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# The longitudinal effect of treatment, gender, socio-economic status and home language on primary school children's reading comprehension, annoyance reactions to road and aircraft noise exposure and coping, in KwaZulu-Natal, South Africa.

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# The longitudinal effect of treatment, gender, socio-economic status and home language on primary school children's reading comprehension, annoyance reactions to road and aircraft noise exposure and coping, in KwaZulu-Natal, South Africa.

A research report submitted to

The Department of Psychology
The School of Human and Community Development
Faculty of Humanities
University of the Witwatersrand

In partial fulfilment of the requirements
for the degree of Masters in Education (Educational Psychology)

by
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## Declaration

I hereby declare that this research project entitled: *"*The longitudinal effect of treatment, gender, socio-economic status and home language on primary school children's reading comprehension, annoyance reactions to road and aircraft noise exposure and coping, in KwaZulu-Natal, South Africa*"* is my own work and that the assistance obtained has been only in the form of professional guidance and supervision and that no part of the research has previously been submitted to any other institution of higher learning or university.

It is submitted in partial fulfilment of the requirements for the degree of Masters in Education (Educational Psychology) at the University of the Witwatersrand, Johannesburg.

Signature: 

Date: January 2017

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**Abstract**

*Aim*: In the context of a multi-cultural South Africa, this study sought to investigate and describe the longitudinal effects of treatment, gender, socio-economic status and home language on primary school children's reading comprehension, annoyance reactions to road and aircraft noise and coping in KwaZulu-Natal, South Africa. This was important to explore in order to provide valuable insight into teacher's instruction, particularly in noisy environments. Additionally, insight into potential scholastic and psychological interventions may be provided.

*Procedure:* This study constituted part of a larger, longitudinal, South African-based study, namely The Road and Aircraft Noise Exposure on Children's Cognition and Health (RANCH – South Africa) study. It was a quantitative, developmental study that utilised data collected in 2009 in schools located within the vicinity of the Durban International Airport and in 2010, after the relocation of the airport to King Shaka International Airport in La Mercy. In total, 408 learners across 5 public schools in the KwaZulu-Natal province participated in the study. A child questionnaire was reviewed to obtain relevant biographical data pertaining to this study, as well as annoyance reactions to road and aircraft noise exposure and coping skills data. The data of the Suffolk Reading Scale 2 (SRS2), which was used to obtain reading comprehension scores, was also reviewed. Data was analysed using both descriptive and inferential statistics. Repeated MANOVA tests were conducted to explore the effects of four variables; treatment group, gender, socio-economic status (SES) and home language. The treatment group consists of learners who were exposed to noise (experimental group) and those who were not exposed to noise (control group).

*Results:* English First Language (EFL) speakers performed significantly better on reading comprehension tasks over time than their counterparts who spoke English as Additional Language (EAL) ($p< .005$). Treatment group, gender and SES did not have significant influence on reading comprehension tasks over time. Annoyance reactions to both road ($p< .05$) and aircraft ($p< .001$) noise exposure are significantly affected by the treatment group to which learners belong. Learners from the experimental group experienced significantly less annoyance than those from the control group. In terms of aircraft noise exposure, language also has a significant effect on annoyance reactions; EFL learners experienced less annoyance than EAL learners over time ($p< .001$). Lastly, learners from the experimental (noise exposed) group were able to cope significantly better than those from the control group ($p< .001$). These results suggest that language and previous exposure to noise have the most significant impact.

*Conclusion:* Reading comprehension, annoyance reactions and coping are indeed affected by a variety of variables, most notably that of language and previous exposure to noise. There is no significant effect of gender or socio-economic status. This research implies that the effect that noise exposure has on the

emotional adjustment and resilience of learners exposed thereto is important to consider, as well as role of the educator and the impact that background noise has on their teaching and their own ability to cope.
*Key Words:* reading comprehension; annoyance reactions; coping; home language; noise exposure; South Africa

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# CHAPTER ONE: INTRODUCTION

It has been proven that noise negatively affects peoples' quality of life and health. The World Health Organisation (WHO) indicates that noise can cause hearing disturbances, sleep disorders, unhappiness, influence social behaviour and the understanding of language, negatively affect the learning process and intellectual tasks (Maèiûnas, Virbickienë, Marcijonas, Juozulynas & Lukuienë, 2005).

Research over the last 30 years has documented detrimental effects of extreme noise levels on children's cognitive processing, psychological feelings and scholastic performance (Dockrell & Shield, 2006; Seabi, 2013). It is evident that aircraft and other background noise is extremely high and this has also been established by Stansfeld et al. (2005), who suggested that such an environmental stressor could impair cognitive development, such as reading comprehension and essential psychological mechanisms in children. Considering that noise levels are on the rise, as a result of an increase in people using airplanes and other such aircraft as their preferred mode of transport (Franssen, van Wiechen, Nagelkerke & Lebret, 2004), as well as an increase in the number of street and household lights and other general road-related noises, it is important to consider to what extent this may impact a child's cognitive development, specifically reading comprehension, annoyance reactions and coping skills. Additional variables may also have an impact on a learner's scholastic performance and cognitive development.

These additional variables include gender, socio-economic status and home language. Previous exposure to noise may also play a role in a child's emotional resilience and academic success. International literature is rich in information on the relationship between language (bi- or multi-lingualism) and reading comprehension proficiency, as well as socio-economic background and the role this plays in reading comprehension accuracy. However, there appears to be a dearth of this research in South Africa. The effect of gender on reading comprehension appears to be less researched both internationally and locally. The same applies for the effect of all aforementioned variables on annoyance reactions and coping skills.

## 1.1 Rationale

Studies as early as 1982, by Green, Pasternack and Shore, looked at noise exposure and its effects on cognitive performance. Results indicated that high levels of environmental noise are inversely related to

reading abilities in primary school children. Stansfeld and Haines later conducted the Schools Environment and Health Study in 1996 and 1997, whereby reading comprehension scores were shown to be significantly delayed in high noise-exposed groups (FICAN, 2000). The Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH) project, the largest European study of noise and children's cognition, was conducted from 2002 and confirmed the aforementioned findings. Little research of this nature exists within the context of Africa, and more specifically in South Africa. Seabi and his colleagues (2013) considered the lack thereof.

Seabi et al. (2013) conducted a longitudinal study of aircraft noise and its effects on primary school teaching and learning in Durban, KwaZulu-Natal, South Africa, based on the premise of the European RANCH project. An epidemiological prospective study of children's health and annoyance reactions to aircraft noise exposure was also completed as part of this longitudinal project. A plethora of rich data was produced from this research and it was only fitting to explore this. No such research has been conducted in South Africa previously and this study was to take advantage of the ample variables and areas measured and studied. Considering this and the context of the large study, it is important to consider how, if at all, other background variables affect a child's scholastic performance and a child's annoyance reactions to noise. As Roth, Speece and Cooper (2002) mention, unfortunately the inclusion of background variables in previous studies have been both inconsistent and insufficient, and that the examination of such is essential to an accurate account of how else reading comprehension proficiency (and annoyance reactions and coping) might be achieved.

Demographic information obtained in the aforementioned study (Seabi et al., 2013) included socio-economic status, gender and home language. Further exploration into these variables and the role previous noise exposure plays, and whether they have a longitudinal effect on reading comprehension, annoyance reactions to aircraft and road noise, as well as coping is important. It is important and valid because this will provide valuable insight into teacher's instruction as well as potential scholastic and psychological interventions in terms of increasing learners' vocabulary, reading comprehension proficiency and resilience to noise exposure. Policy making with regards to school environments being conducive to learning and psychological development might also be addressed.

This study was necessary and important because demographic variables are those that one has no control over. Gender, socio-economic status and home language are variables a child is born with and/or into. These are innate and environmental aspects which have a lasting effect on a child. Thus, it is necessary

to consider the role these might play in a learner's cognitive and academic performance because should there be a negative impact, one can make necessary accommodations suitable to the context of the child. Given the multi-cultural dynamic and nuances of South Africa, one cannot simply look within a child for remediation. Although demographic variables may lend itself to do just this, it is important that we look beyond that of the individual and consider the environmental context within which a child exists, which international studies might neglect.

Noise exposure is also not necessarily a variable a learner has control over. The WHO guidelines for noise suggest that children are more sensitive to noise than adults because they are exposed to it during critical developmental periods, and have fewer possibilities for controlling noise or have less developed coping abilities (van Kempen et al., 2009). Thus, accounting for the affect this might have on a child is also imperative for successful schooling and coping. One cannot simply take that which works in international or global contexts and assume it would be applicable to a South African context. Based on this, it is evident that context-specific research is more beneficial and effective in terms of the outcomes and respective implications thereof. Additionally, it cannot be assumed that relationships observed at one time in development will exist at later points (Davison, Hammer & Lawrence, 2011), and thus longitudinal studies provide insight into changes that may occur. It is therefore important to consider the effect of background and other variables in order to avoid potential scholastic and psychological difficulties, how to best support teachers within noise-exposed environments as well as how to intervene appropriately should the need arise, all within the consideration of a South African context.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Reading Comprehension

### 2.1.1 What is reading comprehension?

Literacy is the ability to read and write; both of which are complex processes. Writing is a system used to communicate using scripts of symbols and signs. Reading is the synthesis of an intricate network of perceptual and cognitive acts along a continuum from word recognition and decoding skills, to comprehension and integration (Owens, 2005).

Reading comprehension is a complex process that involves both lower and higher levels of cognitive processing; in perception, and in accessing and retrieving stored language in long-term memory respectively (Gabig, 2009). Basically, reading comprehension relies on the ability of one to perceive and discriminate letter shapes, to transform them into phonemes and create a phonological sequence for mapping, and to retrieve similar representations stored in memory during the process of word recognition and text construction in reading (Gabig, 2009). Essentially, reading comprehension is dependent on that of listening comprehension, because one must understand a language in the verbal form to be able to read and sufficiently understand its written form (Cain & Oakhill, 2006). Reading comprehension further involves the use of existing knowledge, inference and devices of writing and storytelling to derive meaning (Cain & Oakhill, 2006).

Reading is an essential cognitive, developmental and socially constructed skill which learners use to explore and construct meaning of the world around them (Cornoldi & Oakhill, 1996). It is the cornerstone of language and communication, connecting members of a community. Being literate gives a child the opportunity to learn and become an active member of society.

### 2.1.2 Reading comprehension and literacy

According to data released by the UNESCO Institute for Statistics in 2015, literacy rates for adults and youth continue to rise. Young women aged 15-24 are making the strongest gains, but still lag behind young men. Globally, Central Asia and Central and Eastern Europe have a youth literacy rate of 100%, followed closely by East Asia and the Pacific with a rate of 99%. Rates of 98% and 90% have been found in Latin America and the Caribbean and in the Arab States respectively. Sub-Saharan Africa suffers from a multitude of issues and challenges, amongst which includes illiteracy (Jiyane &

Onyancha, 2010). This area's youth literacy rate is at 70%- according to the UNESCO Institute for Statistics (2013). In South Africa, according to the 2013 General Household Survey (GHS) conducted by Statistics South Africa, the literacy rate for persons over the age of 20 years increased slightly from 91.9% in 2010 to 92.9% in 2013 (Statistics South Africa, 2013). Compared to other developing countries in Africa, South Africa lies third highest in terms of literacy rates (Lenmanciya, 2013).

Reading comprehension is dependent on a range of basic language and cognitive skills (Cain & Oakhill, 2006). Although South Africa lies third highest in Africa in terms of literacy rates, the country has been found to be lower than that of most other countries worldwide (Pretorius & Naude, 2002), and it is important to consider the factors contributing to this. According to the Department of Education of South Africa, literacy is introduced in grade R (children generally aged 5 years turning 6 years of age in that year), which can be considered as the first year of formal schooling in South Africa. South Africa is faced with a plethora of challenges including education level, unemployment and poor literacy. Literacy rates are reduced in the poor communities and parents are often unable to read and write themselves. Literate parents have higher expectations for their child's academic performance and because of this, are more motivated to assist their child, see their child's reports and ensure that they read to their child (Entwisle, Alexander & Olson, 2007). Thus, a child who is part of a less privileged household has very little chance of being taught, assisted or even stimulated using books and shared reading by his parents thereby placing them at risk for academic difficulties such as reading comprehension. Reading comprehension is a skill heavily dependent on language, but why and how so? This will be explored below.

### 2.2 Language

Language is an innate skill acquired by children through the communicative environments in which they are brought up. It is a complex, specialised skill, which develops spontaneously in children, without conscious effort or formal teaching (Pinker, 1994).

Second language learning is referred to as being bilingual or multilingual. Much debate over the effects of this on one's first language, as well as the proficiency of the second language exists. Battle (2009) states that whilst a child's language is developing, the two systems interact with each other and affect the acquisition of each language. In South Africa specifically, English as a second language is referred to as ESL. Children who are exposed to oral language, and who learn English as a second language,

eventually comprehend English (Nel, 2011). However, they often need assistance in learning vocabulary, as this is not easily transferred from one language to another, which then extrapolates to assistance being required with reading and reading comprehension. Language is thus fundamental in learning and academic training, and is either a facilitator to academic development and learning, or a barrier (Webb, 2002).

It is important to distinguish between basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP), in order to understand what is required for language and academic proficiency. CALP requires a child to use language to analyse, synthesise and evaluate information in the academic curriculum in oral communication and in reading and writing (Battle, 2009), where they might need to depend on language to make meaning. BICS refers to the ability to communicate about everyday things when speaking to familiar persons. It also includes learned language where the context provides clues such as facial expression, or pictures and objects, which are used in "highly contextualised situations" and the speaker does not have to rely on language in order to understand or construct meaning (Nel & Nel, 2013). For a learner to be socially and academically successful in language, both BICS and CALP need to be well developed (Nel & Nel, 2013).

These two concepts imply that even if a learner can converse fluently in English, for example, this does not necessarily translate to the academic skill of comprehension of a text in English in school (de Klerk, 2002). Given the linguistic diversity within South Africa, where the medium of teaching and learning is mainly English, one cannot help but question whether such learners who have not acquired both BICS and CALP, would lead to academic difficulties such as reading comprehension. The idea of language being a facilitator, versus a barrier, to academic development comes to mind once again. In contrast to ESL learners, first language English speaking learners have acquired both BICS and CALP and therefore generally perform better on tests of cognitive abilities (Battle, 2009). Conversely, gaining full proficiency in academic language is considered to be particularly challenging for language minority learners, ie. ESL learners, as they face specific difficulties related to both their socio-economic status and their language background (Heppt, Haag, Bo & Stanat, 2014).

Language plays an integral role in the assessment of cognitive functioning, particularly that of reading comprehension. Testing, of any form, in one's first language is imperative to the results being truly reflective of a child's abilities. Tests are generally standardised, which means that it allows for ranking a child's performance on the test against that of typically developing children in the same age group.

Most formal standardised norm-referenced language tests are biased against children from culturally and linguistically diverse backgrounds because these children are not included in the normative sample (Battle, 2009). Scores obtained from testing a South African child with a non-South African test would not be a valid indicator of the child's abilities. Furthermore, experiential limitations would include children not understanding instructions due to second language English, unfamiliarity of terms used that are not generally used in South Africa, as well as children living in third world countries where access and/or exposure to common, everyday objects used in testing is limited due to poor economic and living conditions (Battle, 2009). Thus, testing comprehension in a second language, regardless of the child's perceived fluency, would not indicate their true abilities and there would be no equal ground for different learners in understanding and constructing meaning from a text. For example; a Xhosa first language learner may experience difficulties with comprehending auditory or written information in English and may miss critical information. In general, this is rife in South Africa.

### 2.3 The Role of Language in Reading Comprehension

Studies on the role of language in reading comprehension have been conducted globally, including countries such as England, Germany, Netherlands, Norway, Canada and Hong Kong. Local studies have also been conducted in South Africa.

Research conducted in London, Munich and Netherlands indicated a relationship between chronic aircraft noise exposure at school and performance on standardised reading tests (Stansfeld et al., 2005). This project examined the effect of road traffic and aircraft noise exposure at school on the cognition of nine and ten-year-old primary school children in the United Kingdom, Spain and Netherlands (Stansfeld et al., 2005). Results indicated that aircraft noise is related to impaired performance in reading comprehension; children exposed to higher aircraft noise levels in school scored significantly lower on the reading comprehension test than children in schools with lower aircraft noise exposure (Stansfeld et al., 2005). Furthermore, reading ages in children exposed to high levels of aircraft noise was delayed by up to two months.

A longitudinal study was conducted by Hutchinson, Whitely, Smith and Connors (2003), who followed 43 L1 and 43 L2 learners in England, aged 7 to 9 years, and assessed their oral language and reading skills in English. No differences were found in word-reading accuracy levels at any time in testing, but there was a significant L1 advantage on the measure of reading comprehensions (amongst other skills)

across all testing times. These findings were corroborated by Burgoyne et al. (2009), whereby although L2 learners outperformed their L1 peers on the measure of word-recognition accuracy, they underperformed on the measures of vocabulary and text comprehension. The significance of vocabulary and the role it plays in the performance of reading comprehension in a learner's second language is clearly evident.

Interestingly, the effect of language on reading comprehension applies not only to English as the first and/or second language, but other languages too. Because additional language (L2) learners on average have a poorer command of the first language (L1) they are learning (in), their linguistic comprehension will suffer and they will therefore be at risk of reading comprehension difficulties (Lervåg & Aukrust, 2010). These authors examined the role of decoding and vocabulary skills as longitudinal predictors of reading comprehension in grade two learners in Norway. Longitudinal studies provide information about the rate of growth, whether rates of growth differ between L1 and L2 children, and whether variations in decoding and oral language skills can predict differences in growth rate (Lervåg & Aukrust, 2010). This study had 288 participants; of which 198 had Norwegian as their first language (L1) and 90 had Urdu as their first language (L2). The LoLT at school was Norwegian and both groups were being taught to read in Norwegian. Reading comprehension, word decoding and vocabulary breadth were all measured utilising Norwegian translations of English tests (Lervåg & Aukrust, 2010). Results indicated that L1 learners had better initial reading comprehension skills and faster growth in these skills over time. Individual differences in decoding and vocabulary predicted initial reading comprehension skills, but only vocabulary predicted the subsequent growth of reading comprehension skills (Lervåg & Aukrust, 2010). Thus, the lag in the development of reading comprehension skills may be attributed to the limitations of the vocabulary repertoire (Lervåg & Aukrust, 2010).

Very similar conclusions were made by Burgoyne, Whiteley and Hutchinson (2011), who conducted the same longitudinal research in the United Kingdom, with English as the L1. The aim of their study was to examine the progression of reading and listening comprehension skills in ESL learners and their monolingual peers across two years of school, Year 3 and Year 4, which is the equivalent of South African grades 2 and 3 respectively. Despite demonstrating good decoding skills, it was found that many ESL learners experienced difficulties with reading comprehension, and that vocabulary was strongly related to successful reading comprehension (Burgoyne et al., 2011). Thus, weaker vocabulary skills are likely to place substantial constraints on the development of reading comprehension, and this was found to be a predictor of comprehension for both EFL (English First Language) and EAL (English Additional

Language) groups in this study. The authors concluded that weaker language skills therefore place significant constraints on ESL learners' ability to comprehend text, which was also concluded in a previous study by Burgoyne, Kelly, Whiteley and Spooner (2009). Further to this, results of the longitudinal component indicated that both monolingual and bilingual children progressed from Year 3 to year 4, but greater progress was made by EFL children (Burgoyne et al., 2011).

Mixed results have been found in other longitudinal studies. Some studies suggest that ESL learners' reading comprehension skills do not differ from EFL learners in the first two years of school (Manis, Lindsey & Bailey, 2004), but after that the EFL learners start to fall behind (Nakamoto, Lindsey & Mani, 2007). Droop and Verhoeven (2003) performed research on first- language Dutch learners (L1) versus second-language Dutch learners (L2). They were interested in exploring the influence of different aspects of children's developing language proficiency on their developing second-language reading comprehension. Measurements were taken at three points in time over a period of two years; at the beginning of grade 3, at the end of grade 3 and then at the end of grade 4. Results indicated a clear increase in the scores for both L1 and L2 groups over time; although the L2 learners scored lower on all of the reading comprehension tests than their L1 counterparts. Furthermore, the gap between L1 and L2 performance scores first decreased then increased, and then stayed the same on the three different measures in third and fourth grade (Droop & Verhoeven, 2003). Interestingly, and in congruence with that of Lervåg and Aukrust (2010); and Burgoyne et al. (2011); this study found that the largest difference between the Dutch and L2 groups of children was for their vocabulary knowledge.

In terms of the effect of language on reading comprehension in a South African context, Seabi, Cockcroft, Goldschagg and Greyling (2012) postulated that learners who learn in a second language would perform poorly in comparison to those learning in their first language, given that the test of reading comprehension (Suffolk Reading Scale 2) was an English-based assessment. EAL learners may be at a double jeopardy when both exposed to noise and having to read and comprehend in their second language (Seabi et al., 2012). The results of this study illustrated a significant difference in favour of EFL learners, which suggests that reading comprehension is influenced by language, particularly if the assessment is not in one's home language (Seabi et al., 2012). This was further confirmed by Völkel, Seabi, Cockcroft and Goldschagg (2016) who found that EFL learners perform significantly better on reading comprehension tasks than EAL learners. Furthermore, the performance of EFL learners was above that of the sample mean score, which highlights the observation that reading comprehension performance of EFL speakers generally exceeds the performance of the sample size as a whole (Völkel

et al., 2016). A unique study was conducted on native speakers of Cantonese attending school in Hong Kong (Sharp, 2010). Participants included 490 students who were randomly selected and all spoke English as a second language. Reading comprehension was assessed in English by providing each student with a reading text, cloze test and a questionnaire. The results provided evidence suggesting observable differences in different forms of comprehension; the way this is affected by first language and the way in which that first language is structured (Sharp, 2010). Further to this, and in agreement with the aforementioned ideas of Sharp (2010), Davsion, Hammer and Lawrence (2011) concluded that children need to achieve a threshold level of competency or proficiency in their first language, in order for benefits to be evident in their second language.

Further to the above South African findings, Webb (2002) conducted research into English as a second language at a tertiary institution; the University of Pretoria. The study revealed that the use of a second language as a language of learning and teaching (LoLT) could be unfavourable to the academic growth of students as well as to the assessment of their progress, if the students in question do not have the proficiency in the LoLT (Webb, 2002). Following tertiary education, proficiency in the standard language, which is generally English in South Africa, is imperative and non-negotiable for a professional occupation in today's marketplace. Consequently, the need to take the role of language in academic development and assessment very seriously is evident (Webb, 2002). Although this study is referring in particular to tertiary level academics, it can be postulated that the same applies for secondary and primary level schooling. Poor proficiency in the LoLT has the following effects; poor academic achievement and a poor foundation for cognitive development (Webb, 2022), be it at a primary, secondary or tertiary level.

Conversely to the aforementioned research findings, authors Hipfner-Boucher et al. (2015) conducted research in Canada on narrative abilities that yielded results indicating that overall performance of EAL learners was indistinguishable from that of their EFL counterparts. This study further divided the EAL learners into two groups based on parent reports of the language most often heard and spoken at home (EAL English language users and EAL minority language users). Although the current study will not control for the amount of English exposure to EAL learners, one needs to still consider that perhaps EFL learners will not always necessarily outperform EAL learners on reading comprehension tasks.

When a child's vocabulary repertoire is reduced in a language, and this language is the language of learning and teaching (LoLT), difficulties in academic skills such as reading comprehension become

evident. This may extend further into varying types of reading comprehension (Sharp, 2010), as well as into further schooling and tertiary education (Webb, 2002), which is testament to the indisputable importance of this skill in any multi-linguistic context.

The role of language in reading comprehension is widespread and although it is likely that the effects of any additional language can be applied across the board, it is important to consider that this might not be appropriate. One needs to think context-specifically.

**2.4 Social Disadvantage (Socio-Economic Status)**

Social disadvantage can be described in numerous ways and is difficult to distinctly define. Frequent measures of socio-economic status (SES) include parental education level (usually maternal), occupation (usually paternal), economic deprivation, for example; low family income and poverty, type of housing and high usage of medical and social services (Ginsborg, 2006). In South Africa particularly, the following indicators are increasingly being used as measures of the level and depth of poverty: unemployment, food security, housing, basic services, education and health (Mayekiso & Tshemese, 2007). The international community classifies South Africa as a middle-income country, yet the scale and demographic profile of poverty still indicates that it is one of the countries with the greatest levels of inequalities amongst its citizens (Mayeksio & Tshemese, 2007).

The relation between SES and cognitive ability and academic outcomes has been investigated for several decades (Hart, Soden, Johnson, Schatschneider & Taylor, 2013). Generally, a negative correlation of cognitive and academic achievement with SES has been discovered. More recently, a study from the University of British Columbia found that the neighbourhoods in which children reside predict their reading comprehension skills seven years later. Children who live in neighbourhoods with higher rates of poverty, one of the determinants of SES, showed reduced scores on standardised tests seven years later; regardless of their place of residence at the time of assessing. Children's reading comprehension may be set in a negative course early in life if children and their families are living in resource-deprived areas. Further to this, a study conducted in Israel found that learners from a lower SES achieved lower reading and writing scores than those from a higher SES (Korat, 2011). This was also the case in a French study by Gentaz, Sprenger-Charolles, Theurel and Cole (2013).

A study investigating the relationship between socio-economic status and learning achievement of students at secondary level was conducted in Pakistan (Akhtar & Niazi, 2011). It is interesting to note that the research conducted by Akhtar and Niazi (2011) found that upper class students achieved A and B grade results; middle class students D grade results; and lower class students remained low grade E result achievers. The authors concluded that these results are consistent with those of studies in other countries, which suggested that SES effects learning achievement. Thus, it is evident that socio-economic status not only affects the learning of primary school learners, but that this phenomenon continues into high school. This is important to consider and is the reason for longitudinal studies into the effects of socio-economic status on reading comprehension and other areas of academic performance.

Longitudinal research on first-language Dutch learners, and the potential differences between children coming from high versus low socio-economic status backgrounds, was conducted by Droop and Verhoeven (2003) over a two-year period (three testing times). The authors noted that several studies have shown that Dutch children with a low SES background have lower scores on tests of general language proficiency than those with a high SES background. Thus, further investigation into reading comprehension proficiency was warranted, and results indicated that the high SES children did indeed attain significantly higher scores than the low SES children at all three testing times.

Belfi et al. (2014) noted the interaction between language and low SES, and stated that research has shown that SES-related differences in language proficiency already exist from very early on in children's lives. As Jednoróg et al. (2012) stated, parental SES can affect an individual from very early development in utero as well as throughout life. These authors investigated the influence of socio-economic status on children's brain structure and the results thereof indicated that behaviourally, language is one of the cognitive domains affected by SES. Widespread modifications in children's brain structure were observed through MRI studies of 23 healthy 10-year-old children. Smaller volumes of bilateral grey matter were associated with lower SES, which is suggestive of a potential developmental delay in children from these environments, which may include that of reduced reading comprehension performance.

These SES-related differences have been demonstrated with respect to young children's reading skills. As previously mentioned, literacy rates are reduced in poor communities where parents are often unable to read and write themselves, which leads to reduced vocabulary sizes of children from such backgrounds. Morgan, Farkas and Hibel (2008) suggested that the SES-related differences in young

children's language proficiency is due to the following; low-SES caregivers, in comparison to high-SES caregivers, engage their children to a lesser extent in shared story book reading, keep fewer books at home, and have fewer conversations and interactions with their children in which the children develop their knowledge of print concepts.

SES is believed to influence children's language achievement not only in their early years, but also as they grow older (Belfi et al., 2014). This has been referred to as the 'Matthew Effect', which is based on the phenomenon that socio-economic differences in language proficiency already exist when children start school and increase as their school career progresses (Belfi et al., 2014). Belfi et al. (2014) investigated this phenomenon and conducted longitudinal research on the effect of primary school pupils' socio-economic status on their growth trajectories in three language domains; reading fluency, spelling and reading comprehension. Results indicated that growth in reading comprehension is indeed related to learners' SES. Learners with a higher SES performed better than those with a lower SES throughout the 4 years of testing (grade 3 to grade 6). There are a variety of explanations as to why the language gaps between high- and low-SES pupils are expected to grow over the course of primary school education, as per the Matthew Effect, and these can be divided into two categories; socio-economic differences in family attitude and socio-economic differences in teacher attitude towards children's language development (Belfi et al., 2014). These are not of concern for the current research but are noteworthy to consider in the context of education in South Africa.

There is evidently a general assumption that low SES is related to poor performance on reading comprehension tasks and further exploration into this assumption within a South African context is important.

### 2.4.1 Socio-economic status in the South African context.

The poverty rate in South Africa has decreased substantially from 2006 to 2011 (Statistics South Africa, 2014). In 2006, 57.2% of the population of South Africa was living in poverty. By 2011, this figure stood at 45.5% (approximately 31.8% and 12.0% in rural and urban areas respectively). The poverty rate is indicative of a lower SES, and is measured by the proportion of people in a particular group or area falling below the poverty line. The relationship between population groups and poverty levels has a strong correlation, with more than half (54.0%) of black Africans living in poverty (Statistics South Africa, 2014). Age and poverty are also intertwined; children (55.7%) and youth aged 18 to 24 years (50.7%) display the highest levels of poverty in comparison to that of older individuals (Statistics South

Africa, 2014). Being socially disadvantaged may place children at risk for poor academic achievement, as described below.

In addition to these statistics, Pretorius and Naude (2002) looked at children between the ages of five and a half and seven years, whose first language was Tswana, and who resided and schooled in an informal settlement in South Africa. The aim was to determine what factors might play a role in the poor literacy and numeracy performance of young South African learners in comparison to that of other countries. Every child in the sample was assessed individually in Setswana (test material was translated into Setswana). Results of this study indicated that these children are ill prepared for formal education; they have inadequate literacy skill, poor sentence construction, poor syntax knowledge, and inadequate phonological (sound) development (Pretorius & Naude, 2002). Whilst the fact that language may certainly play a role in the under-developed literacy skills, there is no doubt that the additional factor of being poorly disadvantaged is also linked to poor cognitive and reading comprehension competency. This is corroborated by Hipfner-Boucher et al. (2015), as well as D'Angiulli, Siegel and Maggi (2004), who found a double jeopardy in being disadvantaged and learning in one's second language. Although the current study is not looking at the combined effect of language and SES and their effect on reading comprehension, it is important to keep in mind given the fact that South Africa is a developing and middle-income country, with 11 official languages, and that the interaction between socio-economic inequalities and multilingualism indeed affects a child's academic performance, particularly in literacy, as identified above. A recent South African study considered whether SES affected children's reading comprehension, and the results indicated that children from a lower SES performed better than those from a high SES (Völkel et al., 2016). Interestingly, this was only the case for the first year of testing, after which there was no difference in reading comprehension performance between learners who had a low SES and those who did not (Maynard, 2012).

Another South African study investigated the relationship between academic performance, SES school type and perceptual-motor skills in grade one learners (Pienaar, Barhorst & Twisk, 2013). Academic performance in math, reading ability and writing was assessed using the Mastery of Basic Learning Areas Questionnaire. A total of 812 grade one learners were assessed in the North West Province of South Africa. The results of this study indicated a negative correlation between low SES school types and academic performance. In fact, up to one-third of the learners were classified in the *no-mastery* category for academic performance in maths, reading and writing, and a high percentage of these children grew up in poor socio-economic environments (Pienaar et al., 2013). Poor socio-economic

environments place children at risk for academic difficulties due to the lack of exposure to their language of instruction (LoLT), as well as due to the fact that they receive less language input by EFL speakers than their EFL peers do (Heppt, Haag, Böhme & Stanat, 2014), which may be what attributed to the findings of the aforementioned study. Given the fact that South Africa is a developing and middle-income country, it is evident that the socio-economic inequalities indeed affect a child's academic performance, particularly in literacy, as identified above.

It is clear that both international and local statistics and research indicate a negative correlation between SES and cognitive and academic achievement, and this study aimed to further explore the longitudinal effects socio-economic status has on reading comprehension on learners in an area of KwaZulu-Natal, South Africa. In addition to socio-economic status, gender also plays a role in reading comprehension performance.

### 2.5 Gender

Social institutions today are organised along lines that reflect both common sense and society's principles (Entwisle et al., 2007). Gender differences in schooling tend to focus on academic performance in the older years, yet on social experiences in the younger years. These social experiences include, for example, reading and physical activities. In terms of reading, this is typically considered a more feminine activity whereby mothers play a more significant role in teaching children to read and engaging in shared reading (McGeown, Goodwin, Henderson & Wright, 2012). Boys and girls have shown to differ in their motivation to read, reading choice, frequency thereof, attitudes towards reading, competency and the value of reading (McGeown et al., 2012).

A longitudinal study conducted in 1991 by Burbridge, as cited in Entwisle et al. (2007), found an association between gender gap in reading and family SES and reported that boys in low SES households are far more likely than girls to be held back in school. Conversely, a study conducted in 1982 by Bianchi, as cited in Entwisle et al. (2007), indicated that in poverty-stricken families, boys are more likely than girls to be above the grade average, but as the poverty level decreases to better-off families, boys and girls are similarly likely to be above the grade average. Taking into consideration reading and reading comprehension performance, a study conducted in the United States (Entwisle et al., 2007) indicated that boys and girls begin grade one with approximately equal reading scores but as they grow up, a significant gender gap develops. By grade 5, girls score considerably higher on reading tasks than

boys. In addition to gender differences, the authors also considered SES, and found that the gender gap in reading seems to be characteristic mainly of children from socially disadvantaged families.

Many international studies, which included 35 to 40 countries, examined reading comprehension with 10-year-old children and found gender differences favouring girls in every participating country (Logan & Johnston, 2010). Further to this, the research shows that these differences in reading competence continues into adolescence and that gender differences appear regardless of the type of reading instruction children have received, or the writing system. The attitudes to reading plays a significant role in the competency assessment thereof and gender differences have been found; girls have a more positive attitude towards recreational reading than boys, and this difference has been found to span a wide range of school ages and also widens with increasing age (Logan & Johnston, 2009).

In contrast to previous findings, Roth et al. (2002) conducted research in order to clarify the relationship between oral language and early reading development in 3 areas, one of which included the background variable of gender. Testing took place over three years; in kindergarten (pre-school grade R), grade 1 and grade 2. The original sample comprised of 38 boys (58%) and 28 girls (42%), of which all were native English speakers. Of this sample, 48 children were located for follow-up testing in grade 1 and 39 in grade 2. The main finding of the study was that semantic abilities (i.e. oral definitions and word retrieval), not phonological awareness, predicted 2$^{nd}$ grade reading comprehension. However, further to this, and of more interest to the current study, the only background variable that was significant for predicting first-grade reading from kindergarten was that of family literacy. In terms of predicting second-grade reading from kindergarten, race was the only significant variable. Thus, unlike the previously mentioned studies, gender did not appear to be a significant predictor of grade 1 and grade 2 reading comprehension skills (Roth et al., 2002).

Locally, few studies have been conducted looking at the role that gender plays in reading comprehension. One study corroborates that of Roth et al. (2002) which also found gender to not influence performance on reading comprehension. This was in a recent South African study where there was no significant difference in reading comprehension performance between boys and girls (Völkel et al., 2016).

All of the above findings are important to keep in mind when considering reading comprehension performance on a standardised measure, and more research into the reading habits and preferences needs to be conducted within a South African context, as there is a dearth of information thereof. Although

this study does not aim to look into this, it is important to keep in mind insights from previous research when considering gender difference performances on reading comprehension tasks.

### 2.6 Noise & Noise Annoyance

Noise, which is any 'unwanted sound', has been identified as an environmental stressor and a nuisance (Beutel et al., 2016). Although individuals become used to noise exposure, the degree of this habituation differs a lot between individuals and is seldom complete (Beutel et al., 2016). Environmental noise is a significant risk factor for a variety of short- and long-term adverse health outcomes such as annoyance and cognitive development impairment (Nitschke, Tucker, Simon, Hansen & Pisaniello, 2014). A noise reaction model in the brain exists, which has two principal pathways relevant for the development of adverse health effects of noise (Babisch, 2002). These refer to the 'direct' and 'indirect' arousal and activation of the organism. The 'direct' pathway involves the instantaneous interaction of the different structures of the central nervous system with the auditory nerve (Babisch, 2002). The 'indirect' pathway refers to the cognitive perception of sound, its cortical activation and associated emotional responses such as annoyance (Babisch, 2002). The 'indirect' pathway is of importance when considering annoyance reactions to road and aircraft noise exposure in children.

The World Health Organisation (WHO) introduced noise level guidelines in order to prevent adverse health impacts on everyday life, as well as on understanding speech delays in cognitive development in children and annoyance (Nitschke et al., 2014). Noise annoyance incorporates a wide range of psychological feelings, which include irritation, distress, discomfort and frustration, when noise interrupts one's psychological state or ongoing activities (Guski, 1999). Annoyance is the most extensive and well-documented responses to noise (van Kempen et al., 2009). This may have a ripple effect on an individual's quality of life, as severe annoyance has been associated with reduced well-being and health (Beutel at al., 2016). Further to this, Clark and Stansfeld (2005) suggest that the nature of today's developing world facilities is emitting growing amounts of noise, and this could indirectly result in poor health whereby noise annoyance from chronic (road and aircraft) noise exposure may cause prolonged activation of physiological responses, such as increased blood pressure. Although these authors concluded from a study that noise exposure might not necessarily be associated with serious psychological illness, it may have an impact on the well-being and quality of life of children.

## 2.7 Children's Vulnerability to Noise & Coping

Internationally, studies relating to noise and annoyance reactions are reporting higher annoyance levels and other mental health issues associated with increased noise exposure over time. The project on which the original research of this paper is based, Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH), investigated children's annoyance reactions to aircraft and road traffic noise in both the home and school setting (van Kempen at al., 2009). Children aged 9-11 years were recruited from primary schools in areas around Heathrow airport, Schiphol airport and Madrid-Barajas airport in London, Amsterdam and Spain respectively. The final sample contained 2 844 children. Annoyance was measured as part of a self-administrated questionnaire by means of standard questions. The child questionnaire of the current research is based on these standard questions. For both aircraft and road noise exposure at school, there was significant relation to severe annoyance (van Kempen et al., 2009). The results of this study were consistent with that of previous studies investigating children's reactions to aircraft and road traffic noise, for example that of Evans, Hygge and Bullinger (1998) and Haines, Stansfeld, Job, Berglund and Head (2001). The latter also found that aircraft noise is related to higher annoyance reactions; children exposed to higher aircraft noise levels in school reported significantly higher annoyance than children in schools with lower aircraft noise exposure (Haines et al., 2001). Although van Kempen et al. (2009) did not perform longitudinal studies, perhaps one can postulate that annoyance reactions would remain higher over time for children exposed to aircraft noise in comparison to those who are not.

Recently, it has been suggested that the annoyance of Dutch residents at a given aircraft noise exposure level increases over the years (Janssen, Vos, van Kempen, Breugelmans & Miedema, 2011). The objective of this study was to verify this hypothesised trend and to identify its possible causes. The authors were interested in seeing whether there is a change over time in annoyance due to aircraft noise. Results confirmed recent suggestions; a significant increase in annoyance over the years. The study did not control for noise exposure, which lends to limitations thereof. However, it still has important implications in terms of mental health issues relating to coping in noisy environments and academic performance therein. This may have an influence on future legislature and policy development relating to noise and the learning environment.

Children exposed to noise might experience abnormal psychological feelings, amongst which include anxiety and depression. Beutel et al. (2016) explored the association between aircraft noise annoyance

and mental health, specifically that of anxiety and depression. Cross-sectional data of 15 101 German participants was investigated, and noise annoyance was assessed separately for road traffic and aircraft noise. The results indicated that depression and anxiety increased with the degree of overall noise annoyance. Aircraft noise was found to have the most significant impact. Although annoyance due to aircraft noise could not directly be related to depression and anxiety, it is interesting to note the association in the context of the current study. Relating to noise annoyance and it being a predictor of more serious health conditions, Banerjee (2013) found a positive correlation between long-term noise exposure to road traffic noise and increased annoyance when compared to non-exposed individuals. Interestingly, women were observed to be more annoyed at the noise than men.

Moving toward our local context, teaching in South Africa is predominantly facilitated by a teacher giving oral instructions, whilst learners listen and process the information (Mierman, Jordaan, Kalenbach & Rijhumal, 2010). Classrooms should thus support this communicative behaviour. However, classrooms are generally noisy environments; shoes scuffling, children whispering, chairs scraping and doors closing (Tye-Murray, 2009), over and above additional extraneous noise such as that of aircraft noise. As a result, it is a given that children are susceptible to experiencing difficulties with learning and as mentioned above, psychological feelings such as annoyance. Mixed results have been found in research looking at the adverse effects of aircraft noise on children, and few studies thereof involving children (Clark & Stansfeld, 2007; Ristovska, Georgiev, Gjorgjev & Kocubovski, 2004; Seabi, 2013). Clark and Stansfeld (2007) state that although aircraft noise exposure may not be associated with serious psychological illness or annoyance, it may impact on a child's quality of life. Similar results were found whereby suggestion was made that exposure to chronic (road and aircraft) noise is not subjectively stressful (Ristovska et al., 2004). Conversely, Seabi (2013) found that South African children who were exposed to chronic aircraft noise continued to experience significantly higher annoyance than their counterparts even after the removal of the noise source. This suggests that chronic exposure to aircraft noise may have a lasting impact on children's annoyance, as do many of the international studies. There is however, a lack of such research within the African and South African context, which the current study aims to address.

Related to road and aircraft noise annoyance is the concept of coping and resilience. Resilience may be considered an indirect form of psychological coping which, when utilised effectively, may prevent psychological maladjustment and/or mental health issues, such as anxiety and depression, as described above. When in noisy environments, listening becomes more effortful, which requires increased

cognitive resources to decode verbal information which may be misheard, misunderstood or simply not heard at all (Goldschagg, Cockcroft & Seabi, 2014). A lack of coping might result in psychological distress, as was evident in school children in the vicinity of Heathrow Airport who were found to have higher levels of psychological distress (Haines, Stansfeld, Job, Berglund & Head, 2001). Children are more vulnerable to noise and may have a reduced capacity to anticipate the impact thereof, as well as a lack of well-developed coping strategies for dealing with noisy environments (Goldschagg et al., 2014). When this occurs in places of learning, learners' cognitive processing and subsequent academic potential and success may be hindered.

Internationally, Haines, Brentnall, Stansfeld and Klineberg (2003) conducted a study looking at the qualitative responses of children to environmental noise and how they coped therewith. A sample of 36 children reported that their daily school activities were affected by high noise levels than those from quieter environments. Depending on the noise sources, the children implemented different coping strategies. These strategies included, for example, closing windows, wearing headphones or telling someone to be quiet, which would be indicative of good/increased coping and resilience. Locally, a South African study considered learners' ability to cope in noisy situations (road and aircraft noise), and the findings thereof concluded that children in noisy environments may develop coping mechanisms, including increased control mechanisms, such as working memory (Goldschagg et al., 2014). These coping mechanisms contribute to a learner's resilience, which may or may not allow a learner to grow and thrive. These two studies corroborate one another in that the learners have learnt to utilise different coping strategies in order to cope better with noise.

Although the effect of noise has clearly been studied, most of these studies refer to aircraft noise. Few studies look at road noise, as well as the effect of gender, socio-economic status (SES) and home language on annoyance reactions in a South African context. Thus, this study aims to explore this further.

### 2.8 Summary of the Literature Review

The effect of environmental and demographic factors on reading comprehension, annoyance reactions to aircraft and road noise exposure, and coping has been explored. Most theoretical underpinnings are ascribed to international studies and that relating to aircraft noise. Based on these, one may assume that locally, road and aircraft noise exposure has negative implications on a variety of childhood developmental areas. However, one cannot be certain of this due to cultural differences in coping and

resilience in children, amongst many other factors. This report thus aimed to explore the effects of these variables on South African primary school children's reading comprehension, annoyance reactions to aircraft and road noise exposure, and coping and the steps taken to complete this are described in Chapter 3.

# CHAPTER THREE: METHODS

## 3.1 Context of the Study

This study constituted part of a larger, longitudinal, South African-based study, namely The Road and Aircraft Noise Exposure on Children's Cognition and Health (RANCH – South Africa) study. RANCH SA is based on the original RANCH project that primarily investigated the effects of aircraft and road traffic noise on children's cognitive performance. The RANCH-SA project attempted to determine the effects that aircraft noise has on South African primary school children's reading comprehension, attention, working memory and episodic memory in KwaZulu Natal (Seabi, Goldschagg & Cockcroft, 2010). It is the third longitudinal study in the world to make use of a naturally occurring experiment resulting from the relocation of the Durban International Airport (Seabi, 2013).

The RANCH-SA study administered five instruments. These included the following; the children's questionnaire to obtain biographical information and assess annoyance reactions to aircraft noise exposure, the Suffolk Reading Scale Level 2 (SRS2) to assess reading comprehension, the Toulouse Pieron test that assesses attention, the Child Memory Scale, the Search and Memory task, and the Figure Analogies subtest of the Quantitative battery for Cognitive Abilities test to assess IQ levels. No hearing tests were performed to screen for hearing impairments however, parents were asked if their child(ren) had any known hearing difficulty (Seabi et al., 2010).

For the purpose of this study, archival records were utilised, whereby only the effects of demographic variables on reading comprehension, annoyance reactions to aircraft and road noise exposure, as well as coping were investigated. It utilised data collected by the RANCH-SA study for the years 2009, when the Durban International Airport was still situated close to certain schools, as well as for 2010, after which the Durban International Airport was relocated.

## 3.2 Research Design

This quantitative, developmental study employed a longitudinal, archival design whereby repeated observations of the same variable at two specific points in time have been made. Archival studies, such as this study, make use of previously collected data for new analysis and to answer current research questions (Whitley, 2002). The development of children's reading comprehension, their annoyance reactions to aircraft and road noise, as well as their coping therewith have been tracked over a period of

time (2009-2010). These children were in grades 5 through to grade 8 at the time of testing. Quantitative research involves the collection of data in the form of numbers and aims to quantify constructs as well as take into consideration variables when explaining and analysing data (Babbie & Mouton, 2001). This will be an advantage as the results could be projected to the population (Nykiel, 2007). Descriptive and inferential statistics were utilised in this study.

### 3.3 Sample and Sampling

The sample was drawn from the larger RANCH-SA study. The current research is based on a cohort of 408 learners, who participated in 2 waves of the RANCH-SA study; Wave 1 (2009) before the relocation of the airport, and Wave 2 after the relocation of the airport in 2010.

The RANCH-SA study utilised a non-probability, purposive sampling strategy. Purposive sampling allowed the researcher to select specific participants who provided the most extensive information about the phenomenon being measured (Burns & Grove, 2005). Although this method does not make use of random selection, and thus there was a risk that a biased selection would be obtained, it was convenient and allowed for ease of selection of participants (Creswell, 2003). The researcher endeavored, however, to ensure that the sample was representative and described the sample in a clear and unambiguous manner. The focus of the study was context specific; not everyone is chronically exposed to aircraft noise. Therefore, the study obtained data from learners within close proximity to an airport and compared them to learners who have limited or no exposure to aircraft noise.

The RANCH-SA study considered variables such as intellectual ability, annoyance reactions, reading comprehension and noise measurements. For the purpose of this archival study, however, only treatment group, gender, socio-economic status (SES) and home language were studied. The treatment group consists of learners who were either exposed to noise (experimental group) and those who were not exposed to noise (control group).

### 3.4 Research Questions

This study aimed to investigate the longitudinal effects of background variables on primary school children's reading comprehension, annoyance reactions to aircraft and road noise, as well as coping skills. In order to explore the effects, the following research questions were formulated:

1. What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on reading comprehension?
2. What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on road annoyance reactions?
3. What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on aircraft annoyance reactions?
4. What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on coping with background noise?

## 3.5 Instruments

Whilst numerous instruments were administered as part of the RANCH-SA study, only two instruments were utilised for this study. The child questionnaire (Appendix 1) was reviewed to obtain relevant biographical data relevant to this study. It was also used to obtain data on annoyance reactions to road and aircraft noise exposure, and coping skills. The Suffolk Reading Scale 2 (Appendix 2), which was used to obtain reading comprehension scores, data was reviewed.

### 3.5.1 Child questionnaire.

The child questionnaire aimed to gather information regarding the participants' gender, home language, age, health and support at home and with schoolwork. Socio-economic status was also established from the questionnaire and was determined by whether or not a participant (learner) was entitled to receive free meals at school. A significant correlation has been shown between free school meal ratio and a range of census indicators representative of socioeconomic status (Seabi et al., 2010). Thus, receipt of a free meal was linked to whether a participant's caregiver was receiving a government social grant. The questionnaire was administered in English print form and completed prior to the assessment.

### 3.5.2 Annoyance reactions and coping.

Annoyance to aircraft and road noise was assessed in the child questionnaire with seven adapted questions (Fields, et al. 1997), which measured the level of annoyance on a four-point Likert scale (never, sometimes, often, always) as experienced by the children when they heard aircraft and road noise. The higher the score, the higher the noise annoyance level (range 0-4). Coping was assessed in the child questionnaire with four questions, which measured the frequency of four different coping skills on a four-point Likert scale (never, sometimes, often, always) as experienced by the children when they heard

aircraft and road noise. The higher the score, the higher the frequency of that coping skill utilised (range 0-4).

### 3.5.3 Suffolk Reading Scale 2.

Reading comprehension was measured using the Suffolk Reading Scale 2 (SRS2). It consists of 86 multiple choice sentence completion questions, each with five possible answers. The SRS2 was standardised in the United Kingdom using a sample of primary school children that was representative and mostly randomly selected. It has three comparable levels covering the age range of 6 years to 14 years-11 months. Each level has two parallel forms for easy testing arrangements.

Research was conducted in order to determine whether the SRS2 is a reliable instrument in the South African context (Ramaahlo, 2010). Results indicated that the test is a reliable measure of reading comprehension in the South African context despite it having been developed and standardised in the United Kingdom. The SRS2 proved to have a suitable internal consistency Cronbach alpha coefficient of 0.93 (Ramaahlo, 2010).

## 3.6 Procedure

Data was collected in two phases. In the first phase, biographical information, annoyance reactions to aircraft and road noise exposure, and coping data was obtained, as well as the learners' reading comprehension measured prior to the closure of the Durban International Airport (it relocated to the new King Shaka International Airport site). Noise levels at this original site were high (16 hours outdoor Leq <63dBA) for the experimental group, but low (16 hours outdoor Leq <56dBA) for the control group. In the second phase, biographical information, annoyance reactions to aircraft and road noise exposure, and coping data was obtained again, and learners had their reading comprehension measured subsequent to the airport relocation. Noise levels in this phase were the same for both the experimental and control group, namely 16 hours outdoor Leq <40dBA. Testing took place between 08h00 and 10h30, in the April of the respective years, on weekdays. RANCH-SA protocol was followed when administering the Suffolk Reading Scale 2 (SRS2), whereby testing was preceded by practice items, to guarantee that all learners understood what was required of them during the assessment.

Advantages of utilising existing data for research are (i) records, with a common condition, are readily available to be examined and (ii) the results can be obtained quickly with little expenditure and effort (Sundar Rao & Richard, 2006). A disadvantage, however, is that an archival study cannot make causal

statements on the associations found (Salkind, 2010). The latter was kept in mind when performing the research.

### 3.7 Threats to Validity

Validity refers to the degree to which a measure does what it is proposed to do (Durrheim & Painter, 2006). One of the biggest concerns regarding the validity of the SRS2 was that it was one of the latter tests administered as part of the RANCH-SA battery protocol. As a result, participants may have experienced boredom and fatigue during testing. This may also have affected completion of the questionnaires as not all of the participants managed to complete these prior to testing. Cain and Oakhill (2006) however, state that cloze comprehension tasks are often designed to get progressively difficult. In light of this, failure to complete the questionnaires could in fact be due to a genuine inability to answer the questions, as opposed to being bored or tired.

### 3.8 Data Analysis

Based on the research hypotheses, the general purpose of the study was to determine the longitudinal effects of treatment and background variables on children's reading comprehension, annoyance reactions to aircraft and road noise exposure, as well as coping. The data analysis in this study was performed using the Statistical Package for Social Sciences (SPSS) version 23. Descriptive (mean scores and standard deviation) and inferential statistics were utilised to analyse the data set.

Descriptive statistics allows for the description and analysis of group differences, developmental trends or relationships among the variables (Schiavetti & Metz, 2002). It does not draw conclusions or make inferences about a larger group (Babbie & Mouton, 2001). This study used descriptive statistics to describe the sample in terms of gender, socio-economic status and home language. Frequencies and percentages were calculated for these demographic variables. Mean scores, standard deviations, skewness coefficients and tests for normality of reading comprehension, annoyance reactions to aircraft and road noise exposure, as well as coping scores were examined.

Inferential statistic, conversely, involves researchers using what they have observed in samples, and what is known about sampling errors, to reach conclusions and make inferences about the larger population (Ary et al., 2014). The research questions were examined by using a repeated multifactor

analysis of variance (MANOVA). This was deemed appropriate as it is used to compare the means of one independent variable that is categorical with two or more groups; and there are two or more dependent variables that are continuous, as is the case in the current research.

### 3.9 Ethical Considerations

Research is an intrusion of people's lives; thus it is important for a researcher to ensure participants' well-being throughout the research process (Babbie & Mouton, 1998). Although the current study was part of the larger RANCH-SA study, it still obtained ethical clearance to be conducted; protocol number MEDP/16/003 IH (Appendix 3).

The RANCH-SA study followed various ethical procedures. No data pertaining to any participant was utilised unless parental consent and the child's informed assent had been gained. Prior to testing being carried out, the headmasters of the selected schools were informed about the purpose and details of the study. Each of the participants and their parents were informed as to what the nature of the research was, with no means of deception being utilised. Participants were also ensured that participation was voluntary and that they had the freedom to withdraw from the research at any time.

In the child questionnaire and Suffolk Reading Scale 2, questions relating to the participant's age, race, gender, grade and his/her name were asked as a means of coding, as well as to obtain demographical information. Although anonymity could not be guaranteed, due to the personally identifying information, confidentiality was strictly adhered to at all times. Nonetheless, the participants were assured that anonymity would be maintained in the reporting of the results. Furthermore, they were informed that they could have access to the final report in electronic format at the University of the Witwatersrand library.

As mentioned, in this study, internal departmental ethics was obtained from the University. Archival data from the RANCH-SA study was only be utilised for the purpose of this study. Participant names were unknown to the researcher due to the fact that code numbers were given (instead of names) when data was captured in the RANCH-SA study. Furthermore, a registered psychologist supervised the analysis of data and no identifying information has been incorporated in the write up of this research report.

# CHAPTER FOUR: RESULTS

## 4.1 Overview of Data Analysis

This chapter presents an overview of the statistical analyses conducted in the study and the results thereof. Both descriptive and inferential statistics were utilised to present a detailed set of results. Descriptive statistics were used to describe the data set in terms of gender, language and socio-economic status. This is presented first. Thereafter, inferential statistics are presented. These were paramount to testing the hypotheses of this study in order to understand whether or not the variables in question have an effect on reading comprehension, annoyance reactions to road and aircraft noise exposure and coping.

## 4.2 Descriptive Statistics

The total data set consisted of 408 participants. Table 1 illustrates the number of participants in each of the four independent variables analysed for the purpose of this study; treatment, gender, socio-economic status (SES) and language.

In terms of the treatment of the sample, 206 (50.5%) participants comprised the noise-exposed group and 202 (49.5%) comprised of the group that was not exposed to noise. In terms of the gender of the sample, 206 participants (50.5%) were male and 202 (49.5%) were female. In terms of the socio-economic status (SES) of the sample, 151 (37%) participants were from a low socio-economic background and 257 (63%) were from a high socio-economic background. In terms of the language, 211 (51.7%) participants spoke English as First Language (EFL) and 197 (48.3%) participants spoke English as an Additional Language (EAL).

Table 1

*Participants' Socio-demographic Information*

| Variable | *N* | % |
|---|---|---|
| Experiment | 206 | 50.5 |
| Control | 202 | 49.5 |
| Male | 206 | 50.5 |
| Female | 202 | 49.5 |
| Low SES | 151 | 37 |
| High SES | 257 | 63 |
| EFL | 211 | 51.7 |
| EAL | 197 | 48.3 |

Descriptive statistics for the Suffolk Reading Scale 2 (SRS2), which measured reading comprehension, are presented in Table 2 according to the following variables; Experiment and Control, Male and Female, High SES and Low SES, and EFL and EAL. Measurements were taken at Time 1 (T1) and Time 2 (T2) in 2009 and 2010, respectively. Table 2 illustrates that all variables performed better in 2010 than in 2009.

Table 2

*Reading Comprehension Scores of Treatment, Gender, SES and Language Groups*

| Variable | *N* | Mean T1 | *SD* T1 | Mean T2 | *SD* T2 |
|---|---|---|---|---|---|
| Experiment | 206 | 29.4 | 14.3 | 35.9 | 12.5 |
| Control | 202 | 33.7 | 14.9 | 35.4 | 16.3 |
| Male | 206 | 31.7 | 14.3 | 34.6 | 14.7 |
| Female | 202 | 31.4 | 15.2 | 36.8 | 14.1 |
| High SES | 257 | 30.7 | 14.6 | 35.6 | 14.3 |
| Low SES | 151 | 32.9 | 15.0 | 35.7 | 14.8 |
| EFL | 211 | 32.3 | 15.8 | 37.3 | 15.3 |
| EAL | 197 | 30.8 | 13.5 | 33.5 | 13.3 |

Annoyance to road and aircraft noise was assessed in the child questionnaire with seven adapted questions, which measured the level of annoyance on a four-point Likert scale (never, sometimes, often, always) as experienced by the children when they heard aircraft and road noise. The higher the score, the higher the noise annoyance level (range 0-4). These road and aircraft annoyance results are presented in Table 3 and Table 4 respectively.

Table 3

*Road Annoyance Scores of Treatment, Gender, SES and Language Groups*

| Variable | *N* | Mean T1 | *SD* T1 | Mean T2 | *SD* T2 |
|---|---|---|---|---|---|
| Experiment | 206 | 2.52 | 0.67 | 2.28 | 0.66 |
| Control | 202 | 2.03 | 0.59 | 2.23 | 0.63 |
| Male | 206 | 2.26 | 0.65 | 2.28 | 0.67 |
| Female | 202 | 2.29 | 0.70 | 2.23 | 0.62 |
| High SES | 257 | 2.28 | 0.67 | 2.27 | 0.63 |
| Low SES | 151 | 2.27 | 0.70 | 2.24 | 0.68 |
| EFL | 211 | 2.14 | 0.69 | 2.13 | 0.66 |
| EAL | 197 | 2.42 | 0.63 | 2.39 | 0.61 |

Table 4

*Aircraft Annoyance Scores of Treatment, Gender, SES and Language Groups*

| Variable | *N* | Mean T1 | *SD* T1 | Mean T2 | *SD* T2 |
|---|---|---|---|---|---|
| Experiment | 206 | 2.81 | 0.70 | 2.43 | 0.64 |
| Control | 202 | 1.96 | 0.59 | 2.13 | 0.70 |
| Male | 206 | 2.45 | 0.77 | 2.33 | 0.68 |
| Female | 202 | 2.32 | 0.79 | 2.22 | 0.69 |
| High SES | 257 | 2.37 | 0.76 | 2.28 | 0.68 |
| Low SES | 151 | 2.43 | 0.80 | 2.28 | 0.70 |
| EFL | 211 | 2.28 | 0.77 | 2.11 | 0.70 |
| EAL | 197 | 2.56 | 0.75 | 2.46 | 0.63 |

Coping was assessed in the child questionnaire with four questions measuring the frequency of four different coping skills on a four-point Likert scale (never, sometimes, often, always) as experienced by the children when they heard aircraft and road noise. The higher the score, the higher the frequency of that coping skill utilised (range 0-4), and thus it is assumed that a child is able to cope less with background noise due to the increased use of various coping skills. These results are presented in Table 5.

Table 5

*Coping Scores of Treatment, Gender, SES and Language Groups*

| Variable | *N* | Mean T1 | *SD* T1 | Mean T2 | *SD* T2 |
|---|---|---|---|---|---|
| Experiment | 206 | 2.25 | 0.61 | 2.04 | 0.60 |
| Control | 202 | 1.88 | 0.59 | 1.92 | 0.54 |
| Male | 206 | 2.05 | 0.61 | 1.98 | 0.58 |
| Female | 202 | 2.08 | 0.64 | 1.98 | 0.56 |
| High SES | 257 | 2.03 | 0.60 | 1.96 | 0.55 |
| Low SES | 151 | 2.13 | 0.66 | 2.01 | 0.60 |
| EFL | 211 | 1.99 | 0.61 | 1.95 | 0.55 |
| EAL | 197 | 2.15 | 0.63 | 2.01 | 0.59 |

### 4.3 Inferential Statistics

This research study aimed to explore four questions; (1) What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on reading comprehension? (2) What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on road annoyance reactions? (3) What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on aircraft annoyance reactions? (4) What is the longitudinal effect of treatment, gender, socio-economic status (SES) and language on coping with background noise? The results of these research questions are presented accordingly below.

Based on the above descriptive statistics, a repeated multifactor analysis of variance (MANOVA) was conducted as all assumptions underlying the use of a parametric MANOVA analysis have been fulfilled; namely that the scale of measurement of the dependent variable data is interval or ratio; the independent variable consists of two or more categorical, independent groups; there are no univariate or multivariate outliers; there is multivariate normality; there is a linear relationship between each pair of dependent variables for each group of the independent variable; and there is homogeneity of variance–covariance matrices. A mixed ANOVA would also have been appropriate to use in order to separate within- and across-subject variability within the treatment and conditions group however, it was decided that a repeated MANOVA would be more suitable. The results of the repeated MANOVA are presented below. These tables indicate the degree of freedom (*DF*), obtained Wilk's Lambda value of the test (*F*), and the probability of the result occurring by chance (*p*) for treatment, gender, SES and home language respectively. The researcher set an alpha level of .05 for all statistical tests. Statistical Package for Social Sciences (SPSS) version 24 software was utilised for data analysis of this study.

### 4.3.1 The longitudinal effects of treatment, gender, SES and language on reading comprehension.

The first research question sought to determine the differences in reading comprehension performance between treatment groups, gender, SES and home language over time. As illustrated in Table 6, there was a statistically significant difference between EFL and EAL learners on reading comprehension.

Table 6

*The Effect of Treatment, Gender, SES and Language on Reading Comprehension*

| Variable | *df* | *F* | *p* |
|---|---|---|---|
| Treatment | 1.392 | 0.97 | 0.33 |
| Gender | 1.392 | 0.17 | 0.68 |
| SES | 1.392 | 0.02 | 0.88 |
| Language | 1.392 | 8.64 | 0.003* |

*Indicates significance at the 0.05 level ($p<0.05$)

Although the mean scores for all variables were higher, only that of language was significant in terms of the effect this has on reading comprehension. This suggests that the learners' treatment group, gender and SES do not influence performance on reading comprehension tasks over time.

Learners who speak English as a First Language (*M T1*= 32.3, *SD T1*= 15.8; *M* T2= 37.3, *SD* T2= 15.3) performed significantly better than those who speak English as an Additional Language (*M* T1= 30.8, *SD* T1= 13.5; *M* T2= 33.5, *SD* T2= 13.3), $F(1.392)= 2545.7$, $p< .001$.

### 4.3.2 The longitudinal effects of treatment, gender, SES and language on road noise annoyance reactions.

The second research question sought to determine the differences in road noise annoyance reactions between treatment groups, gender, SES and home language over time. The results presented in Table 7 indicate that only the treatment group to which learners belong has a significant effect on the annoyance of learners when exposed to road noise. Learners from the experimental group (*M T1*= 2.52, *SD T1*= 0.67; *M* T2= 2.28, *SD* T2= 0.66) experienced a significant reduction in annoyance reactions than those from the control group (*M T1*= 2.03, *SD T1*= 0.59; *M* T2= 2.23, *SD* T2= 0.63), $F(1.392)= 4.33$, $p< .05$.

Table 7

*The Effect of Treatment, Gender, SES and Language on Road Noise Annoyance*

| Variable | *df* | *F* | *p* |
|---|---|---|---|
| Treatment | 1.392 | 4.33 | 0.038* |
| Gender | 1.392 | 0.57 | 0.451 |
| SES | 1.392 | 1.85 | 0.174 |
| Language | 1.392 | 1.61 | 0.205 |

*Indicates significance at the 0.05 level (p<0.05)

### 4.3.3 The longitudinal effects of treatment, gender, SES and language on aircraft noise annoyance reactions.

The third research question sought to determine the differences in aircraft noise annoyance reactions between treatment groups, gender, SES and home language over time. As illustrated in Table 8, there was a statistically significant difference between experimental and control groups, as well as between EFL and EAL learners, in annoyance reactions to aircraft noise.

Learners from the experimental group (*M T1*= 2.81, *SD T1*= 0.70; *M* T2= 2.43, *SD* T2= 0.64) experienced significantly less annoyance than those from the control group (*M T1*= 1.96, *SD T1*= 0.59; *M* T2= 2.13, *SD* T2= 0.70), *F(*1.392)= 19.47, *p*< .001.

Learners who speak English as a First Language (*M T1*= 2.28, *SD T1*= 0.77; *M* T2= 2.11, *SD* T2= 0.70) experienced significantly less annoyance than those who speak English as an Additional Language (*M* T1= 2.56, *SD* T1= 0.75; *M* T2= 2.46, *SD* T2= 0.63), *F(*1.392)= 15.05, *p*< .001.

Table 8

*The Effect of Treatment, Gender, SES and Language on Aircraft Annoyance*

| Variable | *df* | *F* | *p* |
|---|---|---|---|
| Treatment | 1.392 | 19.47 | 0.000* |
| Gender | 1.392 | 2.22 | 0.137 |
| SES | 1.392 | 0.06 | 0.810 |
| Language | 1.392 | 15.05 | 0.000* |

*Indicates significance at the 0.05 level (p<0.05)

### 4.3.4 The longitudinal effects of treatment, gender, SES and language on coping with background noise.

Table 9 indicates the effect of treatment, gender, SES and home language on coping. The fourth research question sought to determine the differences in coping with noise between treatment groups, gender, SES and home language over time.

According to these results, the only variable that was significant in terms of the effect on the coping of learners when exposed to background noise, was the treatment group. Learners from the experimental group *(M* T1= 2.25, *SD* T1= 0.61; *M* T2= 2.04, *SD* T2= 0.60) were able to cope significantly better than those from the control group (*M* T1= 1.88, *SD* T1= 0.59; *M* T2= 1.92, *SD* T2= 0.54), F(1.392)= 23.58, *p*< .001.

Table 9

*The Effect of Treatment, Gender, SES and Language on Coping*

| Variable | *df* | *F* | *p* |
|---|---|---|---|
| Treatment | 1.392 | 23.58 | 0.000* |
| Gender | 1.392 | 0.20 | 0.659 |
| SES | 1.392 | 0.15 | 0.697 |
| Language | 1.392 | 0.05 | 0.825 |

*Indicates significance at the 0.05 level (p<0.05)

# CHAPTER FIVE: DISCUSSION

## 5.1 Overview of Chapter

This study aimed to look at the longitudinal effect of the following variables, namely, treatment, gender, socio-economic status and language, on children's reading comprehension, annoyance reactions to road and aircraft noise exposure, and coping. The results thereof, as outlined in the previous chapter, are interpreted and discussed in the context of the literature reviewed in Chapter Two. The first section of this chapter will discuss each of the aforementioned variables and its effect on reading comprehension, annoyance reactions to road and aircraft noise and coping. Thereafter, the strengths and limitations of this study will be discussed, as well as the implications for future research within this field.

## 5.2 The Longitudinal Effects of Treatment, Gender, SES and Language on Reading Comprehension

The first research question sought to determine the longitudinal effects of treatment, gender, SES and language on children's reading comprehension. The only variable that had a significant impact is language, specifically, EFL learners performed significantly better than EAL learners. This is consistent with that of Völkel et al. (2016), although that study only looked at the effect of language at one point in time. Nonetheless, this suggests that learners perform better on reading comprehension tasks that are administered and completed in their native language (Völkel et al., 2016). Thus, perhaps one could postulate that this effect would remain significant over time, which the current study confirms. The current findings also corroborate other studies (Seabi et al., 2012; Lervåg & Aukrust, 2010). The latter authors state that because L2 learners on average have a poorer command of the L1 language they are learning in, their linguistic comprehension suffers and they will therefore be at risk of reading comprehension difficulties. The current study affirms this statement.

Furthermore, they suggest that a learner's reading comprehension skill delay may be attributed to the limitations of their vocabulary, which may very well be the case with the EAL sample of the current study. The current study is also in agreement with Burgoyne et al. (2011) who indicated that both monolingual and bilingual children progressed from a South African-equivalent grade 2 to grade 3, but with greater progress made by the EFL children. This is consistent with Droop and Verhoeven (2003), who demonstrated lower performance among EAL learners than their EFL counterparts over time, and

Hutchinson et al. (2003), who found that there was a significant EFL advantage on the measure of reading comprehension over time.

Treatment did not appear to have a significant effect on the learners' reading comprehension over time. This is inconsistent with Stansfeld et al. (2005) who indicated that aircraft noise is related to impaired performance in reading comprehension; children exposed to higher aircraft noise levels in school scored significantly lower on the reading comprehension test than children in exposed to schools with lower aircraft noise.

SES and gender were also not significant in their effect on the learners' reading comprehension over time. Völkel et al. (2016) found that at one point in time, children from a lower SES performed better than those from a high SES however, it is of vital importance to note that this was the case for only the first year of testing. The current study corroborates Maynard (2012), who found there was no significant difference in reading comprehension performance over time between those learners who had a low SES and those who did not. Conversely, this study is inconsistent with Droop and Verhoeven (2003), and Belfi et al. (2014), who found that success in reading comprehension is related to learners' SES and that in particular, higher SES learners perform better than those with a lower SES over time. This discrepancy can perhaps be attributed to the fact that literacy is affected by the interaction between socio-economic inequalities and multilingualism in South Africa. This is corroborated by Hipfner-Boucher et al. (2015), as well as D'Angiulli, Siegel and Maggi (2004), who found a double jeopardy in being disadvantaged and learning in one's second language. Learners in South Africa perhaps compensate for either of the jeopardies, i.e. having a lower socio-economic status and learning in one's second language, which may then contribute to equal performances in reading comprehension over time between those learners who have a low SES and those who do not.

With regards to gender, the current study validated the results found by Völkel et al. (2016), which indicated that learners' gender does not influence performance on reading comprehension tasks (at one point in time) Similarly, Roth et al. (2002) concluded that gender did not appear to be a significant predictor of grade 1 and grade 2 reading comprehension skills. The current study however, did not corroborate that of Logan and Johnston (2010), who found that gender does play a significant role in reading comprehension; females perform better on reading comprehension tasks than their male counterparts. The current study is also inconsistent with that of Entwisle et al. (2007), which indicated that although boys and girls begin grade one with approximately equal reading scores, a significant

gender gap develops by grade 5 with girls scoring considerably higher on reading tasks than boys. This influence of gender was not the case in the current study.

In summary, the current findings demonstrated that only language has a significant impact on reading comprehension performance. EFL learners performed significantly better than EAL learners. Treatment, gender and SES were not significant in their effect on the learners' reading comprehension, although mixed results have previously been found when studying these variables. Thus, it can be suggested that further studies are necessary in order to conclusively determine the impact that noise exposure, gender and SES have on a child's reading comprehension performance.

### 5.3 The Longitudinal Effects of Treatment, Gender, SES and Language on Road and Aircraft Noise Annoyance Reactions

The second and third research questions investigated the longitudinal impact of treatment, gender, SES and language on children's annoyance reactions to road and aircraft noise. The results indicated that the experimental group was less annoyed to road and aircraft noise than the control group over time. This corroborates conclusions drawn by Ristovska et al. (2004) who found that exposure to chronic noise is not subjectively stressful or annoying over time.

However, this is contrary to that of Seabi (2013) who found that children who were exposed to chronic aircraft noise continued to experience significantly higher annoyance than their counterparts even after the removal of the noise source. However, the current study only looked at the years 2009 and 2010, and perhaps if further investigation occurred, similar results would be found. Perhaps the results of the current study can be attributed to the fact that these learners were exposed to noise during the first testing period in 2009, after which much relief and less annoyance was experienced when the noise was absent following the relocation of the Durban International Airport in 2010. Additionally, although aircraft noise ceased in 2010, road noise was not directly measured nor controlled for and thus perhaps this continued to annoy the learners in the control group in 2010. Interestingly, although insignificant, the control group for both road and aircraft noise annoyance reactions measurements actually experienced increased annoyance over time. This is inconsistent with the postulations of Seabi (2013) and van Kempen et al. (2009) who demonstrated that annoyance reactions remain higher over time for children exposed to noise in comparison to those who are not. Furthermore, the results of the current study are also inconsistent with that of Haines et al. (2001) who found that children exposed to higher aircraft

noise levels in school reported significantly higher annoyance than children in schools with lower aircraft noise exposure. Similarly, Banerjee (2013) found that long-term noise exposure is associated with increased annoyance when compared to non-exposed individuals. A possible explanation for this inconsistency is that there may have been inaccurate filling out of the child questionnaire due to fatigue and/or boredom, a different perception of the noise annoyance a year later and/or a different understanding of the questions being asked.

Although both road and aircraft noise annoyance reactions reduced over time in the current study, more annoyance was experienced from aircrafts at both times of testing. This finding corroborates that of Beutel et al. (2016) who indicate that in general, aircraft noise is found to be more annoying than other sources of noise; and van Kempen (2009), who found that the association with annoyance in children is stronger for aircraft than for road noise. This may be the case because it is possible that aircraft noise has a greater effect on children's annoyance than road traffic noise because of its intensity, variability and unpredictable nature in comparison with road traffic noise (van Kempen et al., 2009).

The importance of removing noise sources, or being removed from them, is evident in this study. When removed from the noise sources, people experience less annoyance and mental health-related issues such as depression and anxiety (Beutel et al., 2016). Although the current study did not look at mental health-related issues concerning noise annoyance and coping therewith, it did find a reduction in noise annoyance reactions, which is consistent with Beutal et al. (2016). Janssen et al. (2011) found a significant increase in annoyance at a given level of aircraft noise exposure over the years, which may lead to impaired (mental) health. Thus, the results of the current study indicate that when removed from road and/or aircraft noise, less annoyance is experienced, which may continue to reduce over time thereby reducing the risk of cognitive and emotional-related complaints (Beutel et al., 2016).

In terms of aircraft noise exposure, language also had a significant effect on annoyance reactions. EFL learners experienced less annoyance than EAL learners over time. This may be attributed to the fact that the child questionnaire was administered in English, and perhaps there was better understanding by the EFL learners of what was being asked. After all, Seabi et al. (2012) postulated that learners who learn in a second language would perform poorly in comparison to those learning in their first language, which might have been the case in the current study. However, language was not a significant factor when completing the road noise annoyance section of the questionnaire, which is essentially very similar to

that of the aircraft noise annoyance section, therefore the interpretation of this notion should be judiciously considered.

Gender and SES did not appear to have a significant effect on the children's annoyance reactions to road and aircraft noise over time. Relating to gender, this is inconsistent with results found by Banerjee (2013) who stated that females present with significantly higher annoyance levels than males. They attributed this to gender differences in biological characteristics as well as the fact that females tend to spend more time in study areas in close proximity to noise sources. With regards to SES, one might postulate that perhaps either low or high SES learners would experience more annoyance than the counterpart due to a variety of environmental and/or genetic protective factors, such as resilience, which would contribute to a child's ability to cope or not.

### 5.4 The Longitudinal Effects of Treatment, Gender, SES and Language on Coping with Background Noise

Lastly, this research aimed to determine the longitudinal effect of treatment, gender, SES and language on children's ability to cope with background noise. As highlighted above, the experimental group was less annoyed with road and aircraft noise over time. Interestingly, this was also the only group that was able to cope better with background noise over time; which may be indicative of the increased resilience of these learners having previously been exposed to noise. Perhaps resilience can be related to emotional adjustment which, in that case, this result is consistent with that of Beutel et al. (2016); annoyance induces stress, which in turn may precipitate or even worsen already existing depression and anxiety disorders. When the noise source is removed, however, stress appears to reduce, which in turn allows one to cope better. This appears to be the case in the current study, which also corroborates findings by Goldschagg et al. (2014) and Haines et al. (2003) who both found that children in noisy environments develop more coping mechanisms than those from quieter environments, and these coping mechanisms assist them to cope better with noise. Conversely, the results of the current study are inconsistent with Haines et al. (2001) who found that children within the vicinity of aircraft noise had higher levels of psychological distress, which is suggestive of decreased coping abilities.

The increase in coping by the experimental group in the current study might also be attributed to nonacoustical factors such as noise sensitivity, attitudes toward the noise source, perceived control and expectations (van Kempen et al., 2009; Stallen, 1999); due to the previous exposure to noise in

comparison to the control group, who had no previous noise exposure. This is consistent with that of Haines et al. (2003) who found that different noise sources were associated with different emotions. The noise sources that elicited positive emotions were coped with more easily.

As with annoyance reactions to road and aircraft noise, when it comes to coping therewith, the control group coped worse over time (although this was not significant). This is interesting and unexpected, but once again, perhaps this can be attributed to learner fatigue and/or boredom when completing the child questionnaire (this section was the very last section of the questionnaire), a different perception of the noise a year later, a different understanding of the questions being asked and/or continued annoyance with road noise which was not directly measured nor controlled for.

Gender, SES and language did not appear to have a significant effect on the learners' ability to cope with background noise over time. There is very limited research on the effects thereof and perhaps this in itself corroborates the current findings and conclusion in that further exploration into these variables and coping need be done.

### 5.5 Strengths of the Current Study

The findings of this study provide awareness into the possible effects of personal and socio-cultural factors on reading comprehension, annoyance reactions to road and aircraft noise and coping. The reasonably large sample size allowed for generalisability and observed significant differences. Looking at the effect of any variable on another over time is more valuable than looking at this at only one point in time. This study looked at reading comprehension scores, annoyance reactions and coping data at two points in time, which were then analysed and used to draw conclusions. Thus, this provided more valuable insight.

The fact that this study looked at both the annoyance reactions to and coping with background noise (road and aircraft noise) allows for insight into the associated resilience and mental health of learners.

The consideration of the academic as well as emotional implications that language and noise exposure have on reading comprehension, annoyance reactions and coping revealed and highlighted the need for educational policy implementation, standardised testing tools to meet the needs of our multi-linguistic nation and an important consideration of the emotional adjustment of learners.

## 5.6 Limitations of the Study

The results of this study should be read in the context of the following limitations. Although the sample size was relatively large, due to the need for participants to have participated in all measurements in both 2009 and 2010, it was reduced to almost half of the original size. Being an archival study has limitations in itself. Any issues in the collection of data were not in the researcher's control.

The validity of the learner information provided by the parents or learner themselves may also limit this study in terms of the accuracy of filling out the socio-demographic questionnaire; specifically with regards to receiving or not receiving free meals, which was used to determine the socio-economic status of the learner. In addition, the reliability of the learner responses in the annoyance reactions and coping sections of the biographical questionnaire may also limit the accuracy of results presented in this report. A factor contributing to this includes, for example, learners getting increasingly tired or bored as they filled out the biographical questionnaire. Although the language variable was differentiated as either EFL or EAL, a variety of languages indeed make up EAL, and thus generalisability of the study is limited.

Lastly, road noise itself was not measured which limits the knowledge of the effect of this noise type alone. Furthermore, although aircraft noise was removed, road noise was not removed which may then have continued to have an impact on learners' reading comprehension, annoyance reactions and coping.

## 5.7 Implications for Future Research and Recommendations

The findings of this study lend to suggestions for future studies in this field. As implicated by Völkel et al. (2016), the tool to measure reading comprehension, be it the SRS 2 or an alternate tool, needs to be standardised and administered in more than one language, which will ensure increased reliability and validity of reading comprehension scores. Further to this, perhaps the language variable needs to be dissected into every single language spoken by the learners, and comparisons made on reading comprehension performance between these languages, over the three-year period. Lastly, with regards to the child questionnaire measurement tool and possible fatigue and/or boredom when completing this, alternating the order in which questions are asked at each testing time might be something to consider for future longitudinal research.

The effect that noise exposure has on the emotional adjustment and resilience of learners exposed thereto is important to consider, and further research into this can be considered. A child's emotional adjustment and resilience has an impact on their academic performance which is why research into this is important to consider.

This study only looked at noise exposure annoyance reactions and coping with noise at school, yet data was available for these occurring at home, which can be investigated and compared to the school data. This would yield interesting results for comparison between noise exposure annoyance reactions and coping with noise at school versus at home.

In order to determine the effects of treatment, gender, socio-economic status and language on reading comprehension, annoyance reactions to noise and coping over additional time, further investigation into each of these variables at all three points in time of measurement could be done.

Lastly, it would be interesting to consider the role of the educator and the impact that background noise has on their teaching and their own ability to cope. The teacher plays an integral role in the academic performance of children and their optimal functioning and coping is necessary for a child's academic success.

### 5.8 Conclusion

This study aimed to examine the longitudinal impact of treatment, gender, socio-economic status and home language on reading comprehension performance, annoyance reactions to road and aircraft noise and coping in a sample of primary school learners in KwaZulu-Natal. The Suffolk Reading Scale 2 was used as a measure of reading comprehension. The child questionnaire was used to obtain relevant biographical data, as well as annoyance reactions to road and aircraft noise exposure, and coping skills. This took place over a period of three consecutive years however, only the first two years of measurements were utilised for the purpose of this study.

The results of this research indicate that reading comprehension, noise annoyance reactions and coping are indeed affected by a variety of variables, of which previous exposure to aircraft and road noise and home language appear to be the most significant. Given the diversity of cultures and languages in South Africa, as well as the variety of noise sources school-aged children are exposed to, one needs to consider

the standardisation and normalisation of assessment tools and potential academic, emotional and health risks respectively.

In terms of gender, it can be noted that females generally perform better on reading comprehension tasks, experience less annoyance reactions to road and aircraft noise and cope better, although not significantly so. Lastly, socio-economic status appears to play a varying (insignificant) role in reading comprehension performance, annoyance reactions and coping.

Regardless of the significance or insignificance of these factors, they all attribute to academic performance, annoyance reactions and coping, and thus an understanding thereof is beneficial to the education of South African youth. Education and resilience will hold a learner steadfast in the achievement of future goals and success. Awareness into the remediation of hindering factors, such as language and noise exposure, can create constructive learning environments and increased adjustment of youth from marginalised backgrounds and communities.

### 5.9 Key Points

- This study explored the longitudinal effects of treatment, gender, socio-economic status and home language on reading comprehension performance, annoyance reactions to road and aircraft noise and coping therewith in primary school children in South Africa.
- Home language plays the most significant role in reading comprehension performance.
- Treatment plays the most significant role in road and aircraft annoyance reactions. Home language also plays a role in aircraft annoyance reactions.
- This study provided support that gender and socio-economic status are not significant predictors of reading comprehension performance, background noise annoyance reactions or coping therewith in primary school children.
- Evidence does, however, suggest that first language English learners perform better on English reading comprehension tasks, thereby highlighting the importance of language spoken at home, and are less annoyed by aircraft noise.
- Furthermore, previous exposure to road and aircraft noise (treatment) appears to contribute to an increased resilience when later exposed to and coping with these noises.
- Assessing learners in their dominant language may provide more accurate insight into academic performance.

- The resilience of children exposed to noise, and the effect this has on their academic performance and overall coping, is also of importance to consider.

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**Appendices**

Appendix 1: Child questionnaire

**Code**_____

**Date**_____

**Level A**_____

# Questionnaire for children

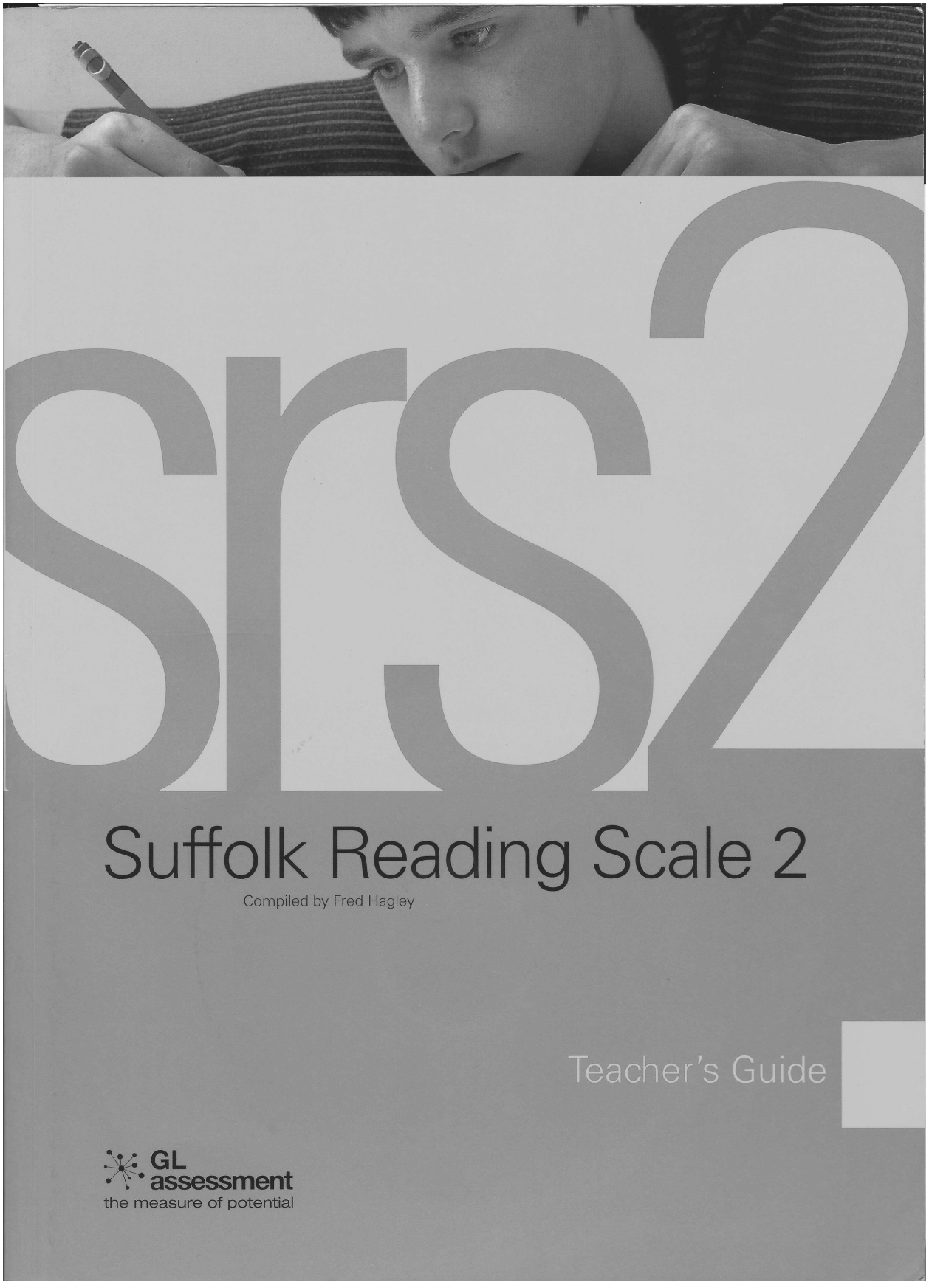


Your answers are **CONFIDENTIAL** .
They will **NOT** be seen by your parents, carers or teachers.

**Everyone's** views are very important to us so please try to complete this questionnaire **without talking**.

If you need someone to help you **put your hand up** and a monitor will come over to you.

Appendix 2: Suffolk Reading Scale 2 (SRS2)



Appendix 3: Non-Medical Ethics Application Form

**UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG**

**HUMAN RESEARCH ETHICS COMMITTEE (SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT**

| | |
|---|---|
| **CLEARANCE CERTIFICATE** | **PROTOCOL NUMBER: MEDP/16/003 IH** |
| **PROJECT TITLE:** | The longitudinal effect of home language, socio-economic status and gender on primary school children's reading comprehension and annoyance reactions to aircraft noise exposure, in KwaZulu-Natal, South Africa. |
| **INVESTIGATORS**<br>**DEPARTMENT** | Volkel Gabriela<br>Psychology |
| **DATE CONSIDERED** | 30/05/16 |
| **DECISION OF COMMITTEE*** | Approved |

**This ethical clearance is valid for 2 years and may be renewed upon application**

**DATE: 30 May 2016**

**CHAIRPERSON**
**(Prof. Brett Bowman)**

cc Supervisor: Dr Zaytoon Amod
Psychology

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**DECLARATION OF INVESTIGATOR (S)**

To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure, as approved, I/we undertake to submit a revised protocol to the Committee.

**This ethical clearance will expire on 31 December 2018**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES