. The summary of the findings is provided in Table 4-2 below. The effect sizes indicate the magnitude of practical significance in the differences.

Table 4-2: *Differences between comprehension test score means for all participants across all conditions for the 5 videos viewed during the study*

		Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
		Effect sizes			
VIDEO	**Mean comprehension score**	**Video 1**	**Video 2**	**Video 3**	**Video 4**
Video 1	6,223				
Video 2	3,965	1,19			
Video 3	4,931	0,68	0,51		
Video 4	5,431	0,42	0,77	0,26	
Video 5	6,106	0,06	1,13	0,62	0,36

Overall, participants scored the highest in their comprehension score for Video 1 with a mean score of 6,223. The participants scored second highest for Video 5 with a mean of 6,106, and third highest for Video 4 with a mean score of 5,431. This was followed by Video 3 with a mean score of 4,931 and Video 2 with a mean score of 3,965. The analysis presented in Table 4-2 compared the comprehension test means for the different videos and presents the effect sizes to indicate whether these differences carry practical significance or not. As shown in Table 4-2, the biggest effect size in the difference between the participants' comprehension test scores was found for Video 1 and Video 2 (1,19); and the second biggest effect size was found between the comprehension test scores for Video 5 and Video 2 (1,13). The effect sizes of these two comparisons were large, indicating practical significant differences. From these effect sizes it may be inferred that the participants' comprehension scores were higher in Video 1 and Video 5 when compared to the performance in Video 2, which had the lowest scores mean. This may be as a

result of the video itself, without factoring in the subtitling conditions, meaning that Video 2 may have been more difficult to comprehend.

Practically visible difference is demonstrated in the medium effect sizes of the differences in means of the participants' comprehension scores for Video 2 and Video 4 (0.77), Video 1 and Video 3 (0,68) and Video 2 and Video 3 (0,51). This means that for the comparison between Video 2 and Videos 4 and 3, participants performed lower in Video 2. This may be due to the video itself, meaning that to some extent Video 2 may be more difficult to comprehend. The readability tests indicated that all the videos' subtitles were appropriate for students in Grade 6 and below. However, the Coh-Metrix measures indicated that Video 2 was the more abstract when compared to these videos, which may explain why the participants found it difficult. The same can be deduced about Video 3 when it is compared to Video 1.

In contrast, the effect sizes for the participants' comprehension scores for Videos 1 and 4 (0,42), Videos 4 and 5 (0,36), Videos 3 and 4 (0,26) and Videos 1 and 5 (0,06) were small indicating no practical significance in the differences. This means that there is no significant difference in the means of the comprehension scores for these videos.

4.3.1.2 Comparisons of the comprehension test means for video conditions

As shown in Table 4-1, the differences in the means of the comprehension scores for video conditions display no statistical significance (p=0,570). This may mean that the video conditions (subtitle style and subtitle language) had no statistically significant effect on participants' comprehension scores. Despite the lack of statistical significance, one may still be able to draw conclusions based on the magnitude of the differences illustrated through effect sizes. The summary of the findings is provided in Table 4-3. The effect sizes indicate the extent of how practically significant the differences in means are.

Table 4-3: *Differences between means of comprehension for the subtitle condition*

Video Condition	Mean comprehension score	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
		Effect sizes			
		FSE	**FSS**	**KSE**	**KSS**
Full Subtitles English (FSE)	5,471				
Full Subtitles Sesotho (FSS)	5,157	0,17			
Keyword Subtitles English (KSE)	5,672	0,11	0,27		
Keyword Subtitles Sesotho (KSS)	5,085	0,20	0,04	0,31	
No Subtitles (NS)	5,271	0,11	0,06	0,21	0,10

Overall participants scored the highest in their comprehension for videos viewed with KSE with a mean score of 5,672. The second highest mean score was found for videos viewed with FSE at 5,471, which was higher than for the videos viewed with NS, with the score mean of 5,271. The second lowest mean comprehension score was recorded for videos viewed with FSS at 5.157, and the participants scored the lowest for the videos with KSS with a mean score of 5,085.

When comparing the test scores means there appears to be a potential influence of language with the comprehension test score means for the English subtitles, FSE (M=5,471) and KSE (M=5,672), being higher than the means for Sesotho subtitles, FSS (M=5,157) and KSS (M=5,085). However, the differences in the means indicate small effect sizes (0,17) for FSE and FSS. Similarly, the difference in the means for KSE and KSS indicate a small effect size (0,31). These small effect sizes indicate that the differences are not practically significant. This may therefore mean that language had no practically significant effect on the comprehension test scores.

In terms of subtitle style (keyword versus full versus no subtitles), the comparison of the test scores means indicate that for the English subtitles, the participants scored higher for the keyword subtitles than for full subtitles. This means that for the English subtitles, the keyword subtitles possibly resulted in higher comprehension. On the other hand, for the Sesotho subtitles, the means indicate that the participants scored higher for the full subtitles than for the keyword subtitles, meaning that for Sesotho subtitles the keyword subtitles possibly resulted in lower

comprehension. However, the effect sizes of the differences between the mean scores were small for FSE and KSE (0,11) and FSS and KSS (0,04). This means that there was practically no difference in the effect of full and keyword subtitles on comprehension. The test scores mean for the NS style on the other hand, were higher than the means of the test scores for Sesotho subtitles and lower than those for the English subtitles. This potentially means that the English subtitles, irrespective of the style, resulted in higher comprehension than the NS style, and the Sesotho subtitles resulted in lower comprehension than the NS style. However, the effect sizes for the differences between test score means were small. The difference between the test score means for the NS and FSE styles had a small effect size (0,11). Similarly, the difference between the test scores means for the NS and FSS was small (0,06). Likewise, the differences of the test score means for NS and KSE, and NS and KSS were small with effect sizes (0,21 and 0,10 respectively). The small effect sizes indicate no practically significant difference in the test scores, possibly meaning that the subtitle style had no practically significant effect on the comprehension test scores.

The lack of practical significance as demonstrated by the effect sizes in Table 4-3, therefore, indicate that video conditions (subtitle style and subtitle language) had no effect on comprehension in the current study.

4.3.1.3 Conclusion on comprehension scores for videos and subtitle conditions

In terms of comprehension, statistically significant differences were found in the mean comprehension scores for the videos. On average participants scored the lowest in terms of comprehension for Video 2. It is the only video where effect sizes for the difference between its means and those of the other videos ranged from medium to large, meaning that there was practical significance in the differences. Therefore, it can be concluded that the content of Video 2 had an influence on comprehension. This video was a lecture on attraction, which can be deemed to be a general topic. Many participants indicated that they were familiar with the topic. The content however, contained academic terminology and concepts, which may not necessarily be familiar to the participants. This was confirmed by many participants indicating that the subject terminology was difficult. This may have resulted in the participants not performing well in the comprehension test for Video 2.

Similar to Kruger *et al.* (2014), the current study found that subtitle conditions did not have any statistically significant effect on comprehension. Minor differences were found in the mean comprehension scores for the different subtitle styles (keyword, full, no subtitles) and languages (English and Sesotho) but the effect sizes were small, indicating no practical significance. This

means that the presence or absence of subtitles had no effect on comprehension. Furthermore, it means that the language and style of subtitles also had no effect on comprehension.

The above findings answer the research questions by refuting the anticipation that Sesotho keyword subtitles would have an effect on comprehension. Even that being the case, further analysis of how the different subtitles were read and the perceptions of the participants about subtitles can shed light onto why no differences were found. Therefore, the following sections will discuss subtitle reading behaviour, participants' perceptions together with the comprehension scores and how these compare.

4.4 Subtitle reading behaviour

Research shows that subtitles are automatically read (d'Ydewalle & De Bruycker, 2007), even if the language of the audio track is known (d'Ydewalle *et al.* 1991). For this study it was important to find out the extent to which the subtitles were read, as Kruger and Steyn (2014) found that if subtitles are read fully participants perform better academically than when they are not read fully. This section, therefore, focuses on the analysis of the reading indices, which measured the extent of subtitle processing in the current study. The indices used, the Reading Index for Dynamic Texts (RIDT) and the Unique Fixations per Mean Word (UFMW), are formulae developed to calculate subtitle processing as measured through eye tracking.

The following subsections present the overall findings of the mixed effect model for the reading indices scores and detailed discussions of the individual means of scores of each reading index, reflecting the extent of subtitle processing for each subtitle condition. The effect sizes of the differences between the means will also be discussed to determine the practical significance of these differences. The sections first discuss the findings for the UFMW score and thereafter the findings for the RIDT scores.

4.4.1 The Unique Fixations per Mean Word (UFMW)

The UFMW scores were calculated for videos presented with keyword and full subtitles (FSE, KSE, FSS, KSS). As with the comprehension data, the subtitle reading data was analysed using a mixed effect model in order to determine the extent to which the different subtitle styles were read.

There was statistical significance for the video (p=0,003) and the video condition, with p = 0,000. This means that the reading behaviour was different across the videos and the different video conditions.

A detailed discussion of the individual means of scores for each video and each subtitle condition will follow in the subsections below. In addition, the effect sizes of the differences between the means will also be discussed. These will be considered in order to determine which subtitle condition was read to the greatest extent. The findings will enable the researcher to draw conclusions on the relation between subtitle reading and comprehension in the discussion of the correlations of data in Section 4.6.1.1.

4.4.1.1 Comparisons of the UFMW means for the videos

The means of the UFMW scores, reflecting the extent to which subtitles (regardless of the language and style) were read for each of the videos, and the effect sizes of the differences between these means are indicated in Table 4-4. Analysis revealed that the highest UFMW mean was recorded for the reading of subtitles in Video 1 (M=0.64). This was followed by the reading scores for the subtitles in Video 5 (M= 0,466). The subtitles in Video 5 were read to a greater extent than the subtitles in Videos 2 and 4, both of which had UFMW means of 0,452. These were followed by the UFMW mean of subtitles in Video 3 (M=0.448). The highest score that can be achieved indicating full processing of the subtitles is 1 (Kruger *et al.,* 2014). The UFMW mean closest to this is for the reading of subtitles in Video 1 (M=0.64), meaning that these subtitles were processed to a greater extent. This may be explained by the findings of the readability tests, which showed that Video 1 subtitle complexity corresponds to Grade 3 level and it had the highest level of word concreteness (34%), meaning its subtitles would be the easiest to follow. In contrast, Video 5 had the lowest UFMW score, and the readability tests found that Video 5 subtitle complexity corresponds to Grade 6 level and it had the second lowest level of word concreteness (5%), indicating that its subtitles would be the more difficult to read compared to those of Video 1.

Table 4-4:　　　*Differences between UFMW means for the videos*

VIDEO	Mean UFMW score	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
		Effect sizes			
		Video 1	Video 2	Video 3	Video 4
1	0.64				
2	0.452	0.75			
3	0.448	0.77	0.02		
4	0.452	0.75	0.00	0.02	
5	0.466	0.69	0.06	0.07	0.06

Effect sizes were calculated to indicate practical difference between the UFMW score means for the different videos. From these a medium effect indicating practically visible difference was seen between the difference in the means of Video 1 and all the other videos used in the study. These effect sizes ranged from 0.69 – 0.77. The effect sizes of the differences between the means for the other videos ranged from 0.07 for Videos 3 and 5, to 0.00 for Videos 2 and 4. All these effect sizes were small indicating no practically significant difference, in other words there was no significant difference in how the subtitles were processed in the different videos.

4.4.1.2 Comparisons of the UFMW means for the subtitle conditions

The means of the UFMW scores, reflecting the extent to which subtitles were read for each subtitle condition, and the effect sizes of the differences between these means are indicated in Table 4-5. Analysis revealed that the highest UFMW means were recorded for the reading of the full subtitles. The highest mean (M=0,699) was found for the reading of the FSE subtitles, followed by the reading scores for the FSS subtitles (M=0,534). The FSS subtitles were read to a greater extent than the KSS subtitles (M= 0,417), which was in turn greater than the UFMW mean of KSE subtitles (M=0,316). The UFMW mean closest to full processing, indicated by a reading score of 1, is for the reading of FSE, meaning that FSE subtitles were read more optimally.

The reading scores reflecting that the full subtitles were read to a greater extent is puzzling as keyword subtitles typically do not include words that are usually skipped in normal reading. A plausible explanation for this may be the novelty of the keywords, as participants found them difficult to read because they were unfamiliar with them.

Table 4-5:   ***Differences between UFMW means for the subtitle conditions***

		Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference		
		Effect sizes		
Video Condition	**Mean UFMW score**	**FSE**	**FSS**	**KSE**
Full Subtitles English (FSE)	0,699			
Full Subtitles Sesotho (FSS)	0,534	0,66		
Keyword Subtitles English (KSE)	0,316	1,53	0,87	
Keyword Subtitles Sesotho (KSS)	0,417	1,12	0,47	0,40

In order to explore the possible impact language had on subtitle reading, the effect sizes of UFMW means for FSE and FSS will be compared, as well as those of KSE and KSS. The means for full subtitles indicate that FSE (M=0,699) has a higher UFMW mean score than FSS (M=0,534). The effect sizes indicate that the difference in the extent to which participants read the FSE and FSS subtitles was medium at 0,66, indicating practically visible significance. This means that for full subtitles, the full English subtitles appear to have been read to a greater extent than the full Sesotho subtitles. The means for the keyword subtitles on the other hand indicate that the reading of KSS (M=0,417) had a higher UFMW mean score than that of KSE (M=0,316). Unlike for the FSE and FSS, effect sizes for the extent to which KSE and KSS were read is considered small at 0,40, indicating no practically significant difference. This means that for keyword subtitles, although the means show that the Sesotho keywords were read to a greater extent than the English keywords, the effect size demonstrates that actually the subtitles are read to the same degree (the language of the subtitles therefore did not have an effect on the reading thereof). Based on these findings language may have a possible influence on how the subtitles were read in the case of full subtitles only, with the English subtitles being read to a greater extent.

Regarding the influence of the subtitle style on the extent of subtitle reading, this section will focus on the effect sizes of the difference in the means of UFMW scores for the extent of reading the FSE and KSE, and FSS and KSS. In Table 4-5, a large effect size (1,53) between the UFMW means for FSE and KSE is demonstrated, indicating practically significant difference in how the subtitles were read. The English full subtitles were read to a greater extent than the English

keywords. However, the effect size of the means of the Sesotho subtitles paint a different picture. Although the means of the UFMW scores for FSS and KSS portray that the full subtitles are read to a greater extent than the keywords, the effect size (0,47) is regarded as small to medium, indicating slightly practically visible difference in the extent of subtitle reading. This means that the full subtitles were read to a slightly greater extent than the keyword subtitles. Based on these findings it can be inferred that subtitle style has an effect on the reading of the subtitles, with the full subtitles being read to a greater extent. Correlations with secondary data in later sections may provide additional insight.

This analysis demonstrates differences in how the different subtitle styles were read. With regard to language the English were seemingly read to a greater extent than the Sesotho subtitles. In terms of style, the English full subtitles were seemingly read to a greater extent compared to the English keyword subtitles. The Sesotho full subtitles, on the other hand, were seemingly read more or less to the same extent as the Sesotho keyword subtitles. However, none of these findings are statistically significant.

4.4.2   The Reading Index for Dynamic Texts (RIDT)

The RIDT scores were calculated for videos presented with keyword and full subtitles (FSE, KSE, FSS, KSS). As with the UFMW score, the RIDT scores were analysed using a mixed effect model in order to determine the extent to which the different subtitle styles were read using the RIDT.

The RIDT shows statistical significance with regard to the video condition ($p = 0.000$). This means that the extent to which the subtitles were read vary from subtitle condition to subtitle condition, as would be expected from the findings for UFMW. The discussion will focus on the effect sizes to describe these differences.

Variance was measured through estimates of covariance parameters which provide an indication of the variance within the data. The estimate for residual was 0,033182 and the estimate for the participant was 0,016323.

4.4.2.1   Comparisons of the RIDT means for the videos

The means of the RIDT scores, reflecting the extent to which subtitles (regardless of the language and style) were read for each video, and the effect sizes of the differences between these means are indicated in Table 4-6. Analysis revealed that similar to the UFMW, the highest RIDT mean was recorded for the reading of subtitles in Video 1 (M=0.439). This was followed by the reading scores for the subtitles in Video 2 (M= 0.346). The subtitles in Video 2 were read to a greater extent than the subtitles in Videos 3 and 5, both of which had RIDT means of 0,34. These were followed by the RIDT mean of subtitles in Video 4 (M=0.337). The means demonstrates that the

subtitles for all the videos were not optimally processed as the highest score achieved is below 0.5 (M=0.439). As indicated previously full processing is indicated by a score of 1 (Kruger *et al.,* 2014). As found for the UFMW, Video 1 subtitles were read to the greatest extent. This may be explained by the fact that the complexity level of these subtitles was found to correspond to Grade 3 level by the readability tests.

Table 4-6: **Differences between UFMW means for the videos**

VIDEO	Mean RIDT score	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
		Effect sizes			
		Video 1	**Video 2**	**Video 3**	**Video 4**
1	0.439				
2	0.346	0.42			
3	0.34	0.44	0.03		
4	0.337	0.46	0.04	0.01	
5	0.34	0.44	0.03	0.00	0.01

In order to indicate practical difference between the RIDT score means for the different videos, effect sizes were calculated. The difference between the means of Video 1 and all the other videos used in the study indicated a small to medium effect, with effect sizes ranging from (0.439 -0.337). This indicates slight practically visible difference. The effect sizes of the differences between the means for the other videos ranged from 0.01 – 0.04, which were small indicating no practically significant difference, in other words there was no significant difference in how the subtitles of these videos were processed.

4.4.2.2 Comparisons of the RIDT means for the subtitle conditions

In the previous subsection the overall findings of the mixed effect model analysis for the UFMW scores were presented. This subsection will provide a detailed discussion of the individual means of scores of each subtitle condition. Furthermore, the effect sizes of the differences between the means will also be discussed, in order to determine which subtitle condition was read to the greatest extent. These findings will enable the researcher to draw some conclusions on the effect of subtitle reading on comprehension by looking into data correlations in a later section, and allows for comparison with previous studies that analysed RIDT scores.

Table 4-7:   *Differences between RIDT means for subtitle conditions*

Video Condition	Mean RIDT score	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference		
		Effect sizes		
		FSE	**FSS**	**KSE**
Full Subtitles English (FSE)	0,538			
Full Subtitles Sesotho (FSS)	0,457	0,36		
Keyword Subtitles English (KSE)	0,206	1,49	1,13	
Keyword Subtitles Sesotho (KSS)	0,242	1,33	0,97	0,16

Table 4-7 demonstrates the means of the RIDT scores, reflecting the extent to which subtitles were read for each subtitle condition, and the effect sizes of the difference between the means. As to be expected, it can be reported that similar to UFMW, the RIDT mean scores mean indicate that the full subtitles were read to a greater extent than the keyword subtitles. On average the FSE subtitle style was read to the greatest extent when compared to all the subtitle styles, generating the highest RIDT mean score of 0,538. This was followed by FSS subtitle style RIDT scores with a mean of 0,457. Similar to the UFMW, the RIDT mean scores show that the Sesotho keyword subtitles (KSS) with the mean of 0,242 were read to a greater extent than the English keyword subtitles (KSE) with the lowest mean score of 0,206. Kruger *et al.* (2014) assert that a score closer to 1 indicates full processing, and Table 4-6 demonstrates the highest reading score just above 0,5 for FSE subtitles, meaning that even the highest scoring subtitles were not processed optimally. The lowest scores at 0,242 (KSS) and 0,206 (KSE) indicate even lower processing.

In order to investigate whether language had a potential impact on subtitle reading, the effect sizes of difference between the RIDT means for the FSE and FSS as well as those of the KSE and KSS will be discussed. The means of the RIDT scores for the full subtitles indicate a higher RIDT score for the FSE, meaning that the full English subtitles were read to a greater extent than the full Sesotho subtitles. On the other hand, the means for the keyword subtitles indicate a higher RIDT score for the KSS subtitles, meaning that the keyword Sesotho subtitles were read to a greater extent than the keyword English subtitles. The effect sizes of the difference between the

RIDT mean scores for the full and keyword subtitles were considered in order to determine the practical significance of the difference in subtitle reading.

In the case of full subtitles, the effect size of the difference in the RIDT scores between the FSE and FSS subtitles is small (d = 0,36), indicating no practically visible significance difference; meaning that no practical difference was observed in how these subtitles were read. Therefore, it cannot be said that the language affected the processing of the full subtitles.

Similarly, the effect sizes of the keyword subtitle (KSE and KSS) means were small, demonstrating no practical significance at 0,16. This means that although the RIDT mean scores show that the Sesotho keyword subtitles were read more than the English keyword subtitles, there was no practical difference observed in how these subtitles were read. This means that the English and the Sesotho subtitles were read to the same extent. It can thus be concluded that for both full and keyword subtitles, language appeared to have had no effect on the extent to which the subtitles were read.

It is interesting to find that language cannot be confirmed to have an effect in how the subtitles were read. A difference was expected considering the fact that the participants' academic background was primarily in English and seeing academic content in Sesotho was a new experience. However, despite the familiarity of English and novelty of Sesotho, the participants read the English and Sesotho subtitles to the same extent. This could be because the use of Sesotho in the classroom is not as novel as thought to be, as codeswitching is common strategy used in the classrooms to facilitate teaching and learning (Probyn, 2009:124).

With regard to influence of the subtitle style on the extent of subtitle reading, this section will focus on the effect sizes of the difference in the means of RIDT scores for the extent of reading the FSE and KSE, and FSS and KSS. A large effect size (1,49) between the RIDT means for FSE and KSE is demonstrated, indicating practically significant difference in how the subtitles were read. This means the English full subtitles were read to a greater extent than the English keywords. Similarly, a large difference (0,93) is demonstrated for the effect sizes of the difference between the FSS and KSS means. This means that the Sesotho full subtitles were read to a greater extent than the Sesotho keywords. The large effect sizes observed in the differences between the RIDT means of both the full and keyword subtitles in both languages indicate practically significant differences in how the subtitles were read. This means that the full subtitles were read to a greater extent than the keywords, possibly due to the fact that participants whose previous exposure to subtitles was full subtitles were unfamiliar with the keywords. Processing keyword subtitles may be difficult since processing missing information in a sentence may be cognitively demanding (Moran, 2012:197).

4.4.3 Conclusion regarding the effect of subtitle language and style on the extent of reading

The possible impact of subtitle language and style on subtitle reading was explored by means of comparing effect sizes of the UFMW and RIDT means across subtitle conditions. The analyses demonstrate differences with regard to the extent to which the subtitles were read in terms of the RIDT and the UFMW scores. As indicated in Figure 4-3, higher scores were recorded for the UFMW than for the RIDT, which can be expected since the RIDT formula penalises the reader for regressing, which would by default generate a lower reading score (Matthew, 2019).
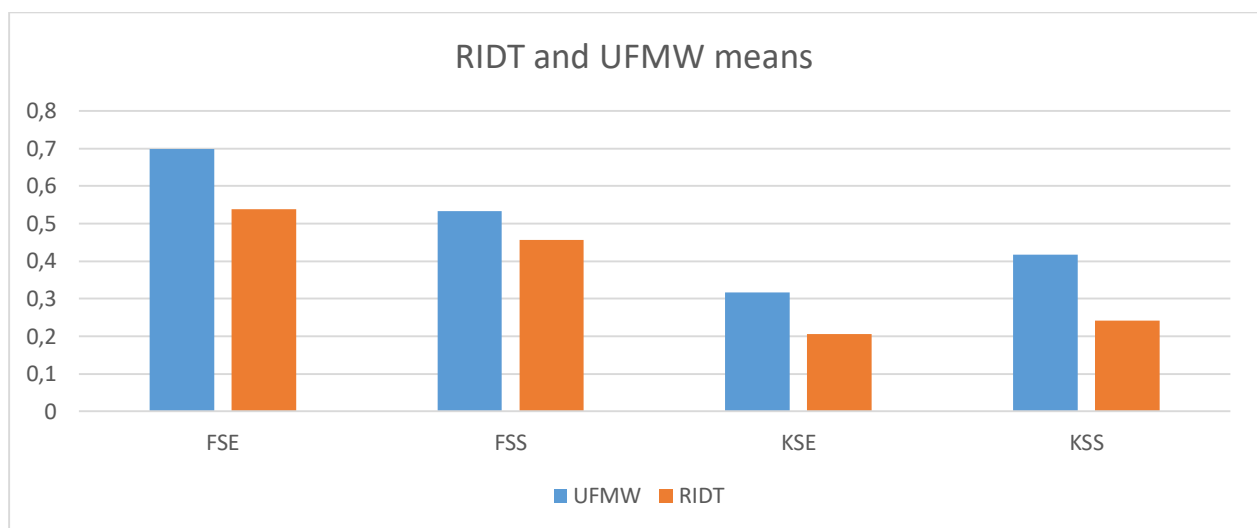
Figure 4-3:   *Comparisons between the means of RIDT and UFMW across the four subtitle conditions*

Some additional differences between the findings of the UFMW and the RIDT were also identified in terms of the subtitle language and the style. With regard to the subtitle language, the analysis demonstrates different findings for the UFMW and the RIDT. For the UFMW the effect size of the difference between the mean scores for FSE and FSS was medium with practically visible difference, meaning that the English subtitles were read to a greater extent. This means that for full subtitles language may have an effect on the degree to which subtitles are read, with the English subtitles being read more. The RIDT on the other hand, demonstrated a small difference with no practically visible difference, meaning there was no difference in how the full subtitles were read. It is interesting to note that even though their findings were not significant, Kruger *et al.* (2014) also found that English subtitles were read to a greater extent than Sesotho subtitles. Since English is the LoLT in the South African education system, it can be expected that the participants would read the English subtitles more as they have been exposed to reading academic texts in English, whilst reading in Sesotho is reserved for the Sesotho language class mainly. This unfamiliarity of reading academic texts in Sesotho could be the reason for the

Sesotho full subtitles being read to a lesser degree. However, when considering both the UFMW and RIDT scores means for the keyword subtitles, it appears that the unfamiliarity did not affect the reading of the keyword subtitles. The means for both indices demonstrate a greater reading of the Sesotho keyword subtitles. However, the effect sizes of the difference between the means are small, denoting no practically significant difference in the reading of the KSE and KSS. It is interesting that despite the unfamiliarity of reading Sesotho academic texts there was no practical difference in the reading of the KSS and the KSE (that the difference observed for the language of full subtitle reading was not observed here), meaning that language did not have an effect on the degree to which keyword subtitles were read.

In terms of subtitle style, the effect size of the difference between the UFMW and RIDT scores means for the reading of the FSE and KSE is large, indicating a practically significant difference in the degree to which the subtitles were read with the full subtitles being read to a greater extent. On the other hand, there is variation in terms of differences between FSS and KSS for the RIDT and the UFMW. The RIDT demonstrates a large effect size indicating practical significance, meaning the full subtitles were read to a greater extent than the keywords. The UFMW on the other hand indicates a small to medium difference indicating slightly practically visible difference, with the keyword subtitles read almost to the same extent as the full subtitles.

These findings generally mean that full subtitles were read to a greater extent than the keyword subtitles, refuting the expectation for keyword subtitles to be read to a greater extent than the full subtitles. The expectation was that the participants would be able to read more of the keyword subtitles than the full subtitles as the keyword subtitles contain less content to read. It is important to acknowledge a potentially significant confound here in that the RIDT was developed with English full subtitles in mind. Reading full sentences requires a different reading style than reading individual words, which together with phrases made up the keyword subtitles. Therefore, it is possible that this skews the results, meaning it is not always possible to compare the reading of full and keyword subtitles. Nevertheless, the UFMW scores, which are a more robust measure for this comparison, indicate similar patterns in the findings, which strengthens the findings.

In order to obtain information that could assist with the interpretation of the results of the comprehension test and subtitle reading data collected, participants were requested to complete questionnaires after each viewing. The questionnaires investigated the participants' perceptions regarding subtitles both in the experiments, in general and in the educational context. The findings of the questionnaire data will be discussed in the next section.

4.5 Questionnaire data

The study used two questionnaires, as described in the methodology section. The first one consisted of nine questions about the participants' experience in the experiment, which was completed after each comprehension test. In the second questionnaire (completed at the end of the study, after all five videos had been viewed), participants were asked about their overall experiences with subtitles and perceptions about subtitles in education. This section discusses the results of the questionnaires and their possible impact on the study results. First, the results of the first questionnaire are discussed, then the results of the second questionnaire.

4.5.1 Questionnaire 1: user experience

After viewing each video, the participants completed a comprehension test, which was followed by the participants completing a questionnaire rating their viewing experience and providing feedback on their perceptions of the video. The questionnaire was used in order to gain more understanding of factors that could possibly have influenced the viewing and reading of the subtitles in the experiment.

A study on subtitles cannot ignore the possibility that subtitles may place cognitive demands on participants. The questionnaire was therefore employed in order to investigate if the participants experienced any task load during the experiment and if the subtitles were perceived to either be the source of the load or to have contributed to the possible load. The first part of the questionnaire consisted of nine questions, which measured various aspects that may contribute to task load perceptions. The questions were presented as statements, which the participants responded to on a ten-point scale. Field (2009:628) explains that this type of investigation, which measures latent variables (those variables that cannot be directly measured) by measuring aspects of the latent variable, is common in social sciences research. This type of investigation results in big data sets, the results of which may not be easy to understand and trends may not be easy to identify. The solution would be to report the data in terms of the latent variables.

One technique for determining groups of variables is exploratory factor analysis (Field, 2009:268). Cohen *et al.* (2018:818) define factor analysis as "a method of grouping together variables which have something in common. It is a process which enables the researcher to take a set of variables and reduce them to a smaller number of underlying (latent) factors which account for as many variables as possible". In addition to data reduction, Hair, Black, Babin, and Anderson (2014:92) assert that exploratory factor analysis is "useful in searching for structure among a set of variables". An exploratory factor analysis was conducted in order to group the questions in the questionnaire according to the latent variables, thereby reducing the size of the data. In addition to grouping the questions into factors, the exploratory factor analysis also serves to ensure validity

of the factors. Hair *et al* (2014:3) define validity as the degree to which a concept of study is correctly represented by a measure. This means that exploratory factor analysis ensures that the questions accurately test what they sought to test, which is the latent variable, i.e., the factor identified. In the sections below, the exploratory factor analysis process will be discussed, followed by the actual analysis of the questionnaire data.

4.5.1.1 Exploratory Factor Analysis

In order to group the items into latent factors, the factorability of the nine items of the first section of the questionnaire was examined by checking for multicollinearity and correlations between the questions. The check was necessary because as Field (2009:648) explains, "If our test questions measure the same underlying dimension (or dimensions) then we would expect them to correlate with each other (because they are measuring the same thing)". These checks therefore assist to ensure that questions that correlate are grouped into the same factors.

There are a number of ways to test for the extent to which the variables are related. Field (2009:649) identifies the "determinant" as one such diagnostic tool. If the determinant presents correlations that are too high, it means that the same question is repeatedly measured. If the determinant is >0.00001 it indicates no severe multicollinearity. For this dataset the determinant =0.46, indicating no severe multicollinearity, meaning that the variables are not related and can thus be allocated to different groups.

In addition to the determinant, Bartlett's Test of Sphericity also tests if the correlations between items are high enough. "Bartlett's test tells us whether our correlation matrix is significantly different from an identity matrix. Therefore, if it is significant then it means that the correlations between variables are (overall) significantly different from zero" (Field, 2009:648). According to Field (2009:648) the scores of this test indicate if the variables can be grouped into a factor. He further asserts that any variables exhibiting very low or very high correlation with other variables should be excluded from the factor analysis. If $p<0.05$ then the correlations are sufficient, and for the current data $p=0.001$.

Field (2009:645) asserts that the correlation coefficients vary according to sample size, particularly so in small samples. However, no clear guideline exists in terms of sample size with some suggesting 10-15 participants per variable to be adequate and others going up to 300 participants. Sampling adequacy, which determines if there is sufficient data, is determined using the Kaiser-Meyer-Olkin (KMO) measure. According to Field (2009:647), KMO measures may be described as follows: <0.5: not acceptable; 0.5-0.7: medium; 0.7-0.8: good; 0.8-0.9: very good and >0.9: superb. Cohen *et al.* (2018:827) recommends a KMO value of 0.6 or higher. The KMO for the questionnaire used in the current data is 0.7 which indicates sample adequacy. Field

(2009:647) asserts that a KMO "value close to 1 indicates that patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors". This therefore means that the sample size in the current study, which the researcher was concerned that it might be considered too small to conduct analysis, is adequate for factor analysis of the questionnaire to produce reliable factors.

Following the determination of the variable correlations and the sample size adequacy, the next step was to check if there was enough variance in the questions retained in the factors extracted. This was done by considering the communalities of the factors; which indicate what proportion of the variance of each question is explained by the extracted factors. The goal is to ensure that each variable is linked to only one factor, thus if a question has little in common with the other questions in the factor, it will demonstrate low communality and the question should be eliminated from the factor group (Hair *et al.*, 2014:117). The authors further assert that variables that are explained by two or more factors should also be eliminated to avoid a complicated structure, which makes interpreting the data difficult (2014:117). On the other hand, high communalities, closer to 1.0, indicate that the factors represent the variables and thus variables are retained in the group. Communalities per variable should be larger than 0.3 (Field, 2009:678). In the current study, all the questions' communalities were above 0.3 except for question 1 and question 9 as demonstrated in Table 4-8. These two variables were retained in the factors despite showing low communalities. According to Yong and Pearce (2013:84), factors are determined by largest loadings, but the low loadings are also important and should be considered when identifying factors. This means that even questions with communalities at 0.3 and below may be represented by a specific factor. It is for this reason that question 9, which has a low communality of 0.302, is retained in the subtitle factor. Furthermore, the question shares a common theme with the other questions in this factor that address the participants' experience of the subtitles. On the other hand, question 1 has a negative communality of -0.454. DeCoster (1998:1) asserts that "Measures that are highly correlated (either positively or negatively) are likely influenced by the same factors…". Therefore, in the case of question 1 we find a negative correlation, which is retained in the content factor as it shares a common theme with the other questions in the factor that deal with the participants' perception of the difficulty of the content.

Lastly, the aspect of total variance percentage was checked in order to determine how many factors should be extracted. Hair *et al.* (2014:107) determine that in order to ensure that the extracted factors are practically significant, they should explain a predetermined minimum amount of variance. They explain that the guidelines for this total variance vary from discipline to discipline, for example the natural sciences require that the extracted factors should explain at least 95% of the total variance, whereas the social sciences may consider the factors accounting for 60% of variance, or even less, as satisfactory (Hair *et al.,* 2014:107). Given that the social

sciences may have a variance lower than 60%, a minimum cumulative percentage threshold of at least 50%, as suggested by Sauro and Kindlund (2005:403), was applied when setting the minimum cumulative percentage in this factor analysis. The results indicate that for this data 52.198% of the variance was explained by the two extracted factors and thus the questionnaire questions were grouped according to the two factors. The common themes of the factors are (1) the participants' perception of the difficulty of the content of the videos and (2) the participants' perceptions of the subtitles. The following results are demonstrated in Table 4-8: questions 1, 2, 3, 4 and 8 are included in factor 1, which is about the difficulty of content, terminology and language. Factor 2, as reflected in Table 4-8, consisted of questions 5, 6, 7 and 9 which are about the helpfulness of the subtitles, the ease to read the subtitles and their effect on concentration. Factor 1 is labelled as "content factor" and factor 2 as "subtitle factor". The values in the columns under the factors are the communality values demonstrating the variance between the questions in the factor. As indicated previously, questions in a factor may have the lowest communality of 0.3 in order to be retained in a factor.

Table 4-8: **Results of a factor analysis determining the variance in the questionnaire questions**

	Factors	
	1 (Content)	2 (Subtitle)
1) How familiar were you with the content of the lecture you just watched?	-0,454	
2) The content of the video was very difficult	0,777	
3) The subject terminology used in the video was very difficult	0,744	
4) The language used in this video was very difficult	0,654	
5) I found the subtitles easy to read		0,860
6) The subtitles helped me understand the topic		0,898
7) The subtitles helped me understand the terminology in the video		0,895
8) The language used in the subtitles was very difficult	0,548	
9) Subtitles made concentrating on the video difficult		0,302

4.5.1.2 Factor Reliability Test

In the previous section, a description of how the factors were determined and their validity was provided. According to Field (2009:673), if factor analysis is used to validate a questionnaire, as this study has done, then a check of the reliability of the scale is recommended. He explains that reliability means that a questionnaire "should consistently reflect the construct that it is measuring.

One way to think of this is that, other things being equal, a person should get the same score on a questionnaire if they complete it at two different points in time" (Field, 2009:674). This means that if the person does not undergo any intervention that might influence the scores, such as attending a workshop addressing the content of the videos, they should get the same scores for the questionnaire completed at different times. Similarly, Levishna (2015:364-365) explains reliability as a way of determining the extent to which the questions in the questionnaire are related and reflect the underlying factors. Field (2009:674) states that this can be determined by dividing the data set into two and calculating the score of each participant for each half. A similar score on both halves indicate a very reliable scale. However, this method is problematic given the numerous ways in which data sets can be divided (Field, 2009:674).

A solution to this problem is found in Cronbach's (1951) measure which Field (2009:674) describes as "equivalent to splitting data in two in every possible way and computing the correlation coefficient for each split". The result is the most common measure of reliability, the Cronbach's Alpha, which is the average of calculated correlation coefficients (Field, 2009:674). This measure calculates the variance within an item plus the covariance between a specific item and any other item in the questionnaire (Field, 2009:674). The Cronbach Alpha value should be at least 0.5 but preferably above 0.7 (Field, 2009:675). For this study the Cronbach Alpha values for both factors were within this guideline. The Cronbach's Alpha for content factor, which consists of questions addressing content difficulty was at 0.635 as reflected in Table 4-9; and for subtitle factor, which consists of questions addressing the participants' perception of the helpfulness of the subtitles, it was at 0.659 as indicated in Table 4- 9. This meant that both factors are deemed as reliable.

Table 4-9: **Results of the reliability test of the questions regarding the content factor**

Reliability Statistics for content factor questions		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,635	0,650	5

Table 4-10: **Results of the reliability of the questions regarding the subtitle factor**

Reliability Statistics for subtitle factor questions		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,659	0,641	4

4.5.1.3 Comparisons of the questionnaire factors

The questionnaire data was analysed using mixed method models in order to determine how the participants perceived the videos to see if they could explain 1) the performance of the participants in the comprehension tests and 2) the participants' processing of the different subtitles. The data was analysed in terms of the two factors of content and subtitles. This section will discuss the findings of the questionnaire analysis for the two factors.

4.5.1.3.1 Factor 1: Perceived difficulty of content

The content factor of the questionnaire included questions that focus on the level of difficulty the participants experienced in terms of the content of the video and subtitles. Participants responded to questions presented as statements on how familiar they were with the content of the lecture, and whether (1) the content of the video, (2) the subject terminology used in the video, (3) the language used in the video and (4) the language used in the subtitles was very difficult. The participants were required to rate their experiences on a scale of 1–10 with 1 being not at all and 10 being is completely the case.

A mixed effect analysis was conducted for the content factor. The findings of the analysis indicate that the video (p=0,041) and the interaction between the video and the video condition (p=0,024) had a statistically significant effect on the participants' perception of the content difficulty. The video condition (p=0,50) on the other hand showed no statistical effect on the participants' perception of content difficulty.

Variance was measured through estimates of covariance parameters, which provide an indication of the variance within the data. The estimate for residual was 1,368968, whereas the estimate for the participant was 0,663734.

A detailed discussion of the individual means of scores for the videos and the interaction between the video and the video condition will follow in the next subsections. The means are calculated from a rating scale of 1-10. A low mean indicates the perception that the content was not difficult, whilst a higher mean indicates that the content was perceived to be difficult. In addition, the effect sizes of the differences between the means will also be discussed. These will be considered in order to make observations regarding the participants' perceptions of content difficulty.

The effect of videos on the perception of content difficulty

In this subsection the means of the content factor for each video will be discussed in detail. The discussions will also include the effect sizes to see if the differences in the means has any

practical significance in order to make inferences regarding the participants' perceptions of the content factor with regard to the video.

Table 4-11:   *Content factor means for the different videos*

VIDEO	Mean	Effect sizes			
		Practical significance guideline: **≈ 0.2 Small, No practically significant difference** **≈ 0.5 Medium, Practically visible difference** **≈ 0.8 Large, Practically significant difference**			
		Video 1	Video 2	Video 3	Video 4
1	3.496				
2	3.6	0.07			
3	3.926	0.30	0.23		
4	3.684	0.13	0.06	0.17	
5	4.297	0.56	0.49	0.26	0.43

As can be seen in Table 4-11, Video 5 (M = 4.297) was found to be relatively difficult and was followed by Video 3 (M = 3.926). The next two videos, Video 4 (M = 3.684) and Video 2 (M = 3.6), were perceived to be more or less equal in terms of content difficulty. Video 1 (M=3.496) was perceived to be the least difficult. Looking at these means one may deduce that they are perceived to be of equal level of difficulty. This is supported by the effect sizes of the differences in the content factor means for all videos, with the exception of the difference between Video 5 and Video 1. This effect size is medium (0.56), showing practically visible difference in the perceptions of difficulty. The differences between the rest of the videos show a small effect, indicating no practically significant difference. This implies that generally the videos had no effect on the participants' perceptions of content difficulty.

The effect of the interaction between the video and the video condition on the perception of content difficulty

This subsection will discuss, in detail, the means of the content factor for each subtitle condition per video as demonstrated in Table 4-12(a) to Table 4-12(e). The discussions will also include the effect sizes to see if the differences in the means has any practical significance in order to make inferences regarding the participants' perceptions of the content factor.

Table 4-12(a): ***Content factor means for interaction between video 1 and subtitle conditions***

	VIDEO	Mean	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
			Effect sizes			
	VIDEO	Mean	FSE	FSS	KSE	KSS
1	Full Subtitles English (FSE)	2,793				
	Full Subtitles Sesotho (FSS)	4,117	0,93			
	Keyword Subtitles English (KSE)	2,233	0,39	1,32		
	Keyword Subtitles Sesotho (KSS)	3,247	0,32	0,61	0,71	
	No Subtitles (NS)	5,088	1,61	0,68	2,00	1,29

Regarding Video 1, Table 4-12(a) demonstrates that the content was found to be relatively difficult for the NS condition (M=5,088), which was followed by the FSS condition (M=4,117). In terms of the KSS condition (M=3,247) the content was perceived to be slightly difficult. The content was not difficult for the FSE (M=2,793) and KSE (M=2,233) conditions. From these means it is observed that content is perceived to be less difficult in the presence of subtitles than when subtitles are absent. It is, however, important to measure the effect of the differences in these means through effect sizes. In terms of the language of the subtitles, the effect size of the differences between the means of content factor for the FSE and FSS is large (0,93) with practically significant difference, whereas that of the KSE and KSS is medium (0,71) with practically visible difference – in both instances, the content of video 1 was perceived to be less difficult in the presence of English subtitles.

With regard to the subtitle style, the effect size of the differences between the content factor means for the FSE and KSE subtitles is small (0,39), with no practically significant difference. This means that the content was perceived to be at the same level of difficulty for the English subtitles, regardless of whether the video was viewed with full or keyword subtitles On the other hand, the effect size of the differences between the means of content factor for the FSS and KSS subtitles is medium (0,61), illustrating practically visible difference. This means that the participants perceived the content to be the less difficult with Sesotho keyword subtitles. Although

the keyword subtitles were perceived to be less difficult in both languages, practically visible difference was found only for the Sesotho subtitles. The effect size of the FSS and NS conditions was also medium (0,68) indicating practically visible difference. This means that the content for Video 1 was found to be more difficult when presented with NS than with subtitles. It can therefore be concluded that the presence of subtitles may have contributed in the video being perceived as less difficult. The effect sizes of the differences between the content factor means of the NS and the other conditions on the other hand, were large, demonstrating practically significant differences. This implies that content was perceived to be more difficult when presented with the NS condition, while the content was perceived to be easier when presented with the other, with the KSE being the easiest. This perception that the content presented with the KSE was the easiest corresponds to the comprehension scores, as the highest mean was achieved with content presented with the KSE.

Table 4-12(b): ***Content factor means for interaction between video 2 and subtitle conditions***

	VIDEO	Mean	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
			Effect sizes			
			FSE	**FSS**	**KSE**	**KSS**
2	Full Subtitles English (FSE)	3,532				
	Full Subtitles Sesotho (FSS)	4,031	0,35			
	Keyword Subtitles English (KSE)	3,917	0,27	0,08		
	Keyword Subtitles Sesotho (KSS)	4,425	0,63	0,28	0,36	
	No Subtitles (NS)	2,095	1,01	1,36	1,28	1,63

With regard to Video 2, the content was perceived to be slightly difficult when presented with the Sesotho subtitles and as demonstrated in Table 4-12(b). The content was perceived to be most difficult with the KSS (M=4,425), which is followed by the FSS (M=4,031). The content presented with the English subtitles was perceived to be less difficult, with KSE (M=3,917) and FSE (M=3,532). The means demonstrate that the content was perceived to be more difficult when presented with keyword subtitles regardless of whether the language of the subtitles was Sesotho or English. The content presented with the NS condition was perceived to be the least difficult

with a mean of 2,095. The effect sizes of the differences between the means are considered in order to determine the practical effect of the differences.

In terms of the subtitle language, the effect of the difference between the content factor means of the FSE and FSS was found to be small (0,35), and thus with no practical significance. Similarly, the KSE and KSS also demonstrated small effect size (0,36) with no practical significance. This means that the language of the subtitles had no impact on the perception of the content difficulty for Video 2.

Regarding the style of the subtitles, the effect size of the difference between the content factor means of the English subtitles (FSE and KSE) was small (0,27) demonstrating no practical significance. Similarly, the effect size of the difference between the means of the content factor for the Sesotho subtitles was also small (0,28) with no practical significance. This means that the content was perceived to be at the same level of difficulty for both the full and keyword subtitles regardless of whether the video was viewed with English or Sesotho subtitles.

On the other hand, the comparison of the content factor means for the NS condition and the subtitle conditions all yielded large effect sizes, with the lowest being 1,01 for NS and FSE conditions. These large effect sizes mean that practically there is a significant difference and it can therefore be concluded that Video 2 was perceived to not be difficult when presented in the NS condition while the content was perceived to be the most challenging when presented with the KSS. This perception that the content presented with the KSS was the most difficult corresponds to the lowest comprehension score that was obtained with content presented with the KSS.

Table 4-12(c): ***Content factor means for interaction between video 3 and subtitle conditions***

	VIDEO	Mean	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
			Effect sizes			
			FSE	**FSS**	**KSE**	**KSS**
3	Full Subtitles English (FSE)	3,475				
	Full Subtitles Sesotho (FSS)	3,288	0,13			
	Keyword Subtitles English (KSE)	3,519	0,03	0,16		
	Keyword Subtitles Sesotho (KSS)	5,426	1,37	1,50	1,34	
	No Subtitles (NS)	3,922	0,31	0,44	0,28	1,05

In terms of Video 3, the content presented with the KSS condition was found to be moderately difficult with the highest mean of 5,426, which was followed by the mean of the NS condition (M=3,922) as seen in Table 12(c). The NS condition mean was followed by that of the KSE condition (M=3,519) which was followed by the FSE (M=3,475). The video was perceived to be least difficult when presented in the FSS condition with the lowest score means (M=3,288). The means for the NS, KSE, FSE and FSS conditions indicate that the participants perceived the content to be slightly difficult when presented with these subtitle conditions. The effect of the difference in the means for the video is demonstrated by the effect sizes.

With regard to the language of the subtitles the effect size of the difference between the content factor means of the FSE and FSS, is small (0,13) with no practically significant difference. This means that the content of video 3 was perceived to be at the same level of difficulty for the full subtitles, regardless of the language of the subtitles. On the other hand, the effect size of the difference between the means of the content factor for the KSE and KSS is large (1,34) with practically significant difference. This means that for the keyword subtitles the content was perceived to be less difficult when presented in Sesotho.

In terms of the subtitle style, the effect size of the difference between the content factor means for the FSE and KSE subtitles is small (0,03), with no practically significant difference. This means that the content was perceived to be at the same level of difficulty when presented with English

subtitles, regardless of whether the video was viewed with full or keyword subtitles. On the other hand, the effect size of the difference between the content factor means of the for FSS and KSS subtitles is large (1,50), illustrating practically significant difference. This means that the participants perceived Video 3 with KSS subtitles to be the more difficult of the Sesotho subtitle conditions. The effect size of the KSS and NS conditions was also large (1,05), indicating practically significant difference. This means that Video 3 was perceived to be more difficult when presented with KSS than with any other subtitle condition. Comparisons between the means of the content factor of the video with the NS and the other conditions on the other hand demonstrate small with no practically significant differences in effect sizes. This implies that content for the video was perceived to be equally difficult when the video was presented with the other subtitle conditions; and that the presence of KSS subtitles may have contributed in making the video content to be perceived as more difficult. This video was a lecture on aggression, which like Video 2 (attraction) can be deemed to be a general topic. The participants' responses however indicated that many of them were unfamiliar with the topic. The content included academic terminology and concepts, and this may have resulted in the participants finding the video difficult. This was confirmed by many participants indicating that they found the subject terminology used in the video difficult. This can be explained by the findings of the Coh-Metrix index, which indicated a high level of abstractness of the content of Video 3. This means that the keywords contained mainly abstract words, which made them difficult.

Table 4-12(d): ***Content factor means for interaction between video 4 and subtitle conditions***

	VIDEO	Mean	Practical significance guideline: ≈ 0.2 Small, No practically significant difference ≈ 0.5 Medium, Practically visible difference ≈ 0.8 Large, Practically significant difference			
			Effect sizes			
	VIDEO	**Mean**	**FSE**	**FSS**	**KSE**	**KSS**
4	Full Subtitles English (FSE)	4,199				
	Full Subtitles Sesotho (FSS)	3,191	0,71			
	Keyword Subtitles English (KSE)	3,356	0,59	0,12		
	Keyword Subtitles Sesotho (KSS)	3,486	0,50	0,21	0,09	
	No Subtitles (NS)	4,188	0,01	0,70	0,58	0,49

With regard to Video 4, a different scenario is noted in Table 4-12(d), with half the effect sizes being medium indicating practically visible differences, and the other half small with no practical significant difference. The content was found to be slightly difficult for the FSE (M=4,199) and NS conditions (M=4,188). The content was perceived to be less difficult with the KSS condition (M=3,486), which was followed by the KSE (M=3,356) and FSS (M=3,191). This means that the content was perceived to be easier when presented with both Sesotho full and keyword subtitles and with the English keyword subtitles. The differences in the means for the video are discussed in terms of their effect sizes.

With regard to the language of the subtitles the effect size the difference between the content factor means of the FSE and FSS, is medium (0,71) with practically visible difference, whereas that of the KSE and KSS is small (0,09) with no practically significant difference. This analysis demonstrates that the content of Video 4 was perceived to be less difficult in the presence of Sesotho full subtitles. For the keyword subtitles the content was perceived to be at the same level of difficulty, regardless of the language of subtitles.

In terms of the subtitle style, the effect size the difference between the content factor means for the FSE and KSE subtitles is medium (0,50), with practically visible difference. This means that the content was perceived to be less difficult for the keyword subtitles for English; meaning for the English subtitles the subtitle style made a difference. On the other hand, the effect size of the

difference between the content factor means of the FSS and KSS subtitles is small (0,21), illustrating no practically significant difference. This means that the participants perceived Video 4 to be of equal difficulty for both full and keyword subtitles in Sesotho. The effect size of the difference between the content factor means of the NS and FSE conditions were small (0,01) with no practically significant difference. This analysis demonstrates that the content of Video 4 was perceived to equally difficult in the presence of NS and FSE. The effect size of the difference between the content factor means of the NS and KSS was small to medium (0,49) indicating a practically visible difference. This means that Video 4 was perceived to be more difficult when presented with NS. The effect sizes of the differences in the means of content factor of the NS and the FSS conditions on the other hand demonstrate definite medium (0,70) with practically visible differences. This means that the participants perceived the content to be less difficult with the FSS condition. Similarly, the effect size of the difference between the content factor means of the NS and KSE is medium (0,58) with practically visible difference. This also implies that content was perceived to be more difficult when the video was presented with the NS condition. This means that the presence of subtitles may have contributed in making the video content to be perceived as less difficult.

Table 4-12(e): Content factor means for interaction between video 5 and subtitle conditions

	VIDEO	Mean	**Practical significance guideline:** ≈ **0.2 Small, No practically significant difference** ≈ **0.5 Medium, Practically visible difference** ≈ **0.8 Large, Practically significant difference**			
			Effect sizes			
	VIDEO	**Mean**	**FSE**	**FSS**	**KSE**	**KSS**
5	Full Subtitles English (FSE)	3,793				
	Full Subtitles Sesotho (FSS)	4,318	0,37			
	Keyword Subtitles English (KSE)	4,599	0,57	0,20		
	Keyword Subtitles Sesotho (KSS)	4,898	0,78	0,41	0,21	
	No Subtitles (NS)	3,876	0,06	0,31	0,51	0,72

In terms of Video 5, the content was found to be most difficult for the KSS condition (M=4,898), which was followed by the mean of the KSE condition (M=4,599). The KSE condition mean was followed by that of the FSS condition (M=4,318) which was followed by the NS condition (M=3,878). The video was perceived to be least difficult when presented in the FSE condition

(M=3,793). This means that the content was perceived to be difficult when presented with the keyword subtitles, however, the difference between the means is not great. The effect of the difference in the means for the video is demonstrated by the effect sizes.

With regard to the language of the subtitles the effect sizes of the difference between the score means of the FSE and FSS and the KSE and KSS are small (0,37 and 0,21 respectively) with no practically significant difference. This analysis demonstrates that the content of Video 5 was perceived to be equally difficult regardless of the language of subtitles.

In terms of the subtitle style, the effect size for the FSE and KSE subtitles is medium (0,57), with practically visible difference. This means that the content was perceived to be more difficult for the English keyword subtitles. On the other hand, the effect size for FSS and KSS subtitles is small (0,41), illustrating no practically significant difference. This means that the participants perceived Video 5 with the Sesotho subtitle styles to be of equal difficulty. The effect size of the NS and FSE and the NS and FSS conditions are small (0,06 and 0,31 respectively), indicating no practically significant difference. This means that Video 5 was perceived to be equally difficult when presented with no subtitles or full subtitle conditions, meaning that the full subtitles made no difference in terms of participants' perceptions of difficulty of content. The effect size of the NS and KSE and the NS and KSS conditions are medium (0,51 and 0,72 respectively), with practically visible differences. This implies that content for the video was perceived to be less difficult when presented with the NS condition. This means that the presence of keyword subtitles may have contributed in making the video content to be perceived as more difficult. It may have been that the participants exerted more effort to process the keywords and understand the video as a whole, which is why it was perceived as more difficult with the keyword subtitles.

Concluding remarks on factor 1: content

Comparisons of the means for Video 1 show that Video 1 was found to be more difficult when presented with NS than with subtitles. This means that the subtitles were perceived to be helpful and make the content seem less difficult. In terms of the language of the subtitles, the effect sizes of the difference between the means for the FSE and FSS (0,93), and KSE and KSS (0,71) indicate that the content of video 1 was perceived to be less difficult when presented with English subtitles. With regard to the subtitle style, the effect size for the FSE and KSE subtitles is small at 0,39, meaning that the participants perceived them to be equally helpful. On the other hand, the effect sizes of the difference between the content factor means of the FSS and KSS subtitles is medium at 0,61. It can thus be concluded that the participants perceived the content presented with keyword subtitles to be the less difficult than the full subtitles.

The effect sizes of the means for Video 2 on the other hand, demonstrate that the video was perceived as least difficult when presented with NS than with subtitles. Small effect sizes for FSE and FSS (0,35) and KSE and KSS (0,36) indicate no practical significance, meaning that the language of the subtitles does not have an influence on the perception of content difficulty. Similarly, the subtitle style had no effect on the perception of content difficulty as demonstrated by small effect sizes between the FSE and KSE at 0,27 and the FSS and KSS at 0,28.

With regard to Video 3, the video was perceived to be most difficult when presented with KSS subtitles. Effect sizes of the difference between content factor means for the KSS and other subtitle conditions are large demonstrating practically significant differences, meaning that the content for Video 3 was considered to be difficult when the video had KSS subtitles. Language has an effect only in terms of the keyword subtitles where the effect size of the difference between content factor means for the of KSE and KSS is large (1,34) with practically significant difference. Similarly subtitle style has an effect where the KSS is involved, with a large effect size (1,50) between content factor means FSS and KSS subtitles, indicating that the content was perceived to be more difficult in the presence of KSS subtitles. The effect sizes between the other subtitle conditions indicate that the content is perceived to be at the same level of difficulty which was low.

In terms of Video 4, the FSE and NS subtitle conditions were perceived to be equally difficult and the most difficult. Language has an effect on the perception in terms of the full subtitles where the Sesotho subtitles (FSS) were perceived to be less difficult as demonstrated by the medium effect size between the FSE and FSS (0,71). In terms of the subtitle style, a difference is identified in the effect size for the FSE and KSE subtitles which is also medium at 0,50, meaning that the content was perceived to be less difficult for the English keyword subtitles.

Similar to Video 3, Video 5 was perceived to be the most difficult when presented with KSS subtitles. However, the effect sizes demonstrate a practically visible difference in the content factor means of KSS and NS. The effect sizes further demonstrate that language has no effect in the perceptions of content difficulty as seen in the small differences of FSE and FSS (0,37) and the KSE and KSS (0,21). In terms of the subtitle style, only the English subtitles show some practically visible difference with a medium (0,57) effect size for the FSE and KSE subtitles. This means that the participants perceived the content to be at more difficult with the English keyword subtitles, with no practical difference in the perception of the Sesotho subtitles.

The analysis showed that the interaction between the videos and the subtitle conditions has a statistically significant effect on the participants' perceptions of content difficulty. The practical significance was checked by calculating the effect sizes of the difference between the means of

the content factor. The results of the effect sizes show varying practical significance depending on the video and the subtitle condition. From these analyses it can be concluded that subtitles, regardless of whether they were in English or Sesotho, keyword or full subtitles do have an effect on the participants' perception of content difficulty. The effect of the subtitle types varies from video to video, however, and is contrary to the hope that the content would be perceived to be less difficult with the KSS specifically.

4.5.1.3.2 Factor 2: Perceived helpfulness of subtitles

The subtitle factor consisted of four questions, which focused on the subtitles in the video and how helpful they were perceived to be. In terms of this factor the participants responded to questions presented as statements, seeking to find out whether (1) they found the subtitles easy to read, (2) the subtitles helped them understand the topic, (3) the subtitles helped them understand the terminology in the video, and (4) the subtitles made concentrating on the video difficult. Similar to questions relating to content, the participants were required to select a level on a scale of 1 – 10 that best described their experiences for the subtitle questions, with 1 being not at all and 10 being is completely the case. A fixed effect analysis was conducted to check the effect of the video, the video conditions and the interaction between the two on the subtitle factor The findings of the analysis show that statistical significance was found for the effect of the video conditions (p=0,002). This means that the subtitle condition likely had an effect on the perception participants had about subtitles' helpfulness, irrespective of the video watched. This finding was expected as it was hoped that the participants would find the keyword subtitles helpful.

This section will furthermore discuss in detail the means of the subtitle factor for each subtitle condition (regardless of the video) as shown in Table 4-13. A low mean indicates the perception that the subtitles were not useful, whilst a higher mean indicates that the subtitles were perceived to be useful. The discussion will also include the effect sizes to see if the differences in the means have any practical significance in order to make inferences regarding the participants' perceptions of the subtitle factor. Because the questions in this factor referred specifically to subtitles, the NS (no subtitle) condition is excluded from the analysis below.

Table 4-13: *Subtitle factor means for subtitle condition across all videos*

Video Condition	Mean	Effect sizes		
		FSE	**FSS**	**KSE**
Full Subtitles English (FSE)	6,938			
Full Subtitles Sesotho (FSS)	6,326	0,30		
Keyword Subtitles English (KSE)	6,593	0,17	0,13	
Keyword Subtitles Sesotho (KSS)	5,602	0,65	0,35	0,48

Practical significance guideline:
≈ 0.2 Small, No practically significant difference
≈ 0.5 Medium, Practically visible difference
≈ 0.8 Large, Practically significant difference

Table 4-13 demonstrates that all the subtitle conditions were perceived to be useful. The FSE had the highest mean (M=6,938) indicating that this condition received the most positive response in terms of the participants' perceptions of the usefulness of the subtitles. This was closely followed by the KSE (M=6,593) and FSS (M=6,326). The lowest means were demonstrated for KSS (M=5,602). According to the means, the FSE was perceived to be most useful whilst the KSS was perceived to be the least useful. It is, however, important to measure the effect of the differences in these means through the effect sizes. The effect size of the difference between the subtitle factor means of the two full subtitles (FSE and FSS) depicts a small (0,30) difference, which is not practically significant. This means that the perceived usefulness of the full subtitles is the same for English as for Sesotho. Similarly, for the keyword subtitles, the effect size of the difference between the subtitle factor means of the KSE and the KSS is small (0,48) indicating a lack of practical significance; meaning that the keyword subtitles are perceived to be equally useful regardless of whether they are presented in English or Sesotho. It can therefore be concluded that language possibly did not influence the participants' perception of the helpfulness of the subtitles.

Furthermore, the effect size of the difference between the subtitle factor means for the FSE and KSE indicates a small (0,17) difference with practically no significance. This means that the perception regarding the helpfulness of subtitles is the same for the English subtitles, regardless of whether the subtitles are full or keyword subtitles. Likewise, the effect size of the difference between the subtitle factor means for the FSS and KSS is small (0,35) which demonstrates no practically significant difference, meaning that the perception regarding the helpfulness of

subtitles is the same for the Sesotho subtitles, regardless of whether the subtitles are full or keyword subtitles. Based on these effect sizes it may be concluded that the style of subtitles possibly had no effect on the participants' perception of the helpfulness of subtitles.

Concluding remarks on factor 2: perceived helpfulness of subtitles

The results for practical significance indicate that even though statistical significance indicates that the conditions of the subtitles have a possible effect on the participants' perceptions on the helpfulness of the subtitles, this effect is small with no practical significance. This means that the subtitles are perceived to be equally useful irrespective of the language or style.

4.5.2   Questionnaire 2: Participants' experience of subtitling in general

The questions in the second questionnaire sought to explicitly explore the participants' experience of subtitles in general and attitudes with regard to subtitles in the educational context. This data may explain the participants' perceptions of the subtitle helpfulness and the processing of subtitles in the study as a whole.

The data gathered from this questionnaire was analysed based on relevance. Questions relating to the participants' subtitle viewing and their perceptions of subtitles in the educational context were analysed by means of the calculation of frequencies, in order to explain the comprehension and eye-tracking data. The findings are presented in the sections below.

4.5.2.1   General television viewing habits

Participants were asked how regularly they watched TV, as exposure to TV and subtitled content may possibly lead to more positive perception of the subtitles and more processing of subtitles in the experiment. With regard to the question of frequency of television viewing, 66.7% reported that they watch TV sometimes, 27.8% watch it seldom, whilst 2,8% watch it often and another 2,8% never watch TV. Most were familiar with subtitled programmes, with 72% indicating that the programmes they watched often contained subtitles and 22,2% reported that the programmes sometimes contained subtitles. Regarding the language used in the subtitles of the TV programmes, participants identified two languages: English and isiZulu. English was identified by 97.2% of the participants and isiZulu by 2,8%. Since the participants are familiar with English subtitles, being exposed to these subtitles in the study would not be an unfamiliar experience. On the other hand, Sesotho subtitles may be unfamiliar, as the participants have not been exposed to Sesotho subtitles in television programmes, which is the main source of subtitles. Therefore, the Sesotho subtitles in the study could have been an unusual experience for the participants. The findings of the UFMW analysis confirm that the English subtitles were read to a greater extent

than the Sesotho subtitles. From this it can be concluded that the familiarity with English subtitles from television exposure could have contributed to the extent of subtitle reading.

4.5.2.2 Perceptions of subtitles in the educational context

The participants were asked if they deemed subtitles to be helpful in understanding academic content by rating their perceptions on a scale of 1-10, with 1 = not at all and 10 = completely the case. Most participants indicated that in general subtitles can help them understand academic content as demonstrated in Figure 4-4 below. These findings will be compared to the correlations data to see how the perception of content difficulty impacted on subtitle reading. A possible finding that is hoped for is that when the participants perceive the content of the video to be difficult, they would read the subtitles to a great extent in an attempt to understand the content of the video better.
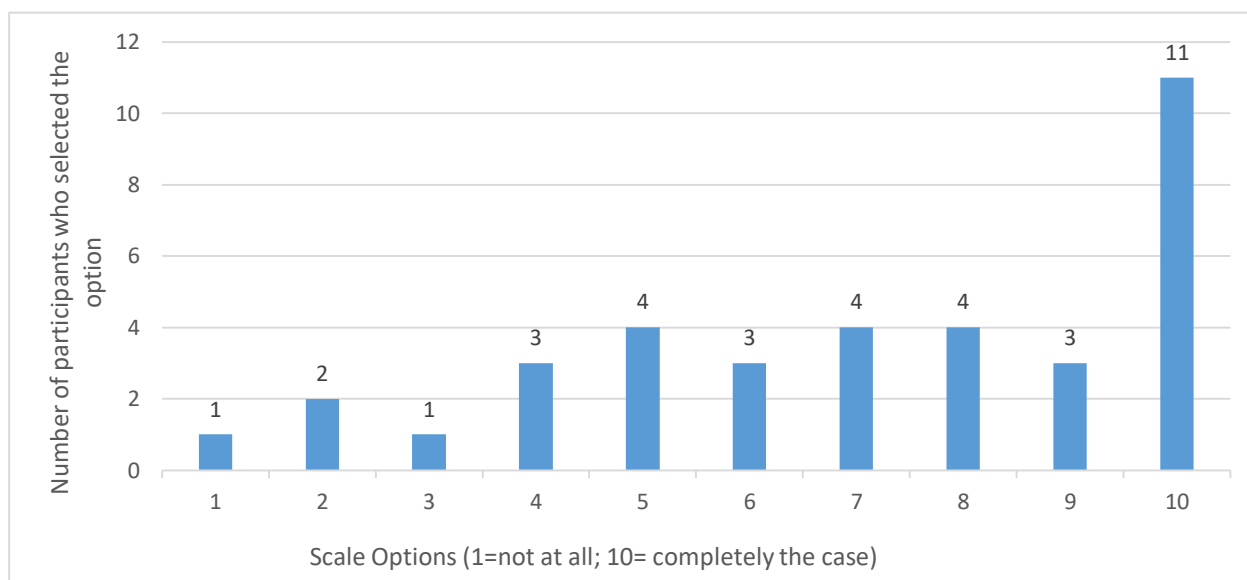
Figure 4-4: ***Participant responses: I think in general, subtitles can help me understand academic content***

4.5.2.3 Preferred subtitle type

The participants were asked to indicate which subtitle condition they preferred. As illustrated in Figure 4-5 the most preferred subtitles were the FSE (36,1%) and KSE (25,0%), which was followed by the FSS (22.2%). The least preferred were the NS and KSS subtitle conditions, with each having 8,3% of the participants preferring them.
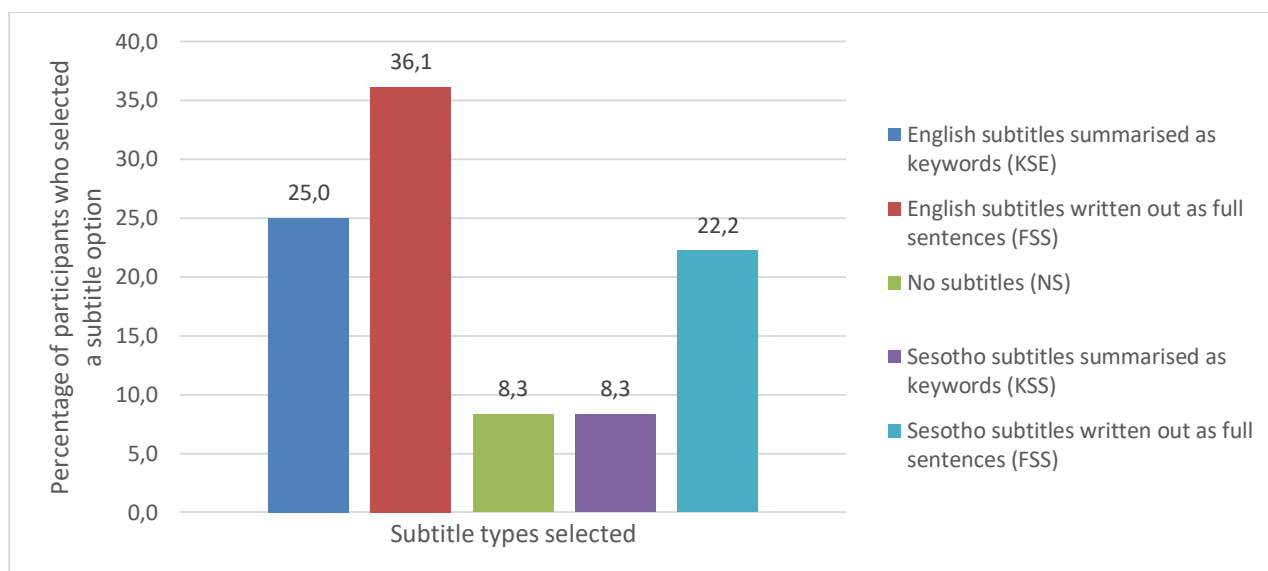
Figure 4-5: *Participant responses: Which of the following subtitle types would you prefer?*

The participants were requested to motivate their choice, and from their responses common themes of comprehension, concentration and familiarity were identified. The motivations will be discussed in terms of these themes.

Comprehension

This study sought to investigate the effect of subtitles styles on comprehension, therefore it was anticipated that comprehension would be identified among reasons for preferring particular subtitles. Participants who selected the FSE identified comprehension as a motivation. They stated that the subtitles enabled them to understand the content and helped them to keep up with the audio content. The KSE was also selected for the reason that it facilitated understanding and memory of the content. The KSS was also preferred because they aid understanding and memory of content.

Concentration

The presence of subtitles in audiovisual texts may be perceived to be a distraction for viewers who have to listen to the audio track, watch the content on the screen and also read the subtitles. This was found to be the case for the participants who preferred the NS – these participants explained that subtitles are distracting as one has to divide attention between the audio and reading subtitles. It was observed that not all subtitles are a distraction; one participant stated that full subtitles impede concentration on the audio. This possibly means that it is easier to concentrate with the keyword subtitles than the full subtitles.

Familiarity

The theme of familiarity was to be expected considering two factors: (1) South African learners are exposed to English in the classroom from as early as Grade 3, and (2) English is the main language of subtitles in South African television. It was, therefore, expected that the participants may prefer the English subtitles due to it being a familiar language, and this was indeed the case: the FSE was the most preferred subtitle type and one of the motivations is that English is a familiar language. Therefore, it can be assumed that for these participants English is the preferred since they are familiar with English in the education context. Familiarity was also cited as a motivation for participants who preferred the FSS. For these participants, it may be assumed that Sesotho is familiar as the mother tongue and thus facilitated understanding of content. Although Sesotho is familiar, some participants stated that when comparing English to Sesotho the lack of terminology was a problem. This is due to the historical background of indigenous languages in South Africa, which were previously marginalised in the academic context, resulting in underdevelopment of coined academic terminology.

4.5.2.4   Subtitle condition that would be recommended

The participants were required to specify the subtitles they would recommend to other students. As seen in Figure 4-6, the English subtitles were the ones that would be most recommended with 44,4% of the participants selecting the FSE and 22.2% selecting the KSE. The least recommended subtitles were FSS at 16,7%, KSS and NS at 8.3% each. It is interesting to note that only 16,7% of the participants would recommend the FSS, despite 22,2% indicating that they prefer them in the discussion above. The English subtitles may be recommended more than the Sesotho subtitles because the participants perceive English as the language for learning and teaching, and also because they are familiar with English subtitles.
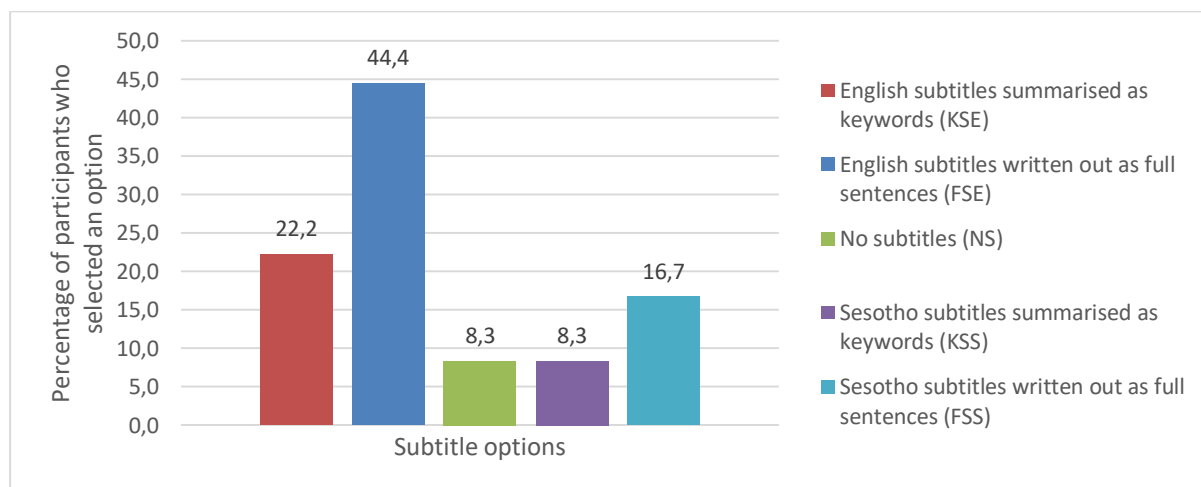
Figure 4-6:   Participant responses: Which of the following subtitle types would you recommend?

4.5.2.5 Conclusion on participant perception of subtitling in general

The majority (72%) of the participants watch television content that is often subtitled and the main language of the subtitles is English. Due to this exposure to English subtitles, it was anticipated that in the experiment the participants would read the English subtitles to a greater extent and this was confirmed. Given this exposure, the findings of the other questions in the questionnaire, with regard to the preferred and recommendable subtitle, were not surprising. The English subtitles were the most recommended with 66,6% of the participants selecting them. They were also the most preferred subtitles, selected by 61.1% of the participants. Most participants would recommend the FSE subtitle, followed by the KSE, then FSS and lastly KSS and NS. This demonstrates that the participants do not deem the KSS as helpful as was hoped.

4.6 Data Correlations

Correlations were conducted to explore possible relationships between (1) comprehension and the extent to which subtitles were read (UFMW and RIDT), (2) comprehension and the questionnaire factors, and (3) the extent of subtitle reading (UFMW and RIDT) and the questionnaire factors. The relationship between comprehension and the extent of subtitle reading will be helpful in determining the impact of subtitles on comprehension. In addition, the relationship between comprehension and the questionnaire will give insight into the possible effect of the participants' perceptions regarding difficulty of content and usefulness of subtitles on comprehension. Furthermore, the relationship between the extent of subtitle processing and the questionnaire factors will provide insight into perceptions, which may influence the reading of subtitles.

The correlations were deemed to indicate a statistically significant relationship when $p < 0.05$. Cohen's effect size was used to indicate practical significance of relationship or effect sizes using the following guideline values (Cohen, 1977:79-80):

> 0,1 = small effect size with no practical significant relationship
> 0,3 = medium effect size with practical visible relationship
> 0,5 = large effect size with practical significant relationship

4.7 Data Correlations

The results of the correlations are displayed in the tables in the sub-sections to follow. Discussions will first focus on general correlations between the data without taking the subtitle conditions into consideration; the discussion will then progress to correlations between the data according to the subtitle conditions.

4.7.1 Correlations between the data regardless of the subtitle conditions

This subsection discusses the general correlations in the data without specifying the subtitle conditions. The discussion focuses on the correlations between comprehension and the extent of subtitle processing, comprehension and the questionnaire factors, subtitle processing and questionnaire factors and lastly the correlation between the two questionnaire factors.

4.7.1.1 Correlations between comprehension and extent of subtitle reading

Possible correlations between comprehension and UFMW and RIDT were considered across the five videos, for the four conditions that contained subtitles (FSE, KSE, FSS, KSS). The purpose of the correlations was to investigate whether there is a possible relationship between comprehension and subtitle processing (using reading indices, UFMW and RIDT).

Table 4-14: *Correlations between comprehension and the extent of subtitle reading (UFMW and RIDT)*

Correlations: Comprehension vs reading indices			
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship; 0,5 large effect size with practical significant relationship **Correlations are significant at p< 0.05**			
		UFMW	**RIDT**
Comprehension	Correlation Coefficient	-0,017	-0,058
	P-value	0,839	0,485
	N	148	148

Negative correlations between comprehension and UFMW and RIDT were found and are illustrated in Table 4-14. This could possibly mean that the lower the comprehension, the greater the extent of subtitle reading. However, as shown in Table 4-14, the correlations were not statistically significant with $p>0.05$ for both the UFMW (0,839) and RIDT (0,485). The effect size for the comprehension and UFMW correlation coefficient was small (-0,017) indicating no practical significant relationship. Similarly, the effect size for the comprehension and RIDT correlation coefficient was also small (-0.058) indicating no practical significant relationship. Due to the lack of statistical significance and practical significance, there is no link between comprehension and subtitle reading, which means greater subtitle reading cannot be related to lower comprehension.

4.7.1.2 Correlations between comprehension and the two questionnaire factors

Further correlations were performed to establish whether possible relationships exist between comprehension and the two questionnaire factors pertaining to content and subtitles. Table 4-15 indicates that there are positive correlations between comprehension and the questionnaire factors, meaning that comprehension increased with an increase in the perceived difficulty of content and usefulness of subtitles.

Table 4-15: ***Correlations between comprehension and the questionnaire factors***

<table>
<tr><td colspan="4">Correlations: Comprehension vs questionnaire factors</td></tr>
<tr><td colspan="4">Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship
 0,5 large effect size with practical significant relationship

Correlations are significant at p< 0.05</td></tr>
<tr><td></td><td></td><td>Content factor</td><td>Subtitle factor</td></tr>
<tr><td>Comprehension</td><td>Correlation Coefficient</td><td>0,049</td><td>.175[*]</td></tr>
<tr><td></td><td>P-value</td><td>0,518</td><td>0,019</td></tr>
<tr><td></td><td>N</td><td>179</td><td>179</td></tr>
<tr><td colspan="4">**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).</td></tr>
</table>

In terms of comprehension and content factor, no statistical significance in the correlation was found with p=0,518. Therefore, it can be concluded that there is no relationship between comprehension and the perceived difficulty of the content. On the other hand, the significance level for the correlation between comprehension and subtitle factor (p=0,019) demonstrates statistical significance, meaning that it can be deduced that the more the participants perceived subtitles to be useful, the more comprehension increased. The practical significance of these correlations were calculated using effect sizes. The effect size for the correlation between comprehension and the content factor was small with the correlation coefficient at 0,049. The correlation coefficient for comprehension and the subtitle factor was also small at 0,175. Despite subtitle factor demonstrating a bigger effect than content factor, it remains a small effect. These small effect sizes of the correlations coefficients mean that although the correlations are positive, there is no practical significant relationship between comprehension and the questionnaire factors.

4.7.1.3 Correlations between subtitle reading and the two questionnaire factors

Correlations were also conducted between the subtitle reading indices and the questionnaire factors to determine if there is a possible relationship between the factors and the extent of the subtitle reading. These correlations are demonstrated in Table 4-16.

Table 4-16:   *Correlations between subtitle reading indices and the two questionnaire factors*

Correlations: Subtitle reading indices vs questionnaire factors			
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship; 0,5 large effect size with practical significant relationship			
Correlations are significant at p< 0.05			
		Content factor	**Subtitle factor**
UFMW	Correlation Coefficient	-0,024	0,122
	P-value	0,779	0,145
	N	144	144
RIDT	Correlation Coefficient	-0,030	0,114
	P-value	0,721	0,175
	N	144	144

In terms of the UFMW and content factor the correlation was negative, possibly meaning that the more difficult the content was perceived to be the less the subtitle were read. However, this finding was not statistically significant (p=0,779), and the effect size indicates a small effect size (-0,024) with no practical relationship. According to these findings, no possible relationship exists between the extent of subtitle processing and the perception of content difficulty. On the other hand, the correlation between UFMW and subtitle factor was positive, suggesting a possibility that higher perceptions of subtitle usefulness can be related to greater subtitle processing. This finding, however, was not statistically significant with p=0,145. The effect size indicated a small effect at 0,122 with no practical relationship. It can be deduced from these findings that no possible relationship exists between the extent of subtitle processing and the perception of subtitle usefulness.

Similar to the UFMW, the correlations between the RIDT and content factor were negative, possibly meaning that the more difficult the content was perceived to be the lower the extent of subtitle reading. However, this finding was not statistically significant (p=0,175), and the effect

size indicates a small effect size (-0.030) with no practical relationship. According to these findings no possible relationship exists between the extent of subtitle processing and the perception of subtitle difficulty. In contrast, the correlation between the RIDT and the subtitle factor was positive suggesting a possibility that higher perceptions of subtitle usefulness can be related to greater subtitle processing. This finding however, was not statistically significant with p=0,175. The effect size also indicated a small effect (0,114) with no practical relationship. It can be inferred from these findings that no possible relationship exists between the extent of subtitle processing and the perception of subtitle usefulness.

4.7.1.4 Correlations between the content and subtitle factors

The questionnaire factors were compared in order to investigate whether one factor had an effect on the other, as indicated by Table 4-17. The correlations between the content and subtitle factors indicate a small to medium negative relationship. This means that the effect size may demonstrate some practical significance, meaning that it may be accepted that the more difficult the content was perceived to be, the less the subtitles were perceived to be helpful.

Table 4-17:   Correlations between the two questionnaire factors

Correlations: Content factor vs subtitle factor		
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship; 0,5 large effect size with practical significant relationship **Correlations are significant at p< 0.05**		
		Subtitle factor
Content factor	Correlation Coefficient	-.234
	P-value	0,002
	N	179

4.7.1.5 Conclusion on data correlations

Overall negative and small correlations were found between comprehension and the extent of subtitle reading, meaning that a lower degree of subtitle reading resulted in higher comprehension scores. However, the effects were small for both the UFMW and the RIDT indices, meaning no relationship exists between comprehension and subtitle reading. Kruger and Steyn (2014) found a similar finding. Likewise, correlations between comprehension and the two questionnaire factors indicate no statistical or practical significance. Positive and small correlations were found between comprehension and the participants' perceptions of the content difficulty and subtitle helpfulness,

meaning that the more the content was perceived as difficult the higher the comprehension scores were; and the more the subtitles were perceived to be helpful the higher the comprehension scores were. However, the effects were small for both the content and the subtitle factors; and therefore it can be deduced that no relationship exists between comprehension and the participants' perceptions in terms of content difficulty and subtitle usefulness.

Based on the above findings, the extent of subtitle reading and participants' perceptions can be ruled out as confounding variables that might have influenced comprehension. These two variables did have effects on comprehension, but the effects were small, meaning that they could not explain the differences in the comprehension scores.

Further correlations were conducted between the subtitle reading and the questionnaire factors. In terms of correlations between the extent of subtitle reading and the content factor, negative and small correlations were found for both reading indices. This means that the more the subtitles were read, the less difficult the content was perceived to be. On the other hand, positive and small correlations were found between the extent of subtitle reading and the subtitle factor for both RIDT and UFMW, meaning that the more the subtitles were read, the more helpful they were perceived to be or vice versa. However, no statistical and practical significance is demonstrated by these correlations, meaning that possibly no relationship exists between the extent of subtitle processing and the perception of subtitle usefulness. Since the effects were small, the questionnaire factors can be ruled out as confounding variables that influenced the reading of subtitles. In addition, correlations between the two questionnaire factors, negative and small correlations are found, meaning that the more useful the subtitles were perceived to be, the less difficult the content was perceived to be. However, the effect is small and thus the factors are ruled out as each other's confounding variables.

4.7.2 Correlations between the data according to the subtitle conditions

The discussions have thus far focused on general correlations, irrespective of the subtitle condition. In the following sections discussions will focus on correlations between variables according to specific subtitle conditions to see if the data can be explained by the subtitle conditions.

4.7.2.1 Correlations between comprehension and subtitle reading according to the subtitle conditions

A more detailed account of the correlations between comprehension and subtitle reading parameters for the different subtitle conditions is given in this section. As indicated in Table 4-18, generally negative correlations were found. Exceptions were found for FSS and KSS, which

showed positive correlations between comprehension and UFMW, and for KSE, which showed a positive correlation between comprehension and RIDT. However, none of these correlations demonstrated any statistical significance (p>0.05). Despite the lack of statistical significance, possible conclusions can still be drawn based on the effect size data, which demonstrates practical significance.

Table 4-18: *Correlations between comprehension and subtitle reading indices according to the subtitle conditions*

Correlations: Comprehension vs reading indices									
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship 0,5 large effect size with practical significant relationship									
Correlations are significant at p< 0.05									
		Full Subtitles English (FSE)		Full Subtitles Sesotho (FSS)		Keyword Subtitles Sesotho (KSS)		Keyword Subtitles English (KSE)	
Variable		**UFMW**	**RIDT**	**UFMW**	**RIDT**	**UFMW**	**RIDT**	**UFMW**	**RIDT**
Comprehension	Correlation	-0,049	-0,082	0,011	-0,051	0,024	-0,106	-0,038	0,020
	P-value	0,769	0,627	0,947	0,766	0,890	0,544	0,823	0,905
	N	38	38	37	37	35	35	38	38

In terms of the UFMW subtitle reading index, the correlations for FSE (-0,049) and KSE (-0,038) subtitles were negative. This may mean that the more the English subtitles were read, the lower the comprehension. However, as shown in Table 4-18 the correlations were not statistically significant with p>0.05 for both the FSE (0,769) and KSE (0,823) subtitles. The effect sizes of the FSE (-0,049) and KSE (-0,038) subtitles demonstrate small effect sizes with no practical significant relationships. It can therefore be deduced that there is no practical relationship between comprehension and the subtitle processing of the English subtitles.

On the other hand, positive correlations were found between comprehension and the UFMW of FSS and KSS, which could possibly mean that the greater the extent of reading Sesotho subtitles the higher the comprehension. However, as shown in Table 4-17 the correlations were not statistically significant with p>0.05 for both the FSS (0,947) and KSS (0,890) subtitles. Similar to the English subtitles, the effect sizes indicated no practically significant relationships. The effect size of the KSS (0,024) demonstrate small effect size with no practical significant relationship. Similarly, the effect size for FSS (0,011) was a small effect size with no practical significant

relationship. As in the case of English, the effect sizes demonstrate no practical relationship between comprehension and the subtitle processing of the Sesotho subtitles. This means that language of the subtitle has no effect on the relationship between comprehension and subtitle processing.

Regarding correlations between comprehension and the RIDT as an indicator of subtitle processing, Table 4-17 shows that negative correlations were found for the FSE (-0,082), FSS (-0,051) and KSS (-0,106) subtitles. These negative correlations could possibly mean that the more these subtitles were read, the lower the comprehension was. However, the effect sizes demonstrated for the correlations were all small, indicating no practically significant relationships.

On the other hand, the correlation between comprehension and the RIDT was positive for the reading of KSE subtitles. This could possibly mean that the more the subtitles were read the higher the comprehension was. However, the effect size was also small at 0,02. This means that there is no practical significant relationship between the RIDT and comprehension for KSE.

4.7.2.2 Correlations between comprehension and the two questionnaire factors according to the subtitle conditions

This section will discuss in more depth the correlations between comprehension and the two questionnaire factors (content and subtitles) according to each subtitle condition. The correlations in terms of the content factor are demonstrated in Table 4-19(a) and the correlations with regard to the subtitle factor are demonstrated in Table 4-19(b).

Table 4-19(a): ***Correlations between comprehension and content factor of the questionnaire according to the subtitle conditions***

Correlations: Comprehension vs content factor						
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship 0,5 large effect size with practical significant relationship **Correlations are significant at p< 0.05**						
Variable		**Content factor**				
		Full Subtitles English (FSE)	Full Subtitles Sesotho (FSS)	Keyword Subtitles Sesotho (KSS)	Keyword Subtitles English (KSE)	No Subtitles (NS)
Comprehension	Correlation	-0,040	0,042	-0,188	0,128	0,260
	P-value	0,813	0,809	0,280	0,438	0,143
	N	37	35	35	39	33

In terms of the correlations between comprehension and the content factor which deals with the perceived difficulty of the content of the videos, negative correlations were found for FSE (-0,040) and KSS (-0,188). These negative correlations could possibly mean that the higher the level of perceived difficulty, the lower the comprehension score. However, Table 4-19a demonstrates that no statistical significance was found for the correlations. The effect sizes were small, demonstrating no practical significant relationship between comprehension and the content factor for FSE and KSS subtitles. This means that the participants' perceptions regarding content had no effect on the comprehension of the content for these videos.

Alternatively, positive correlations were found between comprehension and the content factor for NS, FSS and KSE. The NS demonstrated the highest correlation coefficient of 0,260 which was followed by KSE at 0,128 which preceded FSS at 0,042. The positive correlations mean that the more the participants perceived the content of the videos to be difficult, the higher the comprehension. This means that the more difficult the content was perceived to be, the more participants perceived that the subtitle condition could have contributed to the comprehension of the content. However, the effect sizes for the correlations for these subtitle conditions are small and are regarded to have no practically visible relationships, meaning no relationship is demonstrated between comprehension and the content factor for NS, FSS and KSE conditions. From these results, it can be inferred that the perceptions of relationship between content difficulty

and the comprehension scores is the same for the no subtitle condition (NS) and all the subtitle conditions.

With regard to the correlations between comprehension and subtitle factor which deals with the helpfulness of the subtitles, all subtitle conditions show positive correlations as indicated in Table 4-19(b). Similar to content factor, the table indicates that none of the correlations are statistically significant (p>0.05). Despite the lack of statistical significance, some inferences may be made from the data using effect sizes of the correlation coefficients.

Table 4-19(b): ***Correlations between comprehension and subtitle factor of the questionnaire according to the subtitle conditions***

Correlations: Comprehension vs subtitle factor					
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship 0,5 large effect size with practical significant relationship **Correlations are significant at p< 0.05**					
Variable		**Subtitle factor**			
		Full Subtitles English (FSE)	Full Subtitles Sesotho (FSS)	Keyword Subtitles Sesotho (KSS)	Keyword Subtitles English (KSE)
Comprehension	Correlation	0,295	0,030	0,329	0,263
	P-value	0,076	0,862	0,054	0,105
	N	37	35	35	39

KSS has the highest correlation coefficient at 0,329, followed by FSE and KSE at 0,295 and 0,263 respectively, with FSS demonstrating the lowest coefficient at 0,030. The effect size of the KSS correlation coefficient (0,329) is medium indicating practical visible relationship between comprehension and the subtitle factor. It can thus be deduced that the easier to read and more helpful the participants perceived the subtitles to be, the higher the comprehension scores were. Conversely, small to medium effect sizes are observed for the FSE and KSE correlation coefficients (0,295 and 0,263), indicating possible practically visible relationship between comprehension and the perceived helpfulness of the subtitles. This could possibly mean that the easier to read and more helpful the participants perceived these subtitles to be, the higher comprehension scores were. On the contrary, the effect size of the FSS correlation coefficient (0,030) is small effect indicating that there was no practical significant relationship in the variables.

This means that the participants' perceptions regarding subtitle helpfulness had no effect on the comprehension of the content for the videos with the FSS subtitle condition.

4.7.2.3 Correlations between the extent of subtitle reading and the two questionnaire factors

Further possible correlations were considered between the subtitle reading measures (the UFMW and the RIDT) and the questionnaire factors, and these will be presented in this section. The purpose was to see if the questionnaire factors could explain the differences found in the reading of the different subtitles. As demonstrated in Table 4-20 below, the significance levels are higher than the guideline value of $p < 0.05$ meaning that the correlations are not statistically significant, therefore, there is no evidence that the questionnaire factors had an effect on the reading measures. Despite this lack of statistical significance, some conclusions regarding practical significance can be drawn from the data, considering the effect sizes.

Table 4-20:   Correlations between reading indices and the questionnaire factors

Correlations: Reading indices vs questionnaire factors								
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship 0,5 large effect size with practical significant relationship								
Correlations are significant at p< 0.05								
		Full Subtitles English (FSE)		Full Subtitles Sesotho (FSS)		Keyword Subtitles Sesotho (KSS)		Keyword Subtitles English (KSE)	
Variable		**Content factor**	**Subtitle factor**	**Content factor**	**Subtitle factor**	**Content factor**	**Subtitle factor**	**Content factor**	**Subtitle factor**
UFMW	Correlation	-0,084	0,223	0,066	0,066	-0,257	0,210	0,128	0,263
	P-value	0,621	0,185	0,706	0,706	0,142	0,233	0,438	0,105
	N	37	37	35	35	34	34	39	39
RIDT	Correlation	0,004	0,187	0,048	0,069	-0,192	0,129	0,253	-0,183
	P-value	0,982	0,267	0,783	0,693	0,276	0,468	0,126	0,272
	N	37	37	35	35	34	34	38	38

In terms of the UFMW and content factor, negative correlations were found for FSE (-0,084) and KSS (-0,257) and positive correlations were found for FSS (0,066) and KSE (0,128). The negative correlations for FSE and KSS could possibly mean that the more the subtitles were read the easier the content was perceived to be. However, the effect size of correlations for the FSE were

small with no practical significant relationship. In contrast, the correlations for the KSS were small to medium demonstrating a slight practical visible relationship. It can thus be deduced that the more the subtitles were read the less difficult the content was perceived to be. The positive correlations demonstrated for FSS and KSE may possibly imply that the more difficult the content was perceived to be, the more the subtitles were read. However, the effect sizes of these correlations were small and thus demonstrate no practical significant relationship.

With regard to the correlations between the UFMW and subtitle factor, positive correlations were found. The correlation for KSE at 0,263 was the largest, followed by the correlation for FSE (0,223); both of which were greater than the correlation for KSS (0,210). The lowest correlation was found for FSS at 0,066. The positive correlations could mean that the more difficult the content was perceived to be, the more the subtitles were read, however, the effect sizes for all the correlations are small, thus indicating no practical significant relationship for all the subtitle styles.

The correlations between UFMW and the questionnaire factors had small effect sizes thus demonstrating no practical significant relationship between them. This means that the questionnaire factors do not provide any insight into how the subtitles were processed under the different subtitle conditions.

Regarding the RIDT and content factor, KSS demonstrated negative correlations (-0,192). This could possibly mean that the more the subtitles were read the easier the content was for the participants, however, the effect size is small and thus there is no practical significant relationship. Positive correlations were found for KSE (0,253), FSS (0,048) and FSE (0,004). This could possibly mean that the more difficulty experienced with content, the more the subtitles were read. However, all these correlations have a small effect size, including that of KSE, which is the highest, and thus have no practical significant relationships.

As far as the RIDT and the subtitle factor are concerned, a negative correlation is demonstrated for the KSE condition (-0,183). This could possibly mean that the less the subtitles were read, the more they were perceived to be helpful, however the effect size is small and thus there is no practical significant relationship. Positive correlations were found for the other subtitle conditions, FSE (0,187), KSS (0,129) and FSS (0,069). The positive correlations could possibly mean that the more the subtitles were read the more helpful they were perceived to be, however the effect sizes are small and thus there are no practical significant relationship demonstrated.

Similar to the UFMW, the correlations between RIDT and the questionnaire factors had small effect sizes thus indicating no practical significant relationship between them. This means that the

questionnaire factors do not provide any insight into the processing of subtitles in the different subtitle conditions.

4.7.2.4 Correlations between the content and subtitle factors according to the subtitle conditions

In this section possible correlations between the questionnaire factors were considered in order to gain insight on whether one factor has an influence on the other. As demonstrated in Table 4-21, negative correlations were found.

Table 4-21: Correlations between the two questionnaire factors

Correlations: Subtitle factor vs Content factor						
Correlation guidelines: 0,1 small effect size with no practical significant relationship; 0,3 medium effect size with practical visible relationship, 0,5 large effect size with practical significant relationship **Correlations are significant at p< 0.05**						
		Full Subtitles English (FSE)	Full Subtitles Sesotho (FSS)	Keyword Subtitles Sesotho (KSS)	Keyword Subtitles English (KSE)	No Subtitles (NS)
Variable		**Subtitle factor**	**Subtitle factor**	**Subtitle factor**	**Subtitle factor**	**Subtitle factor**
Content Factor	Correlation	-0,309	-0,242	-0,413*	-0,211	0,148
	P-value	0,063	0,162	0,014	0,197	0,412
	N	37	35	35	39	33
**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).						

For the KSS (-0,413), FSE (-0,309), FSS (-0,242), and KSE (-0,211) conditions the correlations between the content factor and subtitle factor were negative. The correlation for KSS (-0,413) were the largest, followed by correlations for FSE (-0,309) which were greater than those for FSS (-0,242). Statistical significance (p=0,014) was found in the correlation for the KSS only. The negative correlations may mean that the more the subtitles were perceived to be helpful, the less difficult the content was perceived to be. The effect sizes were considered in order to determine practical significance of the correlations. For the FSE and KSS conditions the effect sizes were medium, indicating practical visible relationship between the factors. On the other hand, the FSS and KSE conditions had small effect sizes demonstrating no practical significance in the

relationships. Therefore, it can be deduced that the relationship between how difficult the content was perceived to be and how helpful the subtitles were perceived to be was greater and more practically significant for the FSE and KSS conditions.

4.7.2.5 Conclusion regarding the data correlations

In terms of the correlations between comprehension and the extent of subtitle reading, negative and small correlations were found for FSE and KSE according to the UFMW. This means that the more the subtitles were read, the lower the comprehension scores were. It may appear strange that comprehension would be low despite the subtitles being processed to a greater extent. However, this negative correlation may mean that the participants read the text fully because they struggled with something. After reading they completed the comprehension test for which the scores were low despite having read the subtitles to a greater extent. On the other hand, positive and small correlations were found for the FSS and the KSS, meaning that the more the subtitles were read the higher the comprehension scores were. Although these positive correlations were small, they imply that the Sesotho subtitles, especially the KSS, could result in increased comprehension.

The RIDT, on the other hand, demonstrated positive correlation between comprehension and the extent of subtitle reading for KSE only, meaning that the more these subtitles were read the higher the comprehension scores were. This can be explained by the familiarity with the subtitle language in academic settings, and the fact that keyword subtitles contain less information. This finding supports the research hypothesis that a greater degree to which the subtitles were read, will result in improved comprehension. Negative correlations were found for the rest of the subtitles (FSE, FSS and KSS), meaning the more the subtitles were read the lower the comprehension scores were. These findings refute the hypothesis that a greater degree to which the subtitles were read, will result in improved comprehension. The correlations for FSS and KSS could be explained by a number of reasons including unfamiliarity of Sesotho in the academic context, possible poor reading skills in Sesotho, or the mental effort involved in using two languages simultaneously.

All correlations, however, have small effect sizes, meaning that the extent to which subtitles were read can be ruled out as a confounding variable influencing the comprehension scores for the videos with the different subtitle conditions.

In terms of the correlations between comprehension and the content factor, negative and small correlations were found for FSE and KSS. This means that the less difficult the content was perceived to be, the higher the comprehension scores. Conversely, positive and small correlations

were found for the FSS, KSE and NS, meaning that the more difficult the content was perceived to be the higher the comprehension scores.

On the other hand, the correlations between comprehension and the subtitle factor were positive and small for both the full and keyword subtitles. This means that the more helpful the subtitles were perceived to be the higher the comprehension scores were. Since these findings indicate small correlations, the questionnaire factors can be ruled out as confounding variables that might have influenced comprehension.

In terms of the correlations between the extent of subtitle reading and the content factor, negative and small correlations were found for FSE and KSS according to the UFMW. This means that the more the subtitles were read, the less difficult the content was perceived to be. The negative correlation for the KSS was hoped for as it means the subtitle style and language contributed to the participants perceiving the content to be less difficult. Positive correlations were found for the FSS and the KSE, meaning that the more the subtitles were read the more helpful they were perceived to be. However, the effect of the correlation was small indicating no practically significant relationship.

The RIDT on the other hand demonstrated positive correlation between the extent of subtitle reading and the content factor for the full subtitles (FSS and FSE), meaning that the more these subtitles were read the more difficult the content was perceived to be. Negative correlations were found for keyword subtitles (KSS and KSE), meaning the more the subtitles were read the less difficult the content was perceived to be. The correlations between the extent of subtitle reading and the subtitle factor were positive and small for both the full and keyword subtitles with regard to the UFMW measure. This means that the more the subtitles were read the more they were perceived to be helpful. The RIDT on the other hand, demonstrates similar positive and correlations for FSE, FSS and KSS, whilst the negative correlations are demonstrated for KSE, meaning that the more they were read the less helpful they were perceived to be.

Given that these correlations are all small, the perceptions of content difficulty and subtitle helpfulness can be ruled out as confounding variables influencing the extent to which the subtitles were read.

4.8   Conclusion

The aim of this chapter was to present and discuss the results of the analyses in order to explain the difference(s) found in (1) the effect of English full subtitles and keyword subtitles on the comprehension of Sesotho L1 users (2) the effect of Sesotho full subtitles and keyword subtitles on the comprehension of Sesotho L1 users and (3) the effect of the degree of subtitle reading

(indicated by RIDT and UFMW scores), of the different language and styles of subtitle presentation, on comprehension of Sesotho L1 users. The chapter further explored possible confounding variables from the questionnaire in order to gain more understanding of findings. Mixed effect models were used to analyse the data to report on the comprehension scores, eye-tracking data and questionnaire data, and to find possible differences. Furthermore, correlations were conducted for the data to find how the variables influenced each other.

No practically significant differences were found in the comprehension of the videos with or without the subtitles. The effect sizes demonstrate that the type of subtitle and the language did not influence the comprehension of the participants. Kruger *et al.* (2014) also found similar findings in their study investigating the influence of subtitle language on comprehension.

The analysis of the processing of subtitles as measured by the UFMW and the RIDT shows different findings in terms of the language and style of subtitles. With regard to the effect of the language, the UFMW indicates practically visible difference for full subtitles. According to this finding, the English full subtitles were read to a greater extent than the Sesotho full subtitles – the reported exposure to (and familiarity with) English subtitles could have influenced the reading of the English subtitles in the study. The RIDT on the other hand, demonstrates no practical difference in how the English and Sesotho subtitles were read. These findings are different from the findings of Kruger *et al.* (2014) who found that the participants read the English subtitles to a greater degree than the Sesotho subtitles.

In terms of the effect of the subtitle style, the finding from both the UFMW and RIDT scores demonstrate that the full subtitles were read to a greater extent. However, there was an interesting observation in the UFMW scores for the Sesotho subtitles. The effect size of the difference between the means of the FSS and KSS were calculated. The resultant effect size was 0,47, which is very close to a medium score (0,5) that indicates practically visible effect. This means that the Sesotho full subtitles were read to a greater extent than the keyword subtitles. As indicated in the self-report questionnaire, the Sesotho subtitles were unfamiliar, which could have led to the keyword subtitles not being fully read since they were even more unfamiliar. In addition to that, there is the unfamiliarity of using Sesotho in the academic context, which means that students are generally not used to reading learning material in Sesotho. As a result, they possibly do not have good reading skills in Sesotho. All these factors, plus the possibility of the subtitles having an influence on the perceptions of content difficulty, may affect how the full subtitles were read.

The self-report questionnaire was analysed for possible explanation for the above findings. The questionnaire explored two factors being perceived, namely, content difficulty and perceived

subtitle helpfulness. The interaction between the video and the subtitle condition showed statistical significance for content difficulty. This means that the combined effect of the videos and subtitle conditions had an effect on the participants' perceptions of content difficulty. The video conditions did not show statistical significance, meaning that they possibly had no effect on the participants' perceptions on content difficulty. In terms of the factor dealing with subtitle helpfulness, subtitle condition was found to have a statistically significant effect on the subtitle factor, meaning that subtitle condition had an effect on the participants' perceptions on content difficulty. The findings are summarised in the following subsections.

In terms of the content factor, participants perceived the content in Video 1 to be less difficult in the presence of Sesotho keyword subtitles, whereas with regard to language, the content was perceived to be less difficult in the presence of English subtitles. The content was perceived to be more difficult when presented with the NS condition. In contrast, for Video 2 the language and the style of the subtitles do not have an influence on the perception of content difficulty. The content was found to be easier in the NS condition. Contrary to the findings of Video 1, the content of Video 3 was perceived to be more difficult in the presence of KSS subtitles. In terms of language the content was perceived to be less difficult with both English keyword subtitles and Sesotho full subtitles. On the other hand, in terms of language for Video 4 the content was perceived to be less difficult when presented with the Sesotho full subtitles. With regard to the subtitle style, the content was perceived to be less difficult for the keyword subtitles. The video content was perceived to be more difficult when presented in the NS condition. For Video 5 the content was perceived to be the most difficult when presented with KSS subtitles, and least difficult with the NS condition. The effect sizes further demonstrate that language has no effect on the perceptions of content difficulty. The above discussion shows that the effects of subtitle conditions on perceptions of content difficulty differ from video to video, however, it can be concluded that in general subtitles, particularly keyword subtitles, have a potential role to play in influencing perceptions regarding content difficulty.

With regard to the subtitle usefulness factor, the analysis indicates that the subtitle type had an effect on the participants' perception of subtitle usefulness. However, the effect sizes show that there is no difference in the perception, meaning that they are perceived to be equally useful regardless of the language or style.

The correlations between comprehension and the extent of subtitle reading reveal that the extent to which subtitles are read cannot be regarded as a confounding variable influencing the comprehension scores for the videos with the different subtitle conditions. Similarly, the correlations between comprehension and the questionnaire factors reveal that the participants' perception of content difficulty and subtitle usefulness cannot be regarded as factors influencing

comprehension. In terms of the correlations between the reading indices and the questionnaire factors, both the UFMW and RIDT findings show that the questionnaire factors cannot be regarded as confounding variables for how the subtitles were read.

In conclusion, the analysis shows that the English and Sesotho full and keyword subtitles do not have an effect on the comprehension of Sesotho L1 users. This answers research question 1 regarding the extent to which language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos. Furthermore, the analysis demonstrates that the degree of subtitle reading has no effect on the comprehension of Sesotho L1 users. This answers research question 2 about how the extent of subtitle reading influences the participants' comprehension of content presented through the different languages and styles of subtitle presentation.

According to Oakhill (2020:410), prior knowledge is one of the elements necessary for comprehension. This may possibly explain the finding on comprehension, since the participants in the current study have not been exposed to psychology module then they have no or little background knowledge of the content. Thus, the fact that the subtitles had no effect on comprehension could probably be attributed to the students' lack of prior knowledge. In the chapter that follows, the relevance of the findings and recommendations for further research will be presented.

CHAPTER 5: CONCLUSION

5.1 Introduction

Subtitles in South Africa are mainly used in the entertainment industry and the common language is English. However, subtitles may be a valuable tool in education, particularly interlingual subtitles, given that despite South Africa's multilingualism, most students learn in EAL. Subtitles may help bridge the language barriers for these students. This study aimed to investigate the effect of English and Sesotho subtitles, presented as full or keyword subtitles, on comprehension in an academic context. The study sought to answer the following primary and secondary research questions:

Primary research questions

(1)   To what extent does the language and style of subtitle presentation have an influence on Sesotho L1 participants' comprehension of educational videos?

(2)   How does the extent of subtitle reading (RIDT) influence Sesotho L1 participants' comprehension of content presented through the different languages and styles of subtitle presentation?

Secondary research questions

(1)   What effect does the style of English L2 subtitles (full subtitles (FSE) and keyword subtitles (KSE) have on comprehension?

(2)   What effect does the style of Sesotho L1 subtitles (full subtitles (FSS) and keyword subtitles (KSS) have on comprehension?

(3)   Which style and language of subtitles results in better comprehension?

(4)   What effect does the extent of reading of the English subtitles (full subtitles (FSE) and keyword subtitles (KSE) have on comprehension?

(5)   What effect does the extent of reading of the Sesotho L1 subtitles (full subtitles (FSE) and keyword subtitles (KSE) have on comprehension?

This chapter discusses the main findings and conclusions of the study. Section 5.2 provides an overview of the study. This is followed by Section 5.3, which provides a summary of findings. The discussion of limitations and recommendations for future research follows in Sections 5.4 and 5.5.

5.2 Overview of the study

In Chapter 1 context was provided for the need of subtitles in education, particularly in South Africa where students access academic content in EAL. English may pose as a barrier for some students, since studies have found that students enter higher education with poor proficiency in English (Coetzee-Van Rooy & Verhoef, 2000; Van Rensburg & Weideman, 2002; Webb, 2004; Ayliff, 2010; Webb, 2012). These studies echoed the concerns of the Department of Higher Education (2002:15) that students in higher education may not fully access education and may be unable to complete their education due the language barrier. The chapter further discussed how subtitles can be utilised as a tool to address the language problem in South African classrooms. Subtitles may be used to support students through the subtitling of support materials such as class and tutorial videos, with the intention of improving comprehension.

Chapter 2 discussed the various subtitling studies conducted in the education context. The studies explored focused on different types and styles of subtitles. The subtitle types describe subtitles in terms of the language(s) of the audio and the subtitles (i.e. intralingual or interlingual). Subtitle styles on the other hand, describe subtitles in terms of how the subtitles are edited and presented (i.e. full or keyword subtitles). In addition to this, the chapter discussed the learning theories to demonstrate that the use of subtitles in education is relevant. The learning theories explored support using subtitles in education as they provide the opportunity for learners to access information through more than one channel, and therefore, multimodality. The benefit is that the information from the auditory channel may be reinforced by subtitles in the visual channel. In addition, if learners miss the information in the auditory channel they can access it from subtitles in the visual channel. However, despite these benefits, the theories show that overload may be experienced if too much information is presented in one channel. The implications for subtitles in education is that they may result in overload in the visual channel.

The chapter went on to explore the benefits of subtitles in education. The literature review showed that subtitles have benefits for learning to read, vocabulary acquisition and comprehension. In terms of learning to read, studies have shown that subtitles benefit language learning (Kothari *et al.*, 2002; Kothari *et al.,* 2004; Linebarger *et al.*, 2010). These studies show that subtitled songs and subtitled videos resulted in improved reading skills. Regarding vocabulary learning, studies show that both intralingual and interlingual subtitles are beneficial for vocabulary acquisition (Koolstra & Beentjes, 1999; Kothari *et al.*, 2002; Yuksel & Tanriverdi, 2009; Sydorenko's, 2010; Montero Perez *et al.*, 2014a). With regard to comprehension, conflicting results were found. Some studies could not conclusively confirm that subtitles result in improved comprehension (Hwang & Huang, 2011; Latifi *et al.*, 2011; Mobalegh, & Mohammadi, 2011; Lacroix, 2012; Mahlasela, 2012; Kruger, 2013; Kruger *et al.*, 2014; Kruger & Steyn, 2014). Other studies, on the other hand found

that subtitles result in improved comprehension (Markham, 1989; Garza, 1991; Hayati & Mohmedi, 2011; Winke *et al.*, 2010).

Studies considered in Chapter 2 investigated subtitles presented in different languages and styles in order to reflect on the impact of subtitles on comprehension. In terms of language, studies found that intralingual subtitles did not result in improved performance in comprehension tests (Kruger & Steyn, 2014; Lacroix, 2012; Mayer, Lee & Peebles, 2014). Similarly, studies focusing on the impact of interlingual subtitles on comprehension found no statistical significance (Latifi *et al.*, 2011; Mahlasela, 2012; Kruger, 2013; Kruger *et al.*, 2014). Although the results of their studies indicated no statistical significance, it is important to note what South African studies found. Mahlasela (2012) found that the interlingual subtitles contributed marginally to the improved recall component of comprehension, and Kruger *et al. (*2014) found that interlingual subtitles may have contributed to long-term retention of information. Likewise, Lacroix (2012) found that long-term exposure to intralingual subtitles contributed somewhat to comprehension of subject-specific content. These findings, despite lacking statistical significance, show that there is some potential benefit in presenting interlingual subtitles in education and warranted further investigation for confirmation. The studies discussed thus far focused on one style of subtitles, namely full subtitles. The current study sought to explore a different style of subtitles and investigate its influence on comprehension.

Chapter 2 also discussed the research that explored the benefits of the different subtitle styles, which include subtitles with highlighted keywords, glossed subtitles and keyword subtitles. The literature review focused on studies that investigated keyword subtitles as this style is the focus of the current study. Researchers made use of these different styles in order to explore which style would contribute to comprehension. Similar to full subtitles, different studies found varying results. Some studies found no significant difference between the impact of keyword subtitles and no subtitles on comprehension (Guillory, 1998; Kikuchi 2003; Montero Perez *et al.*, 2013; Montero Perez *et al.*, 2014b; Bensalem, 2016). Other studies found that keyword subtitles have a positive impact on comprehension (Rooney, 2011; Behroozizad & Majidi, 2015).

An important consideration for subtitle studies is to determine if the subtitles were read at all. A popular method used to monitor the reading of the subtitles is eye tracking. Chapter 2 provided an overview of eye tracking and the measures that can be accessed from eye-tracking software. The degree to which the subtitles were read was calculated using the RIDT and UFMW formulae, which are calculated by using eye-tracking measures.

Chapter 3 outlined the methodological procedure used in the study. The chapter explains how the participants were selected and allocated to groups. It further describes the tools used in the study

and how the videos, comprehension tests and self-report questionnaire were designed for the study. The participants in the study were requested to watch five videos, which were presented in different subtitle conditions. At the end of each video, the participants completed a comprehension test, which was followed by the self-report questionnaire. The self-report questionnaire was used to measure the participants' perception of task load experienced while viewing the videos with the different kinds of subtitles. Furthermore, the chapter discussed the analysis procedures.

Lastly, Chapter 4 presented the findings and discussion of the analysis. The summary of the findings is presented in section 5.3 below.

5.3   Summary of findings

The summary of findings will be discussed in terms of the effects of the subtitle language and subtitle style separately; in the process the research questions will be answered.

5.3.1   Summary of findings for the effect of subtitle language on comprehension

One of the aims of the study was to investigate the extent to which language influenced comprehension. This was done by comparing the comprehension of English subtitles (full subtitles and keyword subtitles in English), to that of Sesotho subtitles (full subtitles and keyword subtitles in Sesotho). The findings in Chapter 4 show that the comprehension means for the English subtitles were higher than those for the Sesotho subtitles, with the keyword subtitles in English scoring the highest and the keyword subtitles in Sesotho scoring the lowest. However, the effect sizes of the differences were small, demonstrating no practically significant effect. In other words, the language of the subtitles had no effect on comprehension. This refutes the hypothesis set in Chapter 1 that Sesotho subtitles will result in improved comprehension due to the benefit of content being presented in a language the participants understand better. This finding is in line with other South African studies discussed in previous chapters (Mahlasela, 2012; Kruger *et al.,* 2014). The unfamiliarity of Sesotho in the academic context may be one of the reasons.

This unfamiliarity may emanate from the fact that the main language in South African classrooms is EAL. According to Webb (2004:153), the use of a language in teaching and learning requires more than the ability to speak the language, it requires "academic language proficiency" (Webb, 2004:153). This may be a challenge as most learners are not competent and skilled in English (Chürr, 2013:274), and some of the learners exit primary school education without having mastered English (Desai, 2012). These findings imply that many learners are disadvantaged and may not perform well academically in high school and even in higher education.

Some experts advocate for the use of mother tongue instruction (Webb, 2004; Desai, 2012; Chürr, 2013; Stoop, 2017). Stoop (2017:2) asserts that "the use of the mother tongue is regarded as one of the most effective ways to act and perform cognitively, enables learners to perform to their potential academically". Based on this, the researcher speculated that the inclusion of Sesotho subtitles may contribute positively towards comprehension. The findings however, indicate that language does not contribute to comprehension. This may be due to the fact that the "academic language proficiency" in Sesotho may not be developed since students are taught in English, the result being students who, according to Ayliff (2010:2), cannot express themselves in their mother tongue. The findings of the questionnaire, discussed in a later section, may shed more light in this regard.

5.3.2 Summary of findings for the effect of subtitle style on comprehension

Furthermore, the study intended to explore how subtitle style influenced comprehension by determining the difference in the comprehension of full subtitles and keyword subtitles in English and Sesotho. In Chapter 1, it was hypothesised that for both English and Sesotho, the keyword subtitles will result in improved comprehension due to participants having less content to read and that this may result in the participants perceiving the keyword subtitles to be less cognitively demanding than the full subtitles. The comparison of the comprehension test score means indicates that for English, the keyword subtitles indeed resulted in higher comprehension. On the other hand, the comprehension test score means for Sesotho subtitles indicate the opposite: for Sesotho the full subtitles resulted in higher comprehension. Comparison of the comprehension scores for the subtitles and the no subtitle condition revealed that the English subtitles resulted in higher comprehension than the no subtitle condition, whilst the Sesotho subtitles resulted in lower comprehension than the no subtitle condition. The different findings possibly mean the subtitle style has no effect on comprehension. Furthermore, the effect sizes were small, indicating no practically significant difference. This means that the subtitle style had no practical effect on comprehension. These findings therefore refute the hypothesis regarding the effect of subtitle style on comprehension. This means that the keyword subtitles do not result in higher comprehension as anticipated.

The findings for the current study correspond to that of Montero Perez *et al.* (2014a) who investigated the effectiveness of keyword subtitles; their study also found no significant difference between the comprehension test scores of the keyword subtitles and no subtitles groups. These findings are contrary to Guillory's (1998) findings, who found that both full subtitles and keyword subtitles had a positive effect on comprehension. The full subtitles group scored higher than the keyword subtitles, however, this difference was not significant (Guillory, 1998).

5.3.3 Summary of findings for the extent of subtitle reading

The study also sought to explore the extent to which the degree of subtitle reading influenced comprehension. It was anticipated that there would be differences in comprehension scores, which could possibly be attributed to the extent of reading of the different subtitles, or at the very least that a pattern to this effect would be clear from the data – subtitles that were read to a greater extent would correlate with higher comprehension; subtitles that were read to a lesser degree would correlate with lower comprehension.

The findings according to the UFMW scores indicate that the English full subtitles were read to a greater extent as compared to the Sesotho full subtitles, with the effect sizes demonstrating a medium, practically visible difference. This means that the English full subtitles were read to a greater extent. The English keyword subtitles on the other hand, were read to a greater extent than Sesotho keyword subtitles. However, the effect size of the difference was small, indicating no practical significance in the difference.

Similarly, the English full subtitles were read to a larger extent than the English keyword subtitles, and the effect sizes between the scores of these subtitles indicated a large, practically significant difference. This means that the English full subtitles were read to a greater extent. Likewise, the Sesotho full subtitles were read to a greater extent than the Sesotho keyword subtitles. The effect size of this difference however, is small with no practical significance, meaning that it cannot be said with certainty that the Sesotho subtitles were read to a greater extent.

Similar to the UFMW, the RIDT scores indicate that the English full subtitles were read to a greater extent than the English keyword subtitles. The effect sizes of the difference between the RIDT scores of the English full and keyword subtitles demonstrate a large, practically significant difference. This means that it can be said that the English full subtitles were read to a greater extent. Likewise, the Sesotho full subtitles were read to a greater extent than the Sesotho keyword subtitles, with a large effect size that indicates a practically significant difference.

In contrast, the effect size of the difference between the RIDT scores of the English full and Sesotho full subtitles is small, indicating no practically significant difference. This means that there is no effect in the difference in the extent of reading the English full and Sesotho full subtitles. Similarly, the Sesotho keyword subtitles were read to a greater extent than the English keyword subtitles. However, the effect size of this difference is small with no practical significance.

Correlations were conducted to confirm the relations between the extent of subtitle reading and comprehension. In general, it can be reported that there was a negative correlation for comprehension scores and both the UFMW and RIDT reading scores. This possibly means that

the lower the comprehension the greater the extent to which the subtitles were read, that is if the participants had trouble understanding the content, they would read more so they could understand. Based on the discussions in the previous sections, it can be deduced that the subtitles that were read when the participants encountered difficulty in comprehension were for the English full subtitles and the Sesotho full subtitles. The effect sizes were however small indicating no practically significant relationship between comprehension and the extent of subtitle reading. The lack of significance may be due to the fleeting nature of subtitles. While reading a static text, one may go back and re-read a segment of the text one does not understand in order to gain a better understanding. Unfortunately, this cannot be done when reading subtitles since they are available on screen for a limited time. If the participants in the study could pause and re-read, it is possible that the comprehension could have improved. Future research in the area of educational videos could consider including the option of stopping and rewinding the videos in order to enable participants to re-read subtitles.

With regard to the correlations between comprehension and the reading indices according to the subtitle conditions various correlations were found. In terms of the UFMW, both the English full and keyword subtitles demonstrated negative correlations between comprehension and subtitle reading extent. This possibly means that the lower the comprehension, the higher the extent of reading for both English full and keyword subtitles. The Sesotho full and keyword subtitles on the other hand, show a positive correlation for comprehension and the extent to which the subtitles are read. This means the more the Sesotho subtitles were read the higher the comprehension. This supports the hypothesis that the more the subtitles are read, the higher the comprehension; which means that participants performed better when they read the subtitles, than when they did not read the subtitles (Kruger & Steyn, 2014:118). This is similar to Kruger and Steyn's (2014) findings of a positive correlation between the extent of subtitle reading and comprehension. Although the correlations for this study had no practical significance, they still provide some evidence indicating that subtitles are useful in educational videos aimed at learning content learning. Thus in future, research on educational videos for content learning should consider including Sesotho subtitles.

In terms of the RIDT, three subtitle conditions, the English and Sesotho full subtitles, plus the Sesotho keyword subtitles demonstrated negative correlations between comprehension and subtitle reading extent. This possibly means that the lower the comprehension the greater the extent to which these subtitles were read. This could mean that when the participants experienced difficulty in comprehending, they read the subtitles.

On the other hand, positive correlations between comprehension and the degree to which the subtitles were read were found for the English keyword subtitles. This possibly means that the

greater the extent of subtitle reading, the higher the comprehension; meaning that the more the participants read, the more they comprehended. This means that the participants who understood the content may have read the subtitles to confirm their understanding. The opposite may also apply where the lesser extent of subtitle reading correlate with lower comprehension. And in this case, the participants did not understand the content perhaps because they did not read the subtitles.

The positive correlations support the hypothesis that the greater the extent of subtitle reading, the higher the comprehension. On the other hand, the negative correlations support the inverse of the hypothesis, that is the less the subtitles were read the lower the comprehension. However, there was no statistical or practical significance found in the correlations, meaning that no relationship can be confirmed between comprehension and the extent of subtitle reading

5.3.4   Summary of findings for the questionnaires

This section will provide a summary of findings of the two questionnaires, one focusing on the participants' experience in the experiment and another on the participants' general experience of subtitling.

5.3.4.1   Questionnaire 1: user experience

The questionnaire was employed to investigate the participants' perceptions of the content difficulty and the usefulness of subtitles. Exploratory factor analysis was conducted in order to group the different questions according to the underlying factors observed. Two factors were identified, one deals with questions addressing the participants' perceptions of content difficulty (content factor); and the other deals with questions concerning the participants' perceptions of the helpfulness of the subtitles (subtitle factor). A summary of the content factor will be discussed first and will be followed by a summary of the subtitle factor. The content factor will be discussed in terms of the interaction between the videos and the subtitle conditions; and the subtitle factor will be discussed in terms of the various subtitle conditions.

5.3.4.1.1 Factor 1: Perceived difficulty of content

In terms of the content factor, varying results were found for the interaction between the five videos and the subtitle conditions. Video 1 was perceived to be most difficult when presented with the no subtitle condition, and easiest when presented with the English full subtitles. This means that the participants perceived this video with subtitles condition, especially the English full subtitles, to be easier than with no subtitles. The effect sizes of the differences in perceptions between the different subtitle conditions indicate that in terms of language, the content was

perceived to be less difficult with the English subtitles; and in terms of style, the keyword subtitles were perceived to be less difficult.

For Video 2, the content was perceived to be most difficult when presented with Sesotho keyword subtitles, and least difficult with no subtitles. The effect sizes of the differences in perceptions between the different subtitle conditions indicate that in terms of language, the content was perceived to be equally difficult with the subtitles irrespective of the language; and similar findings were indicated in terms of subtitle style.

Similarly, for Video 3, the content was perceived to be most difficult when presented with Sesotho keyword subtitles, but least difficult with Sesotho full subtitles. The effect sizes of the differences in perceptions between the different subtitle conditions indicate that in terms of language, the content was perceived to be equally difficult for the English and Sesotho full subtitles; however, for the keyword subtitles, the Sesotho were the most difficult. In terms of style, the keyword subtitles were perceived to be more difficult, although practical significance was found in the effect sizes of the difference between the Sesotho full and keyword subtitles only.

In terms of Video 4, the participants perceived the content to be most difficult when presented with English full subtitles and least difficult with Sesotho full subtitles. The effect sizes show that in terms of language, the content was perceived to be least difficult with the Sesotho subtitles. With regard to style, the content was perceived to be less difficult with English keyword subtitles. No significant difference is found between the Sesotho full and keyword subtitles, meaning that the content is perceived to be at the same level of difficulty when presented with subtitles in either of the two styles.

Similar to Video 2 and Video 3, the content of Video 5 was perceived to be most difficult when presented with Sesotho keyword subtitles. It was perceived to be least difficult when presented with English full subtitles. The effect sizes of the differences between the score means indicate no practical significance in the perceptions with regard to language, meaning that the content was perceived to be equally difficult irrespective of the language of the subtitles.

It can be concluded from the analyses that subtitles, whether they were in English or Sesotho, keyword or full subtitles, had an impact on the participants' perception of content difficulty. However, the effect of the subtitle type varies from video to video, and is contrary to the expectation that the content would be perceived as less difficult with the KSS specifically.

5.3.4.1.2 Factor 2: Perceived helpfulness of subtitles

According to the means of the scores for this factor, the English full subtitles were perceived to be most helpful whilst the Sesotho keyword subtitles were regarded to be least helpful. The effect

size of the differences between the subtitle factor means, however, indicates that the differences were small with no practical significance. Based on this it is concluded the language and the style of the subtitles possibly did not influence the participants' perception of the subtitles' helpfulness, meaning that the subtitles were perceived to be equally helpful regardless of language or style.

Furthermore, correlations were conducted between comprehension and the questionnaire factors. Varying correlations were found between comprehension and the subtitle factor according to the subtitle conditions; negative correlations were found for the FSE and the KSS, whereas positive correlations were found for the FSS, KSE and NS. However, these correlations indicated small and no practical significant relationship. Therefore, it appears that there is no clear relationship between perceived helpfulness of the subtitles and comprehension.

In terms of comprehension and subtitle factor, the correlations revealed a medium, practically visible relationship for the Sesotho keyword subtitle. This finding is interesting given that the Sesotho keywords were regarded to be least helpful. Other subtitle conditions, which show possible practically visible relationship between comprehension and the subtitle factor are the English full and keyword subtitles. For these subtitles there is a clear relationship between the perceived helpfulness of subtitles and comprehension. The Sesotho full subtitles show no practically significant relationship between comprehension and the subtitle factor, meaning that the perceptions of subtitle helpfulness seems to have a direct relationship with comprehension.

5.3.4.2 Questionnaire 2: Participants' experience of subtitling in general

This questionnaire sought to explore the participants' general experience of and attitudes towards subtitles in the experiment and in general. The responses in this questionnaire may provide some insight to the findings in Questionnaire 1.

Most participants were found to be familiar with subtitled programmes and the main language used in the subtitles is English. It is therefore not a surprise that when asked to identify the preferred subtitle condition, the most preferred subtitles were the English full subtitles. The participants cited familiarity as one of the reasons for their choice. Participants also indicated that the subtitles assist with comprehension. In addition to the English full subtitles, the keywords subtitles (both English and Sesotho) were preferred for facilitating comprehension and memory.

A few participants preferred the no subtitles conditions, and they stated that the subtitles are a distraction. This was to be expected as Questionnaire 1 also investigated this issue of possible distraction in the subtitle perceived usefulness factor. The findings reveal that even though in general the participants perceived all the subtitles to be useful, some participants found the subtitles distracting. This is similar to the findings of Montero Perez *et al.* (2014a), who

investigated the participants' perception of the usefulness of keyword subtitles and found that the keyword style distracted the participants.

Furthermore, Questionnaire 2 of this study asked the participants which subtitle condition they would recommend for education. In terms of language, the participants would recommend the English subtitles and in terms of style, they would recommend the full subtitles. From the findings of the questionnaires it can be deduced that there is a role for subtitles in education. However, the participants were not asked to motivate their response, this would be an important aspect to investigate in future studies.

5.4   Limitations

The study was small-scale with 38 participants, due to the time limit and the difficulty to get participants. A small sample size is common in subtitling and eye tracking studies. However, when compared to other subtitling and eye-tracking studies, the sample size of the current study is larger than some of the studies, such as Kruger (2013) who had 21 participants, Kruger and Steyn (2014) who had 36 participants and Winke *et al.* (2013) who had 33 participants. According to Sharafi *et al.* (2020:3146) sample sizes of previous eye-tracking studies ranged from 5–169 participants, with many having less than 20 participants. They state that this could be due to various factors such as "the research question and the experimental design (e.g. within subjects vs between subjects)". Another factor could be that studies involving eye tracking may take a lot of time – the current study required at least 2 hours 30 minutes from each of the participants; this could have been a factor in so few students being willing to participate. Moreover, there are few laboratories equipped with many eye-tracking devices, as in this study.

Another limitation for this study is the use of the Sesotho proficiency level as part of the selection criteria only. This information, which was determined by asking the participants to indicate their Grade 12 Sesotho marks in the questionnaire, were used only for ensuring that the participants met the inclusion criteria for this study. Future studies can use the Sesotho marks to see if they had any influence on the comprehension marks. The participants' English marks would also have to be considered to see how they influence the comprehension. It is assumed that the language proficiencies may influence comprehension and the extent to which the different subtitles are read.

An additional limitation was the lack of subject-specific terminology in Sesotho. This was identified by the researcher during the process of translating the English subtitles into Sesotho. Some participants also identified the lack of subject-specific terminology as a problem they experienced with the Sesotho subtitles. In order for support interventions to successfully utilise African languages, terminology needs to be developed. This matter may be addressed by a terminology

coining project involving the terminology users, who include the students and the lectures of the specific field, as well as the Sesotho lecturers and translators.

Another limitation is that participants are using the subtitles in an artificial set-up, which does not reflect a natural learning process. Another option could be to allow participants to be more actively involved by allowing them to rewind the videos if they need to go back to the audio or to the subtitles. Giving participants this opportunity and other innovative solutions may result in more use of the subtitles.

5.5   Recommendations for future research

There was evidence that reading subtitles increased comprehension in the study. Future studies should focus on the styles and languages of the subtitles. It is important to note that the study showed that KSS (or English) did not necessarily correspond to better comprehension. This finding suggests exploring keyword subtitles as well as other styles and languages. Participants in this study may not have been motivated to do their best as their performance had no serious consequence for them and participation did not benefit them in their own studies. Further research may be considered with Psychology students as participants, or videos can be created for a different field of study adapted to the student population who may find participation in the study beneficial. In addition, lecturers may consider creating a context where the comprehension scores contribute to a certain extent to the module mark; as one way to encourage serious engagement.

Despite the study not finding the anticipated results for the keyword subtitles, there is still value in the use of keywords in audiovisual educational tools. From this study, it is evident that students sitting and watching videos does not have significant effect, therefore, future research should consider different approaches in order to optimise student support.

Lastly, future studies can be conducted over an extended period of time. This allows the researcher to observe and monitor the participants' performance and perceptions over a longer period. Increased familiarity can be expected over time, and it may result in potential improvements over the long term.

5.6   Conclusion

Research in education has shown that subtitles are a valuable tool in language learning. Studies focusing on the use of subtitles in comprehension of subject–specific content, however, are limited. This study sought to make a contribution by investigating the influence of subtitle language and style on comprehension of subject-specific content in an academic context. There are some statistical correlations to explore further; although they might not be practically significant.

In order to gain more insight to the findings of the study, participants were required to complete questionnaires. One of the questions was for the participants to identify their preferences regarding the different subtitle conditions in the study. Few participants indicated preference for Sesotho subtitles and the majority indicated that they preferred the English subtitles. The main challenge identified for Sesotho subtitles is the lack of subject-specific terminology. This has implications for terminology development projects. It is acknowledged that some work has been done in this regard but clearly it is not enough; more work needs to be done in this area. The availability of terminology in African languages in various fields of study may open avenues for future studies on subtitles and other modes of translation as tools for providing support in education.

Moreover, it is evident from the responses to the questionnaire that there is a need to examine the attitudes of students toward the use of more languages in education more in depth. By doing so, one could increase awareness of the importance of using many languages in education in general, thereby making the use of subtitles in many languages more useful.

Despite the fact that the current study did not find the benefits of subtitles as anticipated, this does not nullify their benefits as a tool in education. Subtitles can provide support to students by clarifying subject specific terminology.

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APPENDIX A: ADVERTISEMENT

Dear Student

Participation in a Masters Research Project

My name is Keabetswe Motlhodi. I am a Masters student in Language Practice at the NWU, Vaal Triangle Campus. I would like to invite you to be part of a research project I am doing on the use of audiovisual material in education. My supervisors are Dr E. Hefer-Jordaan and Dr Henk Louw.

Who may participate?

If you do not have Psychology as a module, and you answer YES to the following questions, you may be eligible to participate in the research project:

- *Are you 18 years and older?*

- *Are you a first-year student?*

- *Did you have Sesotho as Home Language in Grade 12?*

  Unfortunately, students who are registered for any Psychology modules may not participate.

What does the project involve? What will be expected of me as participant?

This project involves reading and viewing of materials in a research lab. You will be asked to watch video clips on a computer screen, and answering some questions about what you've learnt. While you are watching the videos, your eye movements will be recorded using an eye tracker.

Participation in the project is voluntary. If at any point during the process, you want to exit the project you are free to do so without giving any explanation.

How long will it take?

The research involves two sessions, which are approximately one hour long each.

How will the data be used? What are the risks or benefits?

The information gathered in the project will be kept confidential and used anonymously. The researcher and the supervisors, will use the information gathered in this project and in possible future projects. Your name will not be used or indicated anywhere. Your name will not be used or indicated anywhere, and the findings of the project will in no way influence your marks. There are no risks anticipated in this project. The benefit of

your participation is that it will help future students. You will receive a flash drive at the end of the second session as a token of appreciation for your time.

If you are interested in participating, please complete the Sign Up Form by clicking on this link: https://docs.google.com/forms/d/1ZtnOORErQ6GCDtwXofqTpSP5zgeZo37LJd6K0RqPVsQ/edit

When you have finished completing the form please submit by clicking on the 'Submit' button on the form. Alternatively please email me at Kea.Motlhodi@nwu.ac.za for more information.

Kind regards,

Keabetswe Motlhodi

APPENDIX B: RECRUITMENT VIDEO

The recruitment video can be accessed by clicking on the YouTube link below.

https://youtu.be/WyFmxWnXhW4

APPENDIX C: EXPERIMENT VIDEOS APPENDIX

All videos used in this study can be accessed by clicking on the Google Drive link below.

https://drive.google.com/drive/folders/1JZ9Sl5KUcGTq11qu9l_gjPu1HVcHcpO7?usp=sharing

APPENDIX D: COMPREHENSION TESTS

Comprehension Test: Video 1

1. Compliance is when behaviour is _____.
     [1]

a. Enforced

b. Requested

c. Obeyed

d. Allowed

2. There are a number of compliance techniques discussed in the video (*lowballing, foot in the door, door in the face* and *that's not all*). Please read the following scenario and identify which technique has been used in each scenario: [1]

Scenario

A salesperson might get you to agree to buy a particular cell phone plan at a low price before adding on a number of hidden fees that then make the plan much costlier.

3. What is the difference between "foot in the door" and "door in the face" techniques
     [2]

4. Indicate whether the following statement is True or False:
     [1]

When students arrive on time to class because the classmates said they should be on time, this is an example of obedience.

5. Below is a list of processes in group formation. Please order the sequence of the processes.
     [5]

a) norming

b) storming

c) forming

d) adjourning

e) performing

TOTAL: /10

1) Indicate whether the following statement is True or False:
Two people in a friendship can be a threat to one another if they are too similar.   [1]

2)The video identifies two theories of attraction (the matching hypothesis and the social exchange theory). Pictured below is a young and beautiful celebrity couple Dineo Moeketsi and Solo who won the award for 'Most Stylish Couple' at the SA Style Awards. Please identify the theory that applies to their attraction to each other and motivate your answer.   [3]

3) There are three attachment styles discussed in the video (*avoidance*, *secure*, and *anxious*). Please read the following scenario and identify which attachment style is applicable: [1]

Scenario

Maki is in a trusting, long-term relationship. She seeks out social support, and shares feelings with other people. She has no fears of being abandoned.

4) Mention one thing that may lead to commitment in a relationship?
[1]
5) Sternberg's element of passion has a/an _____ component?
[1]

a) Emotional

b) Motivational

c) Cognitive

5) There are a number of types of love discussed in the video (infatuation, liking, romantic love, empty love, fatuous love, companionate love and consummate love). In the table below there is an example of a love scenario with the type of love and it comprising elements identified. Read the scenarios that follows and please complete the table by identifying the type of love and applicable element.   [3]

Scenario	Type of love	Elements comprising the love
John and Thuli have been married for 5 years. They feel like they are each other's best friend. They are still physically attracted to each other and are committed	consummate love	intimacy, passion and commitment

to staying together and making the relationship work.		
Sometimes Jabu feels alone, even with her partner sitting right next to her. But she cannot divorce him for the sake of the children and their two families	a)	commitment
Sipho and Mpho share a very close bond. They have been friends since childhood and they connect on many levels. They support one another in their different life choices.	b)	c)

Total: /10

1. Which of the following scenarios best illustrates aggression? [1]
   a. Mpho and Carl engage in a heated debate concerning the merits of the Big Mac versus the Box Master.
   b. Maria trips over the scooter her son absentmindedly left in the driveway.
   c. In his attempt to save Samantha from drowning, Mohammad breaks three of her ribs.
   d. Tshepo kicks Thando in the shins to keep her from eating the last Krispy Crème donut.

2. What is the difference between instrumental aggressiveness and emotional aggressiveness? [2]

3. Indicate whether the following statement is true or false and explain the reason for your answer: [3]
   Anger and aggression are the same.

4. A child screaming at a classmate just because it makes them feel better is an example of _____ aggression [1]

5. Name one biological influences of aggression mentioned in the video. [1]

6. Name one non-biological influences of aggression mentioned in the video. [1]

7. A teacher scolds the class so that they may keep quiet. This is an example of _____ reinforcement. [1]
   a. Positive
   b. Negative

Total: /10

1) There are a number of ways of coping with stress discussed in the video (*pro-active coping, emotion focused coping,* or *problem focused coping*). Please read the following scenarios and identify which coping mechanism has been used in each scenario.
[3]
   a) A learner struggles with maths. He decides to go ask the teacher for extra classes.
   b) An employee feels unfairly treated at work, she tells herself to "take a deep breath" before she deals with the situation.
   c) A husband and wife feel that they are unable to solve their problems as a couple. They decide to see their religious leader for counselling.

2) What is the difference between emotion focused coping and problem focused coping mechanisms? [2]

3) Pro-active coping entails… [1]

   a) Positive thinking
   b) Seeking social support
   c) Focusing on the source of the distress
   d) Telling yourself to calm down

4) In your own words give one limitation of job interviews [1]

5) Which standardised test is used to assess the cognitive abilities of the job candidate?
[1]

6) Name one aspect tested by integrity tests. **[1]**

7) Indicate whether the following statement is True or False:
   Assessment centre is a place/venue. [1]

Total: /10

1. Define the term, *community* in your own words. [2]

2. Indicate whether the following statement is True or False and explain the reason for your answer. [2]
   Community psychology focuses on people on an individual basis.

3. Community psychology aims to achieve the following: reduce risk, to facilitate change and to promote the well-being. Please read the following scenarios and identify the aim of each intervention and explain your answer. [4]
   Example:
   Scenario: Building relationships between individuals, e.g. former prisoners, and community groups
   The aim is to reduce risk. The intervention will help the community to accept the individual and thus reduce the risk of the individual feeling rejected which may lead to depression.

   3.1 Community programmes to help marginalised individuals, like foreign nationals, feel more connected with their local communities (2)
   3.2 Developing and implementing action-oriented community-based programs addressing issues like child abuse and drug abuse. (2)

4. A teacher, a doctor, and a psychologist working together on a case of drug abuse is an example of [1]
   a) community facilitation
   b) Promotion of well-being
   c) Reducing risk
   d) Interdisciplinary co-operation

5. Bronfenbrenner's aim of ……. matches the community psychology aim to reduce risk. [1]

Total: /10

APPENDIX E: CONSENT FORM AND BIOGRAPHICAL DETAILS

Informed consent form

Part 1: **General project information**

This section serves to provide you, the participant, with more information, in order for you to make an informed decision about whether or not you want to participate in the experiment.

1. Title of the project

The impact of audiovisual support on student comprehension.

2. Institution: Focus area UPSET at the NWU.

3. Name and contact details of researcher

3.1 Mrs. Keabetswe Motlhodi

- Function in project: researcher (Masters' student)
- Qualifications: BA (Honours)
- Telephone: 071 101 0847
- Address: School of Languages, Room 105, Building 31.VTC

4. *The researcher has obtained ethics clearance from the Ethics Committee for Language Matters at the NWU, under an existing project titled: Investigation of mediated communication in terms of the means of production and the impact of end users (NWU-00425-15-A8).*

5. You are approached to take part in this project and may now have the following questions:

5.1 What are the set requirements that persons must meet to be able to take part in the project? Why and how was I chosen?

You are a first year student, 18 years and older. You had Sesotho as your Home Language in Grade 12. You are not doing Psychology in 2019 and have never before registered for a Psychology module.

5.2 What is the purpose of this project?

The purpose of this project is to determine whether the introduction of audiovisual support in the form of recorded lectures will help improve comprehension of educational material.

5.3 What will be expected of me as participant? In which interventions/procedures will I have to take part? What exactly will it involve?

You will have to attend two individual sessions where you will view video clips of five recorded lectures of the PSYC121 module. You will view these video clips on a

computer screen, and after each video clip you will be asked to write a short comprehension test on that clip. The test will be followed by a short questionnaire regarding your experience whilst viewing each video clip. While watching the video clips, your eye movements will be recorded. You are furthermore requested to grant the researcher permission to access your TALL scores. This will be used for the purpose of selecting participants and allocating participants to groups.

5.4 What are the potential discomforts and/or potential dangers and/or potential permanent consequences (however negligible) that participation in this project holds?

There are no risks anticipated in this project. The eye-tracking equipment that will be used is a remote system, and the only requirement is that you should not move too much during the screening, but this should not cause any discomfort as the video clips are short. There will be short breaks between the screenings of the various video clips.

5.5 What precautions have been taken to protect me as participant?

The reporting of data will be completely anonymous. Your name will not be mentioned.

5.6 How long am I expected to be involved in the project?

The project will take place from March to September 2019 and your individual sessions will be scheduled over a period of two consecutive weeks.

5.7 What direct benefits can I expect from the project? What remuneration (monetary or services) can I expect for my participation?

You will receive a flash drive after successful completion of the second session as a token of appreciation for your time.

5.8 What potential general benefits are there for the broader community, which may arise from the project?

The project may contribute to knowledge in the area of using audiovisual support in education and thus help future students.

5.9 How will the findings of the project (general and individual results) be made available or conveyed to me?

The results of this project will be reported anonymously in MA dissertation, reports and in academic journals. Should you wish to find out about the results of the study, please contact Mrs. Keabetswe Motlhodi (see 3.1 for contact details).

5.10 What measures have been taken to handle and store my data confidentially?

Data will be reported anonymously, i.e. no names or university numbers will be used when reporting on the data. The data will be stored in a code encrypted folder on a computer in a locked room on the Vaal Triangle Campus of the NWU.

As researcher, I confirm to participants that the above information is complete and correct.

_____

Signature of researcher

Date: _____

Signed at: _____
(Place of signature)

Part 2: **General principles**

To the signatory of the consent contained in Part 3 of this document.

You are invited to take part in the research project described in Part 1 of this informed consent form. It is important that you also read and understand the following general principles, which are applicable to all participants in this research project.

1. Participation in this research project is voluntary, i.e. no pressure will be put on you to take part.

2. You are free to withdraw from the project at any time, without stating reasons, and you will not be harmed in any way by doing so.

3. Participation in the project will not influence your academic performance and marks in any way.

4. You will be expected to attend the two individual screening sessions according to the schedule that will be agreed with you.

5. You will receive a token of appreciation for your time at the end of the second session.

6. The knowledge that may be gained by means of this project may provide some solutions to matters related to academic support and thus may benefit students in the future.

7. By agreeing to take part in this project, you are also giving consent for the data that will be generated, as well as other data such as your results in the TALL test written at the beginning of the year, to be used by the researcher and the supervisors. All data will be be used to answer the research questions of this study and will be written up in a research project report, academic articles based on the research project and possible future research publications related to the project. In return, the researcher commits herself to keep the data confidential and anonymous; your name will not be disclosed on any of the reports published from this study.

8. Information regarding the project, the potential risks, factors that may cause you possible inconvenience or discomfort and the benefits that can be expected, are set out in Part 1.

9. If at any stage you have questions regarding the project, feel free to ask the researcher. She will gladly answer your queries.

10. Your well-being is important to the researcher and actions will be taken to protect your interests.

11. No project may be commenced before it is approved by the Ethics Committee. Furthermore, the researcher must report any detrimental effects experienced during the implementation of the project in full and without delay to the chairman of the Ethics Committee. If any unforeseen serious detrimental effects are observed during the project, it may be necessary to terminate the project immediately.

Part 3: Consent

Title of the project: The impact of audiovisual support on student comprehension.

I, _____ with student number, _____

            (Full names and surname)   (*Student number*)

have read the project information, as discussed in Part 1 and Part 2 of this informed consent form, and I declare that I understand the nature of my participation and agree to participate. I have also initialed every page of Part 1 and Part 2.

By signing this document, I give the researcher permission to use and report my data anonymously.

_____   _____

Signature of participant   Date

Signed at: _____

              (Place of signature)

Would you like to participate in future research projects? _____

If YES please provide contact details: _____

Biographical questionnaire

Name: _____

Student number: _____

Please put a cross (X) or a tick (✓) in the block that represents the appropriate answer at the following questions, or write down an answer where requested.

6   Gender

Female		Male		Other	

7   Age

Age		Age		Age			
19 years		20 years		21 years		22 years	
23 years		24 years		Other (specify)			

8 Are you currently enrolled for any PSYC (Psychology) modules?

YES		NO	

  If YES which modules?

9 Have you enrolled for any PSYC (Psychology) modules in the past?

YES		NO	

  If YES which modules?

10 Are you currently enrolled for language practice modules?

YES		NO	

  If YES which modules?

11 Did you take Sesotho as Home Language in Grade 12?

YES		NO	

If YES what symbol did you achieve?

A	80% or higher	
B	70%-79%	
C	60%-69%	

12 What is your mother tongue?

13 Which language do you use at home most of the time?

14 What is your year of study?

15 Do you wear glasses?   YES   NO

APPENDIX F: TASK LOAD QUESTIONNAIRE

Video number:

SECTION A: Reading subtitles in the project

Task Load Questionnaire

You just completed a task consisting of watching a video. Please tick the box that best describes your experience.

1) How familiar were you with the content of the lecture you just watched?

Not at all familiar (knew nothing before I watched the lecture)	0	1	2	3	4	5	6	7	8	9	10	Completely familiar (knew everything before I watched the video)

2) The content of the video was very difficult

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

3) The subject terminology used in the video was very difficult

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

4) The language used in this video was very difficult

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

5 I found the subtitles easy to read

not at all	0	1	2	3	4	5	6	7	8	9	10	Read them thoroughly

6) The subtitles helped me understand the topic

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

7) The subtitles helped me understand the terminology in the video

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

8) The language used in the subtitles was very difficult

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

Video number:

9) Subtitles made concentrating on the video difficult

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

APPENDIX G: ATTITUDINAL QUESTIONNAIRE

Participant code:

Video number:

SECTION A: Reading subtitles in education

1) I think in general, subtitles can help me understand academic content.

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

2) Which of the following subtitle types would you prefer?

Sesotho subtitles written out as full sentences	English subtitles written out as full sentences	Sesotho subtitles summarised as keywords	English subtitles summarised as keywords	No subtitles

3) Please explain the option you chose in question 11.

_____
_____
_____
_____

4) Would you recommend subtitles to a fellow student?

Definitely no	No	Maybe	Yes	Definitely yes

5) Which subtitles would you recommend?

Sesotho subtitles written out as full sentences	English subtitles written out as full sentences	Sesotho subtitles summarised as keywords	English subtitles summarised as keywords	No subtitles

6) Did you LIKE anything about your experience with the subtitling? Why?

_____
_____
_____
_____

7) Did you DISLIKE anything? Why?

_____
_____
_____
_____

8) Do you have any suggestions or comments you wish to make regarding the use of subtitles in education?

_____
_____

Video number:

SECTION B[1] : Reading subtitles in general

Rate each of the following statements by ticking the most applicable answer from the scale given below.

1) I watch TV every day

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

2) The TV programmes I watch contain subtitles.

not at all	0	1	2	3	4	5	6	7	8	9	10	is completely the case

3) If the programmes do contain subtitles, please indicate the language of the subtitles.......................

APPENDIX H: ETHICS CLEARANCE LETTER

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14 December 2018

Dear Dr. E Hefer-Jordaan and Ms. KE Motlhodi,

ETHIC CLEARANCE APPROVED

This letter serves to indicate that your ethics application was approved by the Ethics Committee for Language Matters (Humanities):

Ethics committee: ECLM
Application number: NWU-00425-15-A8
Date of report: 14 December 2018
Applicant: M. KE Motlhodi
Project Title: Investigating the difference in comprehension between Sesotho and English subtitles: The case of full and keyword subtitles
Supervisors: Dr. E Hefer-Jordaan

Your implementation of the reviewers' recommendations regarding your study meets the ethical requirements. Your explanation of using a descriptive version of the title of the study in introducing it to participants is also well argued and acceptable.

The Ethics Committee for Language Matters wishes you well with your study.

Yours sincerely

C. Van Eeden.

Prof C Van Eeden
Chair: Ethics Committee for Language Matters

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