Music Listening and its Cognitive Effect on Learning

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Music Listening and its Cognitive Effect on Learning

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DECLARATION:

In accordance with Rule G5.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

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Abstract

This experimental study focuses on the activity of music-listening and its effect on students' learning and memory. This is particularly relevant today given the 'sound-consuming culture' which results from advanced multimedia technologies. To determine music-listening's effect on students, we examined the cognitive effect that music-listening had on their memory and learning. A non-probability convenience sampling technique was employed to recruit a limited population of 227 male and female participants from three Port Elizabeth high schools between the Grades of 8 and 9. A 'two group design' was used with 189 students (54 males; 123 females) completing a word-recall test and reading comprehension test. During the first round of testing all participants completed both tests under the first music treatment condition: silence. During the second round of testing, a second set of tests was provided with the experimental group placed under a treatment condition of self-selected background music while the control group remained under the condition of silence. Independent sample *t*-tests were used to analyse the data of this study. The results showed that listening to self-selected background music had a negative cognitive effect on students' memory and learning during the completion of the word-recall tests. However, no significant effect was found in students' ability to complete a reading comprehension. In addition, this study also showed that female students seemed to have significant negative cognitive effect during the word-recall test. The findings of this study therefore showed that, depending on the task, word-recall tests (but not reading comprehension tests) were cognitively affected by music-listening.

Keywords

Music; Music-Listening; Background music; Learning; Memory; Cognition; Cognitive effect.

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Chapter 1 - Introduction to Study and Research Problem

1.1 Introduction and background to study

In my experience as a high school teacher over the past three years, I have found that there is always a sequence to a lesson. I would spend part of the lesson teaching the material that would need to be covered, followed by giving the students an activity to work on. No matter what age or subject, there would always be someone putting his or her hand up asking “Ma'am, can we listen to music?” In my first year of teaching, I was always glad to hear this question as it resulted in students sitting quietly and working, and I was encouraged that students were being exposed to some form of musical outlet. However, I came to question whether it was the right decision to regularly allow students to do this. I was also noticing students were sitting and working or studying after school with headphones on their ears. I began to ask, “Isn’t listening to music a distracting factor to the students’ focus and cognition?” Personally I struggled to listen to any music while working as it grabs too much of my attention. However, is it possible that I am wrong and that listening improves their memory and learning, and so has a positive result on their academic performance?

Humans have a unique relationship with the organization of audible sound we call music, with it being viewed as a human resource that is produced and consumed. It is a unique resource in that it’s infinite and kept alive by its use (Titon, 2009 p. 31). Music has always been important to people from different cultures and all walks of life, closing the gap between eras of time, and reflecting people’s attitudes and progression (McDonald, 2013 p. 1). The mass consumption of music-listening today is largely due to an accelerated change in technological innovations in the past 20 years or so. By the creation of internet access, these technologies have shifted from physical shelf space at local stores to virtual shelf space in the online world. Technologies such as phones, tablets, and desktop computers play a crucial part in allowing for a large amount of music on demand. The average teen owns 3.5 gadgets out of 5 which include cell phones, MP3 players,

computers, game consoles and portable gaming devices (Lenhart et al., 2010 p. 9). Self-directed listening serves individuals' needs daily at multiple levels. Papinczak et al. (2015 p. 16) reported that youths listen to an average of 18 hours of music per week. With access to music being increasingly affordable and available, students have turned to music as a successful learning tool. Darrow et al. describe 'background music' as an 'associative task' in which a listener listens to music while engaging in other activities (2006 p. 763). This can be any activity, from driving, reading, or exercising, to playing music in a restaurant or shop. Increased use of background music, by students while studying, has been reported of late. A recent study by Kumar & Aithal (2016 p. 1191) found that out of 200 participants, 120 admitted that they listened to music while studying. There has been some debate about whether students should be studying with music or not. Many people, and especially younger individuals, uncritically accept the idea that music functions as a facilitator to their learning.

Learning is seen as the acquisition of physical or mental knowledge from all our senses, and the process of attempting to place that knowledge into our long-term memory so it can be retrieved later. Memory is crucial to learning, as the means by which we process and store information during learning can have either a positive or negative effect on how easy or hard it is to retrieve later. Knowledge can be gained through many different processes, one of them being, for example, studying. Studying for tests and exams is an activity that is integral to any student's academic success. Study environments and habits differ among students, with many educators and students encouraging the use of available technology. Music might provide a link between memory and learning, and so encourage students to not only look at studying as a positive and productive activity, but also to help them successfully retain information learnt in class and in studying situations on their own. Encoding is the process of placing knowledge into our memory while retrieval simply accesses that stored knowledge in our memory (Karpicke & Blunt, 2011 p. 772). Salame & Baddeley (1989) had found that listening to background music during encoding interferes with learning and memory performance. This study involves exploring students' music-listening habit and examining their effect on the processes of encoding and storing. Is it possible that these processes can function successfully and effectively

in the presence a musical stimulus? If students are using music to help them study, it's crucial to determine if music is causing a beneficial or distracting effect on their cognition. If it is a distracting effect on how students acquire knowledge, then this could definitely be a negative aspect of listening to music while learning. If it is proven to be a facilitator to their cognitive processing, we can encourage the increase of background music, and introduce strategies to students that could have a positive impact on their academic performance.

Even though there is a large quantity of research in this topic, I believe that it requires further investigation for a number of reasons. Firstly, I have not yet found any research like this conducted in South Africa. Is it possible that the results might differ from other countries with contrasting cultures? Secondly, in South Africa, our assessments in both schools and universities are based on continuous assessment where the student's progress is evaluated by the use of tests and examinations. These are used to determine the learner's success in the educational process. Previous research have explored the aspects of memory recall but failed to go further into its various aspects when it comes to learning and studying. There is not enough attention placed on rehearsal which is an important and controllable aspect involved with learning new knowledge or skills. Thirdly, there has been focus on the style or genre of music, but I feel that there is a lack of recognition of the relevance of self-selected, familiar music to participants. Researchers have made stereotypical assumptions about music evoking arousal in participants. I hope to bring awareness of the advantages of using self-selected music on their performance in order to create a realistic illustration of a music-listening situation. I think that it is time to be more aware of the effects of music-listening on memory and learning. If it is hindering the student's performance it will be beneficial for institutions and educators to have this information available, especially with the preponderance of learners listening to music. Even if we have no control over the amount of music students are listening to on a daily basis, when it comes to learning, it could be something to be monitored. However, if it is something that will facilitate learning, we can find ways to use it to benefit students. This could be influential in encouraging educational institutions such as schools,

universities and learning institutions to implement appropriate teaching plans and techniques which might improve the learning and studying habits of learners.

1.2 Aim of this research

The following research aims to lay out the purpose of this study:

- To determine from a limited population of students within the Port Elizabeth district, the amount of students listening to music while working or studying
- To determine from the limited population of students, a comparative difference in listening to music across gender and home language
- To determine the comparative differences in the effects on participants' cognition between musically trained or skilled students vs. those with no musical training or skills
- To determine the effects on participant's cognition when listening to music while working or studying
- To determine if schools should be using background music-listening as a tool to develop and improve students' cognitive performance in memory and learning

Chapter 2 - Literature Review

The term ‘music’ is one that exists in a social context differing between countries, cultures and societies, and varies in ways that people create, perform and react to it. It may be possible that the music of one culture may not be recognized as music by members of another culture. Blacking (1995 p. 224) stated that “although every known human society has what trained musicologists would recognize as music, there are some that have no words for music or whose concept of music has a significance, quite different from that generally associated with the word music”. From what we know, no known culture has ever lacked music and even though music’s existence in society is universal, its meaning is not. According to Titon (2009 p. 3), music was not universal in that everyone understood what music meant, but rather each culture or person may give different meanings to the term ‘music’. Nettl (2000 p. 465) asked the question that if we say music is culturally universal, do all people think they have music? I can imagine not, as with different people having different beliefs, rituals, ceremonies, the musical situation and the value of music must differ and be associated with different activities around the globe. Titon (2009 p. 3) used the term ‘music-culture’ which could involve a single human’s involvement with music or even a large group or community. We can view the term ‘sound’ as anything that is aurally heard and music could be considered a vast body of sound. Music is made or produced by people but where those boundaries begin and end is difficult to say. Since a definition of music is very complex and can include all types of sounds, noises, and even silence, it makes this discussion of music one of the most noticeable pitfalls in the study of music. For the scope of this study, I will place less importance on trying to define the term ‘music’ and more on the action or activity, especially ‘music-listening’ or ‘listening to music’, which can be seen as a human activity, where the listener gives attention to the sounds or music presented to them.

The first section of this chapter explores the activity of music-listening, and its development through the years dating back centuries until today with what we call the ‘technological generation’. We also explore the culture of music-listening by the generation today and their music-listening habits. An important term that will be defined is ‘background music’, a term that will be used throughout this study and will refer to

various styles of music, but its most important characteristic is that it always accompanies an activity or situation, especially working or studying. The second section in this chapter will explore aspects of learning, and since memory is crucial to learning, it will start with a brief discussion of memory pathways, followed by whether music and learning and memory can be interlinked. Studying is considered crucial to student in their success in all schools and universities. For all students, the primary goal of studying is to encode the information successfully therefore we will explore how students learn information with processes such as rehearsal and encoding. Tests or exams are then a way to assess students' abilities to remember these facts and evaluate their knowledge and understanding. Therefore, it's important to explore the assessment of learning in terms of how students retrieve or recall information. Cognitive theories will be explored in the next section of this chapter with, for example, the 'theory of attention' or the 'limited capacity theory'. It will focus on how we process information cognitively and what influence the activity of music-listening could have on these processes. Further we will look at the cognitive effect of music-listening by examining various studies that tried to determine its effects on an individual socially, emotionally and cognitively. Lastly, to discuss the idea of music-listening functioning as either a facilitator or distraction to studying, this section will explore literature of this topic that placed focus of one of these three aspects; the distractor, the task and the listener.

2.1 Music-listening

Humans have always had a unique relationship with the organization of audible sound that we call music. It has played an important part to human culture, for centuries. It can be considered the most ancient and universal forms of communication and the oldest form of expression especially with the voice being considered the most ancestral instrument (Nettl, 2000 p. 118). Human excavation has found some of the oldest artefacts which have included musical instruments such as a bone and ivory flute which shows human presence nearly 35 000 years ago. Findings of animal skin stretched over tree stumps to make drums allows researchers to say with confidence that listening to and/or making music has been part of our species' behavioural repertoire for many years (Levitin, 2007 p. 2; Conard et al., 2009 p. 737). In Patel's essay entitled 'Music, biological

evolution and the brain', he compared music and fire, finding both to be an ancient invention and universal in providing things that are universally valued by humans (2010 p. 9). Nettl (2000 p. 464) also found music to be universal, comparing music and language, believing that both span deep into our human past. Hodges (2000 p. 2) looked at music as being like a language, in that it is a species-specific trait. This is due to human beings having music, and is one of the characteristics of what it means to be a human being. Listening to music is consistently regarded as a pleasurable activity within our human experiences and seen as enigmatic human behaviour. Unlike most human behaviour, it cannot be traced to a practical motive of survival or procreation (Schäfer et al., 2013 p. 1). Music can be viewed as a human resource that is produced and consumed, although what makes it a unique resource is that it is infinite and kept alive with its use (Titon, 2009 p. 31). Music has always been important to people from different cultures and all walks of life, closing the gap between eras, and reflecting people's attitudes and progression (McDonald, 2013 p. 1). It has become part of our daily lives. Even if we choose not to engage in listening to music regularly, we are exposed to it on a daily basis due to cultural and social environments in which we live. This mass consumption of music-listening today is largely due to an accelerated change in technological innovations in the past 20 years or so. In order to grasp the increase of music's involvement in people's lives we need to explore the development of these technological innovation and growth in access to music. They both play a vital role in contributing to creation of today's biggest music-listening generation. The sections to follow will explore those accelerated changes as well as defining different modes of listening and discuss the term of 'background music' and lastly examine the prominent role that music-listening plays in today's generation.

2.1.1 The development and accessibility of music

Researchers are beginning to acknowledge that twenty-first century technologies continue to change at a rate like never before seen and are also changing the way with which people interact with music (North et al., 2004 p. 42; Aspray, ed 2008 p. 451; Nill & Geipel, 2010 pp. 37-38). The first form of recorded technology came with Thomas Edison's invention of the phonograph in 1877, followed by a dominant form of listening

changing consistently through the ages from the radio, vinyl records, the jukebox, cassette tapes, CD's, Walkman's, and MP3. Access to these technologies has shifted from physical shelf space at local stores to virtual shelf space in the online world with the creation of the internet. Online retailers such as Amazon offer 150, 000 different CD titles while Apple Music or iTunes, a media player and library, internet radio and mobile device management application, announced in February 2010 that the iTunes store had officially sold in its ten billionth song (El Gamal, 2012 p. 20). Music has become much more widely and readily available, but according to North et al, (2004 p. 42) has "lost its aura of automatic aesthetic value". North felt that music has become like a commodity, which is produced, distributed and consumed, but the most drastic change is that the context within which people listen to music has become too varied and diverse.

Music-listening has come a long way from the 17th and 18th century, with musicians from Johann Sebastian Bach to Ludwig von Beethoven operating under a patronage system and receiving most of their income from performing (Nill & Geipel, 2010 p. 37). Their music was only heard live and a musician's source of income came from providing entertainment at private homes and public concerts for festivities and celebrations, or through their services as Kapellmeister (director of music). Later, composer' music began to be printed and sold to amateur music-makers and urban residents who were responsible to pass on the music to a larger audience (Spinelli, 2015 p. 6). This meant that, due to its rarity, music was seen as a highly valued treasure - much more prized than it is today and was experienced and valued within clearly defined contexts (North et al., 2004 p. 42). In today's technologically advanced time, musicians are truly independent of only live performance, with it never being easier and more affordable for an artist's music to be heard by a larger audience. All it takes is to create a song, upload to a third-party host through platforms such as SoundCloud, iTunes, Spotify, YouTube and Audiomack, and it is easy to distribute their music to a greatly expanded audience. This can all be done at any venue, city and country around the world with little more than a personal computer and the internet. The internet allows musicians a workplace for consumption and production of their musical works. According to an online survey of 2,755 musicians, 87% use the internet to promote, advertise and post their music. This

study further stated that 32 million Americans consider themselves artists and 10 million receive compensation for their creation and performances (Madden, 2004 pp. 3-4). Technologies such as phones, tablets, computers and desktop computers play a crucial part in allowing for a large amount of music at an instant demand. A study on internet use by teens and young adults found that 58% of 12-year olds, and 93% of adults aged 18-19 years own cell phones, and seven in ten teens own a laptop computer (Lenhart et al., 2010 p. 4 & 10). This gives people considerable choice and control over what they can listen to and more opportunities to integrate music into their daily lives and into various situations (Heye & Lamont, 2010; Sloboda et al., 2009; Krause et al., 2015).

"*Music appears to be a pure pleasure technology, a cocktail of recreational drugs that we ingest through the ear to stimulate a mass of pleasure circuits at once*" (Pinker, 1997 p. 528).

The increase of music in people's daily lives has been fuelled with self-chosen listening situations which are made possible with the music-listening technology accommodating individual needs at multiple levels. Listeners are able to live their daily lives accompanied with their own portable personal playlists. Kallinen's (2002 p. 538) found that portable pocket computers and mobile phones have increased in the last few years, and given the listener access to any form of music and information regardless of the location. This is truer than ever before today, with an average person owning 3.5 of the following gadgets; cell phones, MP3 players, computers, game consoles and portable gaming devices (Lenhart et al. 2010 p. 9). Lenhart et al. (2010 p. 1) and Wilhelm (2002 p. 293) labelled this generation as 'millennials' which he described as young people who use various kinds of technology simultaneously. They are proficient at multitasking, "instant messaging their friends, while doing homework, talking on the phone and listening to music". A study called Generation M2 found that a cell phone is the last thing the majority of young people touch before falling asleep and the first thing they reach for in the morning (Rideout et al., 2010 p. 2). This study also found that over the last five years there has been a dramatic increase in cell phone ownership, from 39% to 66%, as well as in iPod and MP3 player ownership, dramatically increasing from 18% to 76%. This increase in music-listening

device ownership reflects the idea that more listeners now have unparalleled access to their music collection, while consistently on the move.

The Music Consumer Insight Report (2017 p. 13) approached 11 776 internet users aged between 16-64 years of age from the following 13 countries; Mexico, Brazil, South Korea, Italy, Spain, Sweden, the United States of America, Germany, Australia, United Kingdom, France, Canada and Japan. They found that 95% of internet users consume licensed music, which is a 37% increase from 2016. They also discovered that the respondents listen to music using four different licensed ways; 44% purchase physical copies of music or pay for their music downloading while 45% make use of audio streaming services for music such as Apple Music, Pandora or Soundcloud. 75% use video streaming for music such as YouTube and 87% are listening to music on the radio, which is largely due to car radios. 71% of 13 to 15 year olds in this study agreed with the statement: "music is important to me", which is shown in the fact that 85% are streaming music both audio and video. The Music Consumer Insight Report (2017 p. 17) found that 85% of YouTube users, a free video sharing service allowing viewers to watch, like, share, comment and upload videos, used the site for music in the last month translating to an estimate of 1.3 billion users. According to Greasley (2006 p. 963), the dramatic increase in internet downloading programs shaped music listener's preferences with participants in their study, finding that downloading programs not only increase speed and ease in acquiring music, but are also increase the breadth of their musical styles. These programs allowed the listener to access a large range of music, allowing them to check the extent of their musical taste and encouraging them to be open to new music regularly. Does this all play a role in creating most active music-listening generation ever?

2.1.2 Today's music-listening generation

Music is not just an independent art-form to be enjoyed for its own sake, but an integral part of many societies and cultures and an unusual human activity for both its ubiquity and its antiquity (Levitin, 2007 p. 2). Bull (2005 p. 347) refers to today's culture as a 'sound-consuming culture' in which people's daily life is accompanied by a large amount of mechanically reproduced sounds. It's not hard to notice that we have created what Bull

(2000 p. 10) calls ‘sound-worlds’. Music follows us everywhere. The majority of the world wakes up with a piece of music that is chosen as our alarm, drives with music or radio sounds, exercises, shops, eats, drinks, celebrates, and protests with music and often relax and go to sleep accompanied by sound. Music is played at every occasion, including weddings, funerals, graduations, sporting events, birthday celebrations, and even romantic dinners. Yet, despite this routine use of sound in our sound-consuming culture, music continues to be an important desire of the population. Music is seen to play a strong role in culture and an even stronger influence on today’s youth.

According to North et al. (2000) in their study that looked at the importance of music to adolescents, they found that music was extremely important to teens, who listen to music approximately 2.45 hours a day. They also found that adolescents prefer to listen to music more than any other indoor activities such as homework, reading and talking to their parents. The study Generation M2 aimed to try to understand the role of media in young people’s lives aged 8-18 years old and guide their use of media by informing and educating the American youth (Rideout et al., 2010 p. 11 & 28). This study found that media is the most powerful force in young people’s lives, with an average of more than 7.5 hours a day spent on media. This meant that they were spending more time with media than in any other activity besides sleeping, close to what most adults spend at work each day. In terms of music-listening, it continues to be the second most popular media activity, spending an average of 2.5 hours a day. The ‘Share of Ear’ study which is one of the first consistent measurement of all audio consumption, analysing daily music journals of nearly 3000 respondents, found that the average time spent consuming audio was more than 4 hours per day (Webster, 2014). An even more recent study by Papinczak et al. (2015 p. 16) reported that the youth of today listen to an average of 18 hours of music per week. We can agree with Levitin (2007 p. 4) in that children today have probably listened or been exposed to more music than their great-grandparents heard during their entire lives.

Even though I am sure most of us cannot remember much of our primary school education, if you ask someone to recite the alphabet, most people will do it in the tune of ‘*Twinkle twinkle little star’,* taught to us in our first few years at school. This proves a

strong connection between childhood learning and music, as music is used to convey information that will facilitate recall and help the retention of words and information. Yet for some reason, as we become adults, we are required to put music aside and forget the study methods of those silly songs. This might be a mistake, given the power of music as a learning tool. A study that examined the role of how music affected infant memory took three-month-old infants and trained them to move an overhead crib mobile while one or two musical selection were played. They watched them do this after one day and then again seven days later. They found that their retention was the same on day one regardless of the music played, while at day seven infants remembered that kicking produced mobile movements only when they heard the same music that was played during learning. They concluded that the infants used the music to remember; therefore concluding that music can give meaning to a learning situation, at least as early as three months (Fagen, et al., 1997 p. 1064). With access to music being more affordable and available for many of this generation to use, shouldn't music be used as a learning tool? A recent study by Kumar & Aithal (2016 p. 1191) found that out of 200 participants, 120 admitted that they listen to music while studying. Johansson et al. (2012 p. 340) found that students often read and study while listening to music, watching television and listening to people around us and, voluntarily or not, this tended to draw from our attention. Their study found that 81% of their 150 participants answered in their questionnaire that they listen to music while they study and 77% truly felt that it helped them to study successfully. Furnham et al. (1999 p. 390) found that 90% of the 142 subjects in their experiment reported listening to music whilst studying at home. Another questionnaire given to students aged 16-18 years showed that the majority (74,1%) gave a rating of 6 or more on a 10-point scale when asked how often they listen to music while they studied. The majority (59.3%) believed that the music used with studying generally helped (Avila et al., 2011 p. 91). A study which investigated how children listen to music today and examined the relationships between different modes of listening and contexts, such as home and school, stated that, although the literature refers to 'listening styles', they found the term 'modes' is more appropriate. Modes suggest a changing situation which corresponds to the idea that children use or shift different modes in different contexts (Boal-Palheiros & Hargreaves, 2004 p. 40). Another preferred term was 'habitus of

listening' which is when an individual listened for a particular focus and expected to experience a particular kind of emotion (Becker, 2001 p. 138). It is not often today that people sit down deliberately to listen to music, as listening to music is done within a listening situation and accompanied with another activity.

Boal-Palheiros & Hargreaves (2004 p. 41) provided the following 'four modes of listening':

1. Listening to background music: background music does not capture people's attention. Music is heard but not actively or purposefully listened to. Children do not intend to listen to, and not usually aware of, background music.
2. Listening as accompaniment: children intend to listen for the accompanying of non-musical activities in which they are engaged, shifting their attention between music and those activities. Music is more often used as a secondary than as a main activity, by adolescents and young adults.
3. Listening as a main activity: children intend to listen and may be concentrating, thus participating mentally in music. Listening with focused attention may have both cognitive and emotional functions.
4. Listening and performing: children listen attentively and respond physically to the music (for example, singing and dancing to a song). Through performance, children may express enjoyment, increase their participation in music, or identify themselves with their favourite singers.

We have come to accept that music has become an essential part of the majority of people's everyday lives. Whether creating a planned audio environment or just by chance, it has become a common habit among students to study and work while listening to music. The term 'background-music' was first seen as any music played while the listener's primary attention is focused on another activity or task (Radocy & Boyle, 1988 p. 245). According to Darrow et al, (2006 p. 763,) listening to background music was an 'associative task' which is when the listener listened to music, while engaged in other activities such as using a computer while completing homework or studying for a test. This term has been carried through to recent studies being classified as "music that is played while the listener's primary focus is on another task in which they are performing"

(Ahuja 2016 p. 5). Lehmann & Seufert (2017 p. 2) also defined background music as "music that plays in the background while studying". Background music is used informally as Lehmann & Seufert (2017 p. 3) further described in that it was not related to the task but tended to attract the listener's attention and could be seen as a 'seductive detail'. Rey (2012 p. 217) referred to the seductive detail effect as "all kinds of interesting but irrelevant details that are not necessary to achieve the instructional objective". It is clear to see why we are able to call background music a seductive detail, as music can be used to create interest and enjoyment in a person, especially students, with the hope that they focus on the instructional material enough to achieve learning outcomes.

Background music, which can refer to any type of music, can also be seen as 'mood music' or 'easy listening music' in that it is intended to be 'heard but not actively listened to' (Langan & Sachs, 2013 p. 4). By definition, it is a secondary stimulus and if it captures the listener's attention, it has failed to function as background music (Savan, 1999 p. 138; Schellenberg & Weiss, 2013 p. 516). Many researchers have noted that studying while listening to background music or 'piped-in music' has become a common habit among students (Cockril, et al., 2011 p. 165; Reynolds, et al., 2014 p. 410). The concern pointed out by in a study by Lavoie (1975) was whether the music might interfere with the learning and performance of students. This may be a concern especially when 99% of their 1700 high school student respondents concluded that they combined homework and studying with listening to background music (Beentjies, 1996 p. 66). Kotsopoulou & Hallam (2006 p. 611) believed that teenagers were unaware of the extent to which background music interfered with different activities (using background music) while thinking and writing. It is not hard to believe students might become accustomed to using music while studying, that they are unaware of music's ability to distract them or whether, without it, they might comprehend better. Is it unrealistic to assume that adolescents will reflect and try to alter their study habits or implement strategies to assist? Obviously not as Kotsopoulou & Hallam (2006 p. 611) found that while listening to music, no matter the nature of the background material, their participants placed an importance on the nature of the actual task. Even though they seemed unaware of the extent of music's effect, they found that the students knew which music had the most interference on their ability to work on a

task. Griffin (2006 p. 34) investigated the positive effects of background music as determined through research in education, health, consumerism and the workplace. He found 15 benefits of the use of background music, of which the following have relevance to this study: it helps with reducing noise distraction, aids concentration and memorization and increases task performance and enjoyment of mental and physical activity.

Music consumption among young people is what Cockril et al. (2011 p. 165) referred to as a 'global phenomenon' with music as a way to enhance their life quality by escaping boring tasks and activities. Background music can have a calming effect on students helping them to remain calm, silent and focused on the tasks given. Cockril et al. also believed that music consumers were unaware of their music habits, and that their music consumption could turn into a negative behaviour that can affect their lives. The concern was that this unchecked freedom by young people would result in them being unable to function effectively without continuous assess to music, contributing to an addictive or compulsive behaviour. Will this ever change, especially when music industries and companies are consistently fighting to give consumers more choice, larger memory storage and longer battery life? Consumers and society work off the principle that "more is better". Consumers need to be more aware of their music consumption behaviour in order to develop a healthy lifestyle choice (Cockril et al., 2011 p. 165). Then consumption can become a choice rather than habits without consequences. Brodsky believed that the use of music in everyday life has shifted to the centre stage of music science research (2002 p. 220). This shift in focus is not only on which things we do to music such as composing and performing, but what things with music, for example studying. It is hard to believe that although music has become such an important part of everyday life in society, more people and researchers are still failing to address its effects. There are three contexts in which listeners can gain experience and knowledge of music: music in school, music together with friends, and music at home. We should be trying to make a connection between the listeners' out-of-school and in-school musical experiences (Stålhammar, 2006 p. 44). We could do this with more investigation into the combination of music and memory and learning techniques of students today.

Studying for tests and exams is an activity that is integral to all student's academic success and even though the activity is universal, choice of study habits and processes may differ with each student. Study environments and habits may differ among students, with many educators and students encouraging the use of the available advanced technology of today. However, technology doesn't guarantee effective learning. It is how and when we use it that can play a positive role or have detrimental effect on a student's learning. Students and educators are constantly searching for ways to make studying effective in achieving better recall and academic performance, yet making learning exciting and interesting so that students want to study and learn. One method may be in promoting what Stålhammar (2006 p. 44) mentioned as an 'in-school musical experience'; we could find the links to incorporate music with memory and learning. Music might be that interlink between memory and learning; a means to encourage students to view studying as a positive and productive activity and assist to retain information learnt in class and in studying situations successfully. The next section will explore the educational activity of learning and studying. These activities both involve the use of memory, therefore the section will start with a brief discussion of the memory pathways followed by determining the link between music and memory by examining previous studies in this topic. It will then investigate learning techniques by exploring how students learn and study, looking at processes such as encoding, rehearsal and storing and lastly, at how a student's learning is assessed in order to determine their academic achievement.

2.2 Learning

Memory and learning are seen to be intricately connected. Memory is an ability that every living organism needs, and when we have the ability of memory we are able to acquire and retain information known as learning. There is no one definition of learning that is universally accepted by theorists, researchers and practitioners. However, the following definition by Sousa (2011 p. 83) is consistent with the focus of this study, the activity of learning is seen as "the process by which we acquire new knowledge and skills". Learning is seen as the acquisition of physical or mental knowledge from our many sensory sources and the process of attempting to place that knowledge into our long-term memory, so that it can be retrieved later.

Knowledge can be gained through many different processes, with one of them being studying. Within the scope of this study, we will discuss a student's individual acquisition of knowledge which can be referred to as 'studying'. Schools today generally give students different textbooks that contain many facts and information that students are required to understand and memorize. Studying is a universal activity and considered crucial to the success in all schools and universities. For all students, the primary goal of studying is to encode the information successfully. Tests or exams are then a way to assess students' abilities to remember these facts and evaluate their knowledge and understanding. Bennet & Bennet (2015 p. 19) stated that knowledge was considered to be the capacity of understanding, insight, meaning, intuition, creativity and judgment and thus to take effective action in various situations. We are able to retain this new acquired knowledge and skills through our memory systems. Even though this is not a crucial aspect of this study as we will not be looking at a participant's brain and how the memory system are used, it is still important to contain a brief understanding of the memory process on which learning heavily relies. Following the heading of memory pathways this section will also explore how music and learning are interlinked, the processes of learning and studying and how students' abilities in learning are evaluated.

2.2.1 Memory pathways

Memory is complex and multi-dimensional, with several pathways all used to retain information playing a crucial role in our ability to acquire knowledge and develop skills. All the information that the brain first receives begins in our sensory memory where it is held for fractions of seconds until the brain decides what to do with it. Short-term memory is a memory pathway where we retain information, a mental workplace that we can think, and manipulate information in our consciousness (Seamon & Kenrick, 1994 p. 220). It is seen as a passive storage buffer and operates consciously and sub-consciously, holding data for 30 seconds. Information held in the short-term memory can be easily lost if not practiced or rehearsed and is vulnerable to disruptions. Working memory processes information consciously rather than sub-consciously. It is a more complex and active part of the human processing system and is composed of both processing and storage components. Matlin (2005 p. 95) viewed working memory as being a brief, immediate

memory for material. Working memory is important in keeping information active, available and accessible, and allowing us to use it in a wide variety of cognitive tasks. Baddeley (2003 p. 203) believed that working memory is a temporary storage system; however, it is needed for the capacity of thinking and serves to facilitate the performance of a range of cognitive tasks which include learning and reasoning. Working memory and learning are two terms that work hand-in-hand, as all information within a learning situation needs to be processed within the working memory. Working memory can be thought of as a scratch pad upon which information can be scribbled, then erased or thrown away, or held in working memory long enough for chunks of information to move again into the thinking process. A model by Baddeley & Hitch (1974) proposed that working memory can be divided into three sub-systems, with the first sub-system being a phonological loop. The phonological loop was the portion of working memory concerned with verbal and acoustic information and processing a limited number of sounds for a short period of time. The phonological loop was then broken up into two sub-components; a temporary storage system and a sub-vocal rehearsal system. The first system includes memory traces over a matter of seconds, which decays unless refreshed by the second system. The sub-vocal rehearsal system was responsible for maintaining information, while also functioning in registering visual information (Baddeley, 2003 p. 191).

The second sub-system of Baddeley and Hitch's model of working memory was a visuo-spatial sketchpad. This served the function of integrating spatial, visual and kinaesthetic information into a single representation. It is there that it can be temporarily stored and manipulated (Baddeley, 2003 p. 200). The third sub-system is the central executive, which is seen as a limited-capacity attentional controller system of the working memory. It does not store any information; however, it integrated information from the phonological loop, visuo-spatial sketchpad, episodic buffer and long-term memory and was responsible for suppressing and filtering out irrelevant information. (Baddeley, 2003 p. 202; Matlin, 2005 p. 111). A recent fourth sub-system called the episodic buffer was proposed 25 years after Baddeley's original model. It functioned as a temporary workspace where information could be gathered and combined from the phonological loop, visuo-spatial sketchpad, and long-term memory. The episodic buffer also provided an interface

between the other components of working and long-term memory. This sub-system allowed information to be manipulated in order to interpret past experiences, assist in solving new problems and help in planning of future activities (Matlin, 2005, p. 113; Mann, 2008 p. 1162).

Long-term memory is seen as a dynamic and interactive system containing a large storage capacity. It can contain numerous memories, experiences and information gathered in our lifetime. Long-term memory also contains subdivisions, such as episodic memory, which focus on memories for specific events. These can be events that occurred in our past such as ten years ago, or as recently as a conversation 10 minutes ago. Semantic memory helps a person to understand and organize knowledge about the world, such as words and factual information. Autobiographical memory is information about our lives, such as personal facts like our name, family and memory of significant and emotionally-charged events in our life. Lastly, procedural memory refers to knowledge of how to do something; skills and action learnt such as walking, whistling or riding a bicycle (Matlin, 2005 p. 121). In learning, long-term memory takes place when students can accurately recall the learning after a specific period of time. A reasonable guideline of time for determining whether information has been successfully transferred into this long term storage is a 24-hour period (Gathercole & Alloway, 2008 pp. 14-16; Jensen, 2008 p. 163; Alloway, 2011 p. 102; Sousa, 2011 p. 55).

2.2.2 Learning and music

Music and noise is universal and a natural part of life. We live in a world surrounded by noise from cars, people talking and shouting, kids playing, birds chirping and dogs barking to the rain hitting the roof and wind moving the leafs added to that is music from the radio, shopping malls and people's phones. This is what a natural living sound is, and it has become what we are used to, thus we don't even realise that in a classroom students are to adapt to the natural sound of silence. This could be seen as creating an unnatural environment creating isolated and negative feelings in listeners. Many teachers in today's classroom believe that silence is the only way to learn. We need to come to realize that success in learning might not only be due to the material but also the study habits of the

students and the study environments in which they place themselves. Many students are using external stimuli of a musical environment as a method to engage in their work and assist their memory. Memory is crucial to learning. How we process and store information during learning can have either a positive or negative effect on how easy or difficult it is to retrieve the information later. “Children retain 24 percent of what they hear, 40 percent of what they see and 70 percent of what they learn through multisensory experiences” (Collett, 1991 p. 42). This is what Collett discovered in his study which influenced the implemented of the LTRTA (Learning to read through the arts) program. The program’s approach to learning was to integrate the arts into a school’s elementary curriculum. The arts are used to facilitate in all areas of learning such as reading, writing, thinking and communication. They found integrated music experience provided excitement in learning for children, therefore improving their abilities. Learning through all these senses expanded their learning and accommodated differences in children’s learning styles.

Music should accompany a child on their first day, being a friend to support, guide and help their experience and enhance their daily lives (Campbell, 2000 p. 142). That is what Köksala et al. (2013 p. 1897), aimed to promote with their creation of a “multi-stimulant atmosphere” in a classroom. The multi-stimulants would include music, drama, and kinaesthetic elements which they believed would support positive emotions and accelerate learning. In their study, they found that the musical elements helped to create a realistic and meaningful environment with results showing music significantly increased achievement and retention in the English vocabulary learning. The Vision 2020 declaration of MENC - The National Association for Music Education affirmed the goal of music education was to make a place for all music in the curriculum. They promoted that music educators needed to be aware of the power of music and be able to integrate it into a classroom instructions (Hinckley, 2000 p. 23). Educators need to try to cater to the broader vision of education, incorporating music into different methodologies, exercises, and activities to reach all different types of students and their unique forms of intelligence, placing music alongside the teaching and educational language of today’s generation.

Background music, being plausible and inexpensive, is an effective technique for keeping children focused on their tasks and actively engaged in their learning; however, we need

to use it in a way that is effective in helping students and not causing more of a distraction and content overload of their senses. According to many studies, music and text can be combined, for example, when we get students to learn the alphabet with a song. It is astonishing to see how remembering the song will encourage the students to retain the text as well and help with recall. Wallace (1994 p. 1482) tried to demonstrate that text was better recalled when heard as a melody and found that music could help to facilitate the recall of text as the combination made the memory more unique and connected, therefore more accessible. He found that binding melody and text provided an information-rich context leading to a deeper level of encoding in the initial learning phase. However, Wallace (1994 p. 1483) later mentioned that the music needed to be repeated and that if the music that was combined was complex, it may affect students ability to learn and retain enough about the melody to assist in recall and it was then likely to become a distraction to one's attention. Bennet & Bennet (2008 p. 6) found that the limbic system and the subcortical region of the brain were engaged in musical and emotional responses, meaning that when information is attached to music, it was more likely to be encoded and stored, therefore having a better chance of entering into our long-term memory. Mann (2008 p. 1158) also stated that a great advantage of using sound was that memory for material presented in sound was more likely to be durable and resistant to interferences. Music can change the way children process emotions and thought as well as their behaviour, by extending their experiences, assisting with opportunities and creating links between the home, the school and outside world (Qualifications and Curriculum Authority, 1999 p. 162). The challenge for schools and educator when combining music and learning would be to ensure that students have been taught the correct and effective way to join music with their memory of their work in order to help their learning. In order to determine whether music can be brought into the studying process, we must have an understanding of how students learn and where music can be placed in this process.

2.2.3 How we learn

Learning is considered the creation of capacity and involves the identification, selection, and mixing of the relevant neural patterns within the students' mind and with information

from external situations (Bennet & Bennet, 2015 p. 22). Cognitive theories tend to focus on presenting students with information so that students can understand, organize, and relate it to what they know and remember it in a meaningful way. This all relies on the prominent role of memory. Learning follows what Biggs & Moore (1993 p. 206) and Schunk (2010 p. 165) proposed as the information-processing model of learning. The information processing theorists see learning as forming associations between a stimuli and a response. The model promotes the two-store (dual) memory model which involves three stages: *sensory register,* this involves experiencing a variety of sensations from our five senses. These senses deliver a massive amount of information and our sensory register helps us to filter and select information. The second stage is our *working memory,* which is of a limited capacity in that it can only attend to one major thought. Once we have selected the information, our working memory needs to process it in order for it to be retained. Lastly, *long-term memory* is where the information is dismembered, stored and made available for recall for periods as long as a lifetime. The working memory stage is the most crucial stage in learning, as it involves whether the information will be lost or retained in our long-term memory. Biggs & Moore (1993 p. 215) stated that there were two processes that led information to the long-term memory - rehearsal and coding. Rehearsal was used when the student wanted to make sure that their learning is verbatim, but without reference to meaning, and he defined this as 'rote learning'. Coding was when the individual processes information in a structured and meaningful context, therefore using what is termed 'meaningful learning'.

Lang (2000 p. 47) suggested that we look at three major sub-processes of information processing which involve using our memory systems to *encode* information, the *storage* of information and finally recalling from our mind to *retrieve* information. However, Klemm (2007 p. 63) found this process much more complicated and looked at five elements of remembering which includes *registration and attention, association, rehearsal, consolidation* and *cueing and recall*. To remember, information needed to be registered and to be registered, the student needed to pay attention. Attentiveness was seen as the central process of encoding which involved acquiring information and placing it into our working memory storage. By making learning interesting and engaging for students,

information was given more attention thus enabling rehearsal and more rehearsal meant more likelihood that information remained in one's long-term memory. Information is best remembered if it makes a big impact on the person and even more so if there is an emotional component attached. Association can be used for effective memorization, associating new information with what you already know or stored in your long-term memory. Klemm (2007 p. 68) believed that this is why rote memory is the most inefficient kind of memory, as there is no associations made. Rehearsal plays a key role in rote memory and recall and requires the repetition or continuing reprocessing of information numerous times in order to increase the frequency with which the information will be effectively remembered. Rehearsal promotes the shift of information from working memory into long-term memory and one can see why it is such an important aspect of learning and studying. When studying occurs, information is entered into the working memory and if the student does not make sense or meaning or not enough time is given for it to be processed effectively, it is likely to be lost. Rehearsal allows the information to be reviewed, made sense of, elaborating on the details, assigning values and relevance but mostly increasing the chances of entering into long-term storage making it more effective to learning.

According to Feinstein (2006 p. 260) and Sousa (2011 p. 93), there are two main ways by which students attempt to put ideas to memory, both referred to as rehearsal. The two types of rehearsal which the student will encounter when studying are, according to Sousa, 'rote rehearsal', which Feinstein refers to as 'maintenance rehearsal' and 'elaborative rehearsal'. *Rote or maintenance rehearsal* is when a student needs to encode and store information exactly as it is entered into the working memory and it encourages students to acquire information in a certain sequence. This would be, for example, asking students to recall the order of our planets in the solar system. This is often used in the curriculum of schools as we require students to retain information for short periods of time, but is rarely placed in our long-term memory which is evidence that it is not truly learned and remembered. The latter is a "type of rehearsal that is used when it is not only necessary to store information exactly as learned but more importantly to associate the new learnings with prior learning to detect a relationship" (Sousa, 2011 p. 93). It

encourages students not only to learn the information but to apply meaning and relevance or generate new ideas, concepts or situations. A good example is asking them to take the first letter of the planets in the solar system and create a new sentence. Wolfe (2001 p. 102) elaborated on the strategy of rehearsal and “encourages the student to elaborate on the information in a manner that enhances understanding and retention of information”. This works best when paired with other techniques such as visual, artistic or creative techniques or involving aspects of movement and music or opportunities for discussions and dialogue. Learning for understanding would suggest a much deeper grasp of the information with its underlying ideas and concepts, not just merely a recitation, and students should not only retain knowledge but also understand it and be able to apply it (Stoll, et al., 2003 p. 56). Encoding is the process of shifting new information into the information processing system so that it can be stored in the long-term memory (Schunk, 2010 p. 187). An example of encoding is when we attempt to remember a phone number or a shopping list and we do this by using the act of rehearsal. We would use rehearsal by repeating that phone number once or twice or running through the shopping list to ourselves before leaving. Rehearsal assists in improving rote recall while elaboration helps the retention of more meaningful units of information such as sentences (Brown et al., 1999 p. 96). The process of consolidation is that the new information over-writes the ‘scratch-pad’ (Klemm, 2007 p. 64).

Memory retrieval can be dependent on cues that are associated during the learning process. The more cues used in forming association, the more the memory can be consolidated. More routes are created to the information and can be used when trying to recall it. An example of this can be a context-dependent memory (CDM) which is the notion that something studied in a particular condition will be remembered best if that particular condition is repeated during the test phase as well (Konantz, 2012 p. 3). CDM can be viewed negatively as a “change in context or environment that causes material learned in its original context to be lost” (Balch & Lewis, 1996 p. 1354). Some researchers believed that background music can be an important factor in context-dependent memory (Konantz, 2012 p. 2; Balch et al., 1992 p. 26). Background music has been found to affect memory, but in terms of context-dependent memory, it would require the music-listening

situation to be similar when people learn something and repeated again in the test phase. If context is as important, people can also hinder their own learning by including music during studying and not during testing or vice versa resulting in students forgetting what is studied or learned. Konantz (2012 p. 12) felt that this was caused by the students being distracted by the music affecting their ability to encode properly. So when it came to the testing phase, students could not recall and remember effectively.

If information is not encoded or stored effectively, a student's ability to recall the information is affected. Recall is the process whereby cues and hints are used so that we are able to search and retrieve information from the long-term memory. The information is then consolidated and decoded back into our working memory. This process is referred to as 'retrieval' which is locating information in storage and then being able to access that information (Matlin, 2005 p. 121). Forgetting is the inability to retrieve or access that information from our long-term or working memory. This may be due to interferences, memory loss or inadequate cues. The assessment of learning involves the evaluation of a student's knowledge and understanding. Tests and examinations in schools assess the student's ability to study, their ability to encode and successfully rehearse and store information. Mostly, they measure the student's ability to retrieve information and recall their knowledge.

2.2.4 The assessment of learning

Assessment involves the formal attempt to determine a student's knowledge or skill with the use of educational variables (Popham, 2008 p. 6). Feinstein (2006 p. 74) described that process of assessment as gathering information from students in terms of what they knew, understood and could apply. To understand learning, it is essential to understand the use of assessment and the process of retrieving knowledge as well. There is only one tool for assessing knowledge and that is the act of retrieval and recall. As previously mentioned, retrieval is the process of bringing information stored from our long-term memory forward into our working memory. This is an important skill used during the assessment of students. In order to make the retrieval a quick and efficient process using as little brain energy as possible, we need to work and use the information frequently.

There are two forms of assessments in South African schools and universities; a formative assessment, which involves the use of assessment when a teacher's comments are used as sources of feedback to improve one's learning. The second form is summative assessment which measures what students have learned, which normally involves the use of learning activities such as tests or exams (Brown et al., 1999 p. 104). It would make sense that the way in which we learn and encode information is going to affect how the information is remembered and we need to encourage students to take more control of their own learning. Retrieval and testing are neutral events as they merely measure or assess learning and knowledge, and the ability to retain information plays a vital role in the education process. Encoding is the process of placing knowledge into our memory while retrieval is simply accessing that stored knowledge in our memory (Karpicke & Blunt, 2011 p. 772). Retrieval does not produce rote, transient learning; it is the method of improving meaningful long-term retention in student learning. It involves using available cues in order to retrieve knowledge of information immediately after it has been studied (Karpicke & Roediger III, 2007 p. 704; Karpicke, 2012 p. 158). Schools test students' ability to hold this rehearsed body of information and knowledge long enough after which it readily decays and is lost.

The more desired outcome is that students develop 'retention'. Sousa (2011 p. 91) defined retention as the "process whereby long-term memory preserves learning in such a way that it can locate, identify and retrieve it accurately in the future". It would be extremely difficult to test the student's process of studying or rehearsal statistically as this would most likely be done through observation. What schools can test is the student's memory of the learned material, specifically their ability to retain knowledge and the retrieval rate of information. Just as different memory pathways can be established, they are also retrieved in different ways, some easier than others. Sousa (2011 p. 114) again had two factors in the retrieval of information from long-term storage; recall and recognition. "Recognition matches an outside stimulus with stored information" for example, multiple choice tests. As previously touched on, recall was described as the "process whereby cues and hints are sent to long-term memory, which must search and

retrieve information from the long-term storage sites, then consolidate and decode it back into working memory".

I am aware of many different educational methods, strategies and processes of learning that are used by educators and students today. For the scope of this study, my focus will be on the activity of studying which I believe involves what Lang (2000 p. 47) proposed as the information-processing model. This involves the encoding, storage and the recall of information when learning. A memory word-recall test and a reading comprehension would be suitable when looking at the aspects of studying. Since we cannot measure how a student encodes or stores information, we can determine a recall or retrieval rate instead. A word-recall test is a kind of measurement tool that assesses the encoding and storage process and is used in examinations at many levels of education. As previously mentioned, students are given textbooks with information and are required encode information using rote rehearsal, which involves encoding, storing and recalling the information exactly as it is presented. A reading comprehension not only involves assimilating and absorbing information, but also understanding it and finally being able to recall it. Studying will always involve reading and in all educational settings students read a large amount in order to acquire knowledge and information, not only for immediate comprehension but also the memory of information. This will be able to assess their ability to not only read and understand but will also use the encoding aspect of elaborative rehearsal which involves encoding information as it is presented. This is storing it in a way so that they have an understanding of the information and, during recall, can answer questions based on what was read and learned. This means it would be crucial to determine whether these processes are affected by the student's music-listening habits during the encoding and storing phases. Is it possible that these processes can function successfully and effectively with an added process of a musical stimulus? If students are using music to help them study, does become a motivational or distracting effect on their cognition? If it affects how students acquire knowledge, this would definitely be a negative aspect of listening to music while learning. If proven to be a facilitator to their cognitive processing, we can encourage the increase of background music, and introduce strategies to students that could have a positive impact on their academic performance.

2.3 Cognition

Can we do two things at once? Often the answer is dependent on the 'two things'. How are we able to drive and talk, yet many people struggle to rub their stomach with one hand and pat their head with the other? In terms of this study, I ask whether we can listen to music and study. We know that these two activities can be done separately but can they function and operate as dual tasks? Many believe that music and the human mind have a unique relationship, especially as researchers have found that music activates virtually every region of the brain that has so far been mapped by cognitive neuroscientists (Hodges, 2000 p. 5-6; Levitin, 2007 p. 2). Although that result is large and interesting, my study focuses on the activity of music-listening and cognitive processes. Can these two very different systems function as a successful unit or cause a disruption in mental process or interference of listening to our chosen music? Gillis (2010 p. 1) stressed that, with the amount of music we have within our lives, we need to have an understanding of how music affects both our cognition and behaviour in order to determine whether this is a universal effect. Cognition is what Restack (2003 p. 4) referred to as the "ability of the brain and nervous system to attend, identify and act on complex stimuli… it's taking place in our brain and helps us know the world". This can include many mental activities such as alertness, concentration, memory, creativity and emotional experience. With the use of media as a secondary activity to learning environments by students, can the study on our cognition with its theories on our brain and its processes give us the answer - can background music hinder or improve a student's learning performance? The final section will explore cognitive theories such as, for example, the 'theory of attention' or the four mechanisms of the 'limited capacity theory' in order to explain how we process information cognitively. Lastly we will explore the literature of this topic with focus on three aspects; the nature of the distractor, particular task and the listener themselves in order to determine if previous studies have found a cognitive effect that music-listening has on student's memory and learning.

2.3.1 Cognitive theories

As previously discussed, music accompanies nearly every aspect of our lives, from the time we wake up with our alarm, drive to work, or listen to music in our office and on television shows when we get home. As mentioned while looking at background music, music can be something that can successfully be coupled with our lives; however, we cannot give it all of our attention. It has long been successful to use music as a tool to accompany movies and advertising, as it seems to help direct our attention, highlights the film or products, stir the emotions and cause arousal to the viewer (Boltz et al., 1991). According to Kahneman (1973 p. 3), 'attention' referred to aspects of amount and intensity and the intensity of attention relates to the level of arousal. Matlin (2005 p. 67) described attention as a mental activity that allowed an individual to acquire information through a limited amount of streams in our sensory world and memory. An example is our attention to the arousing music in advertisement which shows that when the music fits well, it can draw our attention and enhance cognitive measures such as recall and recognition. Music can attract too much attention onto itself such as when background music results in the advertisement message being ignored, or cancels the learning from an educational program (Kellaris et al., 1993 p. 121; Chebat et al., 2001 p. 116).

Feinstein (2006 p. 93) referred to attention as complex and as a focus on a stimulus. He suggested that there are three aspects of attention; coming to attention, selecting or focusing attention and, lastly, sustaining and maintaining attention. These aspects look at the process of an individual's alertness, their focus on relevant information and their ability to attend to the task. This is done so that they understand what is being heard, read or learned as well as filter out irrelevant information or noise that does not apply to the information that they are attempting to acquire. According to Eysenck & Keane (2000 p. 131) and Matlin (2005 p. 68), there are two types of attention 'Focused or selective attention' which involves a person being presented with two or more stimulus at the same time with the person only able to respond to one and 'divided attention' which is a person is presented with two stimulus but able to attend to both stimulus inputs. When we use music as an associative task and engage in other activities, we are dividing our attention between the music and the task at hand. This could explain when we divide our attention

to listening to music and driving but we tend to turn the radio volume down when we need to find an address or read a map, as we demand the use of focused attention. Is it that the loud arousing music of the radio is causing an interference or distraction to our cognitive processing of reading the map, interpreting and concentration to the directions and situational awareness? Then surely we would need to lower the volume while studying or learning as well?

In the 1950's, they tried to answer this question with a theory by Broadbent (1958) looking at how many channels of audio information people can handle at a time. His research looked at presenting three pairs of digits one after another to one ear while another three different digits were presented to another. He found that one of the stimuli would be allowed to be filtered with the other stimuli remaining in the buffer for later processing (Basil, 1994 p. 178; Eysenck & Keane, 2000 p. 132). This inspired more research using light flashes, letters, numbers or words, although all that this kind of research was able to prove was that people can inspect more than one stimuli, but not be able to understand more than one. The bottleneck theory was referred to as a 'classic dilemma' in psychology concerning the division of attention among concurrent streams of mental activity (Kahneman, 1973 p. 7). This model looked at two observations; firstly, that a person often performed several activities in parallel, such as in the case of this study when listening to music while learning, and dividing one attention between these two activities. Secondly, when the two stimuli are presented at once, often only one is perceived and the other ignored. When both are perceived, the responses that they elicit are made in succession rather than simultaneously. This model believed that it was easy to focus our attention on one object or process such as learning, but when we divided our attention between learning and listening to music, it became more difficult to focus.

The 'limited capacity model' or the 'capacity model of attention' provides a framework that explained the negative effect of dual-tasks on a person's concentration and that disturbance occurs when awareness capacity has been exceeded (Broadbent, 1958 p. 35). Kahneman (1973 p. 8), who advanced a cognitive psychological model, argued that his 'capacity model provides an alternative to the bottleneck theory with the human organism as an information processor. We have a limited amount of attentional capacity

that can be applied and used during different information processing tasks. According to Eysenck and Keane (2000 p. 151), our central processor had limited resources and was sometimes known as ‘attention’ or ‘effort’. Kahneman’s (1973) theory proposed a general capacity model with a few basic mechanisms that could explain why background music might influence cognitive performance. This was also later promoted by Armstrong and Greenberg (1990 p. 357) who grouped and referred to the same mechanism as four types of theoretical explanation for an inhibitory effect.

2.3.1.1 Orientation reaction

One of the processes by Kahneman (1973 p. 42) and Armstrong & Greenberg (1990 p. 357) by which background music might interfere with one’s cognitive processing is elicitation of involuntary orientating responses or orientation reaction (OR), often used to explain background television effect on cognitive processing. According to Thorson and Lang (1992 p. 361) based on Ohman (1979) study, OR are elicited when the cognitive load is high and makes a call on one’s central-processing resources. They described the resources as “serial, flexible, voluntarily controlled and limited in their availability”. They believed that if a television viewer (or in the case of this study, a music listener) was processing the material at a close level, their processing capacity will require additional central processing resources. They believed that this was due to an interference with the ongoing processing of television (music) material. However, if the viewer (listener) was processing at a lower rate to their capacity, it was more likely to result in no interference with the ongoing processing. When we combined both listening to music with a cognitive activity, we caused the central processing to reach its capacity limit. When this happened, it interrupted the ongoing processing and would require additional processing costs in order to re-establish the primary attentional focus (Weber et al., 1986 p. 244). The term ‘attention’ is associated with the concept of focusing mental processes and is strongly influenced by competition. It often involves our ability to focus on one task to the exclusion of others, which, is called ‘selective attention’. Kahneman’s mechanism of OR involves a pre-conscious and rapid re-orientation of attention in response to external stimuli. When the cognitive processing activity is interrupted, a physical and visual-re-orientation (aural in the case of background music) towards the source of the OR occurs. Concurrent with

this, physiological changes facilitating sensory intake or perceptual processing occur at the expense of internally-directed thinking (Kahneman, 1973 p. 47).

2.3.1.2 Capacity interference

Another mechanism to the model developed by Kahneman (1973 p. 178) referred to 'capacity interference'. This referred to when two concurrent tasks were performed simultaneously. In an attempt to accomplish two tasks, we drew from a limited pool of human central processing resources. If the combination of two concurrent tasks exceeded the available cognitive resource or capacity for attention, it could work to the detriment of one or both tasks (Norman & Bobrow, 1975 p. 50; Armstrong & Greenberg, 1990 p. 357; Pool et al., 2003 p. 362; Eysenck & Keane, 2000 p. 151). In line with this study, we can look at the two tasks, one being background music, and the other any tasks that involve our cognition, concentration and attention. Some researchers (Basil, 1994 p. 183; Lang, 2000 p. 47) believed that by adding background stimuli, the student potentially hindered their cognitive performance due to a limited amount of mental resources, and therefore allowed only part of the information to be processed. The combination of background music with complex cognitive tasks may result in a dual-task situation, and by attempting to fully process or pay attention to the background music, or even intentionally ignoring or tuning out the background music, it reduced the processing capacity available for the primary cognitive task performance (Kämpfe et al., 2010 p. 441; Armstrong & Greenberg, 1990 p. 357).

2.3.1.3 Structural interference

In recent years, there has been focus on dual-task interference, with the idea that certain processing resources are needed to perform information-processing tasks (Kahneman, 1973 p. 196). 'Structural interference' was when both tasks being processed used the same type of processing information or required similar sense modalities (visual and auditory) and tended to be more mutually interfering than processing information from two different modalities. Information from two different modalities aided one's attention and focus, assisting the ability to use divided attention (Eysenck & Keane, 2000 p. 147).

According to Sloboda (1985 p. 167), “processes may take place simultaneously provided that they do not use the same kind of mechanisms”. Two concurrent tasks can compete, even when the overall capacity limits are not strained (Wickens, 1984 p. 9; Bourke et al., 1996 p. 526). Many researchers have examined this topic and believed that while attempting two tasks, such as listening to background music it may be disruptive to a concurrent language task such as a reading comprehension, as they both contained internal-language based processing. It is believed that music and language share cognitive and/ or neural resources by nature of their physical similarity and common brain co-activation, and this will cause an overload on our capacity load and result in an interference to our processing (Zatorre et al., 2002; Patel, 2008; Fedorenko et al., 2009; Schön et al., 2010; Koelsch, 2012).

2.3.1.4 Physiological arousal

Lastly, the final mechanism of Kahneman (1973 p. 33) was the impact of physiological arousal. It is not hard to believe that if we are interested or aroused by what we are doing, there will be a greater level of attention and more attention means more intense cognitive processing. In terms of this study, in an educational environment, a student with a high level of aroused attention could show improved performance on tests of retention and transfer. Based on Hecker’s (1984) theory, Chebat et al. (2001 p. 116) stated that in the theories of music and its cognitive effects, an important characteristic was that music had the ability to attract attention onto itself and that music created a mood which was an important variable of the memory process. The arousal-mood hypothesis believed that listening to music had a beneficial effect and boosted physiological arousal levels and moods. Arousal referred to the intensity of the felt emotion while mood referred to an emotion, and also whether that emotion was positive or negative, although both were seen to influence performance on various cognitive processing and skills (Husain et al., 2002 p. 153; Cassidy & MacDonald, 2007 p. 519; Schellenberg et al., 2007 pp. 5-6; Eichenberg, 2010 p. 7). Arousal was a mechanism that was seen to reduce performance on complex tasks while improving performance on simple or repetitive tasks (Armstrong & Greenberg, 1990 p. 358).

Arousal was controlled by two factors, the demands imposed by the activities in which the person engaged (a student completing cognitive task) and the miscellaneous determinants (the effect of music) (Kahneman, 1973 p. 17). Kahneman (1973 p. 13) further assumed that with the level of arousal, one's capacity limit varied; more capacity became available when the arousal was high (Kahneman, 1973 p. 13). This idea was also shared by another well-known psychological model of cognitive human behaviour in that people performed better when motivated, namely the Yerkes – Dodson law (1908). The law stated that an arousal level (drive or motivation) could increase the performance of an individual up to an optimal level, while over-arousal could lead to a deterioration in performance. We could consider the arousal stimulant to be a form of interference once it crossed the threshold. If we increase the strength of the distraction of background music, or raise the level of difficulty of the task, will it result in the deterioration in performance? According to this law, deterioration or impairment on performance could occur more quickly when the particular task was complex or under-learned. On a simple task, the arousal possibly helped to increase performance to peak levels by helping to maintain concentration. Background music could increase arousal and improve performance during simple tasks, while in a complex task it is possible that the level of arousal would become too heightened, therefore impairing the performance. So the more demand on the attentional capacity from a dual-task situation, the more increase on one's arousal levels therefore affecting one's performance in some way. The dilemma is this - to be used successfully by students, we not only need to guarantee that background music can increase every student's mood and arousal in order to impact their learning and performance, but this arousal also needs to be within a medium level, enough to be engaged but not too much that it causes a distraction.

With the idea of the Yerkes-Dodson law in mind, if we increase the level of difficulty of the cognitive task or strengthen the distraction of background music, will it result in a substantial deterioration in performance? Could increasing one aspect but not the other result in some form of positive effect on students' performance? These are important factors to take into consideration, especially in this study. The last aspect that has not been mentioned, but is important to consider, would be the personal preference to the

music, as that might affect the level of arousal and, as stated before, influence the listener's attention and performance. Therefore we can add personal preference to the two already mentioned aspects of arousal (the task difficulty and the complexity of the music) that will be discussed separately.

a) Task difficulty

Background music can be used to maintain students' arousal level for study purposes though some believe the task at hand can play a crucial role. It is thought that the greater the cognitive challenge, the less background stimuli is required. Eysenck and Keane (2000 p. 149) were extremely curious to determine whether the cognitive complexity or difficulty of a task was an important contributor to music having an influence on one's performance. They discovered that two tasks could be performed simultaneously; however, the demand that each task made on the available resources had an effect (Eysenck & Keane, 2000 p. 151). With findings such as this, it makes one question whether it is possible that simple, undemanding repetitive tasks would benefit from music. It might be possible that music acts as a relief from boredom, while its presence may cause a distraction during more demanding and complex tasks. This view is shared by many researchers who found that tasks that require stamina, persistence, or are menial in nature will benefit from background music, causing higher levels of arousal and increased motivation (Lesiuk, 2005 p. 176; Kotsopoulou & Hallam, 2006 p. 607; Griffin, 2006 p. 12). This could explain why Oldham et al. (1995) found that background music used in an office environment resulted in a positive effect on employee's performance, organization, satisfaction, and mood state. This effect was only maintained when the tasks were classified as simple.

b) The complexity of music

The other view is that complex background music with stimulating musical features would lead to a decrease in task performance compared to less complex non-stimulating background music (Furham & Allass, 1999 p. 30; Schlittmeier & Hellbruck, 2009 p. 685; Avila et al., 2011 p. 85). This was seen as a new type of limited-capacity interference that

Ming Chou (2010 p. 11) called ‘attention drainage effect’, which caused distraction to the listener’s attention capacity while performing a cognitive task according to how arousing the distracting sound was. Music can have different information load characteristic such as loudness, variety, complexity and tonal range which can cause different levels of arousal. Kiger (1989 p. 533) reported that background music needed to use a ‘low-information load’ as this would induce the arousal level and result in producing a low-complexity stimulation. ‘High-information load’ music could cause over-arousal and detrimentally affect an individual’s performance resulting in tension and impairing the listener’s concentration. Although there does not seem to be specific criteria to determine a low-information load music, Kiger described it as highly repetitive and with a narrow tonal range. This aligned with the study of Furnham and Allass (1999 p. 30) who found the simple repetitive rhythms in jazz music not to be overly stimulating resulting in over-arousal by the listener and were considered a low complexity stimulus. Vocal features of background music have also been considered to be more disruptive than instrumental music, increasing the information load (Salame & Baddeley, 1989). A few studies investigated the type of background music to cause a distraction such as Mayfield and Moss (1989) found that rock music resulted in significantly higher levels of distraction and Thompson et al. (2011) proved that fast and loud music was most likely to disrupt a student’s ability to complete a reading comprehension. This suggests that complex, fast and loud background music, believed to contain a greater number of auditory events and intensity, induces greater levels of arousal. This then causes the listener to process a higher information load, consuming more of the listener’s attentional resources and making it harder to ignore and habituate.

c) Personal preference

A study by Lehmann and Seufert’s (2017 p. 2) recently found that participants performed better after listening to a stimulus which they preferred. In terms of music preference, this can be expressed as a choice of one musical work or style over other available works or styles. Some prefer the term ‘musical taste’ (Radocy & Boyle, 1988 p. 221). According to Angel et al. (2010 p. 1059), a person’s personal preference is a principal factor, whether there is a preference for music, no music or just ambient sounds. This will predict the

subsequent performance rather than an inherent quality of selected music. The listener preference will relate to auditory condition. Mullikin & Henk (1985 p. 354) stated that the listener preference would be based on their belief that it would improve their performance. A study by Cassidy and MacDonald (2009 p. 359) found that music preference also related to the cognitive processing demands of tasks, as they found a correlation between high performance rate and preference for the music. Moderately arousing music could be chosen to enhance the emotional state and cognitive process, creating meaningful information which is more likely to be encoded and remembered. If the listener is aware that a combination of arousing music and a complex task could cause a change in their arousal optimal levels, this could affect their performance. The listener may select music that allows them to control their processing capacity and focus their attention to the task rather than to the music. The problem as stated by North and Hargreaves (2000 p. 65) was that when the individual listener was given that control, they chose music that achieved an arousal-based goal rather than finding music that created a moderate arousal level. This is a hard element to control and teach as the listener might not understand or want to create a moderate state of arousal. It is also uncertain whether listening to moderately arousing music would result in a state of moderate arousal in each person. Can we not become accustomed to the sound or tune out the background music, not allowing it to interfere with our memory and recall?

The “irrelevant-sound effect” involved a laboratory example of performing a task in the presence of background sound. Researchers had the listeners being aware of the noise being played and informed them that it was intended to distract them. They were asked to attempt to ignore it while completing a serial recall-task in which they were presented with a list of items and asked to recall them immediately after a short retention period. Even although they knew the music was presented to distract them, involuntary effects on the listener resulted (Beaman, 2005 p. 1041). Feinstein (2006 p. 30) played music in the classroom while students were filing in, then turned it down while presenting content. During group work, the music was turned up again with the idea that it could stimulate creativity. He found that the students benefited from the played music even though the music might not be something they would choose to listen to. This could mean that,

regardless of a musical preference and the listener's choice in moderate arousal music, the background music caused an effect beyond the listener's control and occurred despite their best efforts to devote their attentional capacity to the cognitive task. If we understand these cognitive theories and inform educators and listeners of studies, the "irrelevant-sound effect" has great importance in benefiting school classrooms to improve the academic performance among students or office and trading areas in reducing the number of cognitive errors and impacting the well-being of a company overall. With these cognitive theories in mind, surely there must have been researchers interested in proving the possibilities of music having a positive or negative effect on the listener. By exploring previous studies such as the famous Mozart Effect and other findings the next section in this chapter will attempt to determine whether and how music may have an effect on individuals emotionally, socially and cognitively. It will then focus on the cognitive aspects exploring the use of music-listening as a facilitator to memory or learning or determining that it plays a distracting role therefore negatively affecting students' academic achievement. This will be done by focusing on three aspects, the nature of the distractor, particular task and the listener themselves

2.3.2 Cognitive effect

Music's effects on the listener such as physical, emotional, social, and cognitive have been explored, but we still cannot pinpoint why it has such power over us. Even 2500 years ago, Aristotle saw the power of music as an unsolved problem. He questioned why music, just being sounds, has such a strong power over the human psyche? (Aristotle, 1995). Darwin (1871 p. 569-570) referred to the human musical faculty and the power of music as 'the most mysterious with which man is endowed'.

Music's effect is probably most evident in its social effect. Results found by Greasley and Lamont (2006 p. 961) saw that music was not only a practical task of listening but also of reflecting and talking about music. Talking about, displaying, swapping and sharing of music enabled children to achieve goals, develop relationships and define their social identity and express themselves in relation to others, their friends, colleagues, social networks and to the cultures in which they live in (Levitin, 2007 p. 3; Papinczak et al.,

2015 p. 18; Kirk et al., 2016 p. 50). Hay & Minichiello (2005) saw how this was then carried through to adulthood, in their study which investigated the role of music on an older adult's emotional, social, intellectual, and spiritual well-being. They were able to demonstrate that music played a role in identity and making individual connections and understanding of the self. They even promoted that music was an important aspect of our connection with others, our well-being, therapy and health; emotions, arousal and alignment; stimulus, fantasy, and imagination; and beauty, aesthetic and spiritually. Work and war songs and national anthems are examples of how music has the ability to transmit information of emotional states, bonding together families, groups and a whole nation. Music can play an integral role in our social relationships, promoting and contributing to social cohesion and thereby increasing the effectiveness of group action and behaviourally equalizing masses of people (Papinczak et al., 2015). Frith (1996 p. 275) believes we all have a special relationship with music, one that can take us 'out of ourselves' and help us escape from the life we have come accustom to.

In a study that examined the relationship between young people's use of music and their well-being, four ways that music could enhance their well-being were analysed; this included relationship building, modifying cognitions, modifying emotions and immersing in emotions (Papinczak et al., 2015 p. 16). Man believed that music created a ritual that promoted health and well-being in its own right, with music, one could encourage people to achieve harmony, find the time to sit, relax and reflect and enjoy the music they had chosen. Music could be used as 'self- therapy' where the listener learned over time how to use music such as altering their work environment (Lesiuk 2005) in a way that was appropriate to their needs, rather than simply being an outcome of just hearing music (DeNora, 2000 p. 54; Greasley & Lamont, 2006 p. 965). Skånland (2013 p. 1) referred to the listener choosing their music as 'catering for the self', as he acknowledged that music could be used as a resource of self-care for individual's strengths and competencies. This music enabled the listener to put on their headphones and focus in on themselves creating a non-interactive environment that promoted autonomy and may be used for thought, imagination, and mood maintenance (Bull, 2005 p. 349). Therefore, music, can facilitate the listener to achieve optimal functioning and well-being.

Music's emotional effect on its listener can be difficult to prove, yet anyone who has heard music will agree that it causes some form of change in your emotions. According to Thayer, Newman, and McClain (1994 p. 921), music can be used as a mood regulation strategy in young people, it is considered the second most commonly used strategy, after exercise. Levitin believed that music had also become a tool for emotional regulation by humans, joining others such as caffeine or alcohol. He promoted that music could be used to motivate ourselves to accomplish tasks such as getting up in the morning, unwinding, and making it through exercise workouts and used as a means of mood induction or to comfort ourselves during an emotional crisis (2007 p. 2). With the accessibility of music today, we have an array of music and listeners have become experts at selecting suitable music to cater for their emotional goals. We can use music to modulate arousal, increasing our arousal level during whatever activities or lower our arousal level, which can be useful during high emotional states (Levitin, 2007 p. 3). Music can be seen as a 'resource' that the listener can use to achieve different psychological ends rather than just a commodity, a product that is produced, distributed and consumed by the public. (North et al., 2004 p. 42). DeNora (2000 p. 107) also shared the view that sees music as a 'process' rather than an 'object', stating "music not only affects how people feel emotionally, it also affects the physical body by providing a ground for self-perception of the body, and by providing entertainment devices and prosthetic technologies for the body". For young listeners processing music, it can become a personal activity accompanied by individual feelings that are often difficult to express. The moving use of sounds and impactful words of music have the ability to associate the emotional feelings of adolescent's life and experiences, creating a relationship with music that promote feelings of being safe, accepted and trustworthy. We have investigated how music has an effect on nearly every aspect of our life, but the one I feel that is most ignored is music's effect on our knowledge and learning. Each child learns differently, using different learning styles and more and more students are turning to music as a facilitator for their education. We need to give it our attention and focus in order to have a better understanding of how we can benefit from it.

There has been an ongoing debate about whether students should be studying with music or not. The public, especially the younger generation, accept and support the idea that music functions as a facilitator to the activity of studying and have an effect on a student's performance in schools. Others believe that it impairs their cognitive development therefore negatively affecting their academic achievement. This division in thought seems to be carried across in the research of this topic too. There have been many studies examining the distracting or facilitating effect of music on task performance, but the results have generally been inconsistent. Despite the inconclusive results, media across the world which includes not only music but television, radio and the internet is beginning to be encouraged as an aid to the teacher and student. There has been a large interest in designing strategies to determine how media can be used to enhance students' learning performance in the school-context. The problem is what Beentjies et al. (1996 p. 59) had also identified that, in an out-of-school learning environment, students did not regard the use of media as a strategy to improve their learning performance. A form of media such as music-listening is seen as an 'associative task', meaning that we listen to music while engaged in other activities and music's function is to make the primary task more pleasurable (Johnson et al., 2004 p. 763). Regardless of the listener's purpose for listening to music, it still begs the question whether the background music may influence an individual's performance.

From my research, the literature on this topic tends to look at three factors; the *nature of the distractor*, the *particular task* and the *particular individual.* Research studies tend to vary in focus and for the sake of my study I will only look at studies that fall into these factors. Some studies place an importance on the nature of the distractor, attempting to determine what kind of musical distraction causes a positive or negative effect on its listener. Others aim to determine the task, focusing on different skills and abilities that listening to music can be used to facilitate or to be aware of those that it disrupts. Lastly, it determines which listener is most vulnerable to a negative effect of listening to music while completing a performance tasks which is what the last factor examines.

2.3.2.1 The nature of the distractor

Within the scope of this study, we can refer to the distraction as an impairment on a person's ability or conflict in processing during the completion of a task. In this section, the distractor is the music that is listened to by the listener. We cannot start anywhere else, but with the famous Mozart Effect, probably the most well-known study in this field on this topic, mostly due to its misunderstood fame. The Mozart effect was first reported in a brief paper published in Nature by Rauscher et al. (1993). The research had divided 36 college students into three groups. They then used standard intelligence sub-tests in order to attempt to measure spatial-temporal reasoning. Spatial-temporal reasoning was considered to be the "ability to form mental images from physical objects and to see patterns in time and space" (Sousa, 2006 p. 224). One group worked in silence, another listened to relaxing instructions and the last group listened to Mozart's sonata for two piano's in D major (K488) for 10 minutes (Bennet & Bennet, 2008 p. 4). The group that listened to Mozart's music had significantly higher results in their spatial-temporal ability for a short period of time, resulting in what is known as the 'Mozart Effect'. This study received wide publicity, resulting in a huge industry devoted to the Mozart Effect. Mozart's music began being marketed for improving cognition in adults and babies and even prenatal IQ's. However, the Mozart effect was completely taken out of context of its finding as people began to believe that by listening to his music, it would increase their cognition.

Other researchers became interested in these results and some studies have even succeeded at reproducing these results (Rideout & Laubach, 1996; Wilson & Brown, 1997; Rideout et al., 1998). Rauscher et al. (1995) then performed a more extensive follow-up study, run for five days and with 79 college students and found that the students benefited, once again for only a short period of time. As the original findings led to disillusionment, other researchers continued to prove the power of Mozart's music. A study by Savan (1999 p.143) demonstrated improved co-ordination skills, reduced frustration and aggressive and disruptive behaviour of pupils with emotional and behavioural difficulties by playing Mozart's orchestral compositions during a normal science lesson. She also found that a pupil's concentration span lasted the full lesson of 40 minutes and within an obedient behaviour. The University of Texas Imaging Centre in

San Antonio determined that the effect was not caused by Mozart's music and that by testing with other types music, found that other types of music actually helped the subjects do far better. It was more the use of rhythms, tones and patterns in Mozart's music that seemed to enhance the participant's learning (Jensen, 2000b p. 247). This went even further with studies looking at Bach (Ivanov & Geake, 2003) and Beethoven's music effect (Verrusio et al., 2015).

A study with Canadian adult listeners found that listening to Mozart's music while completing an IQ sub-test resulted in a difference in arousal and mood and a parallel difference on the IQ test favouring Mozart's music (Schellenberg et al., 2007 p. 15). These studies are just some examples of how the Mozart Effect theory has been reviewed and re-worked to suggest that music-listening can have specific effects upon any listener and their cognitive performance. There have been a number of negative results (Steele et al., 1997; Stough et al., 1994), especially in the criticism of the original study that the increased intelligence lasted only 10 to 15 minutes. There have also been studies that were unable to reproduce the original findings, finding no evidence that Mozart's music could enhance spatial IQ (Steele et al., 1999; Chabris, 1999; Hetland, 2000; McKelvie & Low, 2002).

Research into the effects of music during the activity of studying have tested many different types of music in order to establish their effects on the students' performance. Findings again have been inconsistent. Given the contrasting results, it is possible the effects of music are dependent on other variables such as the types of music played or the volume and tempo, or even the music being familiar or unfamiliar to the listener. Mullikin and Henk (1985 p. 356) believed that the type of auditory background that a teacher used made a big difference in the life of a student. Their study found that the speed played a role in its effect on the students. Their results showed that the listeners exposed to slow-paced, soft classical music retained more information while reading than the other types of background condition, such as silence and rock music. Their explanation was that with reading being a highly complex interactive process, a slower tempo allowed the reader to relax and concentrate as the classical background music was able to neutralize the other room noises competing for the reader's attention. They

speculated that rock music, being more intense and frantic might result in the reader reading faster and not fully understanding what was being read.

A study by Beentjies et al. (1996) involved a questionnaire which was administrated to 1700 students in Grade 8 to 10 which found that 90% of the respondents reported completing homework with background music. If the tempo of the music is the cause of distraction to students concentration, it is not great news to know that they also found while investigating the media content that there were three genres clearly favoured: pop (70%), house (55%) and rock (25%) all of which are known for fast tempos (Beentjies et al., 1996, p. 66). Furnham & Strbac (2002 p. 213) believed that the music that was considered the most distracting was fast, vocal music, yet it is also the most often chosen and liked by the listeners. While trying to determine the type of music that worked best to improve one's concentration, a study found that 75% of their 200 participants had better concentration during pleasant slow music. They discovered that as the music become louder and faster, it became noise instead of music, thereby decreasing their concentration (Kumar & Aithal, 2016 p. 1194). Kallinen (2002 p. 543) noted that the reading rate and efficiency was significantly improved in the slow tempos' music group as compared to that of the fast music group. Their explanation was that the slower clear accented beats of the music assisted in creating a relaxed, happier and more productive feeling in the listener and helped to anchor the reading process. Oakes and North, (2006 p. 511) also noted that participants recorded a significantly higher level of advertisement content recall in a slow tempo music condition compared to that in fast tempo music condition.

Could a fast tempo background music increase the processing information load, and result in the listener reaching their processing capacity? This would then prove the idea of capacity interference promoted by Kahneman (1973) that when a student attempted to accomplish two tasks, they drew from a limited pool of human central processing resources and the combined demands of the two concurrent tasks exceeded the available cognitive resource or capacity for attention which could work to the detriment of one or both tasks. Loud and fast tempo music may take up too much of our processing resources causing a distraction to the task performance at hand, while slow, soft and repetitive music

may be a low information music, allowing just enough arousal while not depleting one's available cognitive capacity. This idea of fast and loud versus soft and slow music was also shared previously by Kiger (1989 p. 553); however, he warned that silence could also produce a sub-threshold arousal which impaired performance. Therefore, the listener might feel calm and less anxious, but then could not concentrate enough to complete the performance task. Another idea of music as a distractor was that instrumental music has been found to be more facilitating to processing information than vocal music, as the lyrics or presence of words are found to be distracting. There have been a few studies that have looked at the distracting effects of vocal and instrumental music and found that instrumental music improved the performance of participants during the completion of logic and recall tasks. (Furnham et al., 1999 p. 381; Darrow et al., 2006 p. 764; O'Hare, 2011 p. 44). Again we can think that the lyrics in music might deplete the cognitive capacity resulting in a negative effect on a student's performance.

Avila et al. (2011 p. 90) study had participants complete a verbal, numerical and logic test under three music treatment conditions; vocal music, instrumental, and silence. They found that all participants regarded music, regardless whether it contained lyrics or not, to be distracting and too familiar and created an undesirable effect on their working situation. Participants found themselves enjoying the music too much and working slower and then resulted in rushing the test to finish in time. They strongly advised that when working on a complex task or when a student attempted to learn complex material or completed an exam, they do so in silence to ensure maximal performance. Dolegui (2013) administered tests to 32 college students and found that test scores were significantly higher in silence compared to listening to heavy metal and classical piano music. It would seem that silence would be the best option, allowing a student's full attention to be on the activity of studying; however it is unrealistic to think that students can find a room of complete silence at a school. Would a library or quiet classroom work? Furnham & Strbac (2002 p. 213) asked this question and attempted to determine the difference between background noise such as people mumbling in a library or office noise with people talking and telephones ringing compared to actual background music. They tested and found

both music and noise to affect the performance on a reading comprehension and other tasks.

Once again, there seem to be inconsistent results regarding a type of musical distractor Possibly, the idea is too broad and with listeners having such vast tastes, it becomes difficult to focus on one genre of music. It might be easier to look at music that is favoured and familiar versus music that is unfamiliar to the listener at hand. As mentioned previously, this generation has more control and access to the music to which they would like to listen. While studying, it would make sense that students are selecting the songs they want to listen to, but is this facilitating them? A study by Hilliard & Tolin examined whether background music that was familiar to the listener had any effect on their task performance (1979 p. 714). They concluded that when participants were in presence of familiar background music they produced a higher task performance than in the presence of unfamiliar music. A possible explanation for this was given by Etaugh & Michals (1975 p. 553),who found college students who listened to familiar music while studying performed better on reading comprehensions. The more frequently they studied in the presence of music, the less it impaired their performance. Another explanation might be that music which is unfamiliar to the listener would result in causing tension and anxiety, especially on high complex tasks that require high concentration, which could result in an impaired performance (Kiger, 1989 p. 533). However, if they listened to familiar background music, this might increase their awareness level, helping them to perform the task more enthusiastically. This idea aligned with Yerkes – Dodson Law theory which stated that a person's arousal level could increase one's performance up to an optimal level. Familiar music might be stimulating enough and evoke strong emotions and arousal that an individual's level of performance relates to their level of arousal caused by the familiar music (Furnham & Strbac, 2002 p. 205; Jäncke & Sandmann, 2010 p. 11). It seems that the other view of studying within the presence of music added additional irrelevant stimuli. The musical stimuli and cognitive activity increased the cognitive load of the listener and resulted in them competing for limited processing resources. This detrimentally affected the performance of memory and retention. Ahuja (2016 p. 18) found that listening to music that participants enjoyed made it difficult for them to concentrate.

What was interesting, was that they believed that even this enjoyable music became more distracting than music they disliked. This could have been because it resulted in the participants feeling compelled to sing along instead of focusing on the reading passages. This would make answering the questions more difficult as well as taking longer to complete the task. Oswald et al. (2000 p. 349) suggested that students were more distracted by both meaningful and meaningless background music, therefore they suggested that the optimal working environment be in silence.

2.3.2.2 The particular task

After seeing the influence that Mozart's music had on one's spatial-temporal reasoning and thinking, researchers began to question whether music had more power over other aspects of skills. They began testing to see the effect of music on a student's abilities such as arithmetic problem solving (Gardiner et al., 1996; Hallam et al., 2002; Chew et al., 2016), writing (Cho, 2015), drawing (Han, 2016), memory recall (Janata et al., 2002; Nadler & Archibald, 2014; Konantz, 2012) and verbal recall (Chin & Rickard, 2010; Jäncke et al., 2014; Abdolmanafi-Rokni & Ataee, 2014; O'Hare, 2011). They also tested for its effect on speech and language development (Asaridou & McQueen, 2013; Chew et al., 2016), reading and listening comprehension skills (Etaugh & Michaels, 1975; Harmon et al., 2008; Anderson & Fuller, 2010; Sahebdel & Khodadust, 2014) temporal and spatial abilities (Rauscher et al., 1995), IQ (Schellenberg, 2004) and even driving (Spinney, 1997). The use and the effect of background music may be new to the field of education, but has long been a subject of research in the consumer and marketing fields where music has been used to create an atmosphere in retail stores and shopping malls to influence the customer's mood and emotions, consequently affecting consuming habits and purchases (Eichenberg, 2010, p. 5; Alpert et al., 2005 p. 369; Milliman, 1986 p. 286). Classical and pop music were seen to influence purchase intentions and increase sales (North & Hargreaves, 1998 p. 2266). A study of music and its effect on a retail setting found that music with a slower tempo, lower volume, and familiar music resulted in customers staying longer at a venue than when the tempo was fast, music was loud and unfamiliar to the listeners (Garlin & Owen, 2006 p. 761). If background music in retail shops and shopping can influence consumers emotionally into purchasing products and

services, it wouldn't be impossible that music in a classroom could create an atmosphere that will influence students. This is what Cluphf & MacDonald study discovered (2003 p. 23). They found that by using classical background music, a focused atmosphere was created that helped to reduce the number of minutes during the morning and afternoon transitional periods that it took students to settle into their class work and for the teacher to require on-task behaviour. Music that is calming and enjoyable can be used in the role of managing a classroom, creating an enjoyable climate of conductive learning and improving behaviour of students as well as making learning interesting and memorable and reduce stress if it's played consistently through the school day and year (Chalmers et al., 1999; Jackson & Joyce, 2003). Given that educators continually struggle with behavioural issues in schools, this could assist in influencing students in a positive manner and be beneficial in enhancing the learning environment. Therefore music can be the gateway to effective learning and knowledge but also closing the gap between students learning and discipline in behaviour and attention.

This has now filtered into workplaces, small businesses and large industrial companies which are allowing employees to listen to music with the use of a radio or earphones. This is then assessed to determine whether their productivity increased in the presence of background music, or whether silence is recommended for reducing the amount of cognitive errors and contributing to the well-being of companies. Listening to music, which was also termed 'industrial music,' could be used to lift spirits of employees in a workplace and assist in relieving tedium and boredom. Music does seem to create a positive shift in attitude, with many employees demanding that music that be played. However, there are studies that seem to have found no significant effect on employee's performance (Furnham et al., 1999 p. 382; Furham & Allass, 1999 p. 28). Banbury & Berry (1998 p. 499) found background music to be the most common form of interference in an open-plan environment. Haake (2011 p. 122) disagreed, and promoted the idea that listening to music with personal computers and through headphones could play a role in increasing productivity in the workplace, increase one's mood and therefore influence concentration. He suggested that managers implement the use of music to benefit their employees in managing their stress levels, inspiration, well-being and relaxation. Oldham et al. (1995

p. 559 & 562) found that employees who listened to music in an office through a personal stereo for 4 weeks showed improved performance and organization satisfaction, and a decrease in turnover rates, as the music helped to reduce environmental interferences. He was able to prove the Yerkes – Dodson Law, which stated that music helped during simple and routine tasks because the arousal helped to increase performance to peak levels by helping to maintain concentration. Impairment on performance could occur more quickly when the particular task was complex or under-learned. Oldham's study found exactly this where personal stereos helped on simple jobs by counteracting boredom and reducing tension and monotony of individual experience by employees, resulting in increased performance effectiveness (1995 p. 561). In complex mental jobs, music was found to be a possible source of distraction for employees resulting in lowering performance and organization satisfaction. In providing advice to educators and employers, Kiger (1989 p. 553) suggested pairing low-load music with complex tasks while high-load music with simple jobs.

Why can't the idea that music helps employees during monotonous tasks be used with students with music as a study aid? Surely listening to music can be used to help students concentrate, stimulating the student enough to stop them from being distracted and restless and helping their minds from wandering off and stay engaged on the task. Some researchers believe that music can play a crucial role in an educator's teaching and student learning for all ages and in all subjects. Suggestopedia, was one of the first methods to try and prove it. This was a method proposed by the Bulgarian medical doctor, Dr Georgi Lozanov (1978), which used background music to create a desirable learning environment that improved the student's memory and retention while learning foreign languages. His method found that students learned more material in less time reducing a student's workload by two hours in school and four hours at home. It enabled students to finish a nine-month curriculum in seven months. He believed that the mind was capable of learning more efficiently when it entered a mental state which is achieved by eliminating self-imposed barriers and creating an optimal environment. This optimal environment used the tool of music as he believed it helped to absorb and retain more information. He played music when the students were relaxed and listening to the teacher present a

lesson. He believed that students did not concentrate on the words but entered a receptive state and the teacher-dialogue suggested images allowing the information to be absorbed by the students without conscious effort. He even went as far as describing that the best music to use was encouraging music that is in 4/4 time and played at a slow tempo of 60 beats per minutes. His method found that this tempo was successful in lulling the mind into the receptive state where the listener is fully relaxed yet still alert and open to stimuli (Williams, 1983 p. 165). Brownlee (1982 p. 409-410) found that Suggestopedia helped children to relax both physically and mentally, but still be alert to the learning material. He also believed that this helped them to realize that they could learn and learning did not need to be frustrating.

A more recent study found that Suggestopedia was based on the idea of super-learning. This was found to maximize brain capacity. While in a pleasant and relaxed condition, music has been seen to help create that condition and in turn facilitate and accelerate the learning (Abdolmanafi-Rokni & Ataee, 2014 p. 491). Some students have claimed that listening to music will assist them in learning and studying, while many parents and educators believe that it forms more of a distraction. Beentjies et al. (1996 p. 67) found that 67% of the students in their study believed that when they combined homework with music, homework was regarded as a primary task. While some reported that their attention to the background music varied, one-fifth of the students stated that their attention shifted between homework and music. A minority of 17% of students indicated that the music escaped their attention as they reported to “forget that the music is on”. Once again, results were inconsistent and vast. Haynes (2003 p. 46) found that the use of background music while studying before an exam was effective in lowering mathematical test anxiety; however this had no effect on their academic achievement. Paton et al. (1986 p. 440) found that 387 students in Grade 5-9 adjusted their study condition using higher levels of background media when completing mathematics tasks and lower levels while doing reading assignments. Kämpfe et al. (2010 p. 424) found that background music compared to no music created a disturbance in the reading process while having a small but detrimental effect on one’s memory retention. They also found that background music positively influenced people’s emotional reactions to activities at

hand. Tasks that involved memory appeared to be more susceptible to auditory distraction effects while tasks which involved assessment of meaning seem to be not as vulnerable (Beaman, 2005 p. 1058). Background music was found to disrupt writing fluency resulting in a reduction in fluency of about 60 words per hour. This also resulted in effects of poorer writing quality, shorter average sentence length and a tendency to pause randomly, regardless if music is vocal or instrumental or both (Ransdell & Gilroy, 2001 p. 146). They further suggested that student's process words in silence or attempt to reduce background sounds (2001 p. 147). As we can see, there are various studies regarding the nature of background music and different performance tasks, yet still with inconsistent results and no clear answer to give listeners. Is it possible that we need to place the focus away from the characteristic of the music or task and more on the listeners themselves?

2.3.2.3 The listener or individual

Would the differences in gender play a role in increasing or decreasing music as a stimulus and affecting one's ability to study? Neuro-imaging studies found no differences between a man and women (Wager et al., 2003); however, sex differences have been found in verbal cognition (Halpern, 2013) and responses to emotional stimuli (Hamann & Canli, 2004). There have been several studies examining the differences in male and female's emotional responses to things such as pictures (Bradley et al., 2001) and films, (Kring & Gordon, 1998) but results have been somewhat conflicting. Would it be possible that a specific gender could have a greater emotional arousal to their music causing more distraction and lowering their performance score? Some researchers (Nater et al., 2006, p. 301; Miles et al., 2016 p. 1) felt that studies failed to address the differences in male and female with regards to music cognition. Nater et al.'s study found that compared to men, women displayed heightened responses to arousing and unpleasant music stimuli (2006 p. 305). Men disliked classical music and both genders had a heightened psychological reaction to heavy metal music. Miles et al. (2016 p. 8) were able to prove that women were more accurate than men in their familiarity recognition. Even though not a crucial aspect of my study, it is one of the questions asked in my questionnaire,

allowing me to compare the results between the male and female students. It may be a factor to consider when looking at this kind of research.

Again, this is not within the scope of this study; however it is interesting to see that studies have shown a difference in performance, depending on the listener's personality type being either an introvert or extrovert. Furnham & Bradley (1997 p. 452) found that introverts were affected in their abilities during a reading comprehension if there was music played; however, there was no significant difference in results between introverts and extroverts during silence. A study by Furham & Strbac (2002 p. 214) also found evidence that introverts were more affected negatively during complex cognitive tasks by background music. Their explanation was that introverts were used to working and studying in silence or quiet places resulting in worsened performance when placed under a noise environment, compared to extroverts that might prefer noisier environments and tended to adjust easier. However, this study found no correlation between music and a noise distraction self-rating and the frequency of studying with music, therefore this suggests that those who regularly listening to music do not build a tolerance that could begin to reduce the distraction of music on their cognitive processing. Cassidy and MacDonald (2007 p. 533) also found that introverts found listening to music while studying to be distracting while extroverts had a preference to social and arousing environments. They found introverts to be slower in experiencing concentration problems during mental processing than extroverts in noisy conditions. This could be explained according to the theory of arousal by Kahneman (1973) that if introverts and extroverts do differ in their levels of arousal, introverts may experience greater arousal and optimal performance in low-intensity and low-sounding stimulation. Therefore, music may exceed an introvert's arousal threshold, causing a distraction while extroverts have a higher threshold and need more high-intensity musical stimulation to cause an arousal strong enough to affect their cognitive performance potential.

The use of music in research can be a difficult factor as music is highly dependent on each listener. People's experiences of music are unique and personal and people respond and listen to music in a variety of different ways (Hays & Minichiello, 2005). Each individual has a musical preference, and not all genres and styles of music satisfy the

listeners taste to the same extent. According to Kotsopoulou & Hallam (2006), young people listen to music that they know and favour with the most common style of music across broad nationalities being pop music. Why would we want to continue to test the effect of certain types of music if it isn't the favoured choice by listeners? For example, it might not be valuable to determine the effect of classical music, with North et al. (2004 p. 47) having found a growing decline in sales of this genre in today's generation. For this reason, studies that are interested in the effects of music-listening, need to take into account or be aware of the listeners' engagement with music. People differ in how they perceive, interpret and evaluate the music they hear. I believe that this has resulted in many previous studies on this topic being inconclusive as listeners interpretation vastly differ. Beentjies et al. (1996 p. 61) suggested that when performing this kind of research, we determine the actual condition as well as the background music treatment condition under which children do their homework assignments. The use of a questionnaire administrated before the experimental testing may help to determine how many students listen to music while studying. Allowing students provide their own music is another crucial aspect that I feel has been disregarded in many previous studies. An advantage is that it gives a realistic idea of the actual music condition under which students are studying as some researchers believe people choose music for a purpose in order to help fulfil their personal goals, therefore their motivations for music-listening are context–dependent (DeNora, 2000; North et al., 2004; Sloboda et al., 2001). Music becomes situational in that the listener will be an active agent in choosing music that will accompany a given context or activity. (Sloboda, 1999 p. 354). Schäfer (2016 p. 3) referred to this as the 'functionality of music' which he stated as the deliberate use of music to attain specific goals in a specific situation.

A criticism that I and other researchers (North et al., 2004 p. 45) have is that previous studies have participants listening to music of the experimenter's choosing (Furham & Allass, 1999; North & Hargreaves, 1999; Lesiuk, 2005). A more participant-centred approach not only gives the listener more control over the listening situation but would be more likely to capture naturalistic responses to music by the listener. The idea of participants providing their own self-selected songs was inspired by an old study by

Etaugh & Michaels (1975 p. 553) who asked participants to bring a preferred record album to the experimental sessions. It is hypothesized that the experimenter-selected music and a concurrent task could cause a capacity interference overloading the limited resource capacity, due to it containing unfamiliar musical features to the listener, being less liked and distracting (Cassidy & MacDonald, 2009 p. 361). We could assume that self-selected background music would be familiar, being heard before and liked by the listener, and possibly goal-directed to the task context, while the same cannot be said for an experimenter-selected music. We could also assume that self-selected background music would assist the listener in reducing tension and increasing relaxation and possibly play a crucial role in arousal potential and presenting less competition in one's limited processing capacity. We, as researchers, should be focused on whether the music matches the music taste of the listener and causes an arousal. It is difficult to predict how a listener will response to a piece of music simply by musical factors such as tempo or sound level and musical emotions may be involved in any genre of music (Liljeström et al., 2012 p. 580). Studies have concluded that when participants had exercise over the choice of music and a greater degree of liking for the music they chose, results showed a greater personal experience and attention and could more likely be associated with positive mood and arousal (Sloboda et al., 2001 p. 23; North et al., 2004 p. 73).

Paulhus et al. (1990 p. 786) believed that arousability was the consequence of distractibility as interpreted in a series of self-reports by students. When someone is distracted, they were actually reporting on their emotional response to a distraction and not necessarily the effect of distraction on their performance. So could the listeners in these studies and my own be responding to emotions evoked by their music? If so, then the emotional aspect of self-selected background music could play a crucial part. Music liked by the participants affected their performance more on recall tasks compared to music which they disliked. They believed this result in that familiar music captured participant's attention more than unfamiliar and disliked music, making it harder to ignore and difficult to concentrate. Anderson and Fuller's study found that students' results suffered when coupled with music of their preference compared to those of how much attention the music was deflecting from the test or the impact the music had on their

mental processing and ability (2010 p. 186). A study by Etaugh & Ptasnik (1982) tested forty college students and found that those who did not often study with the use of background music produced higher comprehension results during silence conditions. This meant that those participants who did study with the use of background music performed better during music treatment conditions. After reading this study, it made me question the power of music's effect and whether it was something that might differ from person to person, depending on its amount of exposure over time. Could people who regularly have music in their daily lives, such as music professionals or even students who religiously study with music, become accustomed to the musical stimuli? Could it be possible that they build a tolerance to its negative effect on their cognitive processing? This led me to the last role that the particular individual might play in the way that music affects them; the difference between an individual with musical training versus those with none?

Being a musician and playing an instrument requires daily practice and long periods of focused attention in order to develop skills that allow one to read and translate the music notation into a vocal line or precisely timed finger sequences using both hands. Then, musicians use auditory, visual and tactile feedback to adjust what is being heard and seen in order to change the musical output if needed. While performing a unified piece of music, musicians are still required to bring meaning to the music with the use of dynamics, articulation and emotions in order to express musical interpretation. To become a successful musician, one has to take decades of rigorous training and practising from an early age in order to enhance a spectrum of musical abilities. A recent brain imaging study showed that the brain of a skilled musician responded differently to the brain of non-musicians (Pantev, et al, 2001 p. 5). There have been a few studies that have shown that certain regions of a musician's brain can differ from that of a non-musician (Schlaug et al., 1995; Schlaug, 2001; Jäncke et al., 2000; Shahin et al., 2003). A questionnaire could be used to determine whether the participants have musical training in order to make a comparison between scores of music students to non-music students. However, within the scope of my study, less focus will be placed on music's effect on the listener's brain but looking more at the idea that with musical training, improving one's musical abilities

might also improve other non-musical benefits, especially cognitive functions used in learning. Again, there has been interest in the non-musical benefits of music exposure, but joining it is the idea that musical training can also contribute to the above average abilities in academic achievement in both children and adults. The idea is that musical training will potentially enhance other cognitive functions such as spatial abilities (Bilhartz et al., 2000; Rauscher & Zupan, 2000), mathematical abilities (Gardiner et al., 1996), reading abilities (Gardiner et al., 1996; Standley & Hughes, 1997), short term memory (Bilhartz et al., 2000), verbal memory, (Chan et al., 1998; Ho, et al., 2003) verbal recall (Cuddy & Kilgour, 2003) visual and auditory memory (Jakobson et al., 2008) and IQ (Schellenberg, 2004). Could this be music's power having an actual effect on the listener or could it be the use of these systems from a young age, especially when children who are highly plastic and sensitive in their development that strengthen these abilities in adulthood?

Norton et al. (2005 p. 126) believed that there is a plausible explanation for these studies having a correlation to music. They explained that spatial reasoning was enhanced due to music notation itself being spatial. Mathematical skills also benefit because of the rhythmic notation which was required for pattern recognizing and understanding of proportion, ratios, fractions and subdivision. Reading skills could be enhanced, as music and language both require the ability to segment streams of sound into perceptual units as well as the processing of pitch patterns. Some researchers (Knudsen, 2004 p.1412; Miendlarzewska & Trost, 2014 p. 279) referred to a 'sensitive period', which is described as a limited period in development when the effects of experience on the brain are unusually strong. During this period, a person's capabilities are shaped and experiences formed. It is also believed that learning during that period lays the foundation for future learning. This idea is often shared in that children learn language faster and more effectively than in adulthood. Ho et al. (2003 p. 447) found that children demonstrated improvement in verbal learning and retention abilities after receiving just 1 year of musical training. They proposed that this was due to the sensory stimulation which resulted in development in the left temporal lobe in musicians. In turn this assisted the cognitive processing within the specific brain area responsible for verbal memory. However, they

also pointed out that there is no neuro-imaging data to prove this. Verbal memory could result due to developing the skill of memorization, needed during musical training where one is learning many notes, finger patterns and terminology. This early development in children might contribute to better memory abilities which in turn contributes to better verbal memory. This could make sense as musicians have to have the ability to learn a piece of music which involves memorizing the musical score, not only remembering individual units of information but also successfully recalling them in the correct order.

A study which looked at differences in intelligence between adult musicians and non-musicians using primary mental-ability tasks found musicians to perform better only on verbal memory tests which they believed was due to cortical organization, while non-musicians performed better in all four sub-scales of Cattell's Culture Free Intelligence test (Brandler & Rammsayer, 2003 p. 132). Another study by Helmbold et al. (2005 p. 74,) tested musicians' and non-musicians' primary mental abilities. This included verbal comprehension, word fluency, and space, flexibility of closure, perceptual speed, reasoning, number and memory. They found musicians to perform better on only two tasks, flexibility of closure and perceptual speed which they believed was caused by long-term musical training, especially in the practice of sight-reading which relied on those two skills. There also seem to be mixed results on how background music affected the ability to process words. One study found that forty-five psychology undergraduates with previous musical training wrote higher quality essays with longer complex sentence structures than those without any musical training (Ransdell & Gilroy, 2001). They explained that musical training was positively correlated with the writer's ability to deal with the cognitive load of background music efficiently. Darrow et al. (2006 p. 764) agreed with findings that music facilitated those with musical training achieving significantly higher scores on all measures of attention. This surprised me as personally I know my attention is always drawn to the music, listening to the performer sing and drawing my focus away from what I am doing. Wouldn't musicians be more attentive to the music, giving music more of their cognitive capacity load? The other view was that musicians have developed the abilities and skill and probably become accustomed to music accompanying their life, thus being able to function more effectively with the use of music.

Darrow (2006 p. 765) stated that musicians have experience with practicing music and attending to every details of the music, which he felt gave musicians more ability to adapt to orientated tests.

2.4 Conclusion

With the previously discussed literature bringing our attention to the amount of hours that students are spending listening to music daily, we can confidently say that music out of school is an important part of their lives. Since we cannot stop the development of technology and access to music in people's daily lives, we should now be looking forward in searching and trying to understand the power of music-listening over, for example, our habits, well-being, cognition and especially students' academic learning. We need to be in an accurately informed position before we implement or develop strategies for opening doors of using music in the education of children in South Africa. A comprehensive study of this topic has yet to be acknowledged and accepted by the education departments in South Africa and around the world. With very interesting but yet contrasting literature we have been able to explore different views, ideas and concepts of the cognitive effect that the activity of music-listening could have on an individual's memory and learning. I feel that there is still a great need for a clear and defined answer, taking into account the appropriate tasks, selected music and students that we hope to assist. I believe further testing in this field should be encouraged especially if we hope to advise schools, educators and parents to allow students to use music as a gateway in education, assisting their memory and learning, and ultimately having a positive result on their academic achievement.

Chapter 3 – Research Methodology

3.1 Research methodology

According to Kothari, a research methodology is a way to “systemically solve research problems” (2004 p. 8). This chapter will deal with the methodological aspects of the study exploring “what the researcher does to solve the research problem or answer the research questions (Brink, 2006 p. 191).

3.2 Research questions

The following research questions which will include both a primary research question and six secondary questions has been formulated to guide this study. These questions will be the focus of this study and guide all stages of inquiry, analysis and reporting.

3.2.1 Primary research question

The researcher will focus on addressing the following research question:

What are the cognitive effects that listening to self-selected background music will have on a student’s performance in memory and learning?

3.2.2 Secondary research questions

The above question will be addressed by attempting to answer the following sub-questions:

1. From the limited population how many students are listening to music while working or studying?
2. Is there a comparative difference in results across gender and home language?
3. Is there a comparative difference in results between musically trained or skilled pupils vs. those with no musical training or skills?
4. Does listening to self-selected background music affect the participant’s cognitive performance in memory and learning?

5. Does silence result in less disruption to a student's cognitive performance in memory and learning?
6. Should schools be using background music-listening as a tool to develop and improve student's cognitive performance in memory and learning?

3.3 Research methods

The researcher has a wide range of techniques at their disposal, collectively termed "research methods". The following approaches will be used to in order to realise the purpose of this study;

3.3.1 Literature study

The literature study provides an overview of current knowledge surrounding an area of research. This is done in order to ascertain what is known and not known about this particular research problem. The study's theoretical and conceptual framework may emerge from such a review. In this study a literature review was conducted to investigate the topic of listening to music, learning and its effect on an individual's cognition. Evidence was found in terms of the development and accessibility of music and the activity of listening to music, especially background music with specific reference to the present-day prevalence of multimedia technologies. The advantages of using self-selected background music was also examined. An investigation took place on the psychology of learning, looking at the systems used for memory as well as looking at the processes students use to study and learn and how their knowledge is assessed. Cognitive theories that pertain to the correlational between music-listening and learning performance was investigated as well as the effect of music on the individual. For the literature review books, dissertations, academic journals and published or unpublished bibliographies, studies, surveys, experiments and government reports that have provided the most recent theoretical and empirical information on the topic of my research were consulted. This was done to draw information from conversations in this subject area by recent scholars to determine what is already known in order for me to create a comprehensive picture of knowledge in this topic. Presented in the literature review is evidence in the academic

discourse to establish a need for my proposed research. This will not only give the opportunity to bring awareness of previous research in this field, but also allow engagement in the dialogue of what has been written and discovered in order to make a contribution to this knowledge.

3.3.2 Experimental study

According to Brink, quantitative research is said to have its “roots in logical positivism and to focus on measurable aspects of human behaviour” (2006 p. 10). Its purpose, according to Davies, “is to discover answers to questions through the application of scientific procedures” (2007 p. 9). This quantitative study has employed structured procedures and instruments in order to gather information under various conditions of control. More specifically, this study employed an experimental design wherein the researcher exercised control over the experimental situation. This control comprises the researcher’s manipulation of the “independent or causal variable(s)”, along with “observ[ing] and measur[ing] the action or outcome on the dependent variable(s)” (Brink, 2006 p. 92). The type of experimental design that was used is the ‘two group pre-test post-test design’. This involves randomly assigning participants to two groups; an experimental group and a control group, and both of these groups were pre-tested and post-tested in exactly the same way. The experimental group differed in that it they were given the ‘treatment’ between tests, while the control group was not. This was followed by comparison of the post-test results between the two groups, so allowing the researcher to determine the effectiveness of the ‘treatment’. The researcher was also able to see specifically how both the control and the experimental groups changed from the pre-treatment test to post-treatment test. Finally, comparison of the results in the pre-treatment test ensured adequate randomization, thus validating the requirement for minimising the differences between the two groups.

Each of the groups was subjected to one the following music treatment conditions;

- No music/ silence
- Self- selected music

Methodologically speaking, these two treatments represent the variable that the researcher manipulated in order to contribute to or precede a particular outcome. More specifically, it is used to test for an effect on the following two dependent variables; (1) word-recall test result and (2) reading comprehension test result. [1]

During the pre-treatment testing, both the experimental and control groups were placed under the first music treatment condition: no music/ silence. Both groups completed test one: a word-recall test (Appendix G, Word-Recall Test 1) and reading comprehension test (Appendix I, Comprehension Test 1). During the post-treatment testing, both groups completed test two: a word-recall test (Appendix G, Comprehension Test 2) and a reading comprehension test (Appendix K, Comprehension Test 2), but the experimental group was placed under a different treatment to the control group. The control group remained under the "no music/ silence" treatment, while the experimental group was placed under "self-selected music" treatment.

Below is a visual representation of this study's experimental design;

Control Group		**Experimental Group**	
Pre-Treatment Tests	***Post-Treatment Tests***	***Pre-Treatment Tests***	***Post-Treatment Tests***
Word-Recall Test 1	Word-Recall Test 2	Word-Recall Test 1	Word-Recall Test 2
Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2

Placed under the no music/ silence music treatment condition

Placed under self-selected music treatment condition

[1] These dependent variable also considered as 'outcome variables' as they reflect the effect or response to the independent variables.

3.4 Sample

Hungler and Denise (1978 p. 451) referred to ‘sampling’ as the selection of a portion of the population or a ‘sample’ being a subset of the units to represent the entire population. This study has involved non-probability sampling where the sample is chosen from the population using non-random methods. The specific type of non-probability sampling employed is termed ‘convenience sampling’, which Brink refers to as “accidental or availability sampling” which involves the selection of available participants or objects for the study (2006 p. 132). This data was collected from a limited population of three Port Elizabeth district schools. Subject to the schools’ availability and willingness to participate, three schools were selected. All of these were on a similar quintile level, and had the resources to offer music as an educational subject.[2] The majority of the students in these schools were expected to have had access to music-listening devices of their own, such as cell phones or music players, or could get access through, for example, school computers.

This study tested students in the senior phase level of high school being Grades 8 and 9. These grades were selected on the assumption that there is less academic pressure on these educators and students, elevating the likelihood that the school, educators, parents/legal guardians and students would be willing to participate. I also felt that, depending on the results of this study, the schools might be given the opportunity to implement strategies that could be beneficial to the academic performance of the participants in their FET phase (Grade 10-12).

The educators of these students did not participate in this study. A questionnaire (Appendix F) was administered in order to determine students’ demographic information, language preference, listening habits and music abilities or skills. The intention was that approximately 240 English-speaking high school students, male and female and aged between 13 and 16 years in Port Elizabeth, would participate in the study. This target

[2] There are five categories of schools, called quintiles which are used to determine how much government funding is provided to each school. No-fee schools which are the lower quintiles (1 to 3) are required to not charge school fees while schools in quintiles 4 and 5 receive a small amount of government funding and therefore charge school fees. (Dass & Rinquest, 2017, p. 143)

sample size was determined by balancing various constraints. Firstly, the availability of 10 listening devices allowed only 10 participants per session. Secondly, the experiment required students to participate during school hours, and this sample size sought to minimise disruptions to their academic schedules. The participants that were selected were those that routinely use music to work or study. The participants were tested in groups of 10 individuals with a target of 40 Grade 8 participants and 40 Grade 9 participants at each school. In this stage of the study probability sampling was to be used: specifically ‘simple random sampling’. This seeks to ensure that every participant has a fair chance of being included in the study’s sample. Participants were randomly assigned to either the control group or experimental group, which are approximately of equal sample size.

3.5 Measurement instruments

Measurement instruments can be seen as the procedures or tools used to collect data and provide valid and reliable information. The following measuring instruments were used in this study: a questionnaire (Appendix F); two word-recall tests (Appendix G, with answer sheets as in Appendix H); and two comprehension tests (Appendix I & K, together with Appendix J & L, respectively). The questionnaire was answered by a limited population of students in the Grades of 8 and 9 at three Port Elizabeth district schools. This was used to provide demographic information such as their name, grade and school, and was used to link participants to their test scores and age, gender and home language, all for comparative purposes. Students were asked whether they listened to music while working or studying in order to select participants that could provide 10 songs to be used for testing. Students were also asked to indicate whether they have had any musical training for comparative purposes of their test results.

During the administration of the test, each student was provided with headphones and a listening device, loaded with a memory card containing their 10 selected songs. The listening devices were Retro Hot Mini Clip MP3 players equipped with 8GB MicroSD memory cards and the headphones were the Amplify Symphony Headphones. These listening devices, memory cards and headphones were identical in every respect except

colour. In particular their physical and listening specifications were consistent. Listening to music through headphones had the advantage of helping to filter out any unfamiliar external stimuli. The headphones were cleaned after each session using “cleansing wipes” advised by a hearing specialist at the Hear Clearly Group, in Walmer Port Elizabeth.

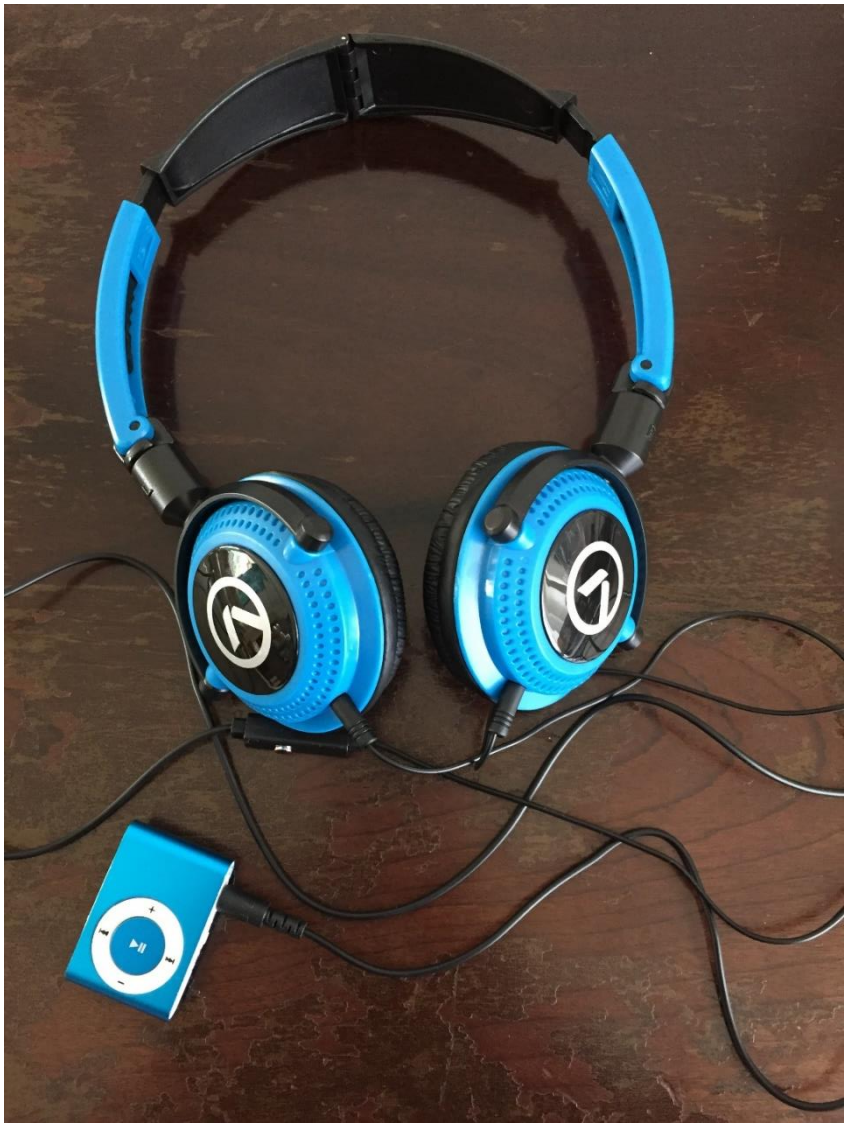

Figure 1 - Listening device and headphones used by participants in the experimental group during testing

The word-recall tests (Appendix G) sourced 30 words from the 2016 Department of Basic Education Spelling Bee South Africa Word List. The participants’ scores were recorded as the number of words from Appendix G correctly recalled on their answering sheet (Appendix H). This was used to evaluate the participants’ cognition, specifically their

ability to use rote rehearsal, and so to determine a recall retrieval rate. As Brink puts it: “validity seeks to ascertain whether an instrument accurately measures what it is supposed to measure, given the context in which it is applied” (2006 p. 159). Reliability refers to the quality of the measurement instruments. A reliable instrument will produce consistent results if repeatedly used on the same person, or if used by two different researchers (Brink, 2006 p. 163). The word-recall test was based on research by Thompson & Mutic (2013), Jäncke et al. (2014), and Chew et al. (2016). The measuring instruments in those studies were successful and considered valid. The test was modified for the needs of this study. To enhance validity, this document contained South African words recognized and used by the South African population. Every word on the list is a six letter word and was displayed in large upper case letters in order to promote reliability and maintain a consistent difficulty in terms of memory recall across both tests and both grades of students.

The reading comprehension tests (Appendix I and K) had been sourced from the University of Cambridge ESOL Examinations (English for Speakers of Other Languages) Preliminary English Test. I had selected Sample Paper 1 and 2, using questions 11-20. The participants’ scores were recorded as the number of correct answers on the answering sheets (Appendix J and L). These questions had been slightly modified, from asking students to indicate A as correct and B as incorrect, to asking student to indicate T for true/correct or F for false/incorrect. This measurement instrument required participants to use elaborative rehearsal and sought to determine their recognition retrieval rate. The measurement instrument of a reading comprehension test was based on research by Harmon et al. (2008), Gillis (2010), Anderson & Fuller (2010) and Thompson, Schellenberg & Letnic (2011). The measurement instrument had been proven to be reliable and valid. According to Sahebdel & Khodadust (2014 p. 107), who also used the test of reading comprehension to test EFL students’ silent reading, the ‘Cambridge English Preliminary test (PET)’ was found to be at an intermediate level and successful in evaluating their ability to use everyday English to communicate.

To ensure reliability and overall suitability, both word-recall lists and reading comprehension were given to the English department heads at all three schools for

evaluation of the instruments (Appendix C). This evaluation ensured equivalence reliability, determining whether similar tests, given at the same time, would produce consistent results. In this case it evaluated whether, for example, the two reading comprehension tests could be given to two different participants under similar conditions, and still result in consistent responses. From these evaluations, only small language changes were made to the measurement instruments and across all three evaluations the instruments were deemed reliable and suitable to this study.

3.6 Data collection

Brink (2006 p. 141) states there are five important question to be asked in the planning process of one's data collection; "what data will be collected, how will the data be collected, who will collect the data, where will the data be collected and when will the data be collected?"

A questionnaire (Appendix F) was given to those Grade 8 and 9 pupils who had agreed to participate and who returned their consent and assent forms. The number of Grade 8 and 9 pupils varied in each school, depending on the willingness and availability of the school and educators to allow pupils to participate. The questionnaire required that they fill out demographic information and state their home language. It also asked them to provide information about any musical training and listening habits. These questionnaires were assessed and forty Grade 8 and Grade 9 pupils were selected from each school to participate in the experiment.

The experiment was conducted on a separate day during school hours (8:00 - 14:15) in classroom provided by the school, with each student seated at his or her table. I advised the school and educators that the selected students were to participate in this experiment during subjects such as guidance/ life orientation or assembly. I was also in contact with their educators to ensure that students were not missing any crucial work, and to inform these students before the experiment of any work that would be missed and homework to be completed. During the experiment I minimised any distractions, ensuring that the school, teachers and students were aware of the experiment. The music was then played

through the listening devices and headphones provided with their 10 preferred songs uploaded on each memory card and inserted into each device.

During the pre-treatment test phase, test one was administrated to participants, comprising a word-recall test (Appendix G & H). Each participant was given a list of 15 words on a laminated sheet to memorize. Each student was given a copy of Appendix G, and 10 minutes in which to memorize the words listed thereon under the treatment condition of no music/ silence. They then handed back Appendix G and received Appendix H, an answer sheet upon which to write the words which they were able to recall. They were given 10 minutes to complete this activity and performed this test in silence. When participants had completed the test and the worksheet had been collected, they were given a de-briefing in case of any questions.

The second test in the pre-treatment test phase was test one of the reading comprehension test (Appendix I). Each participant was given an article on a laminated sheet. They were given 10 minutes to read the article under the treatment condition of no music/silence. They then handed back Appendix I and received Appendix J, answering the questions thereon. Participants were required to answer 'T' (if they believed the statement to be true or correct) or 'F' (if they believed it to be false or incorrect) in relation to the reading comprehension. They were given 10 minutes to complete this activity and performed the test in silence. Upon completion, worksheets were collected and participants were given a de-briefing in case of any questions.

During the post-treatment test phase, participants were randomly allocated to either the experimental group or control group. Both the participants in the experimental group and those in the control group received test two, which included a word-recall test (Appendix G). Each participant was given a list of 15 words on a laminated sheet, and 10 minutes in which to memorise as many as possible of these. While this was underway, the control group were subjected to treatment condition of no music/ silence. The experimental group, on the other hand, received individual listening devices and headphones, and were subjected to the treatment condition of self-selected music. These were the 10 songs that they had each provided in their answers to the questionnaire. The experimental and the

control group participants both then handed back Appendix G and received Appendix H, an answer sheet on which to write their recalled words. They were given 10 minutes to complete this activity and both the experimental group and the control group performed this test in silence. When participants had completed the test and the worksheet had been collected, they were given a de-briefing in case of any questions.

During the second test in the post-treatment test phase, participants remained in their randomly allocated experimental group or control groups. Test two of the reading comprehension test (Appendix K) was now administrated. Each participant was given an article on a laminated sheet, and 10 minutes in which to read it. While reading the article, the control group were subjected treatment condition of no music/ silence. The experimental group received individual listening devices and headphones and were subjected to the treatment condition of self-selected music. Again, this music comprised of the 10 songs that they had provided in their answers to the questionnaire. The experimental and the control group participants both then handed back their reading matter, Appendix K and received answering sheets (Appendix L), containing questions. These required the participants to answer either ‘T’ (if they believed the statement to be true or correct) or ‘F’ (if they believed it to be false or incorrect) in relation to the reading comprehension. They were given 10 minutes to complete this activity, and both the experimental group and control group performed this test in silence. When participants had completed the test and the worksheets had been collected, they were given a debriefing in case of any questions.

3.7 Data analysis

A data analysis involves “categorising, ordering, manipulating, and summarising the data as well as describing them in meaningful terms” (Brink 2006 p. 170). The help of a qualified statistician based at Nelson Mandela University’s Unit for Statistical Consultation had been enlisted. Descriptive statistics were used to describe and summarise the data, including, pie charts, box and whisker plots and frequency tables, as well as measures of central tendency and variability (specifically: average and standard deviation, respectively).

Inferential statistical methods were used in a bid to draw conclusion about a population given the data actually obtained for the sample. To do so, it was necessary to determine whether differences actually observed between the control group and the experimental group might reasonably have occurred by chance, or whether such observed differences were so unlikely as to reasonably indicate a true difference in the population. A multivariate analysis of variance (MANOVA) tests the significance difference between more than one dependent variables (Hungler & Denise 1978 p. 592). MANOVAs are used for experimental situations in which at least one variable has been manipulated. For this reason, a MANOVA is performed in order to establish whether any statistically significant differences existed between the control and experimental groups. Based on the results of the MANOVA, univariate ANOVAs are employed to compare specific averages of three or more groups (or t-tests, in the case of only two groups), and various post-hoc tests are used to confirm such differences once an overall statistically significant difference is shown. In this study, a MANOVA was originally considered for the data analysis. However, upon review of the experimental data obtained, the correlation between the recall difference scores and the comprehension scores (used for the analysis) is too low. Since the dependent variables were not significantly related, separate independent-samples *t*-tests are performed in order to establish whether there were significant differences between the control and experimental groups on their word-recall and comprehension scores.

3.8 Sources used for the development of the measurement instruments

The word-recall tests (Appendix G) sourced 30 words that were taken from the 2016 Department of Basic Education Spelling Bee South Africa Word List (Department of Basic Education, 2016). This word list is used as part of the 'Read to Lead' campaign which hosts an annual National spelling bee championship, where participants compete in spelling words orally. The word list contained 1212 alphabetical South African words varying from fourteen letter words such as 'administration' to the smallest four letter words like 'zest'. The 30 words that were used for this study were selected at random and were all six letter words.

The reading comprehension tests (Appendix I and K) were sourced from the University of Cambridge ESOL Examinations (English for Speakers of Other Languages) Preliminary English Test, Sample Paper 1 and 2, using questions 11-20 (Cambridge Assessment English, n.d.). The 'Cambridge Assessment English' is offered by the University of Cambridge which includes exams that are recognized by schools, universities, employers and governments around the world. They offer free material that can be downloaded to help people improve their English online. The reading comprehensions were taken from the preliminary free sample paper offered on their website.

3.9 Ethical considerations

Ethics deals with sensitive issues such as the honesty and integrity of the researcher while conducting research (Brink, 2006 p. 31). This study required the testing and observation of individuals from vulnerable groups. I ensured that the quality and the integrity of my research was upheld. Before embarking upon this research, I had obtained a letter from the Department of Education giving me permission to approach nine local schools with invitations to participate in my study. I had also received permission from the Nelson Mandela University's Faculty of Arts' Faculty Postgraduate Studies Committee (FPGSC), and institutional ethics clearance through the Central Ethics Committee at Nelson Mandela University. [3]

Four fundamental ethical principles have been upheld throughout the study: the principle of respect for persons, the principle of non-maleficence, the principle of beneficence and the principle of justice. All participants were regarded as autonomous agents. The researcher refrained from obstructing their actions unless such were in detriment of others. The researcher only stated what was required for the experiment, as laid out in the document 'oral information given to participants' (Appendix E). The students had a right to self-determination in that their participation was entirely voluntary, and they could

[3] The ethics clearance reference number assigned was [H17-ART-MUS-005].

decide whether or not to participate in this study without any risk of penalty or prejudice. They could choose to withhold any information at any stage of this study (such as by not answering question(s) and leaving them incomplete), once again without fear of penalty or prejudice. They had the right to refuse or withdraw from the study at any stage and received adequate clarification about the purpose of this study.

The principle of non-maleficence was upheld in that the researcher acted in ways that ensured the protection and well-being of the students. The researcher minimised discomfort or harm in any form, be it physical, emotional, spiritual, economic, social or legal. This study minimised any discomforts to the students by leveraging the familiar setting of their school. The listening devices caused no physical harm and music was played at a consistent and moderate level to minimise hearing discomfort. All tests that participants were required to complete were done individually (no group tasks) in order for students to not feel pressured to perform or embarrassed due to feeling of under-performing. A de-brief followed after each experiment in order to determine if participants required any additional support.

This study promoted the principle of beneficence, taking positive steps to prevent harm to and remove harm from participants, but also seeking to benefit others by contributing to the welfare of both the participants and community. This study helped the participants to understand the activity of listening to music and its effect on their learning and performance. The research results will be made available to the Eastern Cape Department of Education in order to facilitate and inform the educational project and the broader public.

Finally, the principle of justice was upheld in that participants had a right to fair selection and treatment, since participants were only selected for reasons directly related to this study. The study respected the students' rights to privacy in that participants had a choice regarding information shared or withheld. Once shared, participants had a right to expect the researcher to keep such information private. Anonymity was assured in that the schools and participants' names were not identified in any written reports about the study, and students' names were replaced with codes. Confidentiality was assured in that the

data collected during the study was not (and will never be) made available to any other persons.

Before any experimental testing got underway, written informed consent and assent was obtained, indicating that the school and students had voluntarily decided to participate in the study and had an understanding of what it entailed. I obtained written consent from principals of three district schools after providing each with detailed information stating the aims, significance, benefits and methods of this research (Appendix B). Principals were also informed that I would require written informed consent from the participants' parents and informed assent from each participant (Appendix D). Parental consent and participant assent had to be signed after providing each parent and student with detailed information explaining the study, stating the risks and benefits, assuring their anonymity and confidentiality as well as providing contact information in anticipation of any further queries.

Chapter 4 – Results and Discussion

This chapter presents the research results. Participants completed a questionnaire providing biographical variables to be discussed in this section. These include their school and grade, age, gender and language. This information helps to contextualise the findings in relation to the sample and will allow us to later make inferences using this information in order to answer the research question of this study. Participants completed experimental tests, such as the word-recall and comprehension tests to provide primary data to be discussed in this section. Independent sample *t*-tests were applied, and the results thereof are presented, interpreted and discussed here.

4.1 Biographical information about the participants

4.1.1 Participants and schools

Three schools were selected, subject to their availability and willingness to participate in this study. Anonymity was assured in that the schools' names will not be identified in any written reports. Instead, the schools used during testing will be referred to as School 1, School 2 and School 3. The number and percentage of participants from each school is presented in Figure 2.

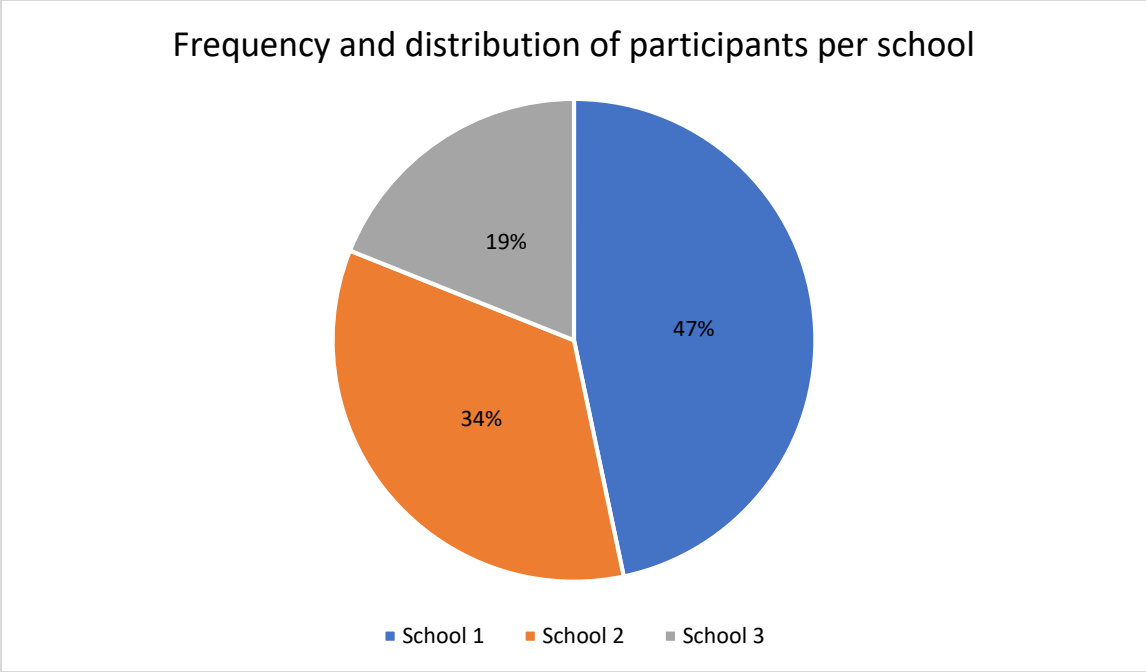

Figure 2 - Frequency and distribution of participants per school

The majority of 227 participants were from School 1 (47%), followed by School 2 (34%) and School 3 (19%). School 1 had approximately double the number of students in Grade 8 and 9 compared to School 2, as is reflected to an extent in the number of participants. School 3 was similar in size to School 1, but contributed the least participants due to time limitations and a lack of willingness by students to participate. Across all three schools, 79% (189) of students completed the experimental testing, falling only 21% (51) short of the planned total of 240. The lack of participants seemed mostly due to unwillingness of many students to participate, as well as to tardiness as regards the return of consent and assent forms. In each school, the time period allocated for the return of permission forms had to be extended due to low compliancy by students. I suggest that there might be two explanations for this, firstly, register educators at each school, responsible to provide and collect these forms from students, did not follow up with students on a regular basis. This resulted in a large number of returned forms by certain classes and only a few in others. The second explanation was that students may have misplaced their forms or had not followed the process of getting parental permission. This was evidently the case in those schools which requested more copies of permission forms, and where a large number of

forms were returned without parental permission resulting in those students being unable to participate within this study.

4.1.2 Grade

The criteria for participation in this study required participants to be within the senior phase level of high school meaning within the Grades of 8 or 9. The grade distribution of the sample is presented in Figure 3.

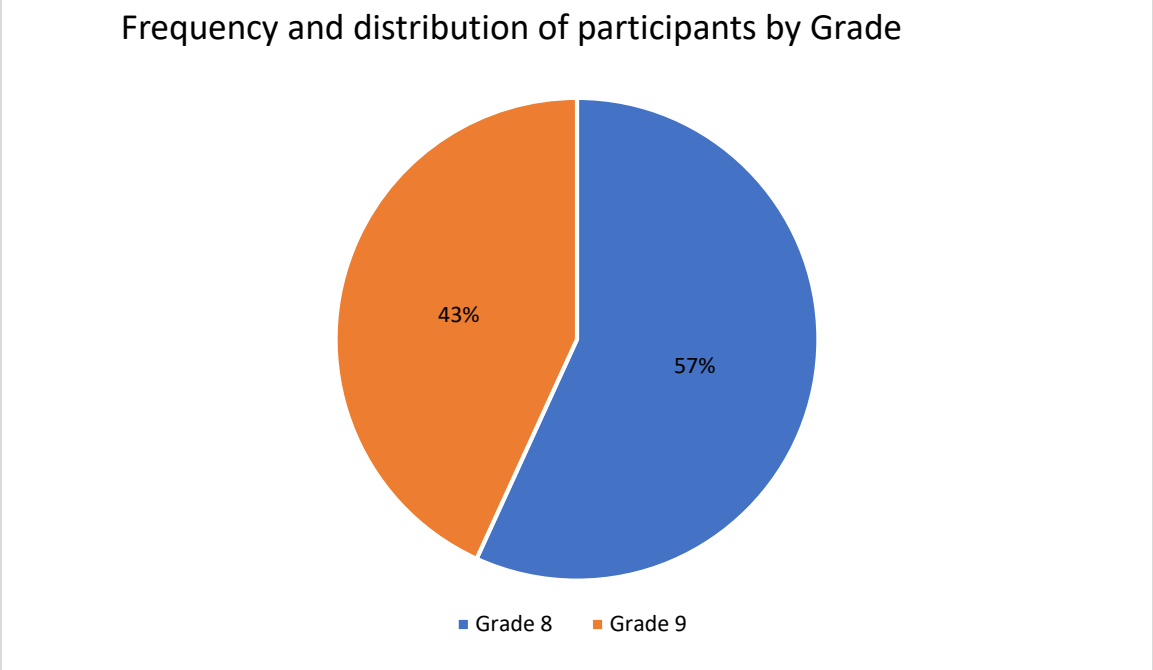

Figure 3 - Frequency and distribution of participants by Grade

At each school there were a larger number of Grade 8s willing to participate compared to students in Grade 9, as reflected overall above.

4.1.3 Age

The criteria for participation in this study requires participants to be between the ages of 13 and 16 years. This is the typical age for students in the Grades 8 and 9. The age distribution of the sample is presented below.

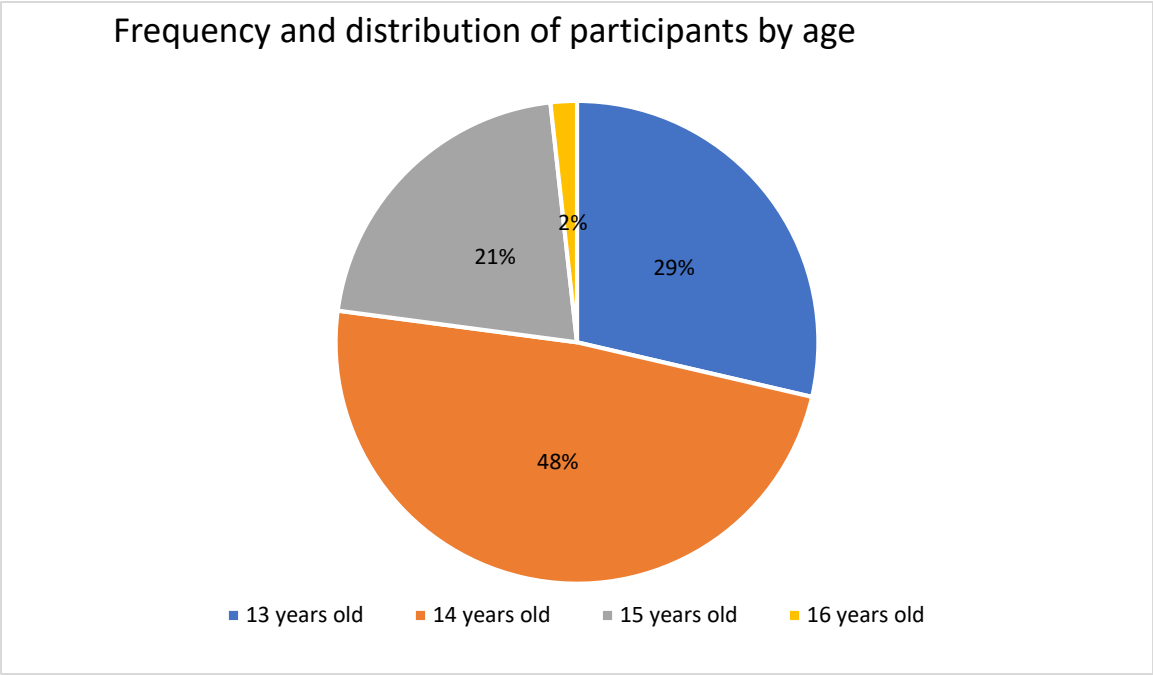

Figure 4 - Frequency and distribution of participants by age

Almost half of the participants, across all three schools, were 14 years of age. Only 4 participants had reached 16 years of age.

4.1.4 Gender

Participants were required to indicate their gender, enabling comparison of participants' test scores by gender. The gender distribution of the sample was as follows:

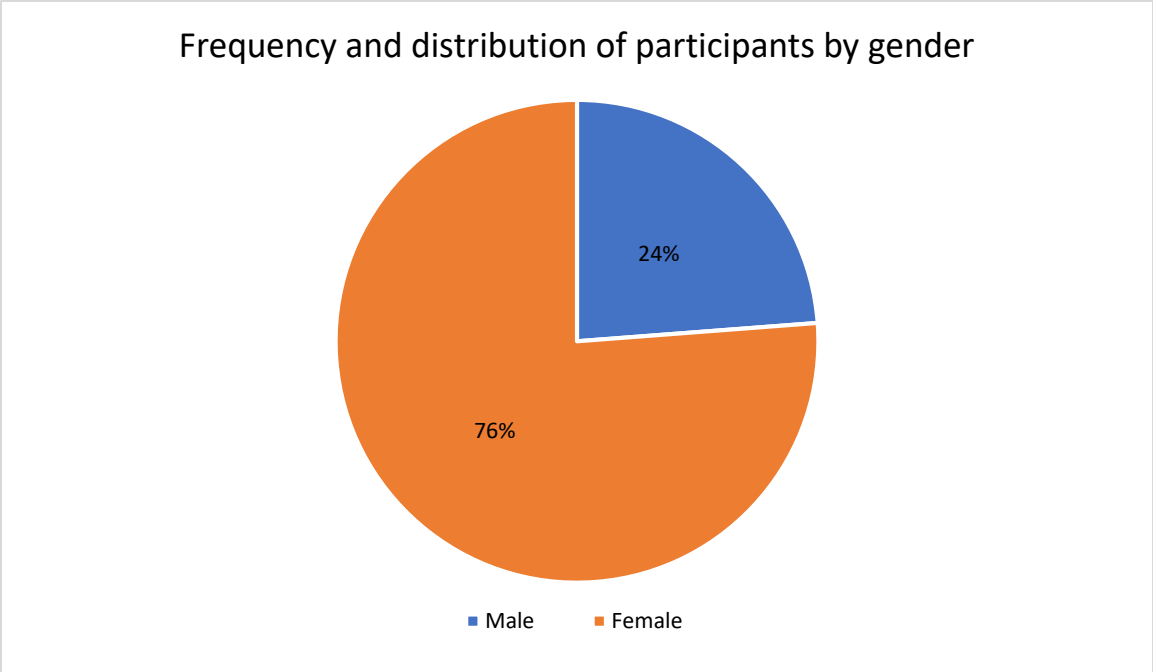

Figure 5 - Frequency and distribution of participants by gender

It is at once evident that, across all three schools, the majority of participants were female, 76% as opposed to just 24% male participants. This largely reflected the demographic of the schools.

4.1.5 Home language

Participants were asked to indicate their home language, provided the following options; English, Afrikaans, isiXhosa, and “Other”. All tests in the study are presented in English. This enabled an exploration of whether there is a correlation between participants’ test scores and their home language.

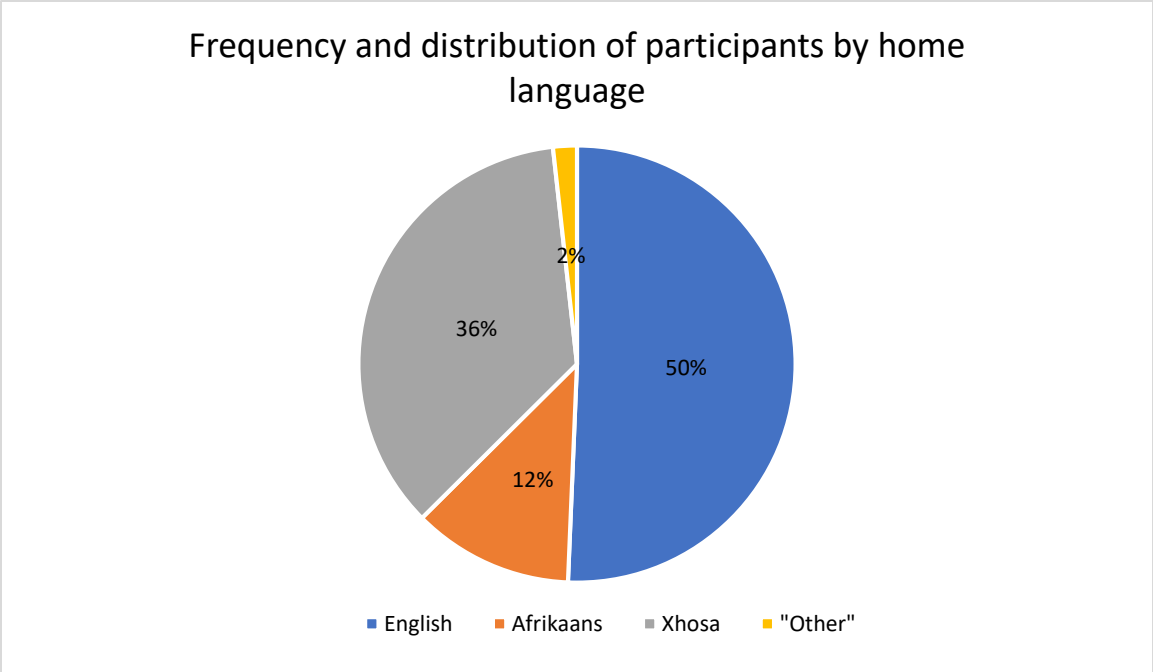

Figure 6 - Frequency and distribution of participants by home language

Across all three schools, English accounted for slightly more than half of the participants (50%) followed by isiXhosa (36%) and Afrikaans (12%). There were only 2% of participants that indicated “Other”. I assumed that all participants were able to read and speak in English, due to all three being English medium schools.

4.1.6 Musical training

The questionnaire asked participants to state, by selecting ‘yes’ or ‘no’, whether they had received any musical training. This would be if they have taken music as a subject in school or received lessons on an instrument of any kind. This enabled a comparison to be made between the test scores of participants with musical training as compared to those with none. The musical training distribution of the sample is presented below.

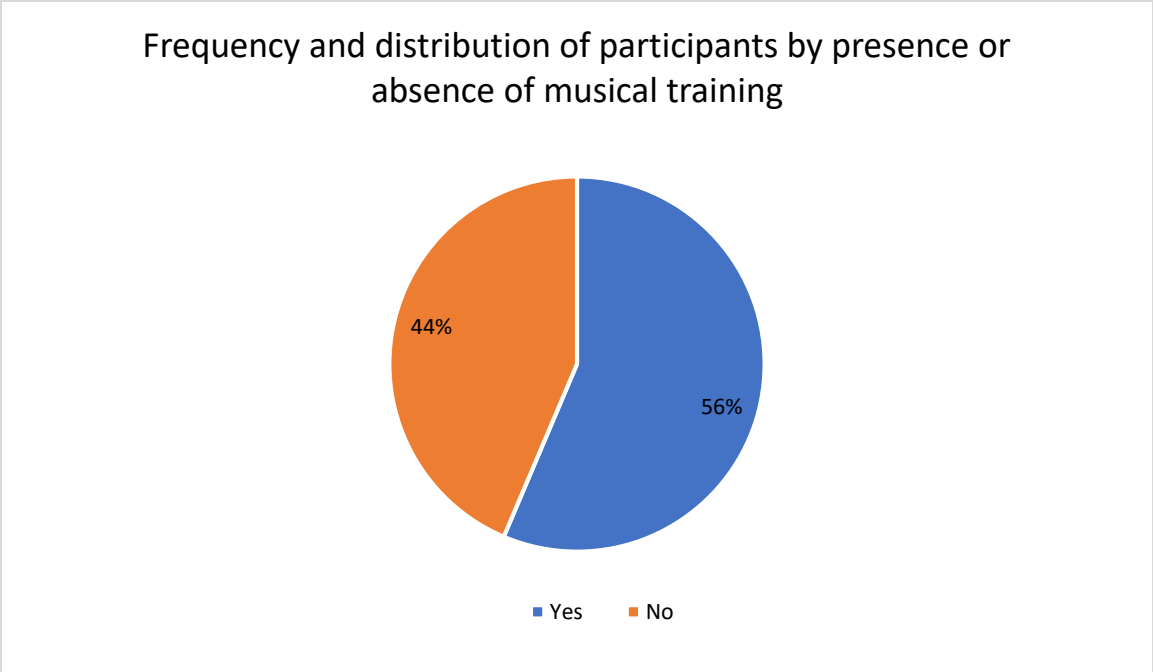

Figure 7 - Frequency and distribution of participants by presence and absence of musical training

Taken across all three schools, 56.4% of participants indicated ‘yes’ to having received musical training, or being able to play a musical instrument of some kind. All three schools that participated in my study had effective music departments, offering lessons on many musical instruments and providing students with the opportunity to take music as a school subject throughout Grades 10 to 12. Of course, this would likely have been very different in schools that did not have resources such as music teachers and instruments available.

4.1.7 Music-listening

Finally, participants were asked to respond with either ‘yes’ or ‘no’ to following question: ‘Do you listen to music when you are working or studying?’ This question was designed to answer the secondary research question 1: ‘From the limited population, how many students are listening to music while working or studying?’

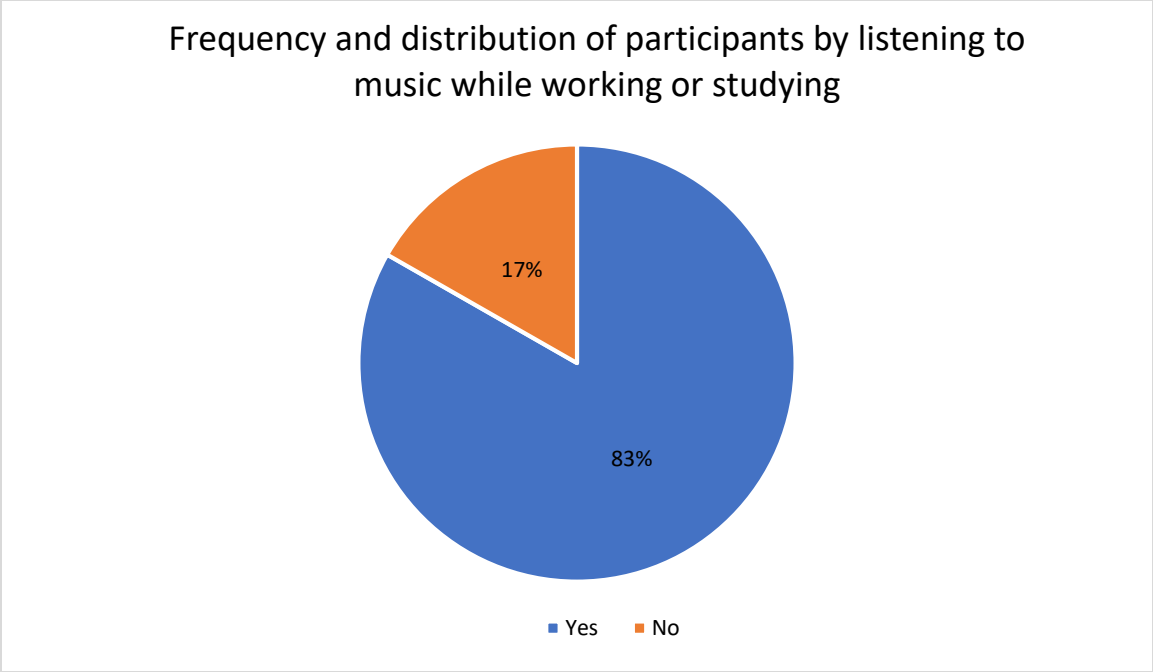

Figure 8 - Frequency and distribution of participants by listening to music while working or studying

A large majority (83.3%) answered ‘yes’ to the question about listening to music while working and studying. Only 17% (of 227) indicated ‘no’ that they did not listen to music while working or studying. This observation is supported by the literature in that music-listening has become a secondary stimulus to a majority of students’ learning and could largely be due to technological advances and access to music through mobile phones and the internet. These results align with previous research such as Kumar and Aithal (2016, p. 1191), who found that out of 200 participants, 120 listened to music while studying. Johansson et al. (2012, p. 340), who also found that 81% of their 150 participants listened to music while studying, and Furnham et al. (1999, p. 390) found that 90% of the 142 subjects in their experiment reported listening to music whilst studying at home.

4.2 Results regarding the effect of music-listening on the word-recall tests

These results will reflect the effect of listening to music on the word-recall tests completed by those participants who agreed to using music-listening while working and studying. All the word-recall tests used in this study and completed by participants were scored out of a total of 15. The difference in scores was calculated by subtracting word-recall test 1 from word-recall test 2 in order to determine the size of the increase or decrease of the overall word-recall score of each participant. The difference in scores was recorded as 'post-pre difference recall scores'. To establish effect of music-listening on recall, an independent sample *t*-test was used to compare the average difference in scores across the control and experimental groups.

4.2.1 Overall performance for word-recall test participants

The following descriptive statistics summarise the overall performance of the participants during the word-recall tests 1 and 2.

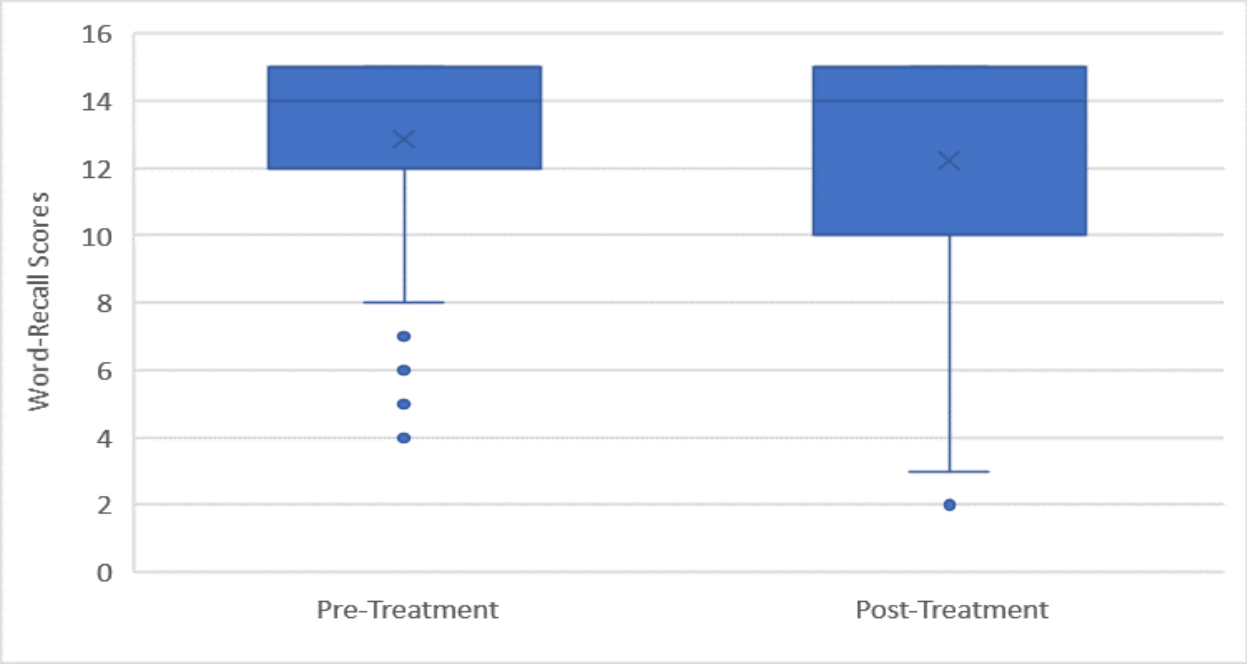

Figure 9 - Summary results for word-recall tests (all participants)

There were 90 control and 99 experimental participants. The pre- and post-treatment word recall tests share the same median score or middle value (14) but drop slightly in average from the pre-treatment tests (13) to the post-treatment tests (12). A larger lower interquartile range was also found in the post-treatment tests as well as lower whiskers. This suggests that the post- treatment scores were not consistent around the median and had a larger dispersion of result scores by participants than in the pre-treatment word-recall tests. Homoscedasticity (homogeneity of variance) was violated as established by Levene's test ($p < 0.05$), suggesting the use of Welch's *t*-test to examine the differences between post-pre difference recall scores. The post-pre difference recall score is higher for those in the control group (0.211 ± 2.315) [4], than in the experimental group (-1.414 ± 3.133) a statistically significant difference of 1.625, $t(179.692) = 4.080$, $p < 0.05$. Cohen's *d* is estimated at 0,59 which is a moderate effect size based on Cohen's (1992 p. 158) guidelines. This effect size is a way of quantifying the difference between two groups and these guidelines characterise a small effect size as being around 0.2, moderate effect size as around 0.5, with 0.8 being a large effect size. The 95% confidence interval for the difference in the post-pre difference recall scores was from 0.839 to 2.411, meaning that, on average those who don't use music-listening while studying for word-recall tests will be expected to perform 5.59% - 16.07% better than those that do use music-listening for the same task. Listening to music evidently affected the participants in this study negatively while completing their word-recall tests.

The experimental group that was placed under treatment of "self-selected background music" performed worse during the word-recall tests than those in the control group who completed the word-recall tests in silence. Encoding is the process of shifting new information into the information processing system so that it can be stored in the long term memory and retrieved for testing (Schunk, 2010 p. 187). A word-recall test assesses the participant's ability during the encoding and storage process. If information is not encoded or stored effectively, then a student's ability to recall the information on a later stage would be diminished. These results provide statistically significant evidence that music-listening interferes with the encoding process as it results in a negative effect on

[4] Refers to average ± standard deviation and will be used for the remainder of this chapter.

the experimental group's memory and ability to recall the word-list. Two possible explanations might be considered, with the first drawing on the limited capacity theory of Kahneman (1973), especially the idea of 'capacity interference'. Capacity interference occurs when two concurrent tasks (in this case, listening to music and encoding the recall word list) exceeds the available cognitive capacity, to the detriment of one or both tasks. While in such a dual-task situation, whilst attempting to process or pay attention to the background music, (or even intentionally ignoring or tuning out the background music), the processing capacity available for the primary cognitive task performance may be reduced. As previously mentioned, attentiveness is seen as the central process of encoding which involved acquiring information and placing it into our working memory storage. When information is given more attention it encourages more rehearsal and more rehearsal increases the likelihood that information remained in one's working memory. We could suggest that participants in the experimental group may have forgotten the words from the word list as they did not give enough attention to the activity. This resulted in an insufficient encoding and rehearsal process and therefore the words did not remain in their working memory and could not be easily recalled. Their self-selected background music, may have pulled too much of their attention away from the rehearsal process resulting in a detriment to the encoding process and the information was easily lost. The second explanation might be the idea of over-arousal shown in the Yerkes–Dodson Law (1908). The law stated that an arousal level could increase the performance of an individual up to an optimal level, while over-arousal could lead to a deterioration in performance. We could consider the arousal stimulant to be a form of interference once it crossed the threshold. The question was previously asked 'if we increase the strength of the distraction of background music, or raise the level of difficulty of the task, will it result in the deterioration in performance?' This could suggest an answer as we used self-selected background music that was familiar to the participants, therefore stimulating and arousing and could strengthen the distraction of the music. Combining this background music with the recall-word list that could be considered a complex task may have resulted in an over-arousal. It is possible that the level of arousal became too heightened when combining a strong distraction of music with a complex task therefore causing an impairment to the encoding process and, ultimately, their performance.

4.2.2 Gender of word-recall participants

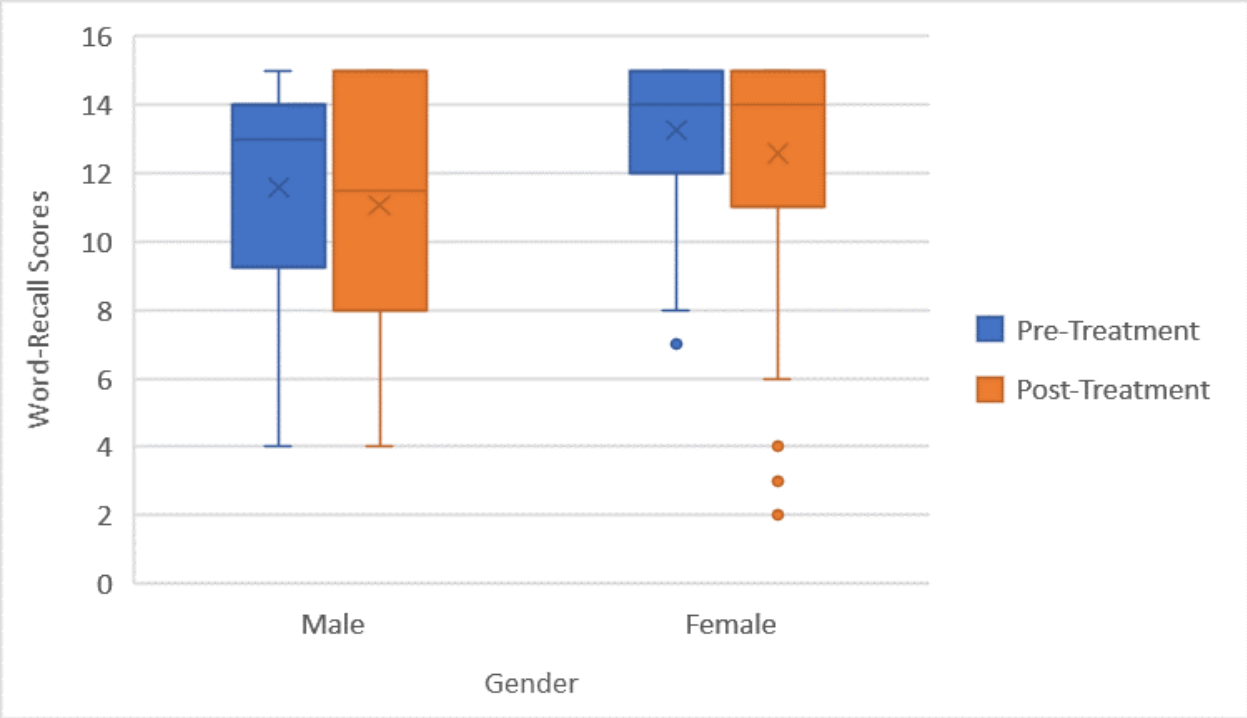

Figure 10 - Overall recall performance of male and female participants during the word-recall tests

There are 18 control and 26 experimental male participants in comparison to 72 control and 73 experimental female participants. Figure 10 shows the differences in pre-to post treatment word-recall scores by male and female participants. The interquartile range of the male participant's word-recall scores differed from pre-to post-treatment with a larger upper range increasing in the post-treatment scores. They also produced a large decrease in median from pre- to post treatment word-recall scores (13 - 11). While in comparison the female participant's median scores stay consistent however, they had a larger lower interquartile range. This may be due to the experimental group's average score decreasing from 13.34, in their pre-treatment to 11.84 in their post-treatment (Table 3, Appendix A). After applying Levene's test for equality of variance ($p < 0.05$) the assumption of homoscedasticity was violated, therefore a Welch *t*-test was run to determine if there were differences in the post-pre difference recall scores by females. The post-pre difference recall score was higher for females in the control group (0.152 ± 2.039) than for females in the experimental group (-1.506 ± 3.100), a statistically significant difference of 1.659, $t(124.688) = 3.813$, $p < 0.05$. Cohen's *d* was estimated at

0,63 which is a moderate effect size based on Cohen's (1992 p. 158) guidelines. The 95% confidence interval for the difference in the post-pre difference recall scores by females is 0.798 to 2.521, which means that, on average, it is expected that those females who don't use music-listening while studying for word-recall tests will perform between 5.32%- 16.80% better than those females who do use music-listening while studying for word-recall tests. This shows that listening to music negatively affects the female participants in this study in the experimental group while completing their word-recall tests.

The preceding results shows that listening to music did not affect the male participants in this study in either the control or the experimental groups while completing their word-recall tests. This may be due to their smaller sample size (54 males compared 173 females). Females in the experimental group (those placed under the music treatment condition of self-selected background music) performed worse during the word-recall tests than females in the control group (those who completed the word-recall tests in silence). This suggest that music-listening interferes with the encoding process, causing a negative effect on the female experimental group's memory and ability to recall the word list. Differences between male and female abilities have been the topic of much debate, though there are still limited findings explaining their ability to recall information. However, this may be attributed generally to women's social and personal use of music-listening. Shepherd and Sigg (2015 p. 512) stated that "……females do not use music socially like males and instead use music emotionally". Men relate their music-listening habits and preference to their social image and this may have a positive or negative impact on their evaluation by others. This is very evident in schools, with many male students listening to music through headphones during lunch or between classes, or even just carrying the headphones around their necks as a fashion accessory. White (2001 p. 14) had found that music is of more central importance in male lives compared to those of women. This might be the reason why men are shown to listen to music more frequently when studying than women do (Etaugh & Michaels, 1975 p. 554).

Table 4 (Appendix A) showed a smaller number of males participated in this study (54), with 81.5% of these indicating a preference towards listening to music while working and

studying. Of the female participants (173), 83.8% preferred listening to music while working and studying. Both males and females may thus have become accustomed to using background music on a daily basis, and the music might not have drawn as much attention as expected, resulting in the absence of any measurable effect. However, males might also not place as much emotional attachment on the music they are listening to as females might. Wells and Hakanen (1991 p. 454) found that adolescent girls associate emotions with music and use music for emotional regulation. These results may have resulted from the experimental female group participants being more distracted during the word-recall test, awarding more attention to their self-selected music due to its more stimulating and familiar character. As stated in the literature, familiar music appears to capture a participant's attention more than unfamiliar and disliked music, making it harder to ignore and more difficult to concentrate. This may be even harder to ignore if females attach emotional feelings towards music. Such heightened emotions may result in increased arousal, so drawing too much attention and increasing the cognitive load, resulting in internal competition for limited processing resources. These results should be recognized as significant to the field of education, since schools wanting to incorporate music within classrooms would need educators who are aware that females have a greater degree of distractibility by music-listening. They would therefore need to explore the implementation of strategies in order to accommodate both genders.

4.2.3 Home language of word-recall participants

In response to a question regarding home language, 3 participants indicated “Other”: 2 in the experimental group and 1 in the control group. Beyond cursory observations of the apparent trends, no further statistical analysis was performed since sample sizes were too small to generate a credible result.

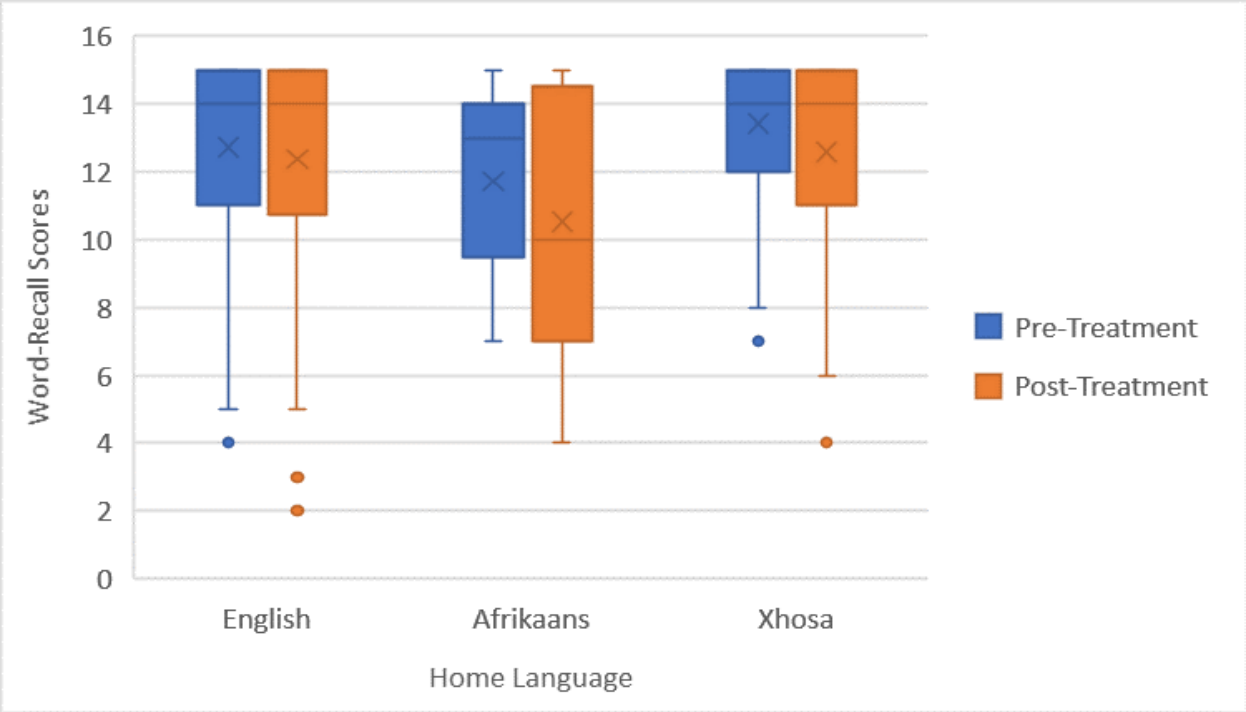

Figure 11 – Word-recall performance by English, Afrikaans and isiXhosa home language participants

There are 48 control and 46 experimental participants who indicated English as their home language, 8 control and 17 experimental Afrikaans home language participants and 33 control and 34 isiXhosa experimental participants. We can see fairly consistent results in median, average and interquartile range for participants in the English home language between pre- and post-treatment word-recall scores. This suggests the scores were more consistent around the median and had a smaller dispersion of result scores by participants. Even though the isiXhosa home language participants produced a consistent median score (14) from pre- and post-treatment test, both their average scores and interquartile range decrease slightly in their post-treatment word-recall scores. With only a small number of participants indicting the home language of ‘Afrikaans’ (11.9%) this may have contributed in its scores producing the lowest average score compared to the

home languages of English and isiXhosa (Table 5-8, Appendix A). As previously mentioned with the smaller number of participants in the Afrikaans home language and even less in “Other” home language (1.8%), *t*-tests were not performed for these two groups. More focus was placed on the home languages of English and isiXhosa, which accounted for the majority of the participants in this study. Levene’s test for equality of variances revealed a violation in the assumption of homoscedasticity ($p < 0.05$), prompting the use of a Welch *t*-test to determine whether there were significant differences in the post-pre difference recall by English home language participants. The post-pre difference recall score is higher for participants in the control group (0.541 ± 2.665) than for participants in the experimental group (-1.260 ± 3.408), a statistically significant difference of 1.802, $t(85.184) = 2.848$, $p < 0.05$. Cohen’s *d* is estimated at 0.589, which is a moderate effect size based on Cohen’s (1992 p. 158) guidelines. The 95% confidence interval for the difference in the post-pre difference recall scores by English home language participants ranged from 0.544 to 3.060. Participants who indicated English as their home language and who don’t use music-listening while studying for word-recall tests are thus expected to perform between 3.63%- 20.4% better than those who do, on average. Listening to music evidently had a negative effect on the English home language participants in the word-recall tests of this study.

For isiXhosa home language participants, again, Levene’s test for equality of variances identified that the assumption of homoscedasticity was violated ($p < 0.05$), thus a Welch *t*-test was run to determine if there were differences in the post-pre difference recall scores. The post-pre difference recall score is higher for those in the control group (-0.121 ± 1.763), than for those in the experimental group (-1.529 ± 3.077), a statistically significant difference of 1.408, $t(52.869) = 2.307$, $p < 0.05$. Cohen’s *d* is estimated at 0.562, which is a moderate effect size based on Cohen’s (1992 p. 158) guidelines. This effect size is a way of quantifying the difference between two groups and these guidelines categorise a small effect size to be around 0.2, moderate effect size within 0.5 and 0.8 being a large effect size. The 95% confidence interval for the difference in the post-pre difference recall scores by isiXhosa home language participants is 0.183 to 2.632. This means that, on average, it is expected that isiXhosa home language participants who

don’t use music-listening while studying for word-recall tests would perform between 1.22%- 17.55% better than those isiXhosa home language participants who do use music-listening while studying for word-recall tests. In other words, listening to music yet again affected these particular the participants negatively while completing their word-recall tests.

Unfortunately, both the Afrikaans and the “Other” home language groups’ sample sizes are too small to generate any effective result. What was shown was that the experimental group participants having English or isiXhosa as home language both performed worse during the word-recall tests than in their respective control groups who completed the word-recall tests in silence. All word-recall tests were presented in English and, as previously mentioned, all three schools that agreed to participate in this study were English-medium schools. Therefore, participants were able to speak English and were accustomed to learning in English. However, this question sought to explore whether there was any correlation between home language and their word-recall scores. The results show that, regardless of the participant’s home language, music-listening interfered with the encoding process which then has a negative effect on the participant’s memory and ability to recall the word list. This may be due to what Kahneman (1973) refers to in his limited capacity theory as ‘structural interference’. Here, two concurrent tasks (in this case, both the word-recall test and whatever attention is given to the music’s lyrics) would need internal-language based processing. Since both use the same type of processing, this causes an overload on our cognitive capacity and results in interference. According to Moreno (2009 p. 359), there is a unique and close relationship between music and language at both a sensory and cognitive level, sharing particular processing functions needed in both domains. A limitation to this study is that I could not evaluate each student’s English proficiency. Since 49.3% of the participants in this study speak more than one language (besides English), this could have played a part in each student’s ability to process and encode the word list and successfully complete the reading comprehension test.

4.2.4 Musical training of word-recall participants

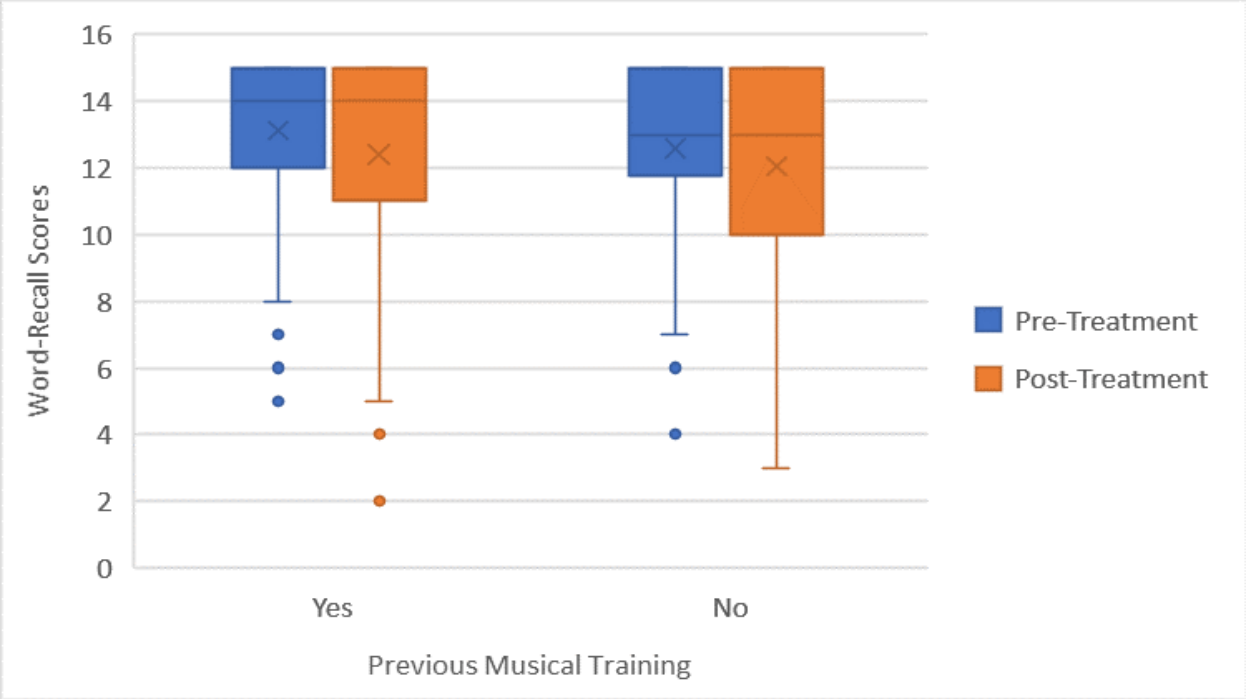

Figure 12 – Word-recall performance by participants with and without any musical training

There are 47 control and 52 experimental participants that had had previous musical training of some kind. Figure 12 shows that those who said 'yes' to previous music training produced a slight decrease in their post-treatment interquartile range compared to their pre-treatment word-recall scores. This may be due to the decrease in average word-recall scores from pre- to post-treatment by the experimental group (13.44 - 11.77). While the control group produced an increase in their average word-recall score from their pre-treatment, 12.77 to the post-treatment of 13.09 (Table 9, Appendix A). The assumption of homoscedasticity was violated, as established by means of Levene's test for equality of variances (p < 0. 05), whereupon a Welch's t-test was run to determine whether there were differences in post-pre difference recall scores for those with previous musical training. The post-pre difference recall score was higher for those in the control group (0.319 ± 2.168) than for those in the experimental group (-1.673 ± 3.376), a statistically significant difference of 1.992, t(87.868) = 3. 526, p < 0. 05. Cohen's d was estimated at 0,702, which is a moderate effect size based on Cohen's (1992 p. 158) guidelines. The 95% confidence interval for the difference in the post-pre difference recall scores was 0.869 to 3.115. This means that, on average, those with previous musical training who

don't use music-listening while studying for word-recall tests will be expected to perform between 5.79%- 20.77 % better than those who do use music-listening while studying for the same word-recall tests.

There were 43 control and 47 experimental participants that had had no previous musical training of any kind. Compared to the median word-recall score from pre- to post-treatment by participants with previous music training (14), these participants produced a lower median score of 13. Their post-treatment score had the lowest average score of 11.28 (Table 10, Appendix A) which may have contributed to producing a lower interquartile range due to less consistent results around the median score. Post-pre difference recall scores of participants with no previous musical training are normally distributed, as assessed by Shapiro-Wilk's test (p > 0. 05), and there was homogeneity of variance, as assessed by Levene's test for equality of variance (p > 0. 05). An independent t-test was therefore run to determine whether there are differences in the post-pre difference recall scores by those with no previous musical training. The post-pre difference recall score is higher for those in the control group (0.093 ± 2.486) than in the experimental group (-1.127 ± 2.848), a statistically significant difference of 1.220 $t(88)$ = 2. 157, p<0.05. Cohen's d was estimated at 0.457, which is a small effect by Cohen's (1992 p. 158) guidelines. This effect size is a way of quantifying the difference between two groups and these guidelines categorise a small effect size to be around 0.2, a moderate effect size to be around 0.5, and 0.8 being a large effect size. The 95% confidence interval for the difference in the post-pre difference recall scores by participants without previous music was from 0.096 to 2.345. This means that, on average, it is expected that those participants without previous musical training who don't use music-listening while studying for word-recall tests will perform between 0.64% - 15.63% better than those participants without previous musical training who do use music-listening while studying for the same word-recall tests.

These results show that, irrespective of the presence or absence of prior musical training, experimental group participants who were all placed under the music treatment condition of their self-selected background music performed worse during the word-recall tests than those in the control groups who completed the word-recall tests in silence. This question

was asked in response to studies that suggest that the brain of a skilled musician responds differently to the brain of non-musicians (Pantev et al., 2001 p. 5). However, this study results showed that, music-listening seemed to interfere with the encoding process of both participants with and without prior musical training. Evidently, it also had a negative effect on the experimental group's memory and ability to recall the word list. Jones (2006, p. 47) acknowledged that both musician and non-musicians were equipped with the same ability to recognize music and demonstrate refined skills in attentive listening. Therefore, the negative effects shared by both musicians and non-musicians in the study may be due to the following possible explanations: capacity interference may have occurred with both the self-selected background music and word-recall tests exceeding the available cognitive capacity. Alternatively, the level of arousal caused by the self-selected background music may have become too heightened, therefore impairing the encoding process and ultimately their performance. I did not determine how much musical training each participant had had, resulting in a broad range. Ho et al. (2003) and Jakobson et al. (2003) felt that this needed to be considered, as their studies found a correlation between the number of years of musical training and measured recall abilities.

4.2.5 Conclusion in relation to word-recall tests

Overall, this study has been able to show that participants who listen to self-selected background music experienced reduced performance during the word-recall tests than those participants that completed the word-recall tests in silence. Encoding is the process of shifting new information into the information processing system so that it can be stored in the long-term memory and retrieved for testing (Schunk, 2010 p. 187). A word-recall test is a measurement tool that assesses the participant's ability during the encoding and storage process. If information is not encoded or stored effectively, then a student's ability to recall the information is affected at a later stage. These results demonstrate that music-listening interferes with the encoding process as it results in a negative effect on the experimental group's memory and ability to recall the word list. There are two explanations as to why music might affect the encoding process. Firstly, in terms of Kahneman's (1973) limited capacity theory a 'capacity interference' may have occurred.

The two concurrent tasks, (in this case, listening to music and encoding the recall-word list) exceed the available cognitive capacity, which can work to the detriment of one or both tasks. While in a dual-task situation, as when attempting to fully process or pay attention to the background music, or even intentionally ignoring or tuning out the background music, such may reduce the processing capacity available for the primary cognitive task performance may be reduced. This may result in participants in the experimental group using selective attention. When they were presented with both the word-recall test and their self-selected background music, they may have only given enough attention to one stimulus, presumably music. The word-recall list would have had to have been processed within our working memory systems. That information can easily become lost when not enough attention is given to the information in our working memory. The second explanation might be the idea of 'over-arousal' characterised in the Yerkes–Dodson Law (1908). The self-selected background music was, by design, familiar to the participants, and therefore stimulating and arousing. Combining this with a complex word-recall task, it is possible that the level of arousal became too heightened, therefore would impairing the encoding process and ultimately their performance.

The results also find that participants that listened to their self-selected background music, regardless of their home language or previous musical training, showed a negative effect, performing worse during the word-recall tests than those participants that completed the word-recall tests in silence. Other than the two previous explanations given in the overall word-recall results, the negative effect in home language may be due to Kahneman's (1973) theory of 'structural interference'. This is when internal-language based processing will occur while completing two concurrent tasks (in this case, a word-recall test and the music's lyrics). Both these tasks use the same type of processing information, it may cause an overload on our cognitive capacity and results in an interference to our processing. Many researchers have shown that musicians differ from non-musicians by responding differently during many physical and cognitive tasks (Schlaug, et al., 1995; Jäncke, et al., 2000; Pantev et al., 2001; Shahin et al., 2003). However, this study finds that musicians and non-musicians alike both suffered negative effects during their word-recall test due to the presence of self-selected background

music. Jones (2006 p. 47) acknowledges that both musician and non-musicians are equipped with the same ability to recognize music and demonstrate refined skills in attentive listening. The biggest surprise in these results was found in relation to gender differences. Though female participants had similar negative effects, males showed no effect when listening to their self-selected background music. This may be due to sample size (54 males as compared 173 females). There seem to be limited findings to try to explain the differences between men and women as regard to their ability to recall information. Wells and Hakanen (1991 p. 454) found that adolescent girls associate emotions with music and use music for emotional regulation. These heightened emotions may result in increasing their arousal, so drawing too much of their attention, increasing the cognitive load, and resulting in competition for limited processing resources. Overall, we are able to conclude that listening to self-selected background music by participants in this study results in a negative effect on their encoding, memory and recall abilities during the completion of a recall word list test.

4.3 Results regarding the effect of music-listening on the comprehension tests

These results reflect the effect of listening to music on the comprehension tests completed by participants. All the comprehension tests used in this study and completed by participants are out of a total of 10. A difference in scores were calculated by subtracting pre- from post- in order to determine the size of the increase or decrease of the overall comprehension score of each participant. A difference in scores was recorded as ‘post-pre difference comprehension scores’. To establish music-listening’s effect on comprehension, an independent samples *t*-test was used to compare the average difference in scores across the control and experimental groups.

4.3.1 Overall performance for comprehension participants

The following descriptive statistics summarise the overall performance of the participants during the comprehension tests 1 and 2.

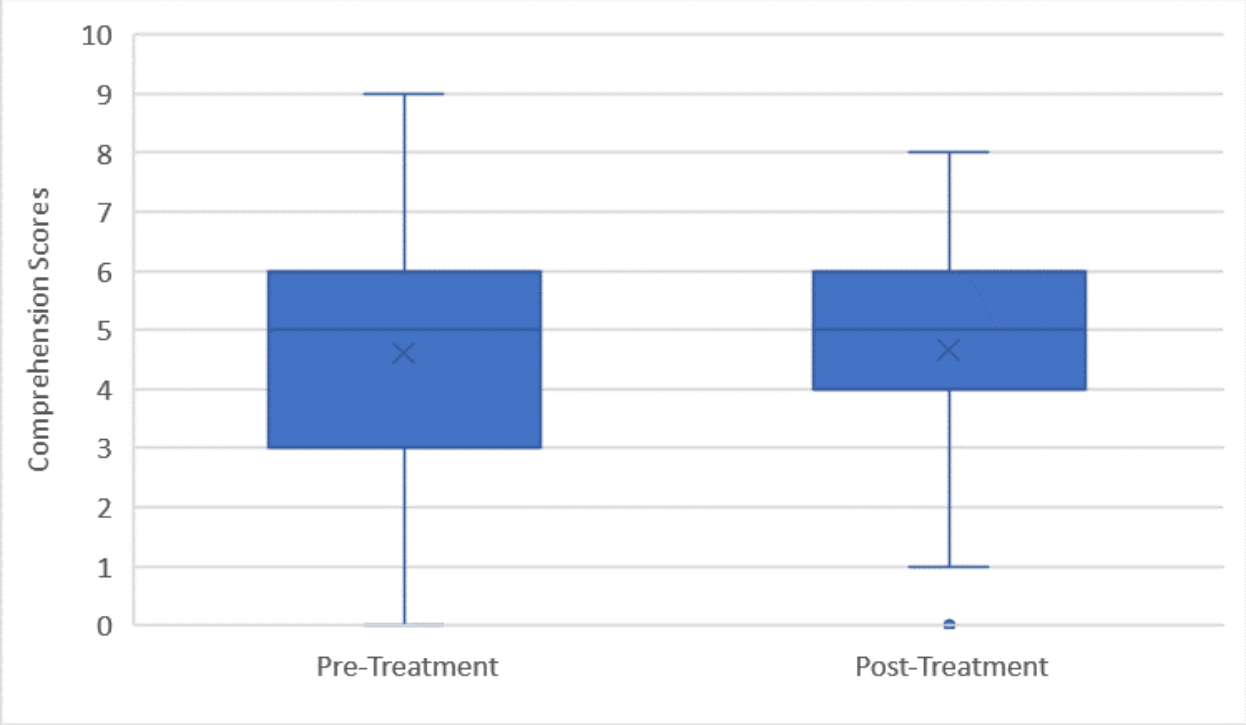

Figure 13 - Summary results for comprehension tests (all participants)

There are 90 control and 99 experimental participants. Figure 13 shows that the pre- to post-treatment comprehension scores by participants produced a similar average and medians, however, the pre-treatment scores produced a lower interquartile range as well lower and higher whiskers. This suggests less consistent scores surrounding the median (5) and a larger dispersion of result scores by participants. As previously mentioned, an independent samples *t*-test was planned to be used to determine an average difference in scores across the control and experimental groups. However, there is no statistically significant difference in the post-pre difference comprehension scores for both the control and experimental groups. Listening to music evidently did not have an effect on the participants in either the control or experimental groups of this study while completing their comprehension tests.

Studying will often involve the activity of reading and, in all educational settings, students read a large amount in order to acquire knowledge and information. The reading comprehension tests assess their ability to read and understand, which involves the encoding of information as it is presented, as well as gaining an understanding of the information in order to answer questions during recall based on what was read and learned. This study involves determining whether participants' self-selected background music affects the encoding and storing processes. The results show that there was no effect of self-selected background music on either the control or experimental groups during the completion of reading comprehension tests. These results can be explained by the idea of arousal. Arousal refers to the intensity of the felt emotion and, depending on whether that emotion is positive or negative, can influence performance in various cognitive processing and skills. Arousal is controlled by two factors, the demands imposed by the activities in which the person engaged and the miscellaneous determinants (such as background music) (Kahneman, 1973 p. 17). The greater these demands, the more of our attention it will be drawn. The Yerkes-Dodson Law (1908) stated that an arousal level could increase the performance of an individual up to an optimal level. An over-arousal could lead to a deterioration in performance, such as background music or a cognitive task attracting too much of our attention resulting in either the task or the music being ignored. With the Yerkes-Dodson Law in mind and results showing no cognitive effect of self-selected background music on a comprehension task, we could assume that there was not enough arousal or attention during the encoding or storage processes to produce a positive or negative effect. Is it possible that either of these demands, the comprehension task or the self-selected music, were not stimulating to the participants producing a possible 'under-arousal'? As previously suggested, two tasks can be performed simultaneously but the demand that each task makes on the available resources has an effect.

The first explanation as to why the self-selected background music had no effect on the reading comprehension test may be the music itself. The music may not have induced sufficiently strong arousal and emotional feelings to result in either a beneficial or detrimental effect on the reading comprehension test. However, why would their self-

selected background music produce enough arousal during the word-recall tests to create a negative effect on their performance and then not produce similar results during the comprehension task? It is possible that, because they had heard the music before, their self-selected music did not exert enough arousal. It may also be that the music caused over-arousal, with participants being so impaired by the music that no effect of music on performance was noted. Wallace (1994 p. 1483) mentioned that if the music that is combined is complex, it might be difficult to learn and retain enough about the melody to assist in recall, and is thus likely to become a distraction to one's attention. These results align with the Avila, Furnham, and McClelland study which found that all participants regarded music to be distracting and too familiar, creating an undesirable effect on their working situation (2011 p. 90). This may also explain why Oswald et al. (2000 p. 349) suggested that students become distracted by both meaningful and meaningless background music. They therefore suggest that the optimal working environment be in silence. Familiar and stimulating music may evoke strong emotions and arousal increasing an individual's level of performance relating to their level of arousal. However, the lack of effect may be due to the second factor. The reading comprehension test may have been insufficiently complex for the participants or was not drawing enough attention or interest from the participants. This was previously explored in the literature, as Eysenck and Keane (2000 p. 149) were curious whether the cognitive complexity or difficulty of a task was an important contributor to the music having an influence on one's performance. This research studied how background music was often used to maintain student's arousal and assist in improving performance during simple tasks by helping to maintain concentration. However, the participants could have become bored and uninterested during the completion of a simple task, especially if there was not enough arousal being presented by their self-selected background music. This could explain the results showing no effect. At all three schools, I had observed that after the experimental testing, while participants were returning to their classroom, they often discussed how many recall words they were able to recall, with little mention of the reading comprehension. This observation may support the idea that the reading comprehension test did not draw interest from the participants and could explain the lack of effect.

Due to the overall-comprehension tests not having any effect from music-listening and showing no statistically significant difference, no independent sample *t*-tests were run to determine any correlation to gender, home language or musical training by participants. However, the overall descriptive statistics will be provided below.

4.3.2 Gender of comprehension participants

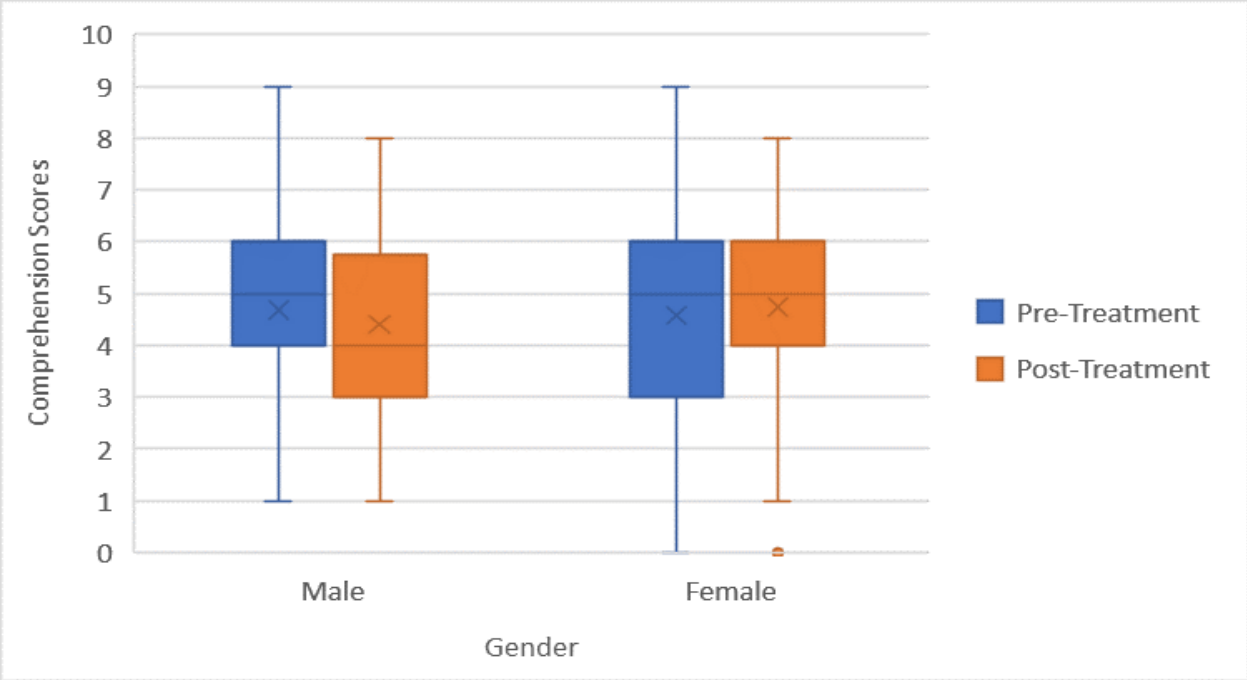

Figure 14 - Comprehension performance of male and female participants during the comprehension tests

There are 18 control and 26 experimental male participants compared to 72 control and 73 experimental female participants. Figure 14 shows the differences in pre-to post treatment comprehension scores by male and female participants. The interquartile range of the male participant's comprehension scores differed from pre-to post-treatment with a larger upper range increasing in the post-treatment scores. However with a slight decrease in average (4.68-4.32) it falls above the low median score in the post-treatment results by the male participants. In comparison, the female participant's comprehension scores had a larger lower interquartile range in the pre-treatment scores with a fairly consistent median (5) and slight increase average score (4.58-4.74) from pre- to post-treatment.

4.3.3 Home language of comprehension participants

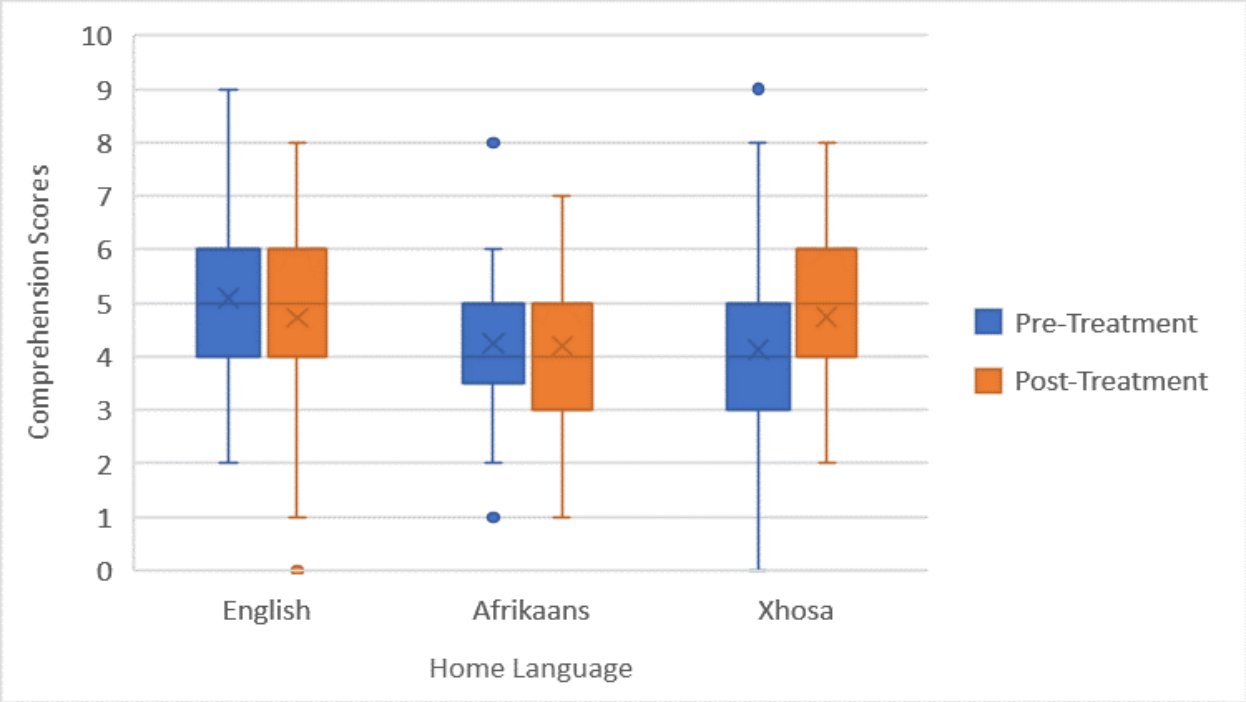

Figure 15 - Comprehension performance by English, Afrikaans and isiXhosa home language participants

There are 1 control and 2 experimental "Other" home language participants. With only 3 participants, it is impossible generate meaningful results as the sample size is too small. However, in terms of a larger home language group, English had 48 control and 46 experimental participants who indicated English as their home language. They produced fairly consistent scores, with only a drop in average (5.1 - 4.73) during their post-treatment results. The Afrikaans home language participant results had a very small variation or dispersion of results and were consistent in their average and median comprehension scores from pre- to post- treatment. This may be due to sample size with only 8 control and 17 experimental Afrikaans home language participants. The isiXhosa home language participants which included 33 control and 34 experimental participants produced the most varied results increasing in average (4.14 - 4.75), median (4 - 5) and large shift in its interquartile range from pre- to post-treatment comprehension scores. This may have been attributed to the experimental participants as in Table 17 (Appendix) we can see the isiXhosa participants average score increased from comprehension test 1 (3.85) to comprehension test 2 (4.62).

4.3.4 Musical training of comprehension participants

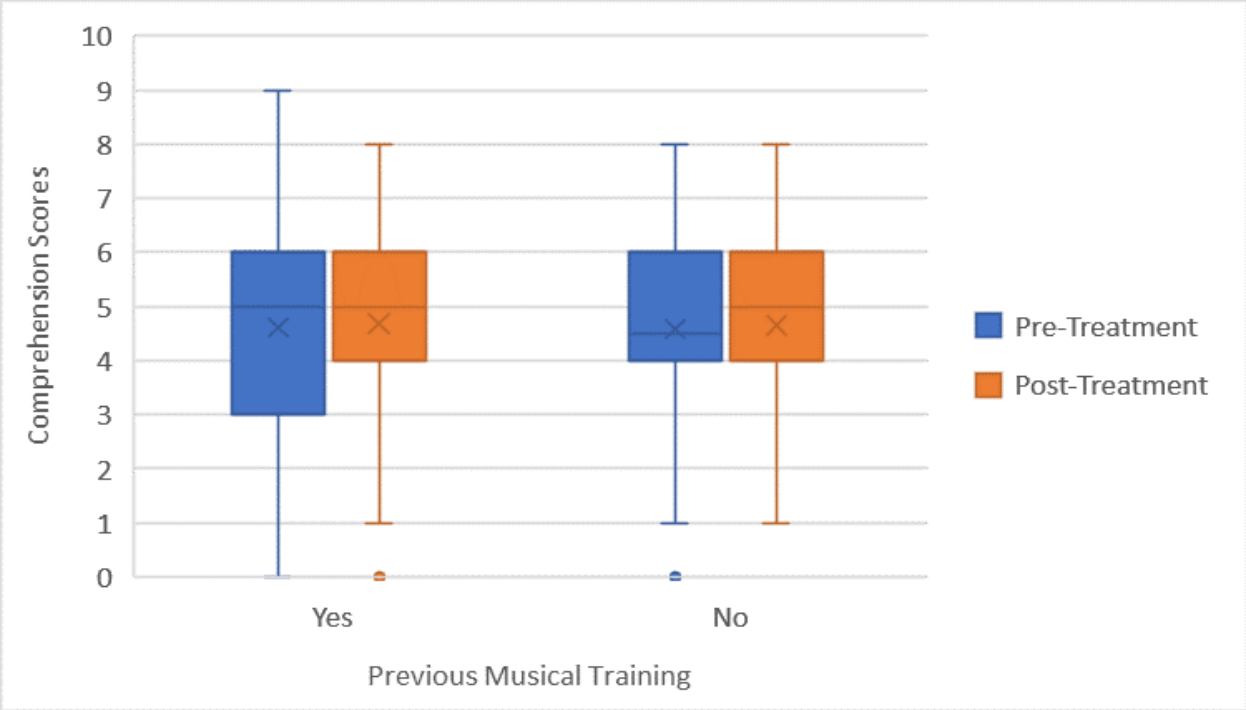

Figure 16 - Comprehension performance by participants with and without any musical training

There are 47 control and 52 experimental participants that had previous musical training compared to 43 control and 47 experimental participants that had no previous musical training of any kind. Participants that indicated 'yes' to previous musical training produced a slightly larger lower interquartile range in their pre-treatment comprehension scores as well as lower and higher whiskers suggesting a larger variation or dispersion of the results. They produced comprehension scores that were consistent from pre- to post-treatment in regards to median and average. Participants that indicated 'no' to previous musical training produced a similar average and interquartile range however there was only a slight increase in their median score (4.5-5).

4.3.5 Conclusion of comprehension

Overall, this study has been able to show that listening to self-selected background music has no effect on participants in the experimental groups during the completion of a reading comprehension test. The reading comprehension tests assessed their ability to read and understand, which involved encoding information from the comprehension tests so that

they could answer based on what was read and learnt. This study involved determining whether participants' self-selected background music affected the encoding and storing processes. The explanation of no effect looks at the idea of arousal which involves two factors: firstly, the demands made by the participants' self-selected background music; and secondly, the demands made by the reading comprehension test. The demands made by the music itself may involve the music not being strong enough to evoke arousal and emotional feelings whereby to exert beneficial or detrimental effect on the reading comprehension test. It is possible that, because they had heard this music before, it did not exert enough arousal in the participants. It may also be that the music may have caused an over-arousal, with participants being too impaired by the music for any effect of music on performance to be noted. The second factor of the demands of the reading comprehension test may have been a lack of effect due to the reading comprehension test being insufficiently complex for the participants. It is possible that the reading comprehension was too simple or did not draw enough attention or interest from the participants. Either one of these factors, or a combination of participants' disinterest in simple tasks and unaroused by their self-selected background music, may have caused these results.

Due to the overall-comprehension tests not having any effect from music-listening and showing no statistically significant difference, no independent sample *t*-tests were run to determine any correlation to gender, home language or musical training. However, we can assume that participants who listened to their self-selected background music in both the control and experimental groups, regardless of gender, home language or previous musical training, showed no-effect during the completion of the reading comprehension tests.

Chapter 5 – Conclusion

This chapter discusses the results obtained in order to answer the primary research question as well as the sub-questions in this study. The results are interpreted and possible reasons for the findings provided, ultimately to reach a conclusion as to what extent the primary research question of this study can be answered. This chapter will also look at the limitations of this study and make suggestions for future research.

5.1 Results with regard to research questions

In order to conclude this study, a brief discussion of the results thereof with regard to the research sub-questions stated in Chapter 1 is presented. The primary research question of this study, as stated in Chapter 1, was: *What is the cognitive effect that listening to self-selected background music has on a student's performance in memory and learning?*

The following sub-research questions will follow in order to answer the primary research question of this study.

5.1.1 Research sub-question 1:

From the limited population, how many students are listening to music while working or studying?

These descriptive results were gathered by the use of a questionnaire that all participants completed. These results only represent a limited population with similar characteristics of participants used in this study. These characteristics include male and female South African students within the city of Port Elizabeth, attending English-speaking schools in the Grades of 8 and 9. To answer this sub-question from a limited population of a 227 students from three schools in the Eastern Cape, Port Elizabeth, only 38 students (16.7%) do not study or work while listening to music. This is compared to a larger percentage of 83.3% translating to 189 students choosing to listen to music while working and studying.

This includes students between the ages of 13- 16 years with 129 Grade 8s and 98 Grade 9s.

5.1.2 Research sub-question 2

Is there a comparative difference in results across gender and home language?

To answer the sub-question regarding gender across all three schools of 227 participants, 173 (76.2%) of the participants were female compared to just 54 male participants (23.8%). Regardless of gender, this study has been able to suggest that listening to self-selected background music has no effect on participants during the completion of reading comprehension test. While in terms of the word-recall test, listening to music does not affect the male participants in this study. In comparison, the result for the females shows that those females who don't use music-listening while studying for word-recall tests could perform between 5.32% -16.80% better than those females that use music- listening while studying for word-recall tests. This may show that listening to music interferes with the encoding process, causing a negative effect on the female participants' memory and ability to recall the word list. These results may be due to the small sample size of males in this study, although even with a small sample size the results showed that 81.5% of the males said yes to listening to music while working and studying, slightly lower than the females with 83.8%. A possible explanation for these results may be that even though music is considered a central part of males' lives, females tend to use music more emotionally. The females placed under the music treatment condition of self-selected background music seemed to give more attention to their music during the word-recall test. Familiar music tends to capture participants' attention, making it harder to ignore and difficult to concentrate. This may even be harder to ignore if females attach emotional feelings towards music. These heightened emotions may result in increasing their arousal, drawing too much of their attention and increasing the cognitive load, as suggested in the theory by Kahneman (1973), resulting in them competing for limited processing resources.

To answer the sub-question regarding home language, across all three schools, the largest group of participants in terms of home language were 115 English home language speakers (50.7%), followed by 81 isiXhosa home language speakers (35.7%), 27 Afrikaans home language speakers (11.9%) and lastly only 4 other home language speakers (1.8%). In both the Afrikaans and "Other" home language groups, the sample sizes were too small to generate any effective results. In the home language groups of English and isiXhosa, the results show that the participants placed under the music treatment condition of their self-selected background music performed worse during the word-recall tests than those who completed the word-recall tests in silence. These results show that, regardless of the participant's home language, music-listening interferes with the encoding process which then has a negative effect on their memory and ability to recall the word list. This may be due to what Kahneman (1973) referred to in his limited capacity theory as 'structural interference'. This is when two concurrent tasks use the same type of processing information, for example (in this case) both using internal-language based processing. This may result in causing an overload on their cognitive capacity and result in an interference in their processing. Once again, this study has been able to show that listening to self-selected background music has no effect on participants during the completion of the reading comprehension test, regardless of home language.

5.1.3 Research sub-question 3

Is there a comparative difference in results between musically trained or skilled pupils vs. those with no musical training or skills?

To answer the sub-question regarding previous musical training, these results show that both participants with and without previous musical training that were placed under the music treatment condition of their self-selected background music, performed worse during the word-recall tests than those who completed the word-recall tests in silence. However, this study also shows that listening to self-selected background music had no effect on participants during the completion of a reading comprehension test. Therefore, regardless of the participant's musical skill and training, music-listening interferes with the encoding process which then have a negative effect on their memory and ability to recall

the word list. These negative effects shared by both musicians and non-musicians may be due to two possible explanations: a capacity interference may have exceeded the available cognitive capacity, or the level of arousal became too heightened, therefore impairing the encoding process and ultimately their performance.

5.1.4 Research sub-question 4

Does listening to self-selected background music affect the participant's cognitive performance in memory and learning?

To answer sub-question 4 in terms of the word-recall test, the results in this study show that those who listen to self-selected background music performed worse than those who complete the word-recall tests in silence. These results suggest that music-listening interferes with the encoding process which involves shifting new information into the information processing system so that it can be stored in the long-term memory and retrieved for later testing. The results showed that, due to this cognitive interference caused by listening to music, a negative cognitive effect occurred on that participant's memory and ability to recall the word list. There may be two possible explanations. The first aligns with the limited capacity theory of Kahneman (1973), especially the idea of 'capacity interference'. This involves the two concurrent tasks, in this case of listening to music and encoding the recall word list, exceeding the available cognitive capacity, and so working to the detriment of one or both tasks. This combination of background music with complex cognitive tasks may result in what Kahneman refers to as a 'dual-task situation'. By attempting to fully process or pay attention to the background music, or even intentionally ignoring or tuning out the background music, it may reduce the processing capacity available for the primary cognitive recall performance. With more demand on the attentional capacity from a dual-task situation, the more increase on one's arousal levels therefore affecting one's performance in some way. The second explanation might be the idea of over-arousal shown in the Yerkes-Dodson Law (1908). Using both the self-selected background music that was familiar to the participants, and therefore stimulating and arousing, and combining it with the complex task of the recall list, it is possible that the level of arousal became too heightened. This then impaired the encoding process and

ultimately their performance. Therefore listening to self-selected background music affects students' cognitive performance in memory and learning during the completion of a word-recall test.

To answer sub-question 4 in terms of the reading comprehension test, the results showed that there was no effect of self-selected background music on the completion of reading comprehension tests. These results could be explained with the idea of arousal. The level of arousal is often determined by the amount and intensity of attention. Arousal is controlled by two factors, one being the demands imposed by the participant's self-selected background music and the second being the demands by the activities in which the person is engaging (in this case the reading comprehension test) (Kahneman, 1973 p. 17). The self-selected background music may not have caused a strong enough arousal and emotional feelings to exert either beneficial or detrimental effect on the reading comprehension test. It is possible that, because they had heard this familiar music before, their selected music did not elicit enough arousal from the participants. It may also be that the music may have caused an over-arousal with participants being impaired by the music, so resulting in no effect of music on performance being noted. Wallace (1994 p. 1483) mentioned that the music needed to be repeated. If the music that was combined was complex, it may affect student's ability to learn and retain enough about the melody to assist in recall. Its then likely to become a distraction to one's attention. However, as this study did find a negative result in the recall due to music-listening, the reason for the reading comprehension showing no effect may be found in the second factor. The second factor is that the reading comprehension test itself may have also been insufficiently complex for the participants. It is possible that the reading comprehension was too simple or was not drawing enough attention or interest from the participants. Either factor, or a combination of both, could explain the results showing no effect. Therefore, listening to self-selected background music has no effect on the students' cognitive performance in memory and learning during the reading comprehension test.

5.1.5 Research sub-question 5

Does silence result in less disruption to a student's cognitive performance in memory and learning?

To answer sub-question 5 in terms of the word-recall test, on average it is expected that those who don't use music-listening while studying for word-recall tests will perform between 5.59% - 16.07% better than those who use music-listening while studying for word-recall tests. As previously mentioned, attention is the central process of encoding, as the more attention we give to something, the more likely that it will be remembered. Therefore, our results demonstrate that silence did not interfere with the encoding process and enough attention was given to the word list to ensure successful recall. The participants may have found the music to be distracting, or too familiar, and enjoyed the music too much, thereby creating an undesirable effect on their working situation. These results align with studies such as Avila, Furnham, and McClelland (2011 p. 90), who strongly advised that when working on a complex task, attempting to learn complex material, or when completing an exam, students should do so in silence to ensure maximal performance. Silence may be the best option, allowing a student's full attention to be on the activity of studying. It may be that students are accustomed to the natural sound of silence in a classroom, therefore music creates an unnatural environment and caused negative feelings, so affecting their encoding and storing process. Therefore, silence results in less disruption to a student's cognitive performance in memory and learning during the completion of a word-recall test.

To answer sub-question 5 in terms of the reading comprehension tests, the results show that there was no effect of silence on the completion of reading comprehension tests. If silence ensures maximal performance during complex tasks, it may be possible that with the reading comprehension, being considered simple and cognitively insufficient, this may have resulted in the lack of effect. The music may have been able to keep the participants focused and interested on the task avoiding neither a negative or positive effect in the results. This would align with Oldham's (1995 p. 561) study where he found personal

stereos helped during simple jobs by counteracting boredom and reducing tension. Therefore, silence results in no effect on a student's cognitive performance in memory and learning during the completion of a reading comprehension task.

5.1.6 Research sub-question 6

Should schools be using background music-listening as a tool to develop and improve student's cognitive performance in memory and learning?

Regardless of the results in this study, educators should be aware of the negative and positive effect of music on their students' academic performance. Parents should also acknowledge the use of music in their homes and take an active role in monitoring their children's engagement with music, especially during learning activities. With the results of this study in mind, it is hard to advise parents and educators confidently in the use or not of music-listening as a tool to develop and improve students' cognitive performance in memory and learning. Even though these results show that listening to self-selected background music had a negative effect on recall, there is no effect on the reading comprehension. As previously mentioned, educators need to cater to the broader vision of education and try to accommodate all kinds of students and their unique forms of intelligence. There might still be a handful of students who might benefit from the use of music in their learning process. It is possible, however, that it would involve an educator developing a teaching strategy based on the ideas that during complex tasks, such as recall, music may be a source of distraction resulting in lowering performance; while in simple tasks, like reading comprehension, music could assist the student's focus and concentration. The educator would not only need to be aware of the level of difficulty in various tasks but also the music and level of arousal. For example, an educator could attempt to pair non-arousing music with complex and valued tasks while familiar, stimulating and enjoyable music be combined with simple and routine jobs. This study cannot confidently state that this will be successful; however, it may close the gap between students' learning and attention, which seem to play a crucial role in the results of this study. Background music, being inexpensive, can be something that can be attempted by educators and schools to assess its effectiveness in helping students while

avoiding more of a distraction and content overload of their senses. I still agree with what was previously mentioned in Chapter 2: the first step for parents and educators is to help those students who prefer to study with music, to be informed of music's positive and negative effects, as suggested in this study, and to develop a repertoire of cognitive skills and strategies to reduce music's ability to distract them, thereby enhancing their students' concentration and attention.

5.2 General conclusions of results

From the above analysis of sub-questions, we can now answer the primary research of this study: *What is the cognitive effect that listening to self-selected background music has on a student's performance in memory and learning?* This study showed statistically significant downwards deviations in the scores of a limited population of 189 students, submitting evidence of no positive effect of listening to self-selected background music during the encoding and storage processes used in memory and learning.

5.3 Limitations to this study

A limitation in this study is that I could only approach and test at three Port Elizabeth high schools due to time and willingness to participate. My study gathered data from 227 participants, resulting in a slightly smaller sample size than intended. There was a small population of male participants due to willingness to participate, with a sample size of only 54 male participants compared to 173 female participants, which resulted in 3 females to every one male. It is expected that the greater the sample size, the more valid and reliable the results will be and, with this imbalance in the gender sample, it is difficult to obtain statistically significant results for the male group. This may have contributed to the conclusion drawn on the difference in male vs. female responses in this study.

A limitation to this study, with regards to home language, is that I could not evaluate each student's English proficiency, especially since 49.3% of the participants in this study spoke more than one language besides English. This could have played a part in each student's ability to process and encode the word list and successfully complete the reading comprehension. Unfortunately, for both the Afrikaans home language and "Other"

home language groups, the sample sizes were too small to generate any effective result, and therefore I only looked at the home languages of English and isiXhosa.

Another limitation to this study, regarding previous musical training, is that I did not determine the period of time that each student had had musical training. Ho, Cheung and Chan (2003) and Jakobson et al. (2003) felt that this needed to be considered, as their studies found a correlation between the number of years of musical training and abilities in memory and prose recall. The inclusion of this might have helped to determine the music-listening effect on more experienced music students (those who had received 3 or more years of instruction, for instance) compared to beginner musicians (those who had received only 1 – 2 years of instruction).

There are three further limitations to this study with regards to the experimental testing. Firstly, all participants in this study completed a word-recall test and reading comprehension test in silence, followed by a second word-recall test and reading comprehension. The second time, however, the participants were placed under a different music treatment condition. Even though the word lists and reading comprehension differed from test 1 to test 2, a limitation in this study is that we could not truly evaluate if the participants were able to adapt after having done the tests a first time. The overall results of the word-recall and reading comprehension showed no consistent increase or decrease in the average scores from test 1 to test 2. Secondly, this study provided participants with their recall word list and reading comprehension, followed by a period of studying and learning, and then finally the testing phase. This required the participants to use -and only allowed us to test- their short-term and working memory. In terms of long-term memory (which is often used in examination of students), a 24-hour period is considered a reasonable time for determining whether information has been successfully transferred into this long term storage (Gathercole & Alloway, 2008 pp. 14-16; Jensen, 2008 p. 163; Alloway, 2011 p. 102; Sousa, 2011 p. 55). A limitation to this study is that we did not do a follow-up test, therefore we could not successfully determine whether their long-term memory and learning was affected by the self-selected background music. Lastly, the focus of my study was on a preferred self-selected background music, as students provided 10 songs in the questionnaire. Recordings of these were given to them

on music-listening devices, rather than supplying experimenter-selected music. This resulted in varied music genres, tempos, styles and even languages. Therefore, we could not assess the cognitive effect that type or genre of music-listening might have had on students' memory and learning performance.

5.4 Suggestions for future studies in this field

As my study only included a limited population of three high schools in Port Elizabeth, a suggested study would be to broaden the field to all Port Elizabeth high schools and, if possible, all high schools across South Africa.

Use of online systems might improve the process of obtaining consent and assent forms from students and parents. Permission can be given by students through an online permission form, after which an email can be sent to parents for parental permission. This might reduce the return time, decrease the likelihood of losing printed forms and assist in getting parental permission as well as increase their overall willingness to participate. The questionnaire could also then be administrated through this online system, which could decrease costs of printing, reduce completion time and encourage participation. However, this can only be done if the schools are equipped with the necessary technological resources.

I found the use of self-selected music, instead of experimenter-selected music, to be extremely successful in my study. I found that it excited and encouraged students to participate and learn, guaranteed that the music was familiar, and provided a realistic idea of the music-listening situation of students today. However, to encourage schools to incorporate music into a classroom, we cannot always guarantee an individual listening or a learning environment accommodating each student's music preference. Therefore, I suggest the need for more research around the idea of suitable classroom music, and also into which situation music could be used to accommodate a teachers' teaching and students' activities.

As previously mentioned, this study was limited in that I could only test students' memory in terms of short-term and working memory. A possible suggestion for future studies

would be to test both short-term working memory as well as long-term memory. This would involve re-testing participants a day (or even a week) later in order to determine whether music-listening were to have an effect on their long-term memory.

As mentioned in the literature, context-dependent memory (CDM) is the notion that when we study in a particular condition, information will be remembered better if that particular condition is kept consistent during the test phase (Konantz, 2012 p. 3). A suggested research study would be to see the effect on memory, specifically with CDM in mind. This would require the researcher to ensure that the music-listening situation used in the encoding and learning phase be substantially similar to that employed in the testing phase.

Due to the focus of my study, I decided to test only participants who stated ‘yes’ to listening to music while working or studying, as they needed to identify 10 songs that were subsequently provided to them. This resulted in those who said ‘no’ to listening to music while working or studying not being included in the experimental phase of this study. A future study could look at whether those who do not study with music would perform better in word-recall and comprehension tests if they did include music in their learning conditions.

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Appendices

Appendix A: Result Tables

	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	12.78	12.99	12.95	11.54
Standard deviation	2.702	2.858	2.396	3.491
Minimum	5	6	4	2
Maximum	15	15	15	15

Table 1 - Summary results for word-recall tests (all participants)

	Male			
	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	11.17	11.61	11.85	10.69
Standard deviation	3.585	3.109	3.055	3.642
Minimum	5	6	4	4
Maximum	15	15	15	15

Table 2 - Overall recall performance of male participants during the word-recall tests

	Female			
	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	13.18	13.33	13.34	11.84
Standard deviation	2.291	2.706	1.995	3.412
Minimum	7	6	8	2
Maximum	15	15	15	15

Table 3 - Overall recall performance of female participants during the word-recall tests

Music-listening						
Gender	**Frequency**		**Total**	**Percentage**		**Total**
	Yes	**No**		**Yes**	**No**	
Male	44	10	54	81.5%	18.5%	100%
Female	145	28	173	83.8%	16.2%	100%
Total	**189**	**38**	**227**			

Table 4 - Frequency and distribution of music-listening while studying by gender

	Afrikaans Home Language			
	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	11.63	11.25	11.76	10.18
Standard deviation	3.249	3.454	2.658	3.644
Minimum	7	6	8	4
Maximum	15	15	15	15

Table 5 – Word-recall performance by Afrikaans home language participants

	Other Home Language			
	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	15	15	15	13.5
Standard deviation	0	0	0	2.121
Minimum	15	15	15	12
Maximum	15	15	15	15

Table 6 – Word-recall performance by "Other" language participants

	English Home language			
	Control		Experimental	
	Word-Recall Test 1	**Word-Recall Test 2**	**Word-Recall Test 1**	**Word-Recall Test 2**
Average	12.46	13	12.98	11.72
Standard deviation	2.968	2.798	2.508	3.594
Minimum	5	6	4	2
Maximum	15	15	15	15

Table 7 – Word-recall performance by English home language participants

	isiXhosa Home language			
	Control		Experimental	
	Word-Recall Test 1	Word-Recall Test 2	Word-Recall Test 1	Word-Recall Test 2
Average	13.45	13.33	13.38	11.85
Standard deviation	1.986	2.758	1.97	3.267
Minimum	7	6	8	4
Maximum	15	15	15	15

Table 8 – Word-recall performance by isiXhosa home language participants

	Previous musical training			
	Control		Experimental	
	Word-Recall Test 1	Word-Recall Test 2	Word-Recall Test 1	Word-Recall Test 2
Average	12.77	13.09	13.44	11.77
Standard deviation	2.950	2.765	1.776	3.664
Minimum	5	6	8	2
Maximum	15	15	15	15

Table 9 – Word-recall performance by participants with any musical training

	No previous musical training			
	Control		Experimental	
	Word-Recall Test 1	Word-Recall Test 2	Word-Recall Test 1	Word-Recall Test 2
Average	12.79	12.88	12.40	11.28
Standard deviation	2.435	2.986	2.856	3.334
Minimum	6	6	4	3
Maximum	15	15	15	15

Table 10 – Word-recall performance by participants with no musical training

	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.73	4.71	4.48	4.63
Standard deviation	1.853	1.368	1.752	1.607
Minimum	0	1	0	0
Maximum	9	8	9	8

Table 11 - Summary results for comprehension tests (all participants)

	Male			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.67	3.78	4.69	4.85
Standard deviation	1.910	1.309	1.871	1.592
Minimum	2	1	1	3
Maximum	9	6	9	8

Table 12 - Overall comprehensionl performance of male participants during comprehension tests

	Female			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.75	4.94	4.41	4.55
Standard deviation	1.852	1.288	1.715	1.616
Minimum	0	2	0	0
Maximum	9	8	8	7

Table 13 - Overall comprehensionl performance of female participants during comprehension tests

	Afrikaans Home Language			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.25	4.25	4.24	4.18
Standard deviation	1.035	1.165	1.786	1.776
Minimum	3	2	1	1
Maximum	6	6	8	7

Table 14 – Comprehension performance by Afrikaans home language participants

	Other Home Language			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	0	6	4	4.5
Standard deviation	0	0	1.414	3.536
Minimum	0	6	3	2
Maximum	0	6	5	7

Table 15 - Comprehension performance by "Other" home language participants

	English Home Language			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	5.13	4.65	5.07	4.8
Standard deviation	1.734	1.229	1.652	1.586
Minimum	2	1	2	0
Maximum	9	7	9	8

Table 16 - Comprehension performance by English home language participants

	isiXhosa Home Language			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.42	4.88	3.85	4.62
Standard deviation	1.953	1.596	1.69	1.477
Minimum	1	2	0	2
Maximum	9	8	7	7

Table 17 - Comprehension performance by isiXhosa home language participants

	Previous Musical Training			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.60	4.64	4.63	4.71
Standard deviation	1.996	1.374	1.772	1.673
Minimum	0	1	2	0
Maximum	9	8	9	8

Table 18 - Comprehension performance by participants with any musical training

	No Previous Musical Training			
	Control		Experimental	
	Comprehension Test 1	Comprehension Test 2	Comprehension Test 1	Comprehension Test 2
Average	4.88	4.79	4.32	4.53
Standard deviation	1.693	1.372	1.773	1.544
Minimum	1	2	0	1
Maximum	8	8	8	7

Table 19 - Comprehension performance by participants with *no musical training*

Appendix B: Letter of Invitation to School Principals

NELSON MANDELA
UNIVERSITY

Music-listening and its Cognitive Effect on Learning

Letter of Invitation to School Principals

My name is Angela Freer, and I am a Master student at the Nelson Mandela University. I am conducting research on music under the supervision of Mark Brand lecturer at Nelson Mandela University. The Provincial Department of Education has given approval to approach schools for my research. A copy of their approval is contained with this letter. I invite you to consider taking part in this research. This study will meet the requirements of the Research Ethics Committee (Human) of the Nelson Mandela University.

Aims of the Research

The research aims to:

- Determine the amount of students listening to music while working or studying
- Determine a comparative difference in listening to music across age and gender.
- Determine the effects on students' cognition when listening to music while working or studying
- Determine the comparative difference in the effect on students' cognition between musically trained or skilled pupils vs. those with no musical training or skills
- Determine if schools should be using background music-listening as a tool to develop and improve students' cognitive performance in memory and learning

Significance of the Research Project

The research is significant in three ways:

1. It will provide insight to students and their participation in the activity of listening to music while working and studying
2. It will provide information on how the activity of listening to music can affect students' cognition when learning and studying.
3. It will provide schools with a greater understanding about the influence of listening to music in order to either monitor or implement strategies or techniques to enhance students' learning and studying habits.

Benefits of the Research to Schools

- Dissemination of results to schools, Eastern Cape Department of Education and the broader public
- These results can inform the curriculum development of the school's education process

Research Plan and Method

A questionnaire will be given to as many Grade 8 and 9 pupils at each school on a selected day. The questionnaire will provide demographic information such as their name, grade and school which will be used to link participants to their test scores and age and gender which will be used for comparative purposes. The questionnaire will provide information regarding how many students listen to music while working or studying in order to select participants that can provide 10 songs to be used for testing. It will also ask students to indicate which pupils have any musical training for comparative purposes of their test results. These questionnaires will be assessed and 40 Grade 8 and 40 Grade 9 pupils will be selected from each school to participate in the experiment. The experiment will be conducted on a separate day during school hours (8:00 - 14:15) in a provided venue, with each student seated on a chair in front of his or her table. The participants will be given a word-recall test; with a list of 15 words on a laminated sheet to memorize. Participants will be given 10 minutes to memorize these words and 10 minutes to recall these 15 words on an answer sheet. The second test will be a reading comprehension test; with each participant being given an article on a laminated sheet to read. Participants will be given 10 minutes to read the article and 10 minutes to answers 10 true/false questions pertaining to the comprehension. These tests will completed under the music treatment condition of no

music/ silence. Participants will then be randomly assigned into two groups where they will be asked to complete a second memory word-recall test and reading comprehension with the same procedure as previously. One group of participants will remain under the music treatment condition of no music/silence while the other will be provided with individual listening devices and headphones to listen to their 'self-selected music', the 10 songs that they provided in the questionnaire.

Permission will be sought from the students and their parents prior to their participation in the research. Only those who consent and whose parents consent will participate. I, Angela Freer will administer the questionnaire and data collection. Questionnaire will take approximately 15 minutes and the data collection will take approximately 60 minutes. All information collected will be treated in strictest confidence and neither the school nor individual students will be identifiable in any reports that are written. Participants may withdraw from the study at any time without penalty. The role of the school is voluntary and the School Principal may decide to withdraw the school's participation at any time without penalty. If a student requires support as a result of their participation in the survey steps can be taken to accommodate this.

School Involvement

Once I have received your consent to approach students to participate in the study, I will

- arrange for informed consent to be obtained from participants' parents
- arrange a time with your school for data collection to take place
- obtain informed consent from participants

Further information

Attached for your information are copies of the Provincial Department of Education approval, Parent Information and Consent Form and also the Participant Information Statement and Consent Form.

Invitation to Participate

If you would like your school to participate in this research, please complete and return the attached form.

Thank you for taking the time to read this information.

Angela Freer

Researcher

Nelson Mandela University

0767912658

angiefreer@gmail.com

Mark Brand

Supervisor

Nelson Mandela University

mark.brand@mandela.ac.za

NELSON MANDELA
UNIVERSITY

Music-listening and its Cognitive Effect on Learning

School Principal Consent Form

I give consent for you to approach students in Grade 8 and 9 to participate in the study; Music-listening and its Cognitive Effect on Learning

I have read the Project Information Statement explaining the purpose of the research project and understand that:

- The role of the school is voluntary
- I may decide to withdraw the school's participation at any time without penalty
- Students in Grade 8 and 9 will be invited to participate and that permission will be sought from them and also from their parents.
- Only students who consent and whose parents consent will participate in the project
- All information obtained will be treated in strictest confidence.
- The students' names will not be used and individual students will not be identifiable in any written reports about the study.
- The school will not be identifiable in any written reports about the study.
- Participants may withdraw from the study at any time without penalty.
- A report of the findings will be made available to the school.
- I may seek further information on the project from Angela Freer on 0767912658 or angiefreer@gmail.com.

_____ _____

Principal Signature

_____

Date

Appendix C: Evaluation Letter by English Teachers

NELSON MANDELA
UNIVERSITY

To Whom It May Concern

I ……., English teacher at…….. ……High School have reviewed the measurement instruments provided by researcher Angela Freer at Nelson Mandela University in regard to her study titled 'Music-listening and its Cognitive Effect on Learning'.

I have reviewed all 30 words that will be used in her memory word-recall tests and the two reading comprehensions titled 'The Ancient Islands of Orkney' and 'Exploring the Arctic' as well as the 20 questions pertaining to these comprehensions.

I regard the measurement instrument of the word-recall list as suitable for the participants in Grade 8 and 9 as the 30 words that will be provided to students can be considered to be within their vocabulary. I regard the measurement instruments of the reading comprehensions as suitable for the participants in Grade 8 and 9 as the reading comprehensions and the questions that will be provided to students can be considered to be within their abilities to read, process and understand their meaning.

From my evaluation of the two word-recall tests and two reading comprehensions I consider these measurement instruments to be reliable. This reliability ensures that they are consistent across standards of language and vocabulary and when given to other students under a similar condition, they would result in consistent responses.

From my evaluation of these measurement instruments, the necessary changes have been made in order for these measurement instruments to be approved for the testing of participants in this study.

_____ _____

Name of Educator Signature

_____

Date

Appendix D: Parental Consent Form and Participant's Assent Form

NELSON MANDELA
UNIVERSITY

Parental Permission for the Participation of Your Child in a Research Study

Music-listening and its Cognitive Effect on Learning

Description of the research and your child's participation

Your child is invited to participate in a research study conducted by Angela Freer from Nelson Mandela University. The purpose of this research is to investigate the activity of listening to music by students, and its cognitive effects on their learning and studying.

Your child's participation will involve completing a short questionnaire with the possibility of being selected for the experimental testing, as only 40 Grade 8 students and 40 Grade 9 students will be selected. The experimental test involves participants being placed under different music-listening conditions. They will be provided with individual listening devices and headphones, and will be asked to complete two memory word-recall tests and two reading comprehensions tests.

The questionnaire will take approximately 15 minutes to complete and, for those selected, the experimental testing will take approximately 60 minutes. This will all be completed over a span of 1-2 weeks.

Risks and discomforts

There are no known risks associated with this research. The students will be in the familiar setting of their school. The listening devices will cause no physical harm and music will be played at a consistent and moderate level. The memory word-recall tests and reading comprehension tests have been evaluated and approved by the head of English at your relevant school and the music will be selected by the participants themselves. All tests that the participants will be required to complete in this study will be done individually in order for students not to feel pressured to perform or embarrassed owing to feelings of under-performing. This has all been done to minimize any risks or discomfort to the participants.

Potential benefits

This research may help in the understanding of how listening to music while students are studying or working can affect their learning and performance. This may be crucial in aiding the school to incorporate music-listening techniques into the education process and could give insight into how music-listening can be used as a study method by students.

Protection of confidentiality

I will do everything I can to protect your child's privacy. This study will ensure confidentiality in that the data collected during the study will not be available to any other persons. The school's and participants' names will not be identified in any written reports about the study. The students' names will not be used as they will be replaced with participants' codes to ensure anonymity.

Voluntary participation

Participation in this research study is voluntary. You may refuse to allow your child to participate or withdraw your child from the study at any time. Your child will not be penalized in any way should you decide not to allow your child to participate or to withdraw your child from this study.

Role of the research

My role as the researcher in this study is to strive to maintain objectivity, in that I will not influence your child's thoughts, feelings or ideas. Your child will act independently throughout this study. My main role is to provide students with the necessary information and instruments in order to participate in this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact Angela Freer at Nelson Mandela University at 0767912658 or angiefreer@gmail.com.

Consent

I have read this parental permission form and have been given the opportunity to ask questions. I give my permission for my child to participate in this study.

_____ _____

Parent/ Legal guardian's Name Parent/ Legal guardian's Signature

_____ _____

Child's Name Date

NELSON MANDELA UNIVERSITY

Music-listening and its Cognitive Effect on Learning

Participant's Assent Form

Explanation of the Study (What will happen to me in this study?)

This study will look at how listening to music while students are studying or working can affect their learning and performance. You are expected to complete a short questionnaire with the possibility of being selected for the experimental testing, as only 40 Grade 8 students and 40 Grade 9 students will be selected. The experimental test involves your being provided with listening devices and headphones and asked to complete two memory word-recall tests and two reading comprehension tests. The questionnaire will take approximately 15 minutes to complete and, if you are selected, the experimental testing will take approximately 60 minutes. This will all be completed over the span of 1-2 weeks.

Risks or Discomforts of Participating in the Study (Can anything bad happen to me?)

This study will cause you no harm or pain. You will be in a familiar setting as this test will take place at your school. The listening devices will cause no physical harm and music will be played at a consistent and moderate level. The memory word-recall tests and reading comprehension tests have been checked by the head of English at your school and the music will be selected by you. All the tests that you will complete will be done individually, so no-one will see your answers.

Benefits of Participating in the Study (Can anything good happen to me?)

This research may help you to understand how listening to music while you are studying or working can affect your learning and performance. This may be important in helping the school to use music-listening techniques and to give you an understanding of how to use music-listening to create better study methods.

Confidentiality (Will anyone know I am in the study?)

I will do everything I can to protect your privacy. Your answers will not be available for anyone to see. The school's name and your name will not be used in any written reports about the study. Your name will not be used as it will be replaced with a participant's code to ensure your results are anonymous and kept secret.

Contact Information (Who can I talk to about the study?)

If you have any questions about this study or if any problems arise, please contact Angela Freer at Nelson Mandela University at 0767912658 or angiefreer@gmail.com

Voluntary Participation (What if I do not want to do this?)

Participation in this research study is voluntary, which means you may stop being in this study at any time. You will not be in trouble in any way should you decide not to participate or to withdraw from this study. You may choose to not answer any question and may withhold information at any stage in this study. Again you will not be penalized.

Role of the researcher (What can I expect from the researcher?)

The researcher should not influence any of your answers, actions or thoughts. The researcher will only provide you with information and instruments such as the tests and music-listening devices in order for you to participate in this study.

Do you understand this study, and are you willing to participate?

Tick either YES or No in the space provided;

YES	**NO**

_____ _____

Signature of Child Date

Appendix E: Oral Information Given to Participants

Oral information given to participants

Questionnaire

Hello Grade 8/9's.

My name is Angela Freer and I am a music master's student at Nelson Mandela University.

You were invited to voluntarily participate in a research project titled; 'Music-listening and its cognitive effects on learning'. Before this time I have presented you with information forms that your parents or legal guardians signed providing consent for you to participate in this study. You also were given a participant assent form that you have signed indicating that you would also like to participate in this study. Is there anyone that has not received these forms or have not signed them indicating their voluntary participation?

To recap; the purpose of this research is to investigate the activity of listening to music and its cognitive effects on learning and studying by students. The first phase of this study which is what you will do now is I will ask you to complete a short questionnaire that will take no longer than 15 minutes.

Participation in this research study is voluntary which means you may stop being in this study at any time. You will not be in trouble in any way should you decided not to participate or to withdraw from this study.

Your answers will not be available for anyone to see. The school's name and your name will not be used in any written reports about the study. Your name will not be used as it will be replaced with a participant's codes to ensure your results are anonymous and kept secret.

This study will cause you no harm or pain and there is no risks and discomforts that could harm you. Although please inform the researcher, myself or your parents if you are sick or in pain as a result of being in this study.

Is there any questions so far?

Please remember if you have any problems you may contact me on the details provided on those information forms.

I will now hand out the questionnaire please do not write anything until I have indicated. You will need to a blue or black pen to complete this questionnaire. Does anyone need a pen?

Hand out questionnaire

The questionnaire that I have provided you has two pages with 9 questions. The first three questions require that you write your details such as your name, age and school. Then there are five questions that require you to tick in the appropriate block which you will see is provided to you. The last question requires you to list ten songs which will only be completed if you tick yes

to the question; "Do you listen to music when you are working or studying?" If you tick no then you will leave the last question empty.

Are there any questions regarding how to complete this questionnaire?

Thank you, you may start to complete your questionnaire.

15 minutes later

Has everyone completed their questionnaire?

Collect the questionnaire from participants

Thank you very much for your participation in my study. Have a wonderful day.

Experiment

Hi again. You might remember me from the last time I came to see you when you completed a questionnaire for me.

My name is Angela Freer and I am a music master's student at Nelson Mandela University.

You were previously invited to voluntarily participate in a research project titled; 'Music-listening and its cognitive effects on learning'. You were presented with an information form that your parents or legal guardians signed providing consent for you to participate in this study. You were also were given a participant assent form that you have signed indicating that you would also like to participate in this study. Is there anyone that had not received those forms or have not signed them indicating their voluntary participation?

I would like to read the information that was provided to you in your participant consent form that you have previously signed. I will ask you again if you understand the study and be willing to continue to participate in this study.

It reads as follows:

Explanation of the Study (What will happen to me in this study?)

This study will look at how listening to music while students are studying or working can affect their learning and performance. You are expected to complete a short questionnaire and with the possibility of being selected for the experimental testing as only 40 Grade 8 students and 40 Grade 9 students will be selected. The experimental test involves you being provided with listening devices and headphones and asked to complete two memory word-recall tests and two reading comprehensions tests. The questionnaire will take approximately 15 minutes to complete and if selected the experimental testing will take approximately 60 minutes. This will all be completed over the span of 1-2 weeks.

Risks or Discomforts of Participating in the Study (Can anything bad happen to me?)

This study will cause you no harm or pain. You will be in a familiar setting as this test will take place at your school. The listening devices will cause no physical harm and music will be played at a consistent and moderate level. The memory word-recall tests and reading comprehension tests have been checked by your heads of English at your school and the music will be selected by you. All the tests that you will complete will be done individually, so no one will see your answers. This has been done to make sure there is no risks and discomforts that could harm you. Although please inform the researcher or your parents if you are sick or in pain as a result of being in this study.

Benefits of Participating in the Study (Can anything good happen to me?)

This research may help you to understand how listening to music while you are studying or working can affect your learning and performance. This may be important in helping the school

use music-listening techniques and give you an understanding of how to use music-listening to create better studying methods.

Confidentiality (Will anyone know I am in the study?)

I will do everything I can to protect your privacy. Your answers will not be available for anyone to see. The school's name and your name will not be used in any written reports about the study. Your name will not be used as it will be replaced with a participant's codes to ensure your results are anonymous and kept secret.

Contact Information (Who can I talk to about the study?)

If you have any questions about this study or if any problems arise, please contact Angela Freer at Nelson Mandela University at 0767912658 or angiefreer@gmail.com

Voluntary Participation (What if I do not want to do this?)

Participation in this research study is voluntary which means you may stop being in this study at any time. You will not be in trouble in any way should you decided not to participate or to withdraw from this study.

Do you understand this study and are still willing to participate?

Pre-Treatment Test

Test One

I am going to give you a laminated sheet with 15 English words on it faced down on your desk in front of you. Please do not turn it over until indicated. You will be given 10 minutes to memorize all 15 words and after 10 minutes you will hand back the laminated sheet. I will then provide you with an answer sheet faced down on your desk in front of you. Once again please do not turn over until indicated. I am going to ask you to write your name and school on this answer sheet and then ask you to recall as many words as you remember. It does not matter if the words are in the wrong order from the laminated sheet. You will need a blue or black pen to write your answers on the answer sheet provided. You will be given another 10 minute to complete this.

Does anyone need a pen?

Are there any questions?

Hand out laminated sheet faced down.

You may turn over your laminated sheet and your 10 minutes starts now

After 10 minutes collect laminated sheet

Hand out answer sheet

You may turn over your answer sheet and write your name and school. Your 10 minutes starts now

Collect answer sheet

Test Two

I am now going to give you a laminated sheet with a reading comprehension faced down on your desk in front of you. Please do not turn it over until indicated. You will be given 10 minutes to read the article titled 'The Ancient Islands of Orkney' and after 10 minutes you will hand back the laminated sheet. I will then provide you with an answer sheet faced down on your desk in front of you. Once again please do not turn over until indicated. I am going to ask you to write your name and school on this answer sheet and then ask you to answer 10 questions related to the reading comprehension you have just read. You will need to decide if the sentences provided on the answer sheet are true or false. If you think it is true you will write the letter T in the dotted space provided next to the sentence you are answering. If you think it is false you will write the letter F in the dotted space provided next to the sentence you are answering. Again you will need a blue or black pen to write your answers on the answers sheet provided. You will be given 10 minute to complete this.

Are there any questions?

Hand out laminated sheet faced down.

You may turn over your laminated sheet and your 10 minutes starts now

After 10 minutes collect laminated sheet

Hand out answer sheet

You may turn over your answer sheet and write your name and school. Your 10 minutes starts now

Collect answer sheet.

Is there questions regarding the two tests you have just completed?

Is anyone is any pain or discomfort?

Are you willing to continue your participation in this study?

Post- Treatment Test

Control and Experimental Group:

- **Verbally state the blocked information only for the experimental group participants**

Test One

I am going to give you another laminated sheet with 15 new English words on it faced down on your desk in front of you. Please do not turn it over until indicated.

I will now provide you with a music-listening device and headphones. On each listening device is the 10 songs you provided in your questionnaire. While listening to the music …

You will be given 10 minutes to memorize all 15 words and after 10 minutes you will hand back the laminated sheet.

You will then take off the headphones and put the listening device down

I will then provide you with an answer sheet faced down on your desk in front of you. Once again please do not turn over until indicated. I am going to ask you to write your name and school on this answer sheet and then ask you to recall as many words as you remember. It does not matter if the words are in the wrong order from the laminated sheet. You will need a blue or black pen to write your answers on the answer sheet provided. You will be given another 10 minute to complete this.

Does anyone need a pen?

Are there any questions?

Hand out listening devices and headphones

Does everyone have their listening devices and headphones? Please put them on and play the first song to make sure it is working.

Hand out laminated sheet faced down.

You may turn over your laminated sheet | and start the music-listening devices. |

Your 10 minutes starts now

After 10 minutes collect laminated sheet

You may now take your headphones off and put the listening devices down.

Hand out answer sheet

You may turn over your answer sheet and write your name and school. Your 10 minutes starts now

Collect answer sheet

Test Two

I am now going to give you another laminated sheet with a new reading comprehension faced down on your desk in front of you. Please do not turn it over until indicated.

I will now provide you with a music-listening device and headphone. On each listening device is the 10 songs you provided in your questionnaire. While listening to the music…

You will be given 10 minutes to read the article titled 'Exploring the Arctic' and after 10 minutes you will hand back the laminated sheet.

You will then take off the headphones and put the listening devices down

I will then provide you with an answer sheet faced down on your desk in front of you. Once again please do not turn over until indicated. I am going to ask you to write your name and school on this answer sheet and then ask you to answer 10 questions related to the reading comprehension you have just read. You will need to decide if the sentences provided on the answer sheet is true or false. If you think it is true you will write the letter T in the dotted space provided next to the sentence you are answering. If you think it is false you will write the letter F in the dotted space provided next to the sentence you are answering. Again you will need a blue or black pen to write your answers on the answers sheet provided. You will be given 10 minute to complete this.

Are there any questions?

Hand out listening devices and headphones

Does everyone have their listening devices and headphones? Please put them on and play the first song to make sure it is working

Hand out laminated sheet faced down.

You may turn over your laminated sheet and start the music-listening devices.

Your 10 minutes starts now

After 10 minutes collect laminated sheet

You may now take your headphones off and put the listening devices down.

Hand out answer sheet

You may turn over your answer sheet and write your name and school. Your 10 minutes starts now

Collect answer sheet.

Is there questions regarding the two tests you have just completed?

Is anyone is any pain or discomfort?

Thank you so much for your participation in my study.

Please remember if you have any problems you may contact me on the details provided on the information forms.

Appendix F: Questionnaire

Name: ……

Age: ……

School: ……....

Tick in the applicable box provided:

Grade:

8	9

Gender:

Female	Male

Home language:

English	Afrikaans	isiXhosa	Other

Do you have any musical training? (For example do you take music as a subject or have lessons on an instrument of any kind)

YES	NO

Do you listen to music when you are working or studying?

YES	NO

If you said yes, please provide any 10 songs you listen to when you are working or studying on a daily basis. Indicate below both the title of the song as well as the artist or group;

1. ……
2. ……
3. ……
4. ……
5. ……
6. ……
7. ……
8. ……
9. ……
10. ……

Appendix G: Word-Recall List

Test 1

ABRUPT	ZIGZAG	VESSEL
CRUTCH	UNIQUE	SHADOW
MENTOR	PICNIC	LEGACY
QUENCH	GUILTY	HORROR
PYJAMA	BREATH	BUBBLE

Test 2

TIPTOE	PLAGUE	CANVAS
SOCIAL	ESTEEM	RANSOM
PORTAL	BRIDGE	BUDGET
MUSCLE	AGENCY	CLUMSY
KNIGHT	CAREER	EMBARK

Appendix H: Word-Recall List Answer Sheet

Answer Sheet

Name: ……

School: ……....

1. ……..
2. ……..
3. ……..
4. ……..
5. ……..
6. ……..
7. ……..
8. ……..
9. ……..
10. ……..
11. ……..
12. ……..
13. ……..
14. ……..
15. ……..

Appendix I: Comprehension Test 1

Test 1

The Ancient Islands of Orkney

Off the north coast of Scotland, there are seventy islands which form the Orkney Islands. Some are no more than tiny rocks with just sheep and sea birds on them; only sixteen have a human population. Apart from Rousay and Hoy, the islands are low-lying and good for farming. Although tourism is now the main industry, farming is still as important to island life as it was thousands of years ago. People have farmed here for more than 4,500 years and you can still see parts of a village from that time on the biggest island, which is called the Mainland. The strange stone box beds that are left show us that the inhabitants used to sleep sitting up rather than lying down.

THINGS TO DO

The Orkney Islands are great for walking and one of the best places in the British Isles for water sports. There are seven lochs or lakes to fish in, and excellent sea fishing. The capital of the islands is a beautiful old town of Kirkwall, where there are shops offering special varieties of cheese and fish. The fishing port of Stromness has a museum, three bookshops and an Arts Centre, which has a good collection of late twentieth century art. In the harbour there are plenty of fishing boats to see, although the boats no longer catch whales as they once did. Every year there is an Arts Festival in June, which has music, drama, dance, poetry and exhibitions of paintings.

It is best to spend most of your time in the Orkney Islands on the Mainland, as there is so much to see and do. However, you can also visit one or two of the other islands such as the island of Hoy, which is particularly famous for its high cliffs. Taxis are available to drive you around Hoy, but you will need to walk up to the top of the cliffs. When tourists reach the cliff edge, particularly in bad weather, they find the safest way to see the view is by lying down on their stomachs!

HOW TO GET THERE

BA Express flies to Kirkwall daily (except Sundays), and from Glasgow and Edinburgh there are connecting services with London Heathrow. There is a ferry every day from Scrabster and weekly ferries from Aberdeen.

WHERE TO STAY

There are many excellent hotel and inns to choose from. Most do very good fish dishes in their restaurants. The Stromness Hotel also offers seven nights from £199 during the Arts Festival and this price includes a meal before or after the concerts.

Appendix J: Comprehension Test 1 Answer Sheet

Test 1

Answer Sheet

Name: ……

School: ……....

Look at the sentences about the Orkney Islands.

Decide if each sentence is true or false.

If it is true, mark T on the space provided.

If it is false, mark F on the space provided

Answers on the dotted lines:

1. Some of the islands are home to animals rather than people. ……
2. Farming on the Orkney Islands has increased in importance over the years. …….
3. There are some ruins on one of the islands. ..…….
4. There is an Arts Centre in the capital of the Orkney Islands. ……
5. If you go to the Arts Centre, you can see some examples of modern art. ……
6. The fishing industry has changed what it catches. ……..
7. To get the most from an Orkney holiday, it is necessary to go to several islands ..…….
8. A taxi can take you to all the tourist places in Hoy. ……
9. You can fly direct from London Heathrow to Kirkwall. ……..
10. One hotel includes tickets for the Arts Festival in its price. ..……

Appendix K: Comprehension Test 2

Test 2

Exploring the Arctic

The Arctic is one of the few places in the world untouched by pollution where you can see nature at its wildest and most beautiful. Join our ship, the *Northern Star* from 2 to 18 July, for a 17-day voyage to the Arctic. During the voyage you will be able to relax and get away from it all. There are no parties or film shows to attend, quizzes to enter, or entertainment to watch. However, we do have specialists on board willing to answer any of your questions about the Arctic and who will talk about the animals and birds that you can see on the trip.

After setting off from Scotland, we go north along the coast of Norway to Bear Island. Along the way you'll see thousands of seabirds and wonderful scenery, with rivers of ice and huge cliffs. You will have the chance to see reindeer, polar bears and other arctic animals. Although we have a timetable, experience has shown that we may have to change our direction a little, depending on the weather and on which animals appear.

Northern Star is a very special ship and our past voyages have been very popular. Our cabins all have the same excellent facilities, which include a private bathroom and refrigerator. Our chefs are happy to prepare any food for the people on special diets. Choose just what you want to eat from the wide varieties available at the dining room buffet. There is a library, shop, clinic and plenty of space for relaxation. If you need some exercise, why not go jogging every morning around the deck, or do some swimming in the indoor pool?

Prices include economy class air travel and 16 nights on board the *Northern Star*, all meals and excursions and all lectures.

Day 1: Board the *Northern Star*

Days 2-7: We sail slowly north along the coast of Norway, stopping at places of interest.

Day 8: Tromsø. You need to get up at sunrise to see the whales as we sail towards Tromsø. Visit Tromsø to see the Arctic Museum, the cathedral and the beautiful old wooden houses. In the evening we sail along the west coast to Bird Island, which is excellent for bird watching.

Days 9-10: Bear Island. We arrive here in the early evening and stay overnight. Bear Island once had an active fishing industry, but today little of this remains. We will explore the island looking out for Artic flowers.

Day 11- 16: Spitsbergen. A place of mountains and rivers of ice, it is home to a large variety of animals.

Day 17: Leave the ship in Spitsbergen and fly to London from Tromsø.

Appendix L: Comprehension Test Answer Sheet

Test 2

Answer Sheet

Name: ……

School: ……....

Look at the sentences about the Exploring the Arctic.

Decide if each sentence is true or false.

If it is true, mark T on the space provided.

If it is false, mark F on the space provided

Answers on the dotted lines:

1. This trip is for people who like peace and quiet. ……
2. Many different activities are organized on board. …….
3. The voyage begins in Scotland. ...…….
4. The ship follows a fixed route. ……
5. There are different types of accommodation. ……
6. Passengers serve themselves in the dining room. ..…….
7. Whales can be seen in the morning near Tromsø ……
8. There are some examples of traditional buildings in Tromsø. …..……
9. The ship stays overnight in Tromsø ....……..
10. Bear Island used to be a busy fishing centre ……..