

**DETERMINING AND SUPPORTING THE READING
COMPREHENSION AND METALINGUISTIC
ABILITIES OF UNDERGRADUATE PRE-SERVICE
TEACHERS**

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The material presented in this thesis does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material published or written by another person except where due reference is made in the text.

The research reported in this thesis has been approved by the University of Canterbury Educational Research Human Ethics Committee.

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“Success is not final, failure is not fatal: it is the courage to continue that counts.”

~ Winston Churchill

Embarking upon a PhD is frequently referred to as a ‘journey’; an analogy that I have often rebuked. The inevitable, however, can only be fought against for so long and I find myself with no more appropriate description of my PhD study. It has been a period of many ongoing challenges, and I cannot attribute my ability to overcome these challenges to myself alone. I am incredibly grateful to many wonderful people who have provided me with the support to complete this ‘journey’. Firstly, Dr Dean Sutherland for convincing me to consider undertaking a PhD, and for teaching me to believe in myself. Your support and mentorship have been invaluable. Secondly, my sincere thanks to Dr Brigid McNeill for sticking with me from the first day through to the very last. You have helped me overcome some of the most difficult challenges, and I am not sure I would be at this point without your support when I needed it most. I have learnt so much from you. Finally, I would like to extend my thanks to Professor John Everatt for sharing your expertise and guiding me through the latter half of my PhD. I am forever grateful that you joined my supervisory team.

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- *Caralyn Purvis*

ABSTRACT

Pre-service teachers have a large role to play in initiatives to raise children's literacy achievement. There is growing concern about the disparity of reading abilities of children, particularly in New Zealand, prompting a greater need to examine the skills and knowledge of the adults who provide reading instruction to these children. Adults engaged in higher education are typically expected to possess strong and proficient literacy skills, yet research examining the literacy skills of the broader adult population reports adult literacy levels to be much lower than assumed. Well over a third of adults in countries including the United States of America and New Zealand do not possess basic literacy skills. There is a paucity of research identifying and addressing the literacy needs of the adult population. Further, there have been limited studies investigating the literacy abilities of adults with relatively higher levels of literacy skill (e.g., those in higher education). Such research is particularly pertinent in the education context due to the influence that teaching professionals have on future generations of readers.

The research reported in this thesis investigated the reading comprehension and metalinguistic abilities of pre-service teachers, and conducted two interventions within this population. The first intervention focussed on improving the reading comprehension of individuals who presented with difficulties understanding written text relative to their peers. The second intervention provided explicit instruction in building students' language structure knowledge within general coursework completed by a whole cohort of pre-service teachers. The findings from this thesis have implications for the provision of support for pre-service teachers with literacy needs in higher education, as well as for augmenting the skills of the

broader pre-service teacher population to prepare them to deliver evidence-based reading instruction.

The first study (presented in Chapter Four) assessed selected cognitive and literacy skills of a cohort of undergraduate pre-service teachers in their initial year of higher education. One-hundred and thirty-one students completed an assessment battery comprising tasks of spelling, reading comprehension, inferencing, working memory, and knowledge of language structure. Analysis of results demonstrated a wide range of abilities across each of the measures, reflecting the large variance in skill with which these individuals enter into higher education. Spelling, inferencing, and working memory were each found to make significant unique contributions to reading comprehension. Furthermore, the elements contributing towards reading comprehension were found to be highly interactive, thus demonstrating the complex interactive nature of the skills that contribute to the reading comprehension process in these individuals.

In the second study (presented in Chapter Five) individuals with difficulties understanding written text were identified using the reading comprehension measure from the first study. Individuals who performed more than one standard deviation below the group mean were identified for inclusion in a reading comprehension intervention. Seventeen individuals met the criteria for inclusion in the intervention and consented to participate (referred to as the IN group). Two control groups were also identified to allow for comparisons to be made pre- and post-intervention. The first control group, referred to as the NT group ($n = 6$), comprised of six participants who qualified for the intervention but who opted not to participate. The second control group, referred to as the CN group ($n = 83$), comprised of the remaining students from the large cohort. Four different strategies designed to assist with reading comprehension were modelled and practiced with each participant in the IN group over four sessions. Each intervention session focussed on one strategy alone and

the intervention was administered on an individual basis. Reading comprehension and summarising assessments were completed following every session to ascertain the effectiveness of each strategy. Results showed that the first strategy (text-to-speech) was detrimental to the participants' reading comprehension scores, while a further strategy (highlighting and summarising) was beneficial for almost all participants. There was a significant gain in reading comprehension score by the IN group after completing the intervention. Neither the NT nor the CN group, however, made any improvement in reading comprehension over this time period. The results also demonstrated that the improvement made by the IN participants increased their mean reading comprehension score to within range of the CN group (i.e., their peers identified with typical ability at the outset of the study).

A third study (presented in Chapter Six) examined the responsiveness of the intervention participants to the reading comprehension intervention at a subgroup and individual level. Four subgroups of participants were identified based on their underlying literacy profile at the outset of the intervention. The first group ($n = 2$) comprised individuals with poor spelling; the second ($n = 4$), individuals with poor listening comprehension; the third ($n = 1$), those with poor spelling and listening comprehension; and the fourth ($n = 10$), individuals who did not demonstrate poor spelling or listening comprehension. There were no differences in the responsiveness of these groups to the four different strategies. There was also no association between an individual's literacy profile and their response to the various strategies. Furthermore, closer examination of four case studies (one from each of the four subgroups) did not demonstrate any clear relationship between the responsiveness to the four different reading comprehension strategies, and their literacy profile.

Finally, the fourth study (presented in Chapter Seven) examined the responsiveness of the whole cohort ($n = 121$) to a teaching intervention targeting metalinguistic knowledge.

Two subgroups were identified within the larger cohort based on participants' word-level skill (determined by spelling ability): good spellers ($n = 24$), and poor spellers ($n = 24$). Two subgroups were also identified based on participants' comprehension-level skills (determined by reading comprehension): individuals with difficulties understanding written text ($n = 22$), and individuals with typical reading comprehension ($n = 99$). The metalinguistic intervention was integrated into an existing literacy course and delivered over seven weeks. The intervention focussed on raising phoneme, morpheme, and orthotactic knowledge amongst the participants in a pre-test / post-test study design. The whole cohort demonstrated significant gains in knowledge in each of the constructs targeted, after just seven hours of teaching integrated into an existing course. Analysis of subgroups of participants demonstrated that individuals with stronger spelling skills responded more favourably to the intervention than their peers with weaker spelling skills. The between-groups differences identified in the subgroups determined by reading comprehension were not as significant as those of the spelling subgroups. Thus, the results suggest the need for differentiated teaching of metalinguistic constructs based on the underlying word-level skills of each individual to ensure that pre-service teachers acquire adequate language structure knowledge within their teacher preparation programme.

The findings from this thesis refute the assumption that individuals who meet the criteria required to enter into higher education present with strong or adequate literacy skills. The pre-service teachers in the reported studies demonstrated a wide range of literacy ability. The results of this assessment identified spelling, inferencing, and working memory as significant predictors of reading comprehension. The appropriateness of the Simple View of Reading framework for this population was also investigated. Individuals who demonstrated lower reading comprehension showed significant increases in their reading comprehension scores when using a strategy that incorporated highlighting and summarising techniques. This

strategy was highly effective across the whole intervention group, in spite of the vast differences in the literacy profiles of these individuals. Findings from a whole-cohort teaching intervention to raise metalinguistic knowledge provide support for the inclusion of differentiated, explicit teaching of these constructs within pre-service teaching programmes. The results reported in this thesis show that by providing targeted intervention to raise the reading comprehension and metalinguistic abilities of pre-service teachers, they become better equipped to provide effective reading instruction for children, and address the disparity in children's literacy achievement.

PRESENTATIONS ARISING FROM THIS THESIS

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CHAPTER ONE

INTRODUCTION AND OVERVIEW OF THE THESIS

1.1. Introduction

The challenge of understanding written text is one that is encountered by children and adults alike. When learning to read, a child must not only be able to decode and identify the words that they see, but they must also be able to understand the information that those words convey. For most children, reading acquisition is a straightforward process they are able to tackle with ease. For others, however, the task can be difficult, complicated, and frustrating. Many of these children subsequently experience lifelong reading difficulties that transcend into adulthood. Yet, despite approximately one in six adults worldwide being classified as illiterate (Archer, 2005), the research investigating the literacy skills and needs of the adult population is relatively sparse.

The ultimate goal of reading is to comprehend what has been read (Nation, 2005; Paris & Hamilton, 2009), and the process of reading comprehension is complex, involving the acquisition and mastery of many different skills. Attempts have been made to explain and understand the process of reading comprehension through the use of theoretical models, ranging from simple models such as the aptly named Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) to more complex models such as the construction-integration model (Kintsch, 1988). Further, information processing models have shown how various component skills combine to result in reading comprehension, demonstrating a compensatory method whereby readers compensate for weak skills by using skills in which they have strengths (Paris & Hamilton, 2009). Pertinent theoretical models of reading

comprehension will be outlined and discussed in Chapter Two of this thesis to provide a framework for the subsequently reported studies.

Reading acquisition has been predominantly explained and described through the assessment of children's reading abilities. Although much research has been undertaken with children in the early years, an increasing number of studies have examined the reading comprehension skills of older students such as upper elementary age (Flynn, Zheng, & Swanson, 2012; Wanzek, Wexler, Vaughn, & Ciullo, 2010), middle and high school students (Calhoon, 2005; Vaughn et al., 2010; Vaughn et al., 2014). Adolescent literacy has received much greater attention in recent years, with research including commissioned meta-analyses (Biancarosa & Snow, 2004; Moore, Bean, Birdyshaw, & Rycik, 1999), assessment and examination of adolescents' reading comprehension skills (J. Cohen, 2007), as well as intervention and instruction of reading (Alvermann, 2002; Calhoon, 2005; Lovett, Lacerenza, & Borden, 2000). While this increase in research into older children has provided greater insight into the development of reading over the early lifespan, it has yet to be extended to a strong focus on the adult population.

It is arguable that some individuals who continue to experience difficulties understanding written text beyond childhood have been able to compensate somewhat for their weaknesses in reading comprehension. Such individuals may not demonstrate clear difficulties with reading comprehension, and may even enter into higher education. Tertiary study is a cognitively and linguistically challenging environment (Cogmen & Saracaloglub, 2009) that may highlight difficulties understanding written text that have previously been undetected. Even successful high school graduates can find that they do not have the reading experience required to manage the text-based study required of them in higher education (Parr & Woloshyn, 2013). But while an increased amount of research has investigated the

assessment and intervention of reading comprehension abilities in childhood, research pertaining to the adult population remains relatively scarce.

Examination of the reading abilities of adults has largely been confined to those who access basic education services. Adults who access these services typically read up to or below the eighth-grade level. In a similar manner to the initial research undertaken with children, these adult studies have predominantly focussed on lower-level literacy skills such as fluency, and in particular, decoding (e.g., Alamprese, MacArthur, Price, & Knight, 2011; Sabatini, Shore, Holtzman, & Scarborough, 2011). Studies investigating the efficacy of reading comprehension intervention for adults accessing basic education services have reported some improvements in skills. Intervention gains, however, have been relatively small given the intensive nature of the interventions explored (Alamprese et al., 2011; Greenberg et al., 2011). It is apparent that there is a lack of understanding surrounding the reading comprehension needs of this population (and adults in general), in addition to the challenge of identifying effective methods of intervention. Many adults who require support, however, do not present with such transparent literacy difficulties and this often remain unnoticed and unsupported.

Despite many students leaving secondary school education without adequate literacy skills to allow them to access higher education (Armbruster et al., 1991), an increasing number of jobs require post-secondary education (Kutner et al., 2007), and the number of students entering higher education worldwide is also increasing (Williams, Ari, & Santamaria, 2011). Students who enter into higher education present with a wide range of literacy abilities, and despite having adequate literacy skills to 'get by' in their school-education, the demands of higher education can sometimes be too much for some individuals. Little attention has been paid to adults who do not present with immediately identifiable risk factors but still have literacy difficulties.

One group of individuals in higher education for whom reading comprehension and literacy is of extreme importance is pre-service teachers. Not only are pre-service teachers required to have strong literacy skills themselves (Harper & Rennie, 2008), they are also required to teach the skill of reading and its constituent parts to their students (Moats, 2009). Whilst there is now a clear understanding of the need to explicitly teach pre-service teachers how to provide reading instruction to their students (Buckingham, Wheldall, & Beaman-Wheldall, 2013; Coltheart & Prior, 2006; National Reading Panel, 2000), there has been little suggestion as to what this should entail, and how to implement this teaching within a higher education environment. Furthermore, whilst Moats (2009) states that she has '*learned to make no assumptions about teachers' prior knowledge*' (p.392) with regard to their knowledge of language structure and reading instruction, it would seem that assumptions are still being made that pre-service teachers possess competent reading comprehension skills. There has been little research investigating the level of reading comprehension skills of this group, and given that 43 percent of adults in the U.S. and 44 percent of New Zealand adults possess only very basic literacy skills (Kutner et al., 2007; Satherley, Lawes, & Sok, 2008) it is questionable whether this pre-service teacher population is as literate as may be implicitly assumed.

The Current Research

This thesis reports four studies designed to investigate the literacy abilities of adult students in higher education (undergraduate pre-service teachers); and more specifically their ability to understand written text. Findings from an experimental intervention study with the goal of (1) increasing levels of reading comprehension and (2) ascertaining which of four reading comprehension strategies is most effective amongst this population are also discussed. Furthermore, the effectiveness of general coursework targeted at improving

language structure knowledge of pre-service teachers' with relatively strong and weak word-level and comprehension-level literacy skills is reported. The following content provides an overview of the research methodologies utilised in the four studies completed.

1.2. Study One: Assessing Selected Literacy Skills of Undergraduate Pre-service Teachers on Entry into Higher Education

This study assessed selected literacy skills within a cohort ($n = 131$) of initial year undergraduate pre-service teachers. The goal of this study was to identify the relative literacy strengths and weaknesses present in this adult population, and determine predictors of reading comprehension amongst the selected measures utilised. An assessment battery was developed and piloted for use with this population (see Chapter Three). This study examined the contribution of measures of spelling, inferencing, language structure knowledge, and working memory, to reading comprehension within this population. Results demonstrated a broad range of ability amongst these participants, indicating the heterogeneous nature of this group's literacy skills. Further analyses from this study found that of the included measures, the strongest predictor of reading comprehension was inferencing, while spelling and working memory also made their own unique contributions to reading comprehension ability. These findings are discussed within the framework of the Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990).

1.3. Study Two: An Investigation of the Effectiveness of Reading Comprehension Strategies for Pre-service Teachers with Difficulties Understanding Written Text

Using the results obtained in Study One (Chapter Four) this study identified participants who presented with difficulties understanding written text relative to their peers. Twenty-six students met the criteria for participation, 17 of whom consented to participate in

an intervention (the IN group) which included instruction in the use of four strategies to improve reading comprehension. Six students who qualified for the intervention but who opted not to participate acted as a no-treatment comparison group (NT). The remaining students from the large cohort formed a control group (CN; $n = 83$). Pre- to post-intervention assessment demonstrated a significant increase in the IN group's mean scores following the intervention. This increase in score reflected a very large effect for the overall change. Comparatively, neither the NT nor the CN group demonstrated a significant increase in their reading comprehension score during this period. Furthermore, following intervention, the IN group raised their reading comprehension to within range of the CN group, while the scores of the NT group remained significantly lower.

Results showed that a text-to-speech strategy was detrimental to the IN group's reading comprehension scores from pre- to post-intervention. The strategies of key words, mind maps, and highlighting and summarising, all demonstrated significant increases in group mean score from the pre-intervention assessment point. Utilisation of a highlighting and summarising strategy was most effective, with the change in score reflecting a very large effect size. These findings have important implications for how to raise the reading comprehension skills of adults in higher education who may present with difficulties understanding written text within this context.

1.4. Study Three: Analysis of the Responsiveness of Subgroups and Individual Case Studies to Four Reading Comprehension Interventions

This study sought to examine whether participants' response to the intervention in Study Two (Chapter Five) was influenced by their underlying literacy skills. The seventeen participants who participated in the intervention were divided into one of four groups depending on their pre-intervention literacy profile. Groups were formed by identifying

strengths and weaknesses amongst these individuals resulting in a poor spelling group, a poor listening comprehension group, a generally poor reader group (both poor spelling and poor listening comprehension), and a group with reading comprehension difficulties despite typical spelling and listening comprehension skills. Analyses of these four groups did not identify any significant between-group differences in their response to intervention.

Subsequently, the profiles of four individual participants (one from each group) were examined in more detail to investigate the response to intervention at an individual level.

The literacy profiles of four participants were compared to the participants' responses to each of the intervention strategies used. Although there were some minor relationships between the underlying literacy skills and the most beneficial strategy to aid reading comprehension ability, the relationship was again unclear. The findings from these case studies reflected the findings at the subgroup level, in that it was not possible to determine a relationship between the literacy skills of an individual and the effectiveness of specific reading comprehension strategies.

1.5. Study Four: Explicit Teaching of Metalinguistic Knowledge within a Literacy Course for Pre-service Teachers

This study examined the effectiveness of an explicit teaching intervention focused on building the metalinguistic knowledge of pre-service teachers, which was integrated within an existing literacy course. This study also aimed to ascertain whether a difference existed in the response to intervention amongst pre-service teachers with strong and weak underlying spelling ability, and those with typical and weak reading comprehension. The same cohort of first year pre-service teachers who participated in Study One were invited to participate in this study as part of their higher education coursework. Participants ($n = 121$) received explicit teaching relating to phoneme, morpheme, and orthotactic knowledge and awareness,

for a total of seven hours across a period of seven weeks. A pre-test, post-test assessment was administered to determine any change over this period.

The whole cohort demonstrated significant increases in their scores from pre- to post-intervention, on measures of all areas targeted in the teaching. A subgroup of participants with good spelling ability ($n = 24$) responded more favourably to all targeted aspects of intervention than their peers with poor spelling ability ($n = 24$), even when accounting for their initial level of knowledge. A subgroup of participants who met the criteria for participation in the reading comprehension intervention in Study Two (see Chapter Five) ($n = 22$) made significantly lower percentage gain in their scores than their peers with typical reading comprehension ($n = 99$), following the intervention, even when controlling for performance at pre-intervention assessment. These improvements were smaller, and more isolated to specific areas (i.e., phoneme and orthotactic knowledge, and not morpheme knowledge) than the improvements identified amongst the groups of poor and good spellers. Furthermore, the relationship between reading comprehension ability and knowledge of language structure was found to be weaker than the relationship between underlying spelling ability and knowledge of language structure.

This final study demonstrated that explicit teaching of metalinguistic constructs included as part of coursework for pre-service teachers, can be an effective way of increasing their knowledge of language structure. Furthermore, individuals with better underlying spelling ability may respond more positively to intervention, while individuals with poorer spelling ability may require more intensive, longer, or specific intervention.

1.6. Conclusion

The final chapter of this thesis (Chapter Eight) aggregates the findings from this research as a whole, reporting them as a general discussion. It provides the main findings

from each of the studies, theoretical and practical implications for the assessment and intervention of adults in the higher education environment, and recommendations for enhancing the knowledge of pre-service teachers. As a final point, limitations of each of the studies, and proposed directions for future research are also discussed.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

The acquisition of proficient reading skills is an expected outcome of education worldwide. The ability to accurately decode the written word, and subsequently comprehend its message is a daily requirement, without which individuals are likely to be restricted in their employment, as well as their educational and social endeavours. While many children successfully acquire reading skills throughout their schooling, a significant proportion of children experience ongoing literacy difficulties. As adults, those who experience difficulties understanding written text may face many barriers preventing them from participating fully in life, and gaining access to information that most individuals take for granted (McShane, 2005).

An estimated 774 million adults worldwide are considered to lack basic literacy skills, with two thirds of this figure being represented by women (UNESCO, 2013). Although illiteracy rates are highest within developing countries, adults' literacy levels are also a concern in developed countries. In the United States, 43 percent of adults lack the literacy skills to allow them to comprehend beyond basic prose and document texts (Kutner et al., 2007). Similar issues are reported in New Zealand, with 44 percent of adults possessing low levels of literacy skills (Satherley et al., 2008). The statistics concerning children's literacy are equally alarming. While New Zealand and other Organisation for Economic Co-operation and Development (OECD) member countries such as England and the U.S. have a large number of children with high levels of literacy, the level of inequality that exists between the literacy outcomes of strong and weak readers within these countries is vast (Martin, Mullis, &

Kennedy, 2007; Mullis, Martin, Foy, & Drucker, 2012; UNICEF, 2010). In fact, New Zealand has the biggest achievement gap between strong and struggling readers on international comparisons of literacy achievement (Mullis et al., 2012; OECD, 2014). Thus it would appear that the needs of children who struggle learning to read are not being met, and these problems continue to pervade many aspects of an individual's life. Reducing such extensive inequalities in child and adult education, however, requires a multifaceted approach, including looking at classroom instruction, and the provision of suitable support and strategies within adult education.

The paucity of research into the literacy abilities of adults in general (Miller, McCardle, & Hernandez, 2010), coupled with the identified need to provide a high level of reading instruction to all children in New Zealand schools, suggests that a research focus on the literacy skills of pre-service teachers may be appropriate. There is an expectation that pre-service teachers not only have excellent literacy skills themselves (Conaway, Saxon, & Woods, 2003), but also that they possess the necessary skills required to provide successful reading instruction for future generations of children (National Reading Panel, 2000). Research has elucidated that neither of these expectations are being fully met, with studies reporting literacy difficulties in the pre-service teacher population (Milton, Rohl, & House, 2007; Rohl & Greaves, 2005), and demonstrating low levels of proficiency in the component skills required to teach literacy (e.g., Fielding-Barnsley, 2010; Moats & Foorman, 2003; Washburn, Joshi, & Binks-Cantrell, 2011). Thus, increased information about the literacy abilities of pre-service teachers, and efficacy of interventions to increase both their knowledge and skill, is critical to ensure that they are adequately equipped to teach future generations.

This thesis investigated the literacy skills of adult students in higher education (undergraduate pre-service teachers) with a focus on their ability to understand written text. It

also addressed the need for increased support of individuals in the higher education environment by investigating the effectiveness and response to two interventions: one focussing on increasing reading comprehension ability for students with difficulties understanding written text, and one focussing on raising the metalinguistic skills of the whole cohort.

The remainder of this chapter outlines the literature underpinning the research presented in this thesis. Thus, for clarity, this literature review is divided into the following components:

- Theoretical models of reading comprehension
- Assessment of reading comprehension in the adult population
- Intervention for reading comprehension difficulties
- Assessment and intervention of language structure knowledge in pre-service teachers
- Summary and thesis aims

2.2. Theoretical Models of Reading Comprehension

The term ‘literacy’ is often used to encompass a wide range of skills with research often focussing on the act of reading (Treiman & Kessler, 2005). However, the definition of literacy extends beyond reading itself. It is the written and oral language that an individual uses on a daily basis and incorporates reading, writing, speaking, and listening. The term literacy is used throughout this thesis to refer to areas that predominantly relate to reading, but that also incorporate additional skills of writing, and expressive and receptive language. Reading and comprehending are two almost interchangeable terms, as the purpose and ultimate goal of reading is comprehension (Nation, 2005; Paris & Hamilton, 2009). For clarity throughout this thesis, the term ‘reading comprehension’ will be used to clarify the reference to what can be described as the understanding of written text.

Assessment of reading comprehension remains complex as the process of reading comprehension cannot be directly observed (Pearson, 2009). To achieve reading comprehension, the reader must successfully transition through several processes that integrate different contributing sources of information. Many theoretical models have been proposed that attempt to explain and describe the specific processes undertaken in reading comprehension. Not only do such models provide an explanation of the process of reading comprehension, they also depict the contributory components required to attain proficient reading comprehension skill. Furthermore, theoretical models have direct practical implications as they can help identify where deficits in comprehension exist, and allow targeted instruction and intervention to be designed to increase an individual's reading comprehension skills (Alvermann, Unrau, & Ruddell, 2013).

Many different theoretical models of reading comprehension have been proposed, yet Paris and Hamilton (2009) state that "*given the importance of reading comprehension for children's literacy and learning, it is surprising that there are so few theories about it.*" (p.32). There are even fewer reading comprehension models that are specific to the adult population as most theoretical frameworks have been drawn from child data. There are thus relatively few models that fully explain the process of reading comprehension in adults. Existing theoretical models of reading comprehension that can be applied to the adult population are outlined and discussed below.

2.2.1. Stage Models of Reading Comprehension

Stage models of reading comprehension attempt to describe a series of phases during which an individual acquires specific skills (during childhood) that lead to proficient reading comprehension. The idea that skills can be acquired in a specific order is central to the stage model theory of reading comprehension. This is in contrast to more recent models which

typically outline less rigid, and less prescriptive progressions in the acquisition of reading comprehension. Chall's (1996) developmental model of six-stages is one of the most prominent stage models of reading comprehension development in the literature. Chall (1996) outlined six sequential stages through which children pass in the route to reading comprehension. During the first phase, pre-reading skills such as print concepts, letter knowledge, and phonemic awareness are acquired. In the second stage, children typically have begun school and have started to develop decoding skills. The third stage is comprised of building sight word vocabularies and increasing fluency, while the fourth stage suggests that children will make the shift from 'learning to read', to 'reading to learn'. Finally, the fifth and sixth stages demonstrate an ability to comprehend more complex text. The fifth stage typically requires children to be able to deal with more than one viewpoint, and possess the ability to acquire knowledge of complex concepts. Finally, the sixth stage focusses on the child's ability to read constructively, that is, constructing knowledge and understanding from their reading of the written text.

When this model was first proposed in 1967, other stage theories such as Piaget's cognitive development theory (Piaget, 1964) were dominant. It therefore seemed plausible that a sequential approach could also be representative of the process of reading comprehension. Despite their prominence, stage models have been limited in their application to reading comprehension (and other aspects of literacy development) for several reasons. They do not consider the individuality of children, and that sequential movement through each stage may not be accurate for all individuals (Snowling, Hulme, & Nation, 1997). Furthermore, children may be at different 'stages' depending on the text they are attempting to read. For example, when reading about a familiar topic, a child may demonstrate stage four skills, yet when reading a text focussed on a topic that is unfamiliar to them, their skills may be more depictive of stage two. A further limitation of stage models in reading

comprehension is that they are inclined to underestimate children's knowledge and abilities. For example, Chall outlines that it is not until the fourth stage that children begin to 'read to learn', however children have demonstrated their ability to do this at earlier stages (Paris & Hamilton, 2009).

Stage models have similarly been used to describe the process of word recognition, whereby in this context the 'stages' have often been referred to as 'phases' so as not to denote the view that each stage must be mastered prior to moving on to the next (Ehri, 2005). If this idea of 'phases' can be applied to stage models of reading comprehension, it enables this theoretical model to be applied to adults. That is, if an individual has difficulties with reading comprehension, this may be the result of an incomplete transition through all of the phases deemed important for reading comprehension development. However, such a model cannot fully explain the wide variety of areas (e.g. aspects of word decoding, linguistic comprehension, vocabulary, background knowledge, speed of reading, and working memory) that have been proposed to contribute to reading comprehension difficulties within the adult population. While the application of a stage / phase model may allow for the identification of an individual's current stage of reading comprehension, without recognition of the specific skills that prevent progression to subsequent stages, it is difficult to provide support and intervention for these individuals. Additionally, stage / phase models have frequently related each stage to an age or school grade by which point the skills of that stage would be expected to have been mastered (Chall, 1967, 1996; Ehri, 1995). This is problematic within the adult population, who would automatically be assumed to be functioning at the highest stage / phase due to their age, a level that may not be reflected in their skill and ability.

2.2.2. Interactive Models of Reading Comprehension

Early models of reading comprehension were influenced by research in other areas such as psychology, and in particular cognitive psychology (Pearson, 2009). From this arose a series of proposed models that initially divided into two schools of thinking (Alvermann et al., 2013): those that proposed a ‘bottom-up’ (or word-level) approach focussing on the process of decoding and understanding words; and those that proposed a ‘top-down’ (or text-level) approach whereby meaning is constructed through the integration of background knowledge with the text (Paris & Hamilton, 2009). Interactive models of reading comprehension held their roots in the late 1970s and early 1980s and involved a combination of the valid insights of both bottom-up and top-down processes, both interacting to shape comprehension. Such a model attempted to account for the robust points of both top-down and bottom-up models as well as proposing that the interaction between the two processes occurred simultaneously.

Rumelhart’s (1977) interactive model suggested that reading was both a perceptual and cognitive process that amalgamated orthographic, lexical, syntactic, semantic, and phonological knowledge to create meaning from written text (Rumelhart, 1977). The incorporation of a mechanism referred to as the ‘message centre’ allowed for information from these influencing sources to be held and redirected as required. Within this mechanism, the sources of knowledge would interact with each other, and thus allow for reciprocity between higher- and lower-level processing. While this model has been applied to the adult population, there are several constraints of its use. The interaction between reader and text assumes a level of competency in both bottom up and top down skills, thus to present with good reading comprehension requires an adequate level of proficiency in both decoding and interpreting text. Moreover, the interactive model uses the printed word as the input to reading comprehension, and describes meaning as the output, without accounting for the

additional input provided by the reader. Their interaction with the text may result in them selecting to include or omit specific words or cues from the text, a consideration that is not accounted for in this proposed model. Although interactive models have been applied to the adult population, this has typically been in a more complex, or expanded format such as the interactive-compensatory model (discussed below).

2.2.2.1. The Interactive-Compensatory Model

Stanovich (1980, 1984) expanded on the interactive model, introducing a compensatory element. The resulting interactive-compensatory model purported that an individual with deficiencies in an area or process, would be able to compensate for this deficit by recruiting stronger skills in another area (Paris & Hamilton, 2009; Stanovich, 1980).

Stanovich (1980) argued that the compensatory aspect of the model would allow for deficiencies at any level to be compensated for with a greater use of information from other intact skills. For example, if a deficiency is present in word decoding skills (a bottom-up skill), higher level language skills such as prior knowledge and topic knowledge (top-down skills) may still allow the individual to understand the written text. The interactive-compensatory model enabled researchers to hypothesise not only how strong readers approached text, but also provided an insight into the processes undertaken by weak readers.

It seems plausible that individuals with low levels of literacy ability may compensate for an area of deficiency by relying more heavily on another, a perspective that has been supported by evidence of children with poor reading and deficient decoding over-relying on contextual cues to recognise words (Catts, Kamhi, & Adlof, 2012). However, if the level of text complexity is high, and the reader has a much higher level of literacy skill (e.g., an adult) it is possible that the demand placed on skills such as word decoding is too high to be compensated for by another distinct skill. Furthermore, some skills, such as oral fluency, are

so specific in the process of reading that they may not be able to be compensated for by using any other skill.

2.2.3. Constructionist Models of Reading Comprehension

Constructionist theory posits that text comprehension is a result of processes that occur at several different levels (Kintsch, 1998). Constructionist models of reading comprehension are comprised of both bottom-up and top-down processes. The reader is required to decode the written text demonstrating a bottom-up process, and also develop a 'situation model' during which top-down processes, such as activation of prior knowledge, must be utilised. In an initial model, Kintsch (1988) outlined the following process of constructionist theory. Firstly, the reader must identify the individual words on a page, decoding the symbols by utilising processes of perception, word recognition, and assigning words to their roles within sentences and phrases (parsing); then subsequently semantically analyse the words to comprehend the word meaning (Kintsch & Rawson, 2005). This results in what Kintsch (1998) refers to as 'surface-level representation'. In order to comprehend the written text in its entirety, the reader must build multilevel representations of the text. This includes the microstructure, i.e., the role of the text at word-level (representative of the inter-relationships between the propositions expressed in the text content), and the macrostructure i.e., the role of the word at a higher-level (representative of the inter-relationships between higher-order topics of microstructure). When combined, Kintsch refers to the microstructure and the macrostructure as the 'textbase', which represents the meaning of the text as it is explicitly expressed by the text (Kintsch & Rawson, 2005). This superficial comprehension of the text itself would prevent the reader gaining a deeper understanding of the written text, so the textbase is used to formulate what is referred to as a 'situation model', whereby a mental model of the situation described by the text is created. This basic understanding of a

constructionist model of reading comprehension was further developed after Kintsch himself acknowledged that the model was too rigid, and that an integration component was required (Kintsch, 1998).

2.2.3.1. A construction-integration model

The construction-integration model proposed by Kintsch (1998) was born out of his originally proposed constructionist model (1988). This model is arguably the most prominent model adopted to describe the process of adult reading comprehension (Paris & Hamilton, 2009). In this model, Kintsch (1998) proposed that the reader simultaneously constructs a literal text model and a situation model, with the merging of the two forming the integration component. Once the reader has constructed meaning from the text to produce a system comprised of concepts they have activated, the reader must then integrate the concepts from this system that are pertinent to the situation model. Any concepts that have been activated that are not relevant to the implied situation are consequently de-activated.

The construction-integration model recruits both bottom-up processing (in the formation of an accurate textbase) and top-down processing (using prior knowledge to interpret the textbase and construct a situation model). However, the construction-integration model fails to address the processes of comprehension themselves such as extraction of information, and the construction of meaning. Similarly, it is unclear in its explanation of how an individual develops the component skills to successfully create a textbase and processes required to integrate prior knowledge and understanding with this (Paris & Hamilton, 2009). Despite its frequent use to describe reading comprehension in adults, the construction-integration model seems to address the end product of reading comprehension, neglecting to identify the core component skills required in order to achieve this result. There therefore appears to be a paucity of research evaluating the relevance of the construction-

integration model to the adult population. Instead, it has been used most frequently to describe the interaction that occurs between top-down and bottom-up processes (Kintsch, 2005). However, without a comprehensive understanding of the key component skills that contribute to these processes, it is difficult to identify areas of reading comprehension deficits in adults and hence determine appropriate intervention to address any such difficulties.

2.2.4. The Simple View of Reading

The models of reading comprehension that have been explored thus far have been complex in their portrayal, reflecting the nature of reading comprehension itself. The simple view of reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990) eschews this idea of complexity, proposing that reading comprehension is the process of just two contributing variables: word decoding (D), and linguistic comprehension (LC). This is further simplified in the presentation of the process of reading comprehension (R) as an equation, whereby:

$$R = D \times LC$$

The equation depicts the multiplicative relationship between the two variables, that is, it is not possible for reading comprehension to exist without an ability to decode words (regardless of their linguistic comprehension skills), and equally, reading comprehension is not possible without some ability to understand the words they have decoded, (regardless of how strong their decoding skills are). Consequently, when both decoding and linguistic comprehension are measured in their entirety, these two factors should explain up to 100 percent of the variance in reading comprehension.

In addition to the multiplicative model of the SVR (Gough & Tunmer, 1986; Hoover & Gough, 1990), research has suggested that the equation may be applicable as an additive model (Dreyer & Katz, 1992; Joshi & Aaron, 2000), thus:

$$R = D + LC$$

In a study of elementary school-aged students, Dreyer and Katz (1992) found that the evidence was stronger for a model based on the sum of the two variables of D and LC, rather than as a product of the two. Interestingly, however, results from a study conducted by Joshi and Aaron (2000) presented equal argument for both the additive and multiplicative formats of the SVR (presenting very similar levels of variance for each), with results from the same age children as the data supporting the additive model (Dreyer & Katz, 1992). Despite their findings, Joshi and Aaron (2000) recommended adopting the multiplicative model, on the basis that it is applicable to a broad range of reading skills, including making allowances for individuals who are non-readers. Regardless of whether the model remained with reading comprehension as a product or as a sum of the two variables, both studies (Dreyer & Katz, 1992; Joshi & Aaron, 2000) concurred that both D and LC are essential factors within the process of reading comprehension. Despite this proposed amendment to the SVR equation, the initial equation depicting reading comprehension as a product, rather than the sum of, decoding and linguistic comprehension has been used most frequently in research.

Support for the SVR has been provided through the description of two groups of children with reading comprehension difficulties. The first group includes individuals who present with word decoding difficulties but appropriate linguistic comprehension (e.g., Catts, Adlof, & Weismer, 2006), and the second group includes individuals who present with difficulties in linguistic comprehension despite an absence of word decoding difficulties, (e.g., Nation, 2005). Word decoding comprises the skills of print concepts, letter knowledge, phonemic awareness, phonics, and spelling, (i.e., skills required in visual, visual phonological, and visual morphological mapping). This allows meaning to be derived effectively from the written word. Word decoding skills are generally assessed using measurement of single word and pseudo word accuracy and fluency. Key constituents of linguistic comprehension typically include skills that are shared with language, such as

semantics, pragmatics, vocabulary, and syntax. Linguistic comprehension is often assessed by using measures of listening comprehension.

The SVR has often been used as a theoretical model to explain children's reading comprehension. For example, it formed the framework of the Rose Report (Rose, 2006), which was undertaken to review the teaching of early reading in the UK. Several earlier studies examined the applicability of the SVR to explain the process of reading comprehension in children. Hoover and Gough (1990) tested its validity by conducting a longitudinal study with early elementary school-aged bilingual children ($n = 254$), assessing their word recognition (representing word decoding) and listening comprehension (representing linguistic comprehension) skills. Results demonstrated that the SVR accounted for 72 to 85 percent of the variance in the children's reading comprehension. Other research with children has demonstrated that the SVR accounts for anything between 40 percent and 80 percent of the variance in reading comprehension (Catts, Adlof, Hogan, & Weismer, 2005; Dreyer & Katz, 1992; Joshi & Aaron, 2000). These studies demonstrate that while in the early years children's cognitive resources are predominantly consumed by the processes required in word decoding, this relationship changes in the later stages of reading, with linguistic comprehension becoming the dominant variable in reading comprehension by grade eight (Catts, Hogan, & Adlof, 2005). This shift is apparent in a study of over 900 university students (Landi, 2010), whereby word decoding skills were found to make a much weaker contribution to reading comprehension (relative to linguistic comprehension skills) amongst this skilled group of adult readers. Older readers (such as those in higher education) are more likely to have established at least a basic level of word decoding skill. Linguistic comprehension is therefore more likely to demonstrate larger deficits relative to word decoding amongst this older population.

The SVR has also been used to identify and describe the types of difficulties encountered in reading comprehension. Research using the SVR framework has demonstrated the existence of individuals who present with strong decoding skills and poor comprehension, as well as conversely, individuals who present with poor decoding skills and strong comprehension skills (e.g., Catts et al., 2006; Catts, Hogan, & Fey, 2003; Nation & Norbury, 2005). This distinction is key in the educational context where the opportunity presents for educational practice to aid the individual in progressing in each component (Kendeou, Savage, & van den Broek, 2009), thus preventing reading comprehension failure.

Despite providing a simple explanation of the complex process of reading comprehension, the SVR neglects to provide an explanation of the complex interaction of constituent skills that comprise the two variables of word decoding and linguistic comprehension. The SVR has been criticised for its failure to explain the role of additional key variables such as vocabulary knowledge, the motivation and background knowledge of the reader, and speed of processing (Aaron, Joshi, Gooden, & Bentum, 2008). Further models of reading comprehension have utilised the SVR as a foundation to which they have added additional elements in an attempt to address such concerns about the SVR. For example, Joshi and Aaron (2000) developed the Component Model of Reading which included a speed aspect in the model, and Tunmer and Chapman (2012) modified the SVR model to incorporate an additional vocabulary measure. Component models are described in further detail below.

2.2.5. Component models of reading comprehension

2.2.5.1. The 'Component Model of Reading' (Joshi & Aaron, 2000)

This model arose from the SVR, and regards the two core elements of word decoding and linguistic comprehension as basic independent information processing systems that

utilise internal representations of symbols and objects. Joshi and Aaron (2000) undertook a study with elementary school-aged children to identify whether an additional factor of speed, when added to the SVR, improved the model's ability to predict reading comprehension skill. The results of the assessments of both D and LC demonstrated that these two components could explain approximately 50 percent of the variance in reading comprehension, with the speed of processing letters explaining a further 10 percent in addition to D and LC. The authors therefore proposed a revised version of the SVR presenting the formula (where S = speed):

$$R = D \times LC + S$$

The additional factor of speed of processing was considered to be an additional rather than a multiplicative component, as Joshi and Aaron did not consider it to be entirely independent of word decoding. They suggested that speed only emerges as an important element in children at approximately grade four, as until this point children rely more heavily on word decoding and building sight vocabularies. It is only once these skills have been consolidated that speed emerges as a more prominent factor (Joshi & Aaron, 2000).

Aaron et al. (2008) utilised the CMR in a subsequent study that sought to identify reading disabilities in a cohort of school children. In this updated version, the CR was outlined as comprising three domains: a cognitive domain, psychological domain, and ecological domain. The authors envisaged that satisfactory levels of literacy skill may not be acquired due to deficits in any one of these three components. Aaron et al. (2008) sought to validate the cognitive domain of reading in their study of 204 children aged between grade two and five. The participants completed assessments of reading comprehension, listening comprehension, word decoding, and processing speed of letter naming. The results confirmed support for the SVR with D and LC accounting for between 38 and 41 percent of the variance in reading comprehension, with speed of processing contributing a further 11 percent in

children of second grade age. However, by fifth grade, this element of speed of processing had diminished to just 2.5 percent. This finding was concurrent with results from a study conducted with children of fourth- and eighth-grade age (Adlof, Catts, & Little, 2006) whereby rate and accuracy in reading connected text was not found to be a significant contributing factor in reading comprehension. The findings of Aaron et al. (2008) supported the hypothesis of the CMR that speed of processing is not an independent component but a by-product of word recognition skill. However, the diminishing contribution of speed of processing with age suggests that this may not be a significant contributor to reading comprehension within the adult population.

2.2.5.2. Further Component Models

Mellard and Fall (2012) proposed a component model of reading for adults with low literacy skills. Mellard and Fall's model was comprised of: word skills, language comprehension, memory, and fluency. These four combined components were shown to account for 75 percent of the variance in reading comprehension in 312 adults. This group comprised individuals who were accessing basic and secondary education services, with over half reporting reading difficulties in childhood, and almost three-quarters with incomplete secondary education. The authors reported that amongst these individuals, recruitment of different components was evident in the process of reading, depending on their level of reading skill (Mellard & Fall, 2012). Adults with the lowest ability in their study were found to rely predominantly on word reading skills, drawing on memory to support their word recognition. Mid-level readers relied on word reading skills but also recruited memory and language comprehension components for reading comprehension. Adults with the highest level of reading skill demonstrated almost equivalent contributions from each of the four components to their reading comprehension. This model is one of the primary models to

specifically address the reading comprehension abilities of adults. However, the point at which adult readers make the transitions from low- to mid-, and mid- to high-levels of reading ability is unclear. Moreover, the component of memory comprised measures of working memory and a language based measure (listening comprehension), the latter of which may have confounded this measurement, due to the reliance on language skills. This strong role of memory in reading comprehension, contradicts many other views of reading comprehension (Daneman & Merikle, 1996; Hannon, 2012; Van Dyke, Johns, & Kukona, 2014).

Mellard and Fall's (2012) study focussed on individuals with relatively low levels of literacy skill. Even the participants who demonstrated a high level of literacy skill within this group were typically functioning at a level below expected in the adult population. It is therefore not possible to extend these findings wider, or to adults with relatively high levels of reading ability. Furthermore, the participants who demonstrated the highest level of reading proficiency in this study recruited skills consistent with more basic models of reading comprehension such as the SVR (word level skills, language and listening comprehension, with smaller contributions made by additional measures such as fluency). These findings therefore do not explicitly argue for the application of a more complex model of reading comprehension to describe the skills of this population, rather the component model proposed produces similar results to that of the SVR.

Mellard, Fall, and Woods (2010) conducted a path analysis of reading comprehension to ascertain whether a model representing the relationship between the component skills of reading would be predictive of reading comprehension ability amongst adults with low levels of literacy. Their model used the foundations of the SVR but regarded the skills required for reading comprehension as component parts. However, they adopted an additive rather than multiplicative model of the SVR as per Dreyer and Katz (1992). The participants of Mellard,

Fall et al.'s (2010) study comprised 174 adults accessing basic education services who were reading at a level equivalent to approximately fifth-grade (a similar level to the participants of the Mellard and Fall (2012) study outlined above). Results demonstrated that these participants relied heavily on word reading ability, with only a marginal contribution made by linguistic comprehension skills such as summarising and inferencing. Mellard et al. (2010) concluded that this model, and other existing models of reading comprehension, could not accurately describe the skills of the population examined. They did however acknowledge that greater linguistic comprehension would be expected in adults with increased levels of reading comprehension ability. Furthermore, they considered the role of strategies that call upon higher level language skills (such as summarising and inferencing), which were shown to be minimally used by adults with low levels of literacy skill in this study (Mellard et al., 2010).

Although these two studies examining component models of reading comprehension have been designed and applied directly to the adult population, their results and lack of specificity for adults with low levels of literacy suggest that these may not be suitable models for adults with higher reading proficiency.

2.2.6. Summary of Reading Comprehension Models

Most well-established models of reading comprehension have been influenced by the reading comprehension acquisition and abilities of children. Models that have been specifically related to, or utilised with, adults have tended to have a theoretical basis influenced by one or more of these original models (e.g., component models). Furthermore, the modifications or additional elements that have been added appear to be somewhat specific to the various populations for whom they have been identified. For example, the CMR (Joshi & Aaron, 2000) modified the SVR to include the element of speed of processing. While this

has been shown to contribute to reading comprehension in children, it diminishes with age and development. It is thus hypothesised that the CMR is not be an appropriate model to apply to the adult population. Word reading ability plays a strong role in the reading comprehension skills of adults with basic, or low, levels of literacy (Mellard & Fall, 2012; Mellard et al., 2010). However analysis of the applicability of a component model did little to describe the contributing elements of language comprehension, memory, and fluency skills identified as being present in adults with higher levels of reading skill (Mellard & Fall, 2012). Thus, such components models cannot be assumed to be accurate for describing reading in adults who have moved beyond a basic literacy level.

Despite it being a popular model to describe reading comprehension in adults (Paris & Hamilton, 2009), the construction-integration model focusses on the product of reading comprehension, with less attention paid to the skills contributing to this end goal. The construction-integration model (and constructionist models of reading in general) propose that the process of reading comprehension requires both understanding of the literal text, and a higher level understanding of the text as a situation model. A lack of explanation of the underlying skills enabling a reader to do this, however, adds little weight to the theoretical foundation of reading comprehension.

It seems plausible that adults with difficulties understanding written text may activate some sort of compensatory process, enabling them to demonstrate reading comprehension ability beyond the sum of their component skills. Individuals who manage to 'get by' during their school education can sometimes present with previously unidentified reading comprehension difficulties, when cognitive workload increases in demanding environments such as higher education (Cogmen & Saracaloglub, 2009; Fidler & Everatt, 2012). This argument provides support for the application of Stanovich's (1980) interactive-compensatory model to the adult population. While the compensatory element of this model

may be credible, this model does little to describe the skills that contribute to reading comprehension. Without knowledge of an adult's underlying literacy skills, it is difficult to provide appropriate intervention for those who may not have experienced typical acquisition of the constituent skills required for reading comprehension (as is often the case in adults).

It would appear that while no singular model of reading comprehension has been successfully identified as being appropriate for the adult population, one common area of agreement is that the components of word decoding and linguistic comprehension are crucial for successful reading comprehension (e.g., Adlof et al., 2006; Catts et al., 2006; Cromley & Azevedo, 2007; Dreyer & Katz, 1992; Joshi & Aaron, 2000; Mellard & Fall, 2012). Thus, despite its ambiguities, and additional population-specific components, the SVR (Gough & Tunmer, 1986; Hoover & Gough, 1990) seems the most appealing and robust model of reading comprehension to provide a framework to assist in understanding the process of reading comprehension in a typical adult population of readers. Those who advocate adopting the SVR model do not reject the idea of other variables contributing to reading comprehension, but present word decoding and linguistic comprehension as core components of this process (Kendeou et al., 2009). Within the adult population, a model of reading comprehension cannot be rigid and prescriptive, and as advocated by Mellard and Fall (2012) it must *"be sensitive...to the difference between more accomplished and less accomplished adult readers...and strategically addressing differing learner needs"* (p.21). The SVR makes it explicitly clear that individuals may differ in their presentation and their skills with respect to the two key components, and permits such considerations to be made, while still providing a theoretical framework for guidance. Finally, the SVR is well supported as a guiding principle and framework for assessment and intervention when applied to the practical environment (Aaron et al., 2008). It was thus deemed appropriate for use within the population and context examined in this thesis.

2.3. Assessment of Reading Comprehension in the Adult Population

The assessment of reading comprehension is made somewhat complex as it is usually measured indirectly through its known contributory parts. This is best undertaken if a theoretical framework, or at the very least, a definition of reading comprehension is applied (Dougherty Stahl, 2009). Hence, this section will be duly outlined adhering to the framework provided by the Simple View of Reading (SVR) (Gough & Tunmer, 1986; Hoover & Gough, 1990) as described in section 2.2.4.

2.3.1. Current Assessment with the Adult Population Using the SVR

The validity of the SVR was initially tested in the work of Hoover and Gough (1990) with elementary school-aged bilingual children. They demonstrated that the SVR accounted for 72 to 85 percent of the variance in the reading comprehension of these children. Other research within the child population has demonstrated that the SVR accounts for anything between 40 and 80 percent of the variance in reading comprehension (Catts, Adlof, et al., 2005; Dreyer & Katz, 1992; Joshi & Aaron, 2000). Research with the adult population has demonstrated that the word decoding and linguistic comprehension components of the SVR accounted for anything from 34 percent (Macaruso & Shankweiler, 2010), to 47 percent (Landi, 2010), to 62.5 percent (Sabatini, Shore, Sawaki, & Scarborough, 2010), depending on the population and measures used. Furthermore, the two components of linguistic comprehension and word decoding have been demonstrated to be independent skills in their contribution to reading comprehension within the adult population (Sabatini et al., 2010; Savage, 2006).

Assessment of the adult population using the SVR as a guiding framework has resulted in many diverse and contradictory findings. This variation is likely due to the different inclusion criteria and abilities of the participants included in the research. Sabatini et

al. (2010) posited that the two independent components of word decoding and linguistic comprehension alone adequately explained the variance in reading comprehension in a group of adults with low literacy ability. In contrast, studies including adults engaged in higher education have found that the additional component of fluency or reading speed also makes an independent contribution to reading comprehension (Jackson, 2005; Macaruso & Shankweiler, 2010). Furthermore, while Sabatini et al. (2010) also reported that vocabulary did not make a unique contribution to reading comprehension in adults with low literacy, vocabulary was found to be the single best predictor of reading comprehension in university students (Landi, 2010). It appears that the degree to which the SVR can account for the variance in reading comprehension may depend on the level of literacy ability of the target participants.

One area of relative consensus within the assessment of reading comprehension skills of adults is the role of word decoding. It has been argued that decoding has a much larger impact on reading comprehension when overall reading ability is low (Perfetti & Bell, 1994). Support for this view has been shown in studies of adults without identified reading difficulties in higher education (who typically exhibit good or strong literacy skills relative to the general population), with a weak relationship observed between word decoding and reading comprehension (Jackson, 2005), and limited predictive power of word decoding to reading comprehension (Landi, 2010). Furthermore, Jackson (2005) concluded that word decoding skills deficits did not strongly predict a difficulty in reading comprehension ability, and that neither word decoding, nor reading fluency were related to overall academic achievement.

Conversely, Savage and Wolforth (2007) found that word decoding was a strong predictor of reading comprehension amongst adult university students (the majority of whom had a diagnosis of reading disability). Their study investigated the application of the SVR, as

both an additive and multiplicative model, with sixty university students. The participants comprised of two thirds of individuals who demonstrated some form of reading disability ($n = 40$), while the remaining participants were made up of students who were considered to be typical readers ($n = 20$). All individuals completed a comprehensive battery of assessments including: reading comprehension, listening comprehension, phonological awareness, spelling, pseudo-word reading, word identification, vocabulary, rapid automatized naming, Results focusing on the group as a whole demonstrated almost equal contribution by skills of word decoding and linguistic comprehension to reading comprehension. Further, the contribution made by all measures included in the assessment battery explained approximately 44 percent of the variance in reading comprehension. Savage and Wolforth (2007) reported very little difference in the application of either an additive or multiplicative SVR in explaining the variance in reading comprehension of these participants, suggesting that they had equal explanatory power. The larger contribution of word decoding skills to reading comprehension in this study than other studies within higher education (Jackson, 2005; Landi, 2010), may be attributable to the high number of participants presenting with reading difficulties. The lower literacy skills of participants in Savage and Wolforth's study compared to studies of adults with typical skill in higher education therefore support Perfetti and Bell's (1994) hypothesis that decoding has a greater impact on reading comprehension when overall literacy skills are lower.

Results from Landi's (2010) study of adults in higher education who did not have a history of reading disability showed that decoding accounted for less than 1 percent of the variance in reading comprehension. This finding supports the proposition that decoding plays a much smaller role in the reading comprehension abilities of skilled adult readers, than in children (Catts, Hogan, et al., 2005; Jackson, 2005; Landi, 2010; Macaruso & Shankweiler, 2010). A further study of 48 typical adult students in higher education used the SVR as a

framework to identify predictors of reading comprehension. Results showed that, of the three measures included (listening comprehension, reading fluency, and decoding), decoding was not a strong predictor of reading comprehension, but instead that listening comprehension was much more predictive (Macaruso & Shankweiler, 2010). Thus, it seems likely that the reading comprehension difficulties experienced amongst adults are typically more likely to be attributable to deficits in linguistic comprehension. Even adults with lower reading ability have been found to have established at least basic word decoding skills, hence linguistic comprehension plays more of a role in reading comprehension ability.

Although much of the existing research has demonstrated the applicability of the SVR to the adult population, it has also confounded the current understanding of which skills comprise the two components of word decoding and linguistic comprehension for adults. The influence of these two key SVR components, and the skills that contribute to them, appears to be specific to the particular population studied, and their level of reading skill. The literature appears to be in consensus about two findings within the adult population. The first, that the two components of the SVR provide a robust grounding upon which other additional measures may be added to fully explain reading comprehension. The second, that word decoding does not play as strong a role in predicting reading comprehension as linguistic comprehension. Despite the latter postulation, there is greater understanding about the role of word decoding skills amongst the adult population relative to the role of linguistic comprehension skills. This paucity of knowledge in the contributory skills of linguistic comprehension to reading comprehension requires greater attention in the adult population as a whole.

The identification of specific areas of deficiency within each of these components, however, is required to provide constructive information to inform both the practitioner and

subsequent instruction or intervention. A discussion of some of these skills is undertaken below.

2.3.2. Word Decoding Skills

The bottom-up skills of word decoding enable the reader to interpret the written word from a page of text. This process (or its constituent skills) is not always developed accurately or fully and deficits in the word decoding component of the SVR can present in adults and children alike.

2.3.2.1. Adults with Low Levels of Literacy Skill

Research that has focussed on the word decoding skills of the adult population has predominantly included participants enrolled in Adult Basic Education (ABE) who present with low levels of literacy (e.g., MacArthur, Konold, Glutting, & Alamprese, 2010; Mellard et al., 2010; Sabatini et al., 2011). ABE serves adults who do not hold a high school diploma, and who are ineligible for other secondary education programmes (Kruidenier, 2002). Individuals accessing ABE courses typically present with relatively low levels of literacy (e.g., reading at or below eighth grade level). Assessment of the word decoding skills of this population has often been undertaken within intervention studies, but has nonetheless provided significant insight into this group's decoding skills.

Alamprese et al. (2011) described the decoding abilities of 349 ABE learners as part of a randomised control trial evaluating the effectiveness of a decoding and spelling intervention. Overall, the participants' non-word reading, word recognition, and spelling ability were equivalent to scores typically achieved in grades three to five, and demonstrated deficits in skills relating to word decoding. Mellard, Woods, and Md Desa (2012) outlined the differences between four distinct groups of readers within a cohort of 296 young adults

accessing ABE literacy services. The researchers divided the cohort into four groups based on error rate and speed of reading – slow and accurate, slow and inaccurate, faster and accurate, faster and inaccurate – and determined whether statistical differences existed in non-word reading, fluency, working memory, and comprehension existed between them. The authors concluded that each group presented with unique strengths and weaknesses when compared to the other three groups. In particular, the fast and accurate group showed relatively strong performance in skills related to word decoding, whereas the slow and inaccurate group demonstrated relatively weak ability in these skills. These results thus highlight the importance of word recognition skills to successful reading comprehension performance within adult populations.

In a more recent study, Mellard, Woods, Md Desa, and Vuyk (2013) used the same participants, but sought to identify differences between participants' underlying skills and abilities. They reported that decoding and encoding skills explained 44.5% of the variance in reading comprehension ability, again indicating the strong contribution that the word decoding component of the SVR makes in reading comprehension.

Results from the studies outlined above cannot however be applied directly to other adult populations, and must be considered with caution. Individuals accessing ABE courses typically present with relatively low levels of literacy. It is therefore not possible to assume that word decoding skills would contribute towards reading comprehension in such a strong capacity for adults with higher level literacy abilities.

2.3.2.2. Adults with Higher Levels of Literacy Skill

One such study that has discussed the presence of word decoding difficulties amongst those with higher levels of literacy is a case study outlined by Apel and Swank (1999). This case study described the poor word decoding ability of a pre-service teacher with a history of

reading difficulty. The student presented with difficulties in non-word reading, word recognition and reading comprehension. He also had poor phonological awareness and morphological awareness, both skills that influence decoding ability. The intervention comprised 33 hours and specifically focussed on the word decoding skills outlined.

Following this intervention, the student made considerable progress in the areas targeted and demonstrated large gains on each of the assessment measures. His overall reading comprehension also improved, supporting the premise that decoding skills independently contribute to reading comprehension ability. This case study presents an individual example of word decoding difficulties in a student engaged in higher education, with much greater literacy ability relative to the ABE population. One isolated instance however cannot be generalised to the larger population, and these findings must be interpreted with caution.

A larger study was conducted with 76 undergraduate university students (Holmes, 2009), seeking to identify the strength of the relationship between word level (bottom up) skills and reading comprehension in adults with higher reading ability. The assessment included measures of word recognition (including phonological and orthographic decision tasks, letter shape matching, and character discrimination) and reading comprehension. There was a strong association between reading comprehension and word recognition, indicating that bottom-up processes such as word decoding can influence reading comprehension, even in experienced readers.

Jackson (2005) described the reading abilities of 193 adult university students through evaluation of word decoding, reading speed, and text comprehension. These scores demonstrated that decoding deficits were not strong indicators of reading comprehension deficits, nor related to overall academic achievement. Word decoding accuracy was most related to spelling and phonemic awareness. Although Jackson (2005) acknowledges the difficulty in determining an appropriate assessment level and choice amongst the higher

education population, the results from the assessments used in this study outlined a broad range of decoding skills within the cohort, with the deficits identified predominantly occurring in phonological awareness and spelling. Students who presented with poor decoding skills, however, did not necessarily demonstrate poor reading comprehension ability, indicating that the word decoding component may not be predictive of reading comprehension.

A study of adults (Ransby & Swanson, 2003) explored the extent of the contribution made to reading comprehension by word decoding skills. The performance of participants who had received diagnoses of developmental dyslexia in childhood were compared to a control group of age matched adults, and reading-level matched children. Measures comprised phonological processing (e.g., non-word reading, phoneme counting, and deletion) naming speed (rapid automatized naming), working memory, general knowledge, vocabulary, and reading comprehension. Phonological processing measures and naming speed both made unique contributions to the variance in reading comprehension accuracy in the group of adults with childhood diagnoses of dyslexia. Ransby and Swanson (2003) posited that no single cognitive process examined dominated, but rather the coordination of these processes may provide the best prediction of reading comprehension. Thus, they argued that the development of reading comprehension in adults with dyslexia (who typically present with weak word decoding skills) reflected not only deficits within word decoding skills, but also deficits in the component of linguistic comprehension such as vocabulary and listening comprehension.

The assessment of word decoding skill amongst adults has presented many conflicting findings. Studies including ABE students have demonstrated the strong influence of word decoding skills in explaining the variance in reading comprehension. Studies of adults with higher levels of literacy have been more conflicting in their findings, reporting varying

degrees of support for the role of word decoding in predicting reading comprehension amongst this population. It seems plausible that the level of contribution made by word decoding skill in explaining the variance in reading comprehension is specific to the population studied, and the assessment measures utilised. Further research is required to examine word decoding skills amongst typical higher education populations, using more complex measures of word decoding, and larger sample sizes.

2.3.3. Linguistic comprehension skills

Linguistic comprehension is the remaining contributory component of reading comprehension outlined in the SVR, the definition of which is provided as '*the ability to take lexical information and derive sentence and discourse interpretations*' (Hoover & Gough, 1990) (p.131). Whereas word decoding refers to the bottom-up process of identifying written text and subsequently applying grapheme-phoneme correspondence rules, linguistic comprehension refers to the ability to interpret the words and sentences that have previously been decoded. Skills that contribute to the component of linguistic comprehension include 'lower level' language skills such as vocabulary and grammar, as well as 'higher level' language skills required in a discourse context such as inferencing, knowledge of text structure, comprehension monitoring, and metacognitive skills (Cain, Oakhill, & Bryant, 2004; Cain, Oakhill, & Elbro, 2003; Cain, Oakhill, & Lemmon, 2004; Hogan, Sittner Bridges, Justice, & Cain, 2011). Typically, lower level language skills become the foundation upon which higher level language skills are built, however the two levels often demonstrate a reciprocal relationship (Hogan et al., 2011). There is a strong correlation between reading comprehension and linguistic comprehension, particularly in adults (Perfetti & Bell, 1994), where difficulties are more likely to be due to constraints of knowledge and understanding rather than word decoding (Hoover & Gough, 1990).

Assessment of reading comprehension has often focussed primarily on literal, or factual, comprehension. That is, the individual reads a passage of text and is then asked a series of questions relating to the text that simply require recall of basic facts or concepts. These questions are useful in determining an individual's basic comprehension of text but they do not probe their ability to integrate across the text, as there is no requirement for them to make inferences to answer the questions posed. A combination of factual and inferential questions can create a strong assessment of reading comprehension ability as they require the reader to call upon explicit and implicit knowledge to make causal and referential relations within the text (Hogan et al., 2011; Rapp, Van den Broek, McMaster, Kendeou, & Espin, 2007). It is this distinction between linguistic comprehension skills that enables comprehension of straightforward factual elements (typically lower level language skills such as vocabulary and grammar), and more complex understanding, to take place (typically higher level language skills such as inferencing, understanding text structure, comprehension monitoring, and metacognitive skills).

2.3.3.1. Lower Level Linguistic Comprehension Skills

While several studies have argued for the importance of vocabulary (within the element of linguistic comprehension) in children's reading comprehension (Nation & Snowling, 2004; Ricketts, Nation, & Bishop, 2007), the adult literature appears to be inconclusive. Sabatini et al. (2010) demonstrated the importance of word decoding and linguistic comprehension skills amongst 476 ABE students, but their findings did not suggest that vocabulary held an independent role in explaining the variance in reading comprehension. Conversely, Braze, Tabor, Shankweiler, and Mencl (2007) assessed the literacy skills of 44 young adults between the ages of 16 and 24 from a diverse range of backgrounds but all of whom were thought to have struggled with reading during their

schooling. Following a comprehensive battery of assessments, their data indicated that vocabulary made a significant contribution to reading comprehension above that explained by word decoding and other linguistic comprehension components. These findings contradict those of Sabatini et al. (2010), thus suggesting that the role of vocabulary in adults may be specific to the target population and / or the measures utilised. Both these studies, however, included adult participants with low literacy levels, and it is likely that the role of higher level linguistic comprehension skills will be more prevalent in adults with increased literacy skill (Landi, 2010; Perfetti & Bell, 1994). Despite the inconclusive evidence as to the role of vocabulary, it seems plausible that, in more skilled populations, higher level linguistic comprehension skills will subsume any influence made by lower level skills such as vocabulary.

It also is important to acknowledge that different measures of assessment were used in the studies outlined, which may account for the inconsistent findings. For example, Braze et al. (2007) used a sentence-picture matching task to assess reading comprehension, whilst Sabatini et al. (2010) used a short passage comprehension text. It has been argued that different reading comprehension tasks (even standardised assessments) can recruit different underlying skills, thus impacting on the measured relationship between comprehension and other skills (Cutting & Scarborough, 2006).

2.3.3.2. Higher level linguistic comprehension skills

2.3.3.2.1. Higher level skills amongst children.

Inferencing is considered to be a higher level linguistic comprehension skill which assists the reader in accessing information about the text beyond the literal meaning of the words, in order to fill in the gaps in language (Hogan et al., 2011). Furthermore, the ability to make inferences from text enables the written concepts and ideas conveyed to be understood,

thus allowing the reader to view the text as a cohesive whole rather than as an individual series of words and sentences (Rapp et al., 2007). Inferencing has been recognised as a key contributory component of reading comprehension, predominantly due to the increasing amount of literature reporting the underlying skills of reading comprehension in children.

Early descriptions of the inferencing skills of children (Oakhill, 1982, 1984) showed that those with poor comprehension abilities but adequate decoding abilities had specific deficits in inferencing and constructive memory compared to their peers with good comprehension (and similar word decoding) skills. This finding has been echoed continuously in subsequent research demonstrating that children's ability to make inferences cannot be labelled as a by-product of strong reading comprehension, but that good inference skills contribute to the outcome of strong reading comprehension (Cain & Oakhill, 1999; Yuill & Oakhill, 1991). Furthermore, inferencing difficulties amongst children with poor comprehension are not constrained to the written form alone. Cain, Oakhill, Barnes, and Bryant (2001) demonstrated that these difficulties were apparent in listening comprehension tasks as well as reading comprehension tasks.

Research focusing on the linguistic comprehension skills of children has frequently reported reduced higher level language skills in children with poor reading comprehension ability (Cain & Oakhill, 2006b; Catts et al., 2006; Nation, Clarke, Marshall, & Durand, 2004; Nation, Cocksey, Taylor, & Bishop, 2010). Results from several longitudinal studies have described the linguistic comprehension skills of children with poor reading comprehension (Nation et al., 2010; Oakhill & Cain, 2012). In a study of 242 children who presented with poor comprehension ability despite good word decoding ability, Nation et al. (2010) examined their language and reading skills over three years (from age 5 to age 8). By age eight, 15 children from the original sample still met the poor comprehender criteria, at which point comparisons were made to a further group of fifteen control children. Assessments

demonstrated deficits in lower level skills of vocabulary and grammar, as well as higher level skills of listening comprehension and knowledge of text structure.

One further longitudinal study of children by Oakhill and Cain (2012) sought to identify predictors of reading comprehension. The study of 10 to 11 year old children reported that the higher level language skills of inference, comprehension monitoring, and knowledge / use of story structure were the strongest predictors of reading comprehension. The authors suggested that these specific skills should be taught to children during reading instruction to aid their development of reading comprehension.

Early research comparing the inference strategies used by children and adults to understand written text, found diverse results amongst both populations (Phillips, 1988). They reported that regardless of age (adult or child), individuals who demonstrated high reading proficiency relied on different strategies to those incorporated by individuals with low reading proficiency. The strategies associated most frequently with highly proficient readers included empathising with text content and confirming prior interpretations of text, whereas strategies associated with readers with lower levels of proficiency included withholding or reiterating information and summing default interpretations. Additionally, the strategies utilised changed depending on whether the text was familiar or unfamiliar to the individual. Thus, a complex interaction was displayed between an individual's level of proficiency and background knowledge, but not by either one of these alone. Thus, this study suggested a relationship between an individuals' reading proficiency and their use of inferencing strategy, which may help to explain the differences presented in inferencing ability when children's skill has been assessed.

2.3.3.2.2. Higher level skills in the adult population.

While assessment of the linguistic comprehension skills of children have demonstrated a clear contribution of these skills to reading comprehension ability, research with adult readers has been less prevalent. It is not appropriate to simply apply the research undertaken with children to the adult population, as the contribution made to reading comprehension by higher level and lower level skills in adults differs somewhat from the child population.

Inferencing is one such higher level skill that has been examined in older populations. As the complexity and content of a text increases, however, the demand for inferencing becomes greater. Hence, as an individual progresses through education, inferencing assumes a much greater role in reading comprehension (Cartwright, 2009). This is particularly true in the higher education environment whereby readers are often required to make inferences from complex ideas within large texts or even across multiple texts. Adequate competency in the higher level skill of inferencing is therefore considered to be essential for good reading comprehension (Cain et al., 2001).

Cromley and Azevedo (2007) sought to address the role of higher level linguistic skills in the reading comprehension abilities of adolescents. They considered five 'domains' hypothesised to be predictors of reading comprehension: background knowledge, inferences, strategies, vocabulary, and word reading. Cromley and Azevedo (2007) suggested that individuals who have higher levels of reading skill build a great amount of prior knowledge and word reading ability, skills which subsequently affect comprehension. Furthermore, they argued for a reciprocal relationship between reading comprehension and background knowledge. The model of reading comprehension used (Direct and Inferential Mediation Model) proposed that the ability to use strategies such as summarising and inferencing

provided greater contribution to the ultimate goal of reading comprehension in adolescents and adults, than in children (Cromley & Azevedo, 2007; Mellard et al., 2010).

Two studies examining the inferencing abilities of adults included participants from higher education institutions (Hannon & Daneman, 1998; Long, Oppy, & Seely, 1994). Reading ability was determined in each study by performance on a standardised test of reading comprehension (Hannon & Daneman, 1998) or performance on the verbal measure of the SAT test (Long et al., 1994), allowing for differentiation between skilled readers and less skilled readers to be made. Both studies reported that the adults considered to be skilled readers make knowledge-based inferences spontaneously during reading, whereas adults considered to be less-skilled readers did not. Both studies indicate that groups of skilled readers can be differentiated from less skilled readers by their performance on tasks requiring them to make inferences; reflecting the findings from similar research with children.

Inferencing is a complex skill to master, and research has indicated that even highly-educated people with a strong history of reading have difficulty with some tasks requiring these skills (Franks, 1998). It has however been shown to be an essential skill in reading comprehension (Cain et al., 2001), and one which is required to a greater extent when the demands of the written text are increased (Rapp et al., 2007). It is therefore postulated that this skill will be necessary in the reading comprehension of adults in higher education, and may be one which serves to differentiate between individuals with good reading comprehension, and those with relatively poorer reading comprehension abilities. Further research is required to identify whether inferencing is a significant predictor of reading comprehension in adults, when considered within a SVR framework.

2.3.3.3. Metacognitive skill

Metacognitive skill, the knowledge of one's own cognitive processes, has been shown to contribute to reading comprehension, with skilled readers utilising metacognitive strategies more frequently than less skilled readers (Cartwright, 2009). Nicholson (1998) outlined two key processes as being particularly influential in reading comprehension. Firstly, the ability to recognise when the text is not understood and, secondly, the ability to consciously use comprehension strategies when text comprehension fails. Ultimately, individuals who are considered to be successful readers utilise metacognitive skills and strategies before, during, and after reading (Pressley & Gaskins, 2006).

The higher level ability of comprehension monitoring is one such example of a metacognitive skill employed in the process of reading (Cain, Oakhill, & Lemmon, 2004; Hogan et al., 2011). The contribution made to reading comprehension by comprehension monitoring was examined by Cain, Oakhill, and Bryant (2004) in their study of 102 elementary school age children. They assessed comprehension monitoring using short stories containing inconsistencies that required the participants to detect these errors. Results showed comprehension monitoring was predictive of reading comprehension ability (once other background influences were controlled) within this population. Not only does metacognitive skill influence reading comprehension, it has also been demonstrated that improved metacognitive ability may be a consequence of increased reading comprehension ability, thus presenting a complex relationship between the two (Baker & Beall, 2009). What these findings of influence and consequence suggest is that there is likely a reciprocal relationship between reading comprehension and metacognitive skill, with improvement in one of these resulting in improvement in the other, and vice versa.

Unfortunately, there is a recognised paucity of literature reporting the metacognitive skills and their application in reading comprehension amongst the adult population (Cromley,

2005). While the use of metacognitive skills have been advocated as an effective method to increase reading comprehension in various adult populations (e.g., Hock & Mellard, 2005; Hong-Nam & Leavell, 2011; Sheorey & Mokhtari, 2001; Thiede, Anderson, & Therriault, 2003), due to the difficulty in measuring this, there has been little research reporting findings from assessment of these skills in the adult population. Deficits in the use of metacognitive strategies have been attributed to a lack of reading comprehension ability (Hock & Mellard, 2011), as well as a lack of knowledge of when to use these metacognitive skills (Pressley, 2000). Strategies such as summarising require individuals to reflect on what they have read, delete and condense information, and subsequently paraphrase this information (Hock & Mellard, 2005), applying metacognitive skills throughout this process (Rich & Shepherd, 1993). A further specific metacognitive strategy is the integration of mind maps (sometimes referred to as concept or knowledge maps). The process of creating a non-linear representation of the text requires integration of skills similar to those used during summarising (Rich & Shepherd, 1993) and has been shown to improve recall of information with adult students in higher education (Farrand, Hussain, & Hennessy, 2002). Other frequently used strategies include generating and asking questions about written text, activating prior knowledge, and making predictions (Cromley, 2005).

Studies utilising questionnaires have probed the awareness of individuals' reading comprehension strategy use (Kozminsky & Kozminsky, 2001), and demonstrated their appropriateness for the child and adult population (Mokhtari & Reichard, 2002). Kozminsky and Kozminsky (2001) assessed 205 students between 14 and 16 years of age, and found that students with higher reading comprehension skill had the most knowledge and use of reading comprehension strategies compared to students with comparatively lower levels of reading comprehension ability. Furthermore, the Metacognitive Awareness of Reading Strategies Inventory (MARSI; (Mokhtari & Reichard, 2002)) was designed for use by both children and

adults, to aid individuals in increasing their metacognitive awareness and strategy use while reading. The authors suggest that the tool can be used to increase awareness of individuals' reading strategies, evaluate themselves comparatively to other readers, and finally change any negative ideas they may have about reading and learning from text (Mokhtari & Reichard, 2002). In addition, questionnaires such as those outlined can be useful in their practical application, providing educators with their own means of assessing, monitoring, and documenting the metacognitive skills and usage of their students.

It is apparent that despite a recognition that metacognitive skills are a key influential component, or consequence of, reading comprehension, many individuals will not accurately monitor their own comprehension or apply metacognitive skills while reading text (Cromley, 2005). If an individual is unable to differentiate between what they have read and understood, versus what they have 'read' but not understood, it seems unlikely that they will subsequently allocate more time and resources to fully comprehend text and improve reading comprehension (Thiede et al., 2003). Thus, it may be pertinent to include metacognitive skills in both reading comprehension assessment and intervention (as discussed in section 2.4.3.3.), for adults who present with difficulties understanding written text.

2.3.4. Working Memory Skill

It is recognised that if one is examining the role of metacognition in reading comprehension, other factors that influence metacognition and reading comprehension must also be considered (Baker & Beall, 2009). One such factor that has received attention and sparked much debate is that of working memory, and its significance in the reading comprehension abilities of both children and adults. The term 'working memory' is typically defined and understood as referring to the capacity to store and process information simultaneously (Baddeley, 2012).

The complex nature of reading comprehension draws on a number of different processes requiring the integration of information across words, sentences, passages, and sometimes texts to produce a text that is organised at both a local and global level. These processes therefore require the storage of semantic and syntactic information, which must then be recalled and applied to the corresponding section of the text. Although Gough and Tunmer's SVR proposes that the process of reading comprehension is comprised of the two components of word decoding and linguistic comprehension, increasing research has sought to describe further underlying skills that influence reading comprehension. Working memory has been shown to be a direct predictor of reading comprehension in children, when this skill has been contrasted with vocabulary and decoding skills (Seigneuric, Ehrlich, Oakhill, & Yuill, 2000). Studies by both Seigneuric et al. (2000) and Cain, Oakhill, and Bryant (2004) have demonstrated the unique contribution made to reading comprehension in children, when controlling for the SVR influential components of word reading (element of word decoding) and verbal ability (element of linguistic comprehension). This argues for the direct contribution of working memory in the process of reading comprehension (Seigneuric & Ehrlich, 2005).

A meta-analysis of 77 studies of memory and cognition completed by Daneman and Merikle (1996) provided strong support for the notion that working memory plays an important role in language comprehension. Their results showed a moderate effect size for the correlation between reading span and comprehension ($r = .41$), as well as showing that measures of working memory that recruit both processing and storage aspects better predict language comprehension than measures that tax only the storage component (Daneman & Merikle, 1996). While this meta-analysis outlined correlations between working memory and language comprehension, further research has sought to describe the skills which influence reading comprehension specifically. This research has typically focussed on individuals who

present with difficulties in reading comprehension to try and identify whether working memory contributes to the breakdown or deficit in comprehension.

It is within the research focussing on individuals with reading comprehension difficulties where a greater debate as to the role of working memory has ensued. A meta-analysis of 18 studies sought to address this debate by examining the relevance of working memory in its capacity to differentiate between individuals with good and poor reading comprehension (Carretti, Borella, Cornoldi, & De Beni, 2009). Results demonstrated that memory tasks demanding attentional control and requiring verbal information processing are the most effective to distinguish between poor and good comprehenders. This finding is consistent with a large body of literature indicating that working memory tasks requiring processing and storage are strong predictors of reading comprehension (e.g., Cain, Oakhill, & Lemmon, 2004; Daneman & Merikle, 1996; Yuill, Oakhill, & Parkin, 1989).

Seigneuric and Ehrlich (2005) undertook a longitudinal study to investigate the predictive power of working memory in reading comprehension. They completed assessments of reading comprehension, working memory capacity, non-word reading, and vocabulary knowledge, each year for a three year period, with a sample of 74 children. Results were mixed, with working memory predictive of reading comprehension at grade three, but not grade one or two. Further analysis suggested that working memory may increase its predictive power with age (due to the automation of word recognition throughout the early years). Thus, it may be more pertinent to examine its role in reading comprehension within older participants.

Research focussing on the working memory skills of children who are poor and good comprehenders has found that those with good comprehension outperform individuals with poor comprehension on working memory measures (Cain & Oakhill, 2006b; Carretti et al., 2009; Nation, Adams, Bowyer-Crane, & Snowling, 1999; Swanson & Berninger, 1995).

There is, however, a paucity of literature available describing the contribution of working memory to reading comprehension in the adult population, especially when differentiating between poor and good comprehenders. Hannon (2012) assessed the reading comprehension abilities of 150 adult students recruited from a higher education facility. The assessment battery included a standardised measure of reading comprehension, evaluation of lower level skills (phonemic and orthographic decision tasks), evaluation of higher level skills (text memory, text inferencing, knowledge access, knowledge integration, and speed), and evaluation of working memory (reading span and operation span; both verbal and non-verbal contributions). Results demonstrated that working memory influenced higher-level processes, and that lower level skills, higher level skills, and working memory each made a significant contribution to explaining the variance in reading comprehension (Hannon, 2012). The findings of this study demonstrated no relationship between lower-level word processes and working memory, implicating these as two separate elements of reading comprehension.

Conversely, Macaruso and Shankweiler (2010) found working memory did not make a unique contribution to predicting reading comprehension in 48 adults engaged in higher education. While the measure of verbal working memory was not found to independently contribute to reading comprehension, it was one of two variables (along with phonological awareness) that best differentiated individuals with reading comprehension difficulties from those with typical skills. The authors suggested that the SVR should be expanded to account for individual differences in the adult population. Similarly, Hannon (2012) highlighted that working memory can (in some cases) differentiate between adults with strong and poor reading comprehension ability.

It is argued that adults who present with reading comprehension difficulties are disadvantaged in higher level skills that require integration of information, due to the high demands placed on their working memory capacity (Daneman & Carpenter, 1980; Hannon &

Daneman, 2001). This is consistent with the findings from Daneman and Merikle's (1996) meta-analysis reporting that working memory utilising both processing and storage components (such as the reading and operation span included by (Hannon, 2012)) accounted for 17% of the variance in performance on general measures of reading comprehension.

Although there is a growing foundation of research attributing poor reading comprehension to limitations of working memory resources impeding comprehension processes, some researchers have continued to dispute this relationship. One alternative hypothesis proposed to explain the difficulties of poor comprehenders is that the deficits that have been attributed to working memory difficulties occur as a consequence of underlying language difficulties and the two occur in conjunction with each other. Thus, the working memory deficits that have been identified are simply a result of the language difficulties believed to be the true attributable cause of reading comprehension failure (Nation, 2005; Nation et al., 1999; Stothard & Hulme, 1992). In one of three experiments designed to assess memory skills in children with and without reading comprehension difficulties, Nation et al. (1999) describe observable deficits in working memory amongst the poor comprehenders only in tasks of working memory that placed a significant cognitive load on semantic processing skills. Based on these findings, the authors posited that verbal memory is related to language competency, and that individuals with poor reading comprehension demonstrated deficits within the semantic system that are highlighted in tasks requiring verbal working memory.

More recently, the view that poor working memory contributes to poor reading comprehension has been further disputed by Van Dyke et al. (2014). Conclusions drawn from their study of 65 young adult participants (with no history of reading difficulty) supports the view presented by Nation et al. (1999) that working memory is not a direct cause of reading comprehension failure. Participants completed a range of assessments in the areas of reading

comprehension, phonological processing, word reading, word decoding, and verbal working memory to determine the role of each in reading comprehension. Following analysis of results using mixed-effect modelling, the authors concluded that the association of working memory and reading comprehension could be attributable to the collinearity of working memory with multiple other skills related to reading comprehension, such as IQ.

Furthermore, the conclusions drawn from this study propose that interference in retrieval of information from memory is the key determinant in reading comprehension ability, rather than working memory capacity. Despite findings from this study arguing against working memory playing a significant role in reading comprehension, Van Dyke et al. (2014) still highlight the need for a *'more comprehensive understanding of the factors that contribute to poor reading comprehension skills in adults.'* (p. 400). It therefore appears that two contrasting views remain with regard to the role working memory plays in contributing to reading comprehension, particularly in relation to adults. Further research is required amongst the adult population using nonverbal working memory measures, to allow for conclusions to be drawn as to whether working memory does, or does not, contribute to reading comprehension.

2.3.5. Summary of the Component Skills of Reading Comprehension

Typically, reading comprehension assessment (and assessment of its constituent skills) is most prevalent in the school environment, where teachers use it as a tool to monitor their students' performance and identify any difficulties or deficits amongst their students. A large number of standardised assessments are available for use with the school-age population (Cain & Oakhill, 2006a), including those that measure reading comprehension directly (e.g., the Neale Analysis of Reading Ability (NARA): Neale, 1999) and those that measure component skills (e.g., an assessment of decoding skills using the Woodcock

Reading Mastery Test, 3rd Edition (WRMT-III): Woodcock, 1987). A difficulty arises when considering robust and reliable assessment for adults, as very few standardised assessments are designed specifically for this population. Although it can sometimes provide useful insight, the use of children's reading assessment is generally not recommended for use with adults (Kruidenier, MacArthur, & Wrigley, 2010). Furthermore, while there may be weight in using children's assessment with adults with low literacy skills due to their similar presenting profiles, for adults with higher literacy skills (but underlying reading comprehension difficulties) this is increasingly problematic, as their literacy profiles are often significantly more complex. Accurate assessment of reading comprehension for adults in higher education is required for the same reasons as in the school-based context – for progress monitoring, and to identify individuals who may have difficulties at the outset of their university study (Williams et al., 2011). Further research is required to identify whether adults who successfully reach higher education (who are assumed to possess strong reading comprehension) have underlying literacy difficulties that may have not previously been identified.

Research examining the component skills of reading comprehension in adults is diverse in its description and conclusions. While it has been argued that word decoding skills are typically more solidified by adulthood, studies comprised of the ABE population have demonstrated that this is not necessarily the case. In more highly educated students, it is assumed that word decoding skills are strong and that elements of linguistic comprehension are deficient, with skills such as inferencing presenting the ability to differentiate between groups of skilled readers and less skilled readers. Knowledge of linguistic comprehension ability within the adult population is limited. Therefore the role that these skills play in reading comprehension remains undetermined and should be addressed within future studies.

Similarly, the argument as to the influence of working memory appears to be ongoing with support for and against its significance.

One area in which there is significant consensus is that proficient reading comprehension amongst the adult population requires strong skills in the two components of the SVR – word decoding and linguistic comprehension. Individual performance on assessment of these two key skills allows for possible classification in one of four groups: those with deficits in both D and LC (generally poor readers); those with poor D and average or better LC (dyslexics); those with poor LC and average or better D (poor comprehenders); and those with no impairments in either of the two components (typical readers) as observed in the literature (Catts et al., 2006; Catts et al., 2003; Elwér, Keenan, Olson, Byrne, & Samuelsson, 2013). Assessment of the component skills of reading comprehension allows individuals to be grouped according to their strengths and weaknesses, thus more pertinent and specific intervention can be provided to improve overall reading comprehension through targeting of specific skills.

2.4. Intervention for Reading Comprehension Difficulties

A large body of research has examined the nature and remediation of reading comprehension difficulties amongst children, with numerous studies focussing on early intervention (Denton, Fletcher, Anthony, & Francis, 2006; Jenkins & O'Connor, 2002; Lovett et al., 2000). Relatively few studies have focussed on the effectiveness of literacy instruction with adolescents and older children such as upper elementary age (Flynn et al., 2012; Wanzek et al., 2010), middle and high school students (Calhoun, 2005; Vaughn et al., 2010; Vaughn et al., 2014). Despite the research completed with children, there has been little recognition of the continuous development of literacy over the lifespan (Moore et al., 1999), and there is a

paucity of research describing both assessment and intervention of reading comprehension difficulties in adulthood.

Many interventions have been designed to accommodate the typically weaker word decoding skills present in children, thus have a focus on bottom-up processing skills such as phonological awareness and word recognition (e.g., Rashotte, MacPhee, & Torgesen, 2001; Torgesen, 1999). Despite the success of these interventions in their targeted elements, there has been mixed findings in their transfer to enhanced reading comprehension amongst children. Results from such studies implicate the need for reading comprehension intervention that targets skills beyond word decoding alone. There has been limited focus, however, on evaluating interventions that target the linguistic comprehension component of the SVR for children (Cutting & Scarborough, 2006). Similar findings are apparent in the adult literature, with a focus upon intervention targeting word decoding skills (e.g., Greenberg et al., 2011; Sabatini et al., 2011; Scarborough et al., 2013), with relatively less literature reporting intervention studies targeting skills comprising linguistic comprehension. Further studies are required to address the effectiveness of intervention targeting aspects of linguistic comprehension in improving reading comprehension for adults.

2.4.1. Adult Intervention Studies within the ABE Population

Adults with literacy difficulties have received increasing research attention in response to the high prevalence of reading impairment within this population (Scarborough et al., 2013). This research has centred on individuals who access basic adult education services (Greenberg, Pae, Morris, Calhoun, & Nanda, 2009; Greenberg et al., 2011; Hock & Mellard, 2011; Mellard et al., 2013; Sabatini et al., 2011), but little attention has been given to adults who progress beyond such services, or who do not require such basic level input. Perhaps as a result of the identified areas of literacy difficulty, studies of adults who access basic

education services have predominantly focussed on lower-level literacy skills such as fluency and, in particular, decoding (e.g., Alamprese et al., 2011; Sabatini et al., 2011). Traditionally, the component of comprehension, which is ultimately considered to be the goal of reading (Paris & Hamilton, 2009), has received little attention.

Recently, several adult intervention studies have incorporated the component of comprehension in their assessment of the population, with one including comprehension as part of the intervention itself. Greenberg et al. (2011) conducted a randomised control trial examining the effects of four different methods of instruction on the reading comprehension abilities of 198 ABE students. Participants were randomly allocated to one of five instructional programs (decoding and fluency; decoding, comprehension, and fluency; extensive reading; decoding, comprehension, extensive reading, and fluency; and a control / comparison approach), and received a mean of 94 hours of group classroom instruction. The authors reported significant gains for the whole cohort (regardless of instruction group) in decoding, fluency, and reading comprehension. The effect sizes associated with these improvements following the period of instruction were small (.03-.18). Surprisingly, a significant difference was only observed between the instruction groups on one measure (non-word reading). These findings suggested that intervention targeting different component literacy skills did not impact on the overall changes made by the participants, and that differentiated intervention may not be appropriate for this group of adults.

Alamprese et al. (2011) also utilised a randomised control trial to investigate the effectiveness of an intervention specifically focussed on decoding and spelling. Classes of ABE students were randomly allocated to an experimental intervention group (of decoding and spelling instruction) or a control group (who continued their existing reading instruction), resulting in 349 participants completing both pre- and post-assessments. Fewer hours of intervention were delivered to participants than those of the Greenberg et al. (2011) study,

with a mean of 57 hours over approximately 30 weeks. Measures utilised at pre- and post-testing included reading comprehension, vocabulary, decoding, fluency, word recognition, and spelling. The experimental group demonstrated small mean gains on all measures. These gains were significantly greater than the control group for one measure of decoding alone. Findings demonstrated a small effect size (0.19) for this decoding measure with insignificant gains made in reading comprehension, echoing findings reported by (Greenberg et al., 2011).

Sabatini et al. (2011) employed three different reading instruction programmes in an intervention study with ABE participants. Participants were identified and then randomly assigned to one of three interventions: an adaptation of Corrective Reading (CR; intervention focussing on strengthening and expanding grapheme-phoneme correspondences, and word recognition); modification of Retrieval, Automaticity, Vocabulary Elaboration-Orthography (RAVE-O; phonics instruction supplemented with fluency training); and Guided Repeated Reading (guided repeated reading to strengthen fluency skills, with some phonics instruction). Participants received a mean of 43.75 hours (range of 12-63 hours) of individual tutoring, with 148 participants completing at least ten instructional sessions. Participants demonstrated significant gains from pre- to post-assessment in decoding, fluency, word recognition, decoding efficiency, and reading comprehension across all conditions. Although some of the gains made were higher than the previous studies outlined (e.g., decoding scores demonstrated a moderate effect size), generally the reported effect sizes were small or lower (ranging from $d = 0.19 - 0.34$). Notably, gains made in comprehension were significant, but minimal ($d = 0.20$). Again, as outlined in the studies above, there were no significant differences between the intervention groups, suggesting that it was intervention in general that was effective, rather than the type of intervention that was received.

Results from studies examining intervention for adults accessing ABE services show that identifying effective methods of instruction remains problematic. There were minimal

gains in monitored skills despite the intensive nature of the inputs described. These interventions, however, typically focussed on word decoding skills rather than linguistic comprehension skills, due to the participants' literacy profile (i.e., weak word level literacy skills). Further research is required to examine the effectiveness of interventions that focus on skills other than, or in addition to, word decoding to determine whether intervention targeting contributory skills of reading comprehension is effective for adults. It is also important that the effectiveness of interventions designed to support adults who are struggling to comprehend more advanced written material in higher education or vocational environments are explored.

2.4.2. Intervention for Adults with Higher Levels of Literacy Skill

There is also a significant group of adults who do not present with such transparent literacy difficulties, but who could benefit from input to support their reading comprehension. Such individuals will likely be ineligible for basic education support and may go unnoticed. At the time individuals leave secondary school, many do not have adequate literacy skills to allow them to access higher education (Armbruster et al., 1991). Increasingly, however, many jobs require post-secondary education (Kutner et al., 2007), therefore reducing the opportunities available to school-leavers with reduced literacy skills. The higher education population is changing worldwide with a much broader demographic accessing the higher education environment (Parry, 2009). Furthermore, an increasing number of students with identified language and learning disabilities are entering into higher education (Heiman & Precel, 2003; Henderson, 1999; Vogel et al., 1998). Although the needs of individuals with registered learning disabilities are often addressed, little is known about the individuals who lack diagnoses, but who present with less transparent needs such as underlying literacy difficulties.

There are large demands placed on the literacy skills of an individual in higher education, with most courses requiring students to read large and complex texts, as well as drawing on reading comprehension skills to access course materials (Fidler & Everatt, 2012). Reading comprehension is considered to be an important outcome of higher education (Holder, Jones, Robinson, & Krass, 1999), as well as a necessary skill for success throughout higher education study. Despite what is known about the increasing number of students accessing higher education with unidentified literacy difficulties, and the high demands of reading comprehension, there has been limited focus outside of the ABE student population to include more advanced readers such as those presenting in the higher education environment.

One group of students engaged in higher education whose literacy performance has been scrutinized within the literature are pre-service teachers. Research focussing on the literacy skills and attitudes of this group has demonstrated a wide range of achievement on reading comprehension and personal attitudes towards reading (Benevides & Peterson, 2010). These findings have been echoed in other studies, similarly reporting that pre-service teachers as a group are not well-engaged in strong reading habits (Nathanson, Pruslow, & Levitt, 2008), with approximately 50 percent of these students feeling unenthusiastic towards reading (Applegate & Applegate, 2004). Additionally, there are multiple reports across a number of international contexts that pre-service teachers perform poorly in metalinguistic tasks (e.g., phonological awareness) related to literacy achievement (e.g., Carroll, Gillon, & McNeill, 2012; Washburn, Joshi, & Binks-Cantrell, 2011). These studies suggest there is a need to provide support to pre-service teachers to develop their own literacy skills and their ability to explicitly teach such literacy skills within the classroom (Benevides & Peterson, 2010).

2.4.3. Strategies to Enhance Reading Comprehension Ability

The reading comprehension intervention within this thesis focusses on enhancing the skills of pre-service teachers. This particular group of adults are required to teach the application of strategies to aid reading comprehension to their students. This is a complex skill, and to be able to teach this to developing readers within the education system, teachers must be competent in their own use and understanding of comprehension strategies (National Reading Panel, 2000). Despite a noted lack of research into instructional reading comprehension interventions for adults (Kruidenier, 2002), a range of strategies have been reported, with those pertaining to adults including summarising, generating questions, creating visual images, concept mapping, and computer assisted technology.

2.4.3.1. Text-to-speech

One such strategy that is frequently advocated for use by adult students with dyslexia is the use of text-to-speech software. This strategy focusses on the decoding aspect of reading comprehension by reading written text aloud to the individual. Draffan, Evans, and Blenkhorn (2007) surveyed 455 adult students with dyslexia in higher education, 79.8 percent of whom reported being supplied with text-to-speech software. The majority of participants were positive about the strategy, with three positive comments for every negative comment. Although the effectiveness of the tool was not directly evaluated, the authors also highlighted the possibility that students may potentially find this strategy distracting. This belief was supported by the results of a study with 80 higher education students with learning disabilities, investigating the efficacy of text-to-speech software (Higgins & Zvi, 1995). This study compared participants' reading comprehension performance when using text-to-speech software, to another person reading the text aloud, and when reading the text silently themselves. Results indicated that the more severe the reading comprehension difficulty, the

greater the improvement in performance when using the text-to-speech software. Conversely, students who achieved a higher self-reading score demonstrated poorer performance using the text-to-speech strategy. There were no significant differences between any of the three conditions in reading comprehension.

Based on these findings, it is apparent that text-to-speech software may be beneficial for adults who present with greater levels of reading comprehension difficulty, but it may not be a suitable strategy for those who have already achieved a relatively high level of reading proficiency (Lindstrom, 2007). Without clear differentiation between the poorly and higher performing students, it is difficult to ascertain the literacy level at which this strategy stops being useful. Higgins and Zvi (1995) did not provide in-depth insight into the participants for whom this strategy was beneficial, simply that relative to the other participants in the cohort they presented with more severe reading difficulties. Furthermore, their participants had a broad diagnosis of learning disability rather than literacy difficulties. It is pertinent to investigate the provision of a text-to-speech strategy for adults engaged in higher education who present with difficulties directly related to reading (and in particular decoding and decoding fluency), to better determine the appropriateness of this tool.

2.4.3.2. Prediction / Pre-learning

The concept of using 'prediction' to increase reading comprehension has been addressed in a number of different ways. Hock and Mellard (2011) included prediction as one of four strategies in a randomised control trial of learning instruction with ABE students, using a mnemonic to prompt individuals to make predictions about the text. The results when using this particular strategy were not significant when compared to a control group of typical instruction, and groups receiving three other reading comprehension strategies. The study,

however, had high a high rate of participant attrition and sporadic attendance which may have influenced the efficacy of the interventions examined.

In a study of university students with a diagnosis of dyslexia, Fidler (2009) used ‘key words’ that had been extracted from text to prime participants prior to gaining access to the text. This strategy also assisted participants in decoding these ‘key words’ by providing a definition and pronunciation for each item that had been identified as potentially challenging. The key word strategy showed gains in the reading comprehension of four of the nine participants for whom profiles were provided, demonstrating gains from the baseline assessment when using this strategy. Similar to reports regarding the effectiveness of text-to-speech, Fidler’s results suggested that a strategy including prediction and word decoding was effective for individuals with relatively low reading comprehension prior to intervention. These findings supported the notion that strategies that occur prior, or subsequent, to reading can be effective in supporting reading comprehension (Thiede et al., 2003). It is important for future research to ascertain whether such strategies are effective for adults engaged in higher education, who do not have reading difficulties specifically related to areas of word decoding (e.g. focused on adults without a diagnosis of dyslexia).

2.4.3.3. Metacognitive Strategies

Metacognitive strategies have been found to be effective methods of increasing reading comprehension in several populations (e.g., Hock & Mellard, 2005; Hong-Nam & Leavell, 2011; Sheorey & Mokhtari, 2001; Thiede et al., 2003). Decreased use of metacognitive strategies in adults has been attributed to a lack of reading comprehension ability (Hock & Mellard, 2011), as well as a lack of knowledge of when to use these metacognitive skills (Pressley, 2000). One such metacognitive strategy is that of summarising, which requires individuals to reflect on what they have read, delete, condense,

and subsequently paraphrase this information (Hock & Mellard, 2005). In order to be able to effectively summarise written text, individuals must apply metacognitive skills throughout the process (Rich & Shepherd, 1993). A further metacognitive strategy is the creation and integration of mind maps (sometimes referred to as concept or knowledge maps). This is a process that results in a non-linear representation of the text, hence, this requires the utilisation of skills similar to those used during summarising (Rich & Shepherd, 1993). Representing the text through the use of mind maps has been shown to improve recall of information with adult students in higher education (Farrand et al., 2002).

The explicit teaching of metacognitive strategy use has enhanced the reading comprehension performance of students within the school environment (Pressley & Gaskins, 2006). It is often apparent that individuals are engaging in the use of metacognition in their daily lives, but not transferring these skills to ensure that they understand what they have read in reading specifically, and other academic learning (Cromley, 2005). It therefore seems feasible to conclude that many adults who are left to their own devices will not employ metacognitive skills to monitor their comprehension whilst reading (Thiede et al., 2003). This is problematic as if adults are unaware of what they have and have not understood within a written text, they will be unlikely to return to the parts in which they have experienced difficulties.

Simpson and Nist (2000) reviewed the literature surrounding reading strategies, presenting four evidence-based strategies of question generation, summarisation, elaborations, and information organisation, which they advocated may be useful to teach students. Further, they strongly suggested that metacognitive processing should be the instructional focus. Two studies have investigated the long-term and short-term effects of strategic teaching for university students (Caverly, Nicholson, & Radcliffe, 2004). The first study examined the effectiveness of strategic reading as a stand-alone course for 36 adult

readers with identified reading difficulties. Participants completed a semester long intervention including explicit instruction of how to follow four steps of predicting, locating (prior knowledge), adding (their own knowledge to the text), and noting. Significant gains were made from pre- to post-intervention on cognitive, metacognitive, and affective measures. Participants also self-reported transferring this information from the stand-alone course to other courses in the subsequent semester. The second study reported by Caverly et al. (2004) compared a group of adult readers who chose to complete a course of strategic reading instruction ($n = 51$) to a group who did not participate in any instruction ($n = 78$). Both groups comprised participants who had been identified with low reading performance relative to their university peers. The group who had completed the intervention outperformed the control group on a standardised assessment of reading (specific to the American state where the research was undertaken), and in their mean grade on a reading-intensive history course, despite no significant differences at pre-intervention assessment point. The authors posited that participants who had completed the intervention were able to transfer their learnt strategic reading skills to their broader curriculum learning. Further research is required to ascertain which specific elements of this intervention were most beneficial for students, and compare the effectiveness of different strategies to enhance reading comprehension.

A small study of four college students described the development of reading comprehension that included the direct instruction of metacognitive reading comprehension strategies (Falk-Ross, 2001). All four participants completed the same intervention across the semester with several classes of an hour occurring each week. The students were exposed to several different strategies including note-taking, summarising, identification of different types of text, and skimming the text for key information. Standardised assessments conducted post-intervention revealed a significant gain in reading comprehension scores for each

participant. Further qualitative assessment data reported improvement in all four participants' reading comprehension strategy use, application of new information, and more focused, critical, and productive reading. While this study does depict the success of including metacognitive strategies as support to improve reading comprehension, caution must be observed as this intervention included several other aspects of content and it is not possible to attribute gains to one particular element of the intervention alone. Further, the participants of this study had reading comprehension scores at or below eight-grade level, akin to the level of ABE students considered to present with low literacy skills. It is therefore pertinent to examine the effectiveness of metacognitive strategies for adults in higher education who do not present with a diagnosis of learning disabilities on entry into higher education.

There is a significant amount of literature that advocates for the inclusion of metacognitive strategy instruction in reading comprehension for adults and children alike (e.g., Baker & Beall, 2009; Pressley, 2000). The research reporting its effectiveness (particularly with adults), is not as forthcoming. The studies that have detailed the use of metacognitive strategies for this population have been positive about the gains in reading comprehension that can be made. There is, however, a lack of research addressing the needs of adults who experience literacy difficulties in higher education without previously diagnosed learning difficulties, and the possible application of metacognitive strategies to these students. It is therefore arguable that intervention to improve reading comprehension for adults, regardless of their level of literacy skill, should provide a constituent that focusses on enhancing metacognitive skills amongst the adult population. Or, as Mellard et al. (2010) state, "*...interventions that encourage improved reflective thinking about one's own reading may help this population, particularly when learning disabilities are present.*" (p. 162)

The literature reviewed within this current section (2.4.) has explored intervention for adults who present with reading comprehension (or general literacy) difficulties. It is

recognised that the higher education environment may result in individuals who have not previously presented with literacy-related difficulties, experiencing difficulties in meeting the demands placed on them. While the need for the provision of support for these students cannot be underestimated, the needs of the cohort as a whole must also be addressed. Pre-service teachers in particular have been identified as a cohort of individuals for whom population-wide literacy difficulties have been identified. The following section of this literature review examines the literature around assessment and intervention for this whole cohort of individuals, with a focus on metalinguistic knowledge.

2.5. Assessment and Intervention of Language Structure Knowledge in Pre-service Teachers

The principle of ‘The Peter Effect’ (whereby one cannot give what one does not possess) was first applied to the instruction of reading by Applegate and Applegate (2004), suggesting that pre-service teachers could not pass on an enthusiasm for reading if they themselves were not enthusiastic about reading. The Peter Effect has since been applied to teacher educators (i.e., educators in higher education responsible for teaching pre-service teachers) (Binks-Cantrell, Washburn, Joshi, & Hougen, 2012) to argue that teacher educators cannot provide effective instruction for pre-service teachers if their own knowledge is inadequate. Despite this, the Peter Effect has not been applied to the pre-service teacher population with regard to their own level of skill. It could be argued that pre-service (or in-service) teachers cannot provide adequate reading instruction to children if their own reading comprehension skills are weak, and / or that they cannot use reading comprehension strategies to assist their own comprehension. Additionally, if they do not have explicit knowledge of the independent skills required to provide reading instruction, it could further be argued that they cannot pass on this knowledge to the children they teach. The teaching of

reading is cyclic in nature, with the reading skills of children being dependent on the teaching skills of teachers. As outlined by Duke, Pearson, Strachan, and Billman (2011) “*If learning to read effectively is a journey toward ever-increasing ability to comprehend texts, then teachers are the tour guides...*” (p.51). Yet if teachers do not possess effective reading abilities themselves, then the Peter Effect argues that they will not pass this knowledge onto their students.

2.5.1. Assessment of Pre-service and In-service Teachers’ Language Structure Knowledge

It is widely accepted that explicit instruction to develop children’s awareness of language structure is crucial for the successful development of reading and spelling. The extensive research supporting the importance of teaching metalinguistic knowledge has resulted in policy and curriculum changes in literacy education across a variety of contexts (National Inquiry into the Teaching of Literacy, 2005; National Reading Panel, 2000; Rose, 2006). Despite such recommendations regarding best practice in literacy instruction, research worldwide has ascertained that in-service teachers and pre-service teachers do not have strong personal metalinguistic knowledge (Fielding-Barnsley, 2010; Mather, Bos, & Babur, 2001; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003; Stainthorp, 2004; Washburn, Joshi, & Binks-Cantrell, 2011), which is likely to inhibit their ability to provide explicit teaching of language structure in the classroom. Results from studies examining the effectiveness of intervention to build pre-service teachers’ language structure have important implications for improving the preparation of teachers to deliver evidence-based literacy instruction within the early school years.

Research has elucidated that pre-service and in-service teachers present with relatively low levels of language structure knowledge across a variety of international contexts. Similarly, there is now a large body of literature across multiple English-speaking

contexts that suggests teacher education programmes are ineffective at building the language structure knowledge of pre-service teachers. Carroll et al. (2012) examined students' knowledge in the first semester ($n = 153$) and those in their final semester ($n = 98$) of a three year New Zealand teacher education programme, and compared students' scores to those achieved by in-service teachers ($n = 208$). Results showed all groups performed at ceiling level for syllable identification. In-service teachers demonstrated the strongest phoneme awareness knowledge whilst first year students demonstrated the weakest knowledge. Phoneme awareness scores obtained by the third years students ($M = 3.22$, $SD = 2.65$) were greater than the first year students ($M = 2.03$, $SD = 2.08$), demonstrating an increase in knowledge of almost 12 percent over the two years. The first and final year students demonstrated the weakest knowledge. Despite this increase, however, the third year students' scores still remained at only 32 percent of items correct, and scores across all three groups remained low, with in-service teachers averaging less than 50 percent of items correct. It is clear that this low level of phoneme knowledge exhibited by pre-service and in-service teachers will impact on their ability to provide explicit phoneme awareness and phonics instruction in the classroom.

Similar findings of weak phoneme awareness were found in several studies conducted in Australia. Coltheart and Prior (2006) surveyed fourth year Bachelor of Education students across Australia. The authors reported that many pre-service teachers in Australia have deficits in areas of literacy themselves, which included lack of knowledge about language structure concepts (e.g., phonics, phonemic awareness). Similarly, an assessment of the linguistic knowledge of in-service teachers and pre-service teachers ($n = 120$) in Australia (Mahar & Richdale, 2008) found that less than 50 percent of questions were answered correctly by this cohort, reporting highly variable results and limited metalinguistic knowledge.

More recently, 162 Australian pre-service teachers across all years of their training, responded to a questionnaire including questions relating to their knowledge of phonemic awareness (Fielding-Barnsley, 2010). The results showed that participants recognised the importance of teaching phonics, and 73% were able to provide the correct definition of a phoneme from a choice of four responses. Participants were not as successful at identifying the number of phonemes in three different words with correct responses ranging from 4 percent (the word 'box'), to 33 percent (the word 'chop'), demonstrating that they struggled to practically apply their knowledge of the definition of a phoneme. This confusion in phoneme identification has been reported amongst other nationalities of pre-service teachers, with scores as low as 2 percent in a cohort of 131 pre-service teachers on an item included in the study completed by Mather et al. (2001) in America.

Studies that have examined pre-service teachers' metalinguistic knowledge beyond phonological awareness mirror the findings discussed above. Washburn, Joshi, and Binks-Cantrell (2011) assessed phoneme awareness, morphological awareness, and orthographic awareness knowledge of 91 American final-year pre-service teachers. This study also reported a dissociation between students' knowledge of the definition of the phoneme and the application of this knowledge when asked to identify phonemes within words. Other data demonstrated near-ceiling levels in syllable identification but conversely low skills for morpheme knowledge (i.e., 12-45%). The survey was administered prior to the participants receiving instruction in their final (of four) literacy courses, which contained content teaching the structure of the English language from a scientific perspective. Although assessment data were obtained, there was no follow-up survey administered following the final literacy course, which would have been useful to identify whether participants' scores had changed as a result of this teaching.

2.5.2. Interventions to Improve Pre-service and In-service Teachers' Language Structure

Knowledge

Given the generally poor performance of pre-service teachers on language structure tasks, few studies have examined the effectiveness of interventions to increase students' language structure knowledge within teacher preparation programmes. An intervention study was undertaken by Stainthorp (2004) in which 38 pre-service teachers in the United Kingdom completed a phonological awareness assessment followed by a feedback session to provide explicit teaching instruction about language structure and its importance in teaching reading and spelling. Further instruction was provided (the content and length of which were not outlined by the authors) in the participants' regular courses which included instruction regarding the development of literacy. The initial phonological awareness test was re-administered six months into the course. Pre-intervention results demonstrated that the participants had very strong skills in their ability to identify rhyme, alliteration and syllables. Tasks requiring explicit phoneme awareness (phoneme counting, identification of second and final phoneme) resulted in a significant change (and large effect size) in mean score from pre-intervention to post-intervention assessment. However, despite a significant change, results following the intervention still demonstrated a mean score of less than 50 percent correct achieved on the phoneme counting task, indicating that the cohort still struggled with the demands of this task. A score of 50 percent is akin to the score achieved by the in-service teachers examined in Carroll et al. (2012) study of education professionals, thus indicating that the gains made by the pre-service teachers in Stainthorp (2004) study were still no higher than their in-service counterparts. Although the results are encouraging, it is concerning that the teaching intervention administered still did not result in strong performance amongst pre-service teachers' knowledge at the phoneme level, the most important level utilised in decoding and spelling instruction (Moats, 2000). Furthermore, there was no documentation of

the time spent administering intervention, or the content of the taught components, thus making it difficult to ascertain the specificity of intervention and replicate it in future studies.

Spear-Swerling and Brucker (2003) examined the effects of instruction in word structure knowledge amongst 90 pre-service teachers. Participants were allocated to one of three groups: two intervention groups (determined by students' attendance of either day or night classes) and a control group. Six hours of instruction was provided over two weeks with instruction including (but not limited to): a focus on the importance of teaching of word decoding; the alphabetic writing system; phonemic awareness; syllable knowledge, and the importance of orthographic and morphemic units in reading and spelling. The same three tasks were included in the pre- and post-assessment (i.e., graphophonemic segmentation, classification of pseudowords by syllable type, and classification of real words as phonetically regular or irregular). Results showed that the two intervention groups demonstrated significantly greater results than the control group in the post-assessment on the graphophonemic segmentation and syllable-type measures, but not on the measure of irregular words. This study demonstrated that increases in the knowledge of teacher education students can be made, and provides further support for the viewpoint that teacher education needs to be more explicit in teaching knowledge of language structure. However, the results were inconclusive about the aspects of intervention that were effective, and the acknowledged influence of prior experience of providing reading instruction on results makes it difficult to disentangle the impact of teaching experience and intervention effectiveness of the outcomes. Furthermore, the effect of the teachers' improved knowledge on their students' literacy performance was not observed.

The above pre-service intervention studies demonstrated that many participants still had difficulties with word structure knowledge following a period of targeted intervention, suggesting that more intensive intervention may be needed. Equally however, the scores from

these studies demonstrated that some participants were near ceiling following the period of intervention suggesting that there may be a difference in response to intervention by individuals within a cohort. It would be useful for future studies to begin to examine the responsiveness to instruction in metalinguistic knowledge in groups of pre-service teachers within large cohorts. It would be particularly pertinent to examine the response made to instruction within individuals who are more likely to experience difficulties (e.g., individuals who possess lower literacy skills at the outset of intervention, relative to the rest of the cohort). Consideration of such differences and the diverse range of skills that present within this population will provide important information about the effectiveness of intervention for all individuals within a cohort rather than at a group level alone. Further, future studies are required to explicitly detail the level, intensity, duration, and content of intervention provided for the pre-service teacher population to allow replication of successful intervention.

2.6. Summary and thesis aims

2.6.1. Summary

Ensuring that pre-service teachers are competent and confident in the knowledge of the skills that contribute towards literacy, as well as having strong literacy skills themselves are critical components of effective teacher preparation. The ability to comprehend the written word impacts on all areas of teaching, learning, and daily life, making it a vital skill required by all pre-service teachers. The paucity of literature addressing the reading comprehension abilities of the pre-service teacher population means that whilst assumptions are made that they possess the knowledge and skills required to perform their job well, there is little research to support such an assumption. The limited amount of information describing the skills of this population impacts on the research into appropriate interventions for this

group, and thus impacts on the skills with which pre-service teachers enter into the profession.

The New Zealand context in particular provides an appropriate platform on which to address the paucity of research in the adult literacy context. A lack of difficulties identified in the area of children's literacy resulted in a lack of recognition of the needs of the adult New Zealand population (Cain Johnson & Benseman, 2005). It was assumed that because children's literacy skills were adequate, the profiles of adults would be similar. Where this is particularly pertinent is in the pre-service teacher population, in which deficits are subsequently passed onto future generations, resulting in an entrenched cyclic pattern. In order to provide effective teaching, and in particular, reading instruction, these individuals require both strong literacy skills, and sufficient knowledge of language structure and metalinguistic concepts (Buckingham et al., 2013). Furthermore, it has been suggested that some universities in New Zealand and Australia have been admitting a wider range of individuals into pre-service teacher education, including a larger proportion of students who do not possess strong literacy skills themselves (Buckingham, 2014). In light of this perceived increase in the range of literacy skills of students', several state governments in Australia have announced the future implementation of a compulsory literacy and numeracy test before pre-service teachers graduate (AITSL, 2014). This initiative aims to increase the quality of graduate level teachers, with a view to subsequently impacting on the standard of education provided in the school environment. Yet the question arises as to whether higher education institutions have a responsibility to provide support to pre-service teachers during, rather than at the culmination of their training, if they are knowingly accepting students with weaker literacy skills at the outset of the programme.

Ultimately, the quality of teaching, and the quality of teachers, is what impacts the most on the standard of education within the school environment; and consequently, the

achievements made by children. If the literacy skills and knowledge of this population are not examined or addressed, this will undoubtedly continue to affect future generations of readers, through the education they receive within the school environment. Ultimately, '*teachers matter, especially for complex cognitive tasks like reading for understanding.*' (p.51) (Duke et al., 2011).

2.6.2. Thesis Aims

This thesis intends to examine the literacy skills of adult students in higher education, specifically, pre-service teachers in their initial undergraduate year. This body of work initially focusses on identifying relative strengths and weaknesses of literacy amongst this group of individuals, through analysis of their performance on a range of selected literacy assessment measures. Predictors of reading comprehension are identified using the results from the assessment battery utilised. A sub-group of individuals presenting with difficulties understanding written text are identified using components from assessment battery and the literacy abilities of this group are discussed in detail. Findings from an experimental intervention study to increase this sub-group's level of reading comprehension, and ascertain which of a number of intervention strategies were found to be most effective are also presented at a group and individual level. Finally, the impact of an intervention that aimed to improve knowledge of language structure amongst this cohort of pre-service teachers is examined. The findings of this thesis have implications for the support of students with literacy learning needs in higher education, as well as enhancing the skills of the broader pre-service teacher population to better prepare them to implement evidence-based reading instruction to children.

The studies reported in this thesis therefore address the following primary aims:

1. To ascertain and describe the range of skill and knowledge within selected aspects of literacy that is present amongst undergraduate pre-service teachers on entry into higher education.
2. To use selected measures to assess areas of hypothesised potential literacy difficulty amongst skilled adult readers, and identify which of these specified skills contribute to reading comprehension (placing them within a theoretical framework, or model, of reading comprehension where possible).
3. To identify whether pre-service teachers who present with difficulties understanding written text differ on additional measures of literacy, from their peers who do not demonstrate difficulties. To determine whether a pattern of difficulties exists for adults within this population who present with difficulties understanding written text.
4. To determine the effectiveness of four different interventions aiming to increase reading comprehension ability for adults who present with difficulties understanding written text.
5. To determine the effectiveness of explicit teaching of language structure concepts for pre-service teachers in increasing their knowledge in areas of phoneme, morpheme, and orthotactic knowledge.

CHAPTER THREE

DEVELOPING & VALIDATING MEASURES OF ASSESSMENT

3.1. Introduction

The studies within this thesis centred around ascertaining the level of skill of a cohort of pre-service teachers in higher education using selected literacy measures. Thus, the assessment of students' literacy skill was not only critical for addressing the research questions posed, but also provided an initial point from which the subsequent studies were based.

Many of the existing studies that have assessed reading comprehension and other literacy skills have utilised assessment materials and measures that have been designed for, and normed upon, children. Miller et al. (2010) posited that in order to inform both theoretical and practical research pertaining to adult literacy, further development and trials of assessment measures are required. Further, they argued that current measures of literacy are inadequate for the adult population, and prevent existing and future research from progressing. The participants in the current research presented with a greater challenge, as many children's measures that could be used for ABE students (who typically have literacy skills up to the eighth-grade level) would be unsuitable for this population. Furthermore, the format required for the current assessment (i.e., large group administration) presented an additional challenge. Many existing assessment measures necessitate an individual testing environment to elicit the target responses.

Consideration of the environmental and procedural constraints, alongside recommendations made within the adult literature (Miller et al., 2010), suggested that it would be most appropriate to develop an assessment battery specific to this population. A

subsequent pilot study of the developed assessment would allow for conclusions to be drawn from this trial, as well as provide crucial information about the appropriateness of the measures for the target population (van Teijlingen & Hundley, 2002). By conducting a pilot study, it was anticipated that it would provide insight into the possible failings of aspects of the assessment battery, as well as the suitability of the level of complexity for this population (van Teijlingen & Hundley, 2002).

Development of an appropriate assessment battery that would demonstrate appropriate variability in responses across the cohort was fundamental to the subsequent studies comprising this thesis. Results from the literacy assessment utilised provided answers to research questions posed in Study One (Chapter Four), enabled students to be grouped to form Studies Two and Three (Chapters Five and Six), and formed the basis of the assessment for Study Four (Chapter Seven). After reviewing the literature, it was important to develop an assessment battery that would comprise measures that were specific to this target population and present the level of complexity required. It is pertinent to note that the areas of literacy that were assessed were not exhaustive, but were theoretically motivated, and valid within the context of the large-scale group assessment.

This chapter describes each measure in detail and the rationale supporting its use and inclusion in the assessment battery is presented. This chapter also serves as a reference point for each of the measures when discussed at later points within the thesis as a whole. The full assessment can be viewed in Appendices A and B.

3.1.1. Rationale for Proposed Assessment Measures

3.1.1.1. Spelling

The first measure that was included in this battery of assessments was spelling. Spelling was selected as an indicator of participants' word level literacy that would allow for

evaluation within the group testing format. Although spelling is a word encoding skill rather than decoding skill, spelling tasks require application of the same underlying skills as word decoding tasks. These include knowledge of phonology, orthography, and morphology (Wolf & Kennedy, 2003). Strong spelling ability requires the development of proficient phonological, morphological, and orthographic awareness to create a strong mental representation of the word (Moats, 2009; Wolter & Apel, 2010).

More basic tasks of word decoding skill (such as word identification and non-word reading) were not included in the assessment for several reasons. Firstly, many typical word decoding tasks are administered individually and would not be suitable for inclusion in a large group format. More pertinently, word decoding tasks such as word identification and pseudo-word reading have been reported to demonstrate very little contribution to reading comprehension in adults in higher education (Jackson, 2005; Macaruso & Shankweiler, 2010). Furthermore, findings from these studies of adults with higher literacy skill demonstrated that spelling was a much stronger predictor of reading comprehension than word decoding assessments typically utilised with children (e.g., non-word and real-word reading). The target population for the current assessment was very similar to the studies identified above. It was therefore hypothesised that spelling would provide the most appropriate measure of word-level literacy skill.

3.1.1.2. Inferencing

Given the literature outlining a stronger contribution to reading comprehension from linguistic comprehension skills than word decoding skills amongst adults than children (e.g., Cromley & Azevedo, 2007; Landi, 2010; Mellard et al., 2010), it was hypothesised that a focus on higher level language skills within the assessment battery would be most appropriate. The skill of inferencing has been shown to assume a much larger role in reading

comprehension when the complexity and content of a text increases (Cartwright, 2009). Hence this measure was chosen as the linguistic comprehension measure from the SVR due to the target participants being engaged in higher education; an environment in which this shift in text complexity and content is exhibited. Furthermore, inferencing has been demonstrated to allow for the differentiation to be made between highly skilled readers and less skilled readers, even within groups of participants engaged in higher education (Hannon & Daneman, 1998; Long et al., 1994). It was hypothesised that the inclusion of an inferencing measure would be beneficial in describing the variance in reading comprehension amongst the higher education population, due to prior research indicating that even highly educated individuals experience difficulty with aspects of inferencing (Franks, 1998), particularly when the demands of written text are increased (Rapp et al., 2007).

3.1.1.3. Working Memory

A working memory measure was incorporated into the assessment battery, as it has also been found to differentiate between typical and less skilled adult readers (e.g., Hannon, 2012; Hatcher, Snowling, & Griffiths, 2002; Macaruso & Shankweiler, 2010). Furthermore, the ongoing debate in the literature about the role of working memory in reading comprehension has called for additional research to develop a more comprehensive understanding of its application to adults (Van Dyke et al., 2014). Working memory has been shown to be a significant predictor of reading comprehension in children (Cain, Oakhill, & Bryant, 2004; Seigneuric et al., 2000). Conversely, the research has also argued that deficits that have been attributed to working memory may instead occur as a consequence of underlying language difficulties (Nation, 2005; Nation et al., 1999; Stothard & Hulme, 1992). These conflicting views have arisen due to working memory typically having been measured using language-based tasks. The task developed for utilisation in the current research was

comprised of numerical content, to limit the linguistic requirement of the task. Finally, due to the increased complexity, content, and number of texts experienced by individuals in higher education (Cogmena & Saracaloglub, 2009; Fidler & Everatt, 2012), it was hypothesised that working memory would be relied on more heavily in this context.

3.1.1.4. Knowledge of Language Structure

Four different aspects of metalinguistic knowledge were included in the knowledge of language structure component of the assessment battery. An increasing number of studies of metalinguistic ability have demonstrated low knowledge across several components, particularly in the pre-service teacher population (e.g., Fielding-Barnsley, 2010; Moats, 1994; Spear-Swerling & Brucker, 2006; Washburn, Joshi, & Binks-Cantrell, 2011). Knowledge and proficiency of the more intricate constructs of the English language (e.g. phonology, morphology, and orthography) is crucial for teachers to enable them to provide effective literacy instruction in their professional practice (Moats, 2014).

Morpheme knowledge was included in the assessment battery as it has been demonstrated to be predictive of spelling ability (Masterson & Apel, 2007; Shankweiler, Lundquist, Dreyer, & Dickinson, 1996), and thus indirectly contribute to reading comprehension. Phonological awareness has been reported as a strong predictor of reading comprehension (Al Otaiba, Kosanovich, & Torgesen, 2012; Gillon, 2004; Goswami, 2000), therefore phoneme knowledge (a phoneme identification task) was included as a component skill of phonological awareness. Further, it has been reported to be a key component within spelling and reading development (Goswami & Bryant, 1990; Stanovich, 1986). Orthotactic knowledge (e.g., knowledge about the spelling rules of the English language) has also been shown to be very important for spelling instruction (Moats, 2009; Snow, Griffin, & Burns, 2005), and may indirectly contribute to reading comprehension. All four of the metalinguistic

measures were included in the assessment battery not only to assess individuals' knowledge in contributing to their own reading comprehension, but also to investigate their underlying knowledge of the skills required to provide effective explicit instruction in reading and spelling in their professional practice.

3.1.1.5. Reading Comprehension

Reading comprehension was included in the assessment battery as the outcome (independent) measure of reading. There are many standardised assessments available for, and normed upon, the school-age population (Cain & Oakhill, 2006a). In contrast, there is a paucity of standardised assessments designed specifically for the adult population (Kruidenier et al., 2010), and fewer still that are appropriate to use with adults of higher literacy skill (e.g., those engaged in higher education). An assessment that was standardised on the higher education population within the United Kingdom – the Adult Reading Test (ART; P. Brooks, Everatt, & Fidler, 2004) – was determined to be the most appropriate measure of reading comprehension for the target population. This assessment had previously been approved by the British Dyslexia Association, and argued to be comparable to the Passage Comprehension subtest of the Woodcock Reading Mastery Test (Woodcock, 1987) in earlier research (Fidler, 2009). Furthermore, the ART included multiple texts of the same reading level, thus allowing for inclusion of different texts of the same level to be utilised at pre- and post-assessment to negate practice effects. One text and the corresponding questions from two levels of the ART were included to provide a measure of reading comprehension within the proposed assessment battery (outlined below).

3.1.2. Proposed Assessment Battery for Piloting

An assessment battery targeting six key areas and comprising 10 subtests was developed. These subtests measured students' in areas of spelling, reading comprehension, knowledge of language structure, inferencing, and working memory. Table 3.1. outlines the subtests within the assessment battery.

Table 3.1. *An index of the subtests comprising the assessment battery*

Target Area of Literacy	Subtest
Spelling	Spelling Dictation Task
Reading Comprehension	Comprehension Passage and Questions
	Lower level text
	Higher level text
Knowledge of Language Structure	Phoneme Knowledge
	Syllable Knowledge
	Morpheme Knowledge
	Orthotactic Knowledge
Inferencing	Listening Comprehension
	Ambiguous Sentences
Working Memory	Processing and storing of digits

3.2. Piloting the Assessment Battery

The measures of literacy outlined in this chapter were piloted on a group of students within the broader population of those that would be targeted for the full scale assessment (Study One). Participants invited to participate in the pilot study included students within the

same academic faculty (education) at this higher education institution, but from a broader range of degree subjects and year groups. It was ensured that no participants from the year group targeted for inclusion in the main studies of this research (year one) were invited to participate in the pilot study.

3.2.1. Research Questions (Pilot Study)

The aims of this pilot study were to investigate the appropriateness of the measures contained in the assessment battery and, in addition, there was an interest as to whether an online version of the assessment would be comparable to results obtained from the face-to-face assessment. The latter aim was pertinent as the finalised assessment would be offered to both on campus students (who would receive the face-to-face version), and distance learning students (who would complete the online version). The following research questions were proposed:

1. Would a literacy assessment comprised of experimental and adapted measures be appropriate for large-scale use with the higher education population?
2. Would a literacy assessment designed for students within a higher education environment produce comparable results in both a face-to-face format, and an online format?

3.3. Method (Pilot Study)

3.3.1. Participants

Twenty-one adult students (20 female; 1 male) aged between 18; 4 (years; months) 43; 2 ($M = 22.27$; $SD = 7.12$), and engaged in study at a New Zealand university participated in this study. Eleven different groups of students, across six different degrees (and a variety of year groups) were invited to participate in this research. Students who were in the year

group and degree programme targeted within the main assessment of this thesis (Study One – Chapter Four) were not invited to participate. This was to ensure that they would not have had prior exposure to the assessment tasks before Study One. The invited students were emailed information about the study and were invited to participate voluntarily. A total of 659 students were contacted via email about the research opportunity and 25 students responded to this request for volunteer participants. Of the 25 students, four were unable to participate due to the timing of the research, resulting in a final cohort of 21 students. Nineteen of the students spoke English as their first language, while two reported English to be their second language, but had demonstrated the required level of proficiency for entrance onto their degree.

3.3.2. Procedure

A cross-over research design was employed to examine whether an online format of assessment would yield equivalent results to face-to-face assessment when assessing the selected measures of literacy. This specific design was chosen to account for the likelihood of a test, re-test effect if participants simply completed one version of the assessment after the other. By alternating the modality order for half of the participants, half were exposed to the face-to-face assessment format first, while the remaining half were exposed to the online format first. Students were randomly allocated to Group 1 ($n = 11$) or Group 2 ($n = 10$). Results from an independent samples t -test demonstrated no significant difference between these two groups on measures of age [$t(20) = 0.017, p = .987, d = 0.008$] (see Table 3.2 for details). Furthermore, a Chi squared test for independence indicated no significant difference between the gender distribution of the two groups $\chi^2(3, n = 21) = 0.002, p = .961, phi = 0.235$, and no significant difference between the degree studied by participants between the two groups $\chi^2(3, n = 21) = 1.289, p = .732, Cramer's V = 0.248$.

Table 3.2. *Demographic information for control and experimental groups of participants*

	Group 1 (<i>n</i> = 11)	Group 2 (<i>n</i> = 10)	Difference	Effect Size
Age				
<i>M</i> (<i>SD</i>)	22.30 (6.87)	22.24 (7.76)	<i>p</i> = .987	<i>d</i> = 0.008
<i>Range</i>	18;4 – 42;3	18;5 – 43;2		
Gender				
Female (%)	100% (<i>n</i> = 11)	90% (<i>n</i> = 9)		
Male (%)	0% (<i>n</i> = 0)	10% (<i>n</i> = 1)		
Total (%)	100% (<i>n</i> = 11)	100% (<i>n</i> = 10)	<i>p</i> = .961	<i>phi</i> = 0.235
Degree Course				
UG Education 1	45.5% (<i>n</i> = 5)	30.0% (<i>n</i> = 3)		
UG Education 2	27.3% (<i>n</i> = 3)	62.5% (<i>n</i> = 5)		
UG Education 3	9.1% (<i>n</i> = 1)	10.0% (<i>n</i> = 1)		
PG Education 1	18.2% (<i>n</i> = 2)	10.0% (<i>n</i> = 1)		<i>Cramer's V</i>
Total (%)	100% (<i>n</i> = 11)	100% (<i>n</i> = 10)	<i>p</i> = .732	= 0.248

Group 1 completed the paper version of the assessment first which was delivered in person (referred to from this point as the face-to-face condition), while Group 2 completed the computer version of the assessment first which was delivered in quiz format through the university's online learning environment (referred to from this point on as the online condition). It was ensured that a period of at least a week had lapsed before the second assessment session took place. At this point, the modalities undertaken by the two groups switched, with Group 1 completing the online assessment, and Group 2 completing the face-to-face assessment.

3.3.3. Face-to-face and Online Assessment Delivery Conditions

All the tasks utilised in this study were included in both conditions, with the exception of the Working Memory Task for which it was not feasible to convert into an online version (and thus was presented solely in the face-to-face format). Further validation of the working memory task was provided by re-administering the task to participants in an individual, rather than group, environment. Full details of this validation are discussed in section 3.4.1.5.3.

The face-to-face paper version of the assessment was presented in a classroom environment, with a projector and screen at the front of the room, and seating in rows throughout the rest of the room. The assessment was delivered through the use of a PowerPoint presentation with the directions for all tasks provided in both written and spoken mediums. For questions in which timing was required, this was made clear through the use of timing 'bars' that ran along the bottom of each slide. Participants were required to write down their responses for each task in a response booklet provided. To allow as many participants as possible to attend, there were a total of three face-to-face sessions held for each of the groups. The same person administered each of the sessions to ensure as much continuity as possible.

The computer administered version of this assessment was delivered through an online learning environment specific to the university through which the participants were all enrolled. This online learning environment had specific settings and layouts restricting the format of the assessment presentation. It allowed for timed quizzes to be assembled and presented in a large linked string, thus presenting the quizzes as a whole assessment that could be tracked through in one attempt. The online version of the assessment was available to participants to undertake in their own time over a period of one week. Instructions for the tasks were presented primarily in written format, due to the constraints of the online learning environment. Once participants reached the end of one task they were provided with a link to

click on that would take them to the next task, so that the assessment presented as a complete assessment battery.

3.3.4. Face-to-face and Online Assessment Content

A brief description of each of the tasks that made up the full assessment battery is outlined below, and a full description of each of the finalised measures is presented in the latter part of this chapter.

3.3.4.1. Task One – Spelling

This was a spelling dictation task, whereby participants were asked to write down a word that was presented to them orally. This task was made up of 30 items, comprised of 15 morphologically related pairs (i.e., a root word (e.g., ‘repeat’) and a word morphologically derived from the root word (e.g., ‘repetition’)). These pairs were presented apart from each other, with all items presented in random order. The items were selected based on previous literacy testing that was conducted by the institution on earlier cohorts of students at this level of study. This previous testing demonstrated variability in performance on these items amongst undergraduate pre-service teachers. Each item was spoken aloud in isolation, then within a sentence, then in isolation once more. Participants were then asked to write the target word down. An example of this is provided below:

“Separate.

The twins ended up in separate classes.

Separate.”

Raw scores out of a possible 30 were collected for analysis.

3.3.4.2. Task Two – Reading Comprehension

Participants were required to read and respond to questions from two passages of two differing levels from The Adult Reading Test (ART; P. Brooks et al., 2004). The initial text had a Flesch-Kincaid score of 11.8, while the second text had a Flesch-Kincaid score of 15.1 (see (P. Brooks et al., 2004; Fidler, 2009) for further details). Participants were given each passage of written text, asked to read it, and make notes if desired. A time allowance of two minutes was given for participants to read through the first text, and a time of four minutes was allowed for the second text. Following this, participants were asked to answer 10 questions that related to the text they had just read. Five of these questions were direct factual questions and the remaining five questions were inferential. Participants were allocated five minutes to read and attempt the questions, during which time they were able to refer back to the text. Scores from both passages were summed together to provide a total score out of 20 for reading comprehension.

3.3.4.3. Task Three – Knowledge of Language Structure: Phoneme Knowledge, Syllable Knowledge, Morpheme Knowledge, and Orthotactic Knowledge

This subtest consisted of a number of different tasks that all related to the assessment of participants' knowledge of the structure of language. All items within the phoneme, syllable, and morpheme tasks were taken from the Basic Language Constructs survey designed and employed by Binks-Cantrell, Joshi, and Washburn (2012). Items included in the orthotactic knowledge section were selected from three different sources, the same Basic Language Constructs survey (Binks-Cantrell, Joshi, et al., 2012), and two teacher knowledge assessments (Mather et al., 2001; Moats, 2000). This subtest was divided into the following tasks, each of which targeted a different knowledge area:

- a.) Phoneme knowledge: There were seven stimuli words for which participants were asked to identify the number of phonemes in each word e.g., *“how many speech sounds are there in the word ‘ship’?”* Stimuli included words that contained between two and four phonemes. Participants were allocated a total of two minutes to complete the seven stimuli items in this task.
- b.) Syllable knowledge: Participants were asked to identify the number of syllables in each stimuli word, e.g., *“determine the number of syllables in the word ‘disassemble’?”* There were seven items in total, but these were different to those utilised for the phoneme knowledge task. The stimuli included words that varied between one and four syllables in length. Participants were allocated a total of one minute and thirty seconds to complete this task.
- c.) Morpheme knowledge: The same seven stimuli from the syllable knowledge task were used, but this time participants were asked to identify the number of morphemes within in each word e.g., *“determine the number of morphemes in the word ‘frogs’?”* Stimuli included words that contained between one and three morphemes. A total time of two minutes was allocated to the participants to complete the seven items in this task.
- d.) Orthotactic knowledge: There were six questions that related to general spelling rules of the English language, for which participants were asked to choose their answer from either four or five multiple choice answers. An example of this is provided below:

A combination of two or three consonants pronounced so that each letter keeps its own identify is called:

- a. *Silent consonant*
- b. *Consonant digraph*
- c. *Diphthong*
- d. *Consonant blend*

3.3.4.4. Task Four – Inferencing

There were two subsections for this task which were delivered consecutively. These items were adapted from the Listening Comprehension: Making Inferences and Ambiguous Sentences subtests from the Test of Language Competence-Expanded Edition (TLC-E; Wiig & Secord, 1993). A training item was provided at the outset of each of these subtests to present an example of the response required. These training items were presented in both written and spoken formats, and included in both the online and face-to-face modalities. The inferencing measures used within the assessment were presented orally and visually to eliminate the possibility of a decoding difficulty influencing this measure.

- a.) Listening comprehension: The first subsection of the inferencing task required participants to make inferences from spoken text, based on relationships or existing causal relationships within the short paragraphs presented. There were six items, each with two correct answers to be identified from four options, an example of which is provided below:

The sun was shining when the Robertsons started out for their picnic.

Unfortunately they had their picnic in the living room.

They had their picnic in the living room because:

- a. They didn't like to eat at a picnic table*
- b. Their car broke down and had to be fixed*
- c. It was a beautiful sunny day*
- d. It rained heavily all afternoon*

Participants had forty-five seconds in which to listen to presentation of the sentences, and provide their responses for each. This subsection was marked out of 12, with raw scores being collected for analysis.

- b.) Ambiguous sentences: The second subsection within the inferencing task assessed each participant's ability to interpret sentences that contained either lexical or structural ambiguities. Participants were presented with a sentence in spoken and written format and were asked to write down two possible interpretations for each sentence (an example of which is provided below):

The man was sure that the duck was ready to eat.

Interpretation 1: The duck itself was ready to eat something.

Interpretation 2: The duck was ready to be served to be eaten.

Participants had forty-five seconds to provide their answers for each of the questions. There were six sentences in total, each with two possible interpretations; therefore a raw score was given out of 12 for this subsection.

3.3.4.5. Task Six – Working Memory

An experimental group-administered working memory task was utilised. The assessment format was based on a previous measure that had been implemented individually to children (Cain, Oakhill, & Bryant, 2004). Participants were presented with a row of three, double digit numbers e.g., 10, 92, 71 and were asked to identify the highest number in this row. The row then disappeared, while a further row of three numbers was presented. Participants were required to remember the highest number from each of the rows, while the process continued. Once the total number of rows for each question had been presented,

participants were asked to write down the highest number from each in order of presentation. The task began with two questions containing three rows of numbers, increasing a row at a time every second question, up to a maximum of six rows of numbers. Each correct item was given a mark, with the task providing a raw score out of a maximum 24 for statistical analysis.

3.3.5. Reliability

For the computer administered version of the assessment, reliability data were collected through several mediums. Firstly, the online learning environment automatically recorded all the responses from each participant, as well as the amount of time taken to complete each task. Secondly, responses were marked using pen and paper following completion of the task online. In the paper administered (face-to-face) version of the assessment, reliability data were collected by responses to tasks being marked using pen and paper.

Twenty percent of data were randomly selected from each modality and remarked and reviewed by an independent reviewer. The reviewer was blind to both the participants and their group status. The reliability of scoring was reviewed for the computer administration, whereby the reliability between responses recorded 'on-line' by the computer, and the secondary marking using pen and paper, was 100 percent. Inter-rater reliability was examined for both modalities of assessment. The percentage of agreement between the two examiners was 97.2 percent. Any differences in scoring were subsequently resolved by consensus.

3.4. Results

3.4.1. Appropriateness of Measures

Basic descriptive statistics and item analyses were undertaken to ascertain whether the measures utilised in this pilot study were appropriate for use with a large scale population. Statistical Package for the Social Sciences (SPSS) software (Version 20.0) was used to analyse this data, and all study data throughout this thesis.

3.4.1.1. Spelling

3.4.1.1.1. Results from the pilot study.

The number of items correctly spelled in each of the modalities (for the two combined groups) is shown in Table 3.3.below:

Table 3.3. *Spelling subtest - item analysis*

Stimuli Word	Face-to-face ($n = 21$)		Online ($n = 21$)	
	Number Correct	Number of Errors	Number Correct	Number of Errors
Attend	21	0	21	0
Attendance	20	1	21	0
Literate	20	1	21	0
Literature	21	0	21	0
Explain	21	0	21	0
Explanation	19	2	21	0
Continue	21	0	21	0
Continuity	20	1	21	0
Begin	21	0	20	1
Beginning	16	5	18	3
Space	21	0	21	0
Spacious	16	5	19	2

Courage	21	0	21	0
Courageous	16	5	16	5
Define	21	0	21	0
Definitely	14	7	15	6
Commit	21	0	20	1
Committee	13	8	15	6
Repeat	21	0	21	0
Repetition	14	7	16	5
Acquire	20	1	20	1
Acquisition	18	3	15	6
Assess	18	3	18	3
Assessor	14	7	15	6
Immerse	15	6	17	4
Immersion	17	4	19	2
Separate	8	13	10	11
Inseparable	6	15	8	13
Liaise	6	15	10	11
Liaison	6	15	9	12

3.4.1.1.2. Changes made to the finalised assessment.

The participant responses were examined in their morphological pairs in both online and face-to-face modalities. Items that demonstrated consistently correct scores across both modalities were considered for removal from this subtest. Inclusion of such items would reduce the variability obtained through the data in the large assessment and increase the likelihood of ceiling effects within the spelling measure. Consequently, the pairs ‘*attend*’ and ‘*attendance*’, ‘*explain*’ and ‘*explanation*’, ‘*literate*’ and ‘*literature*’ were removed due to the lack of variability in these scores in the pilot cohort (these items are shown in grey in Table 3.3.). Although the pair of ‘*continue*’ and ‘*continuity*’ showed little variance also, it was deemed appropriate to retain these two items. This was largely due to results and anecdotal

information obtained from tertiary educators about the target population's consistent difficulty with the derivation of '*continue*' to produce '*continuity*'. Consequently, the spelling subtest as a whole was reduced from 30 individual items (15 pairs) to 24 individual items (12 pairs).

3.4.1.2. Reading Comprehension

3.4.1.2.1. Results from the pilot study.

Mean scores obtained by the participants across both modalities are provided in Table 3.4., while the frequency and range of scores are provided in Table 3.5.

Table 3.4. *Mean scores obtained on measures of reading comprehension*

Text	Face-to-face (<i>n</i> = 21)		Online (<i>n</i> = 21)	
	Mean (10)	Range	Mean (10)	Range
1 – Grade level 11.8	7.67	6 - 10	7.00	1 – 10
2 – Grade level 15.1	6.81	4 - 9	6.29	2 - 10

Table 3.5. *Frequency of scores obtained in reading comprehension texts 1 and 2*

Score	Face-to-face (<i>n</i> = 21)		Online (<i>n</i> = 21)		Total Frequency Scores	
	Number of Participants		Number of Participants		Number of Participants	
	Text 1	Text 2	Text 1	Text 2	Text 1	Text 2
1	0	1	0	0	1	0
2	0	0	0	1	0	1
3	0	0	0	1	0	1
4	0	3	1	1	3	2
5	0	1	4	4	1	8
6	8	1	5	5	9	10
7	4	6	2	4	10	6
8	0	4	6	1	4	7
9	5	1	3	3	6	6
10	4	4	0	1	8	1

3.4.1.2.2. *Changes made to the finalised assessment.*

The range of scores was much greater in the computer modality than in the paper based assessment modality, but when the online and paper based scores were considered together, a number of participants were achieving (or close to) ceiling scores, particularly within the first text. Further, examination of responses provided for the inference-based questions across both assessment modalities showed many answers were somewhat

ambiguous due to whole passages of the target text being copied word for word as a response. It was therefore impossible to tell whether the participants knew the correct answer and were just indicating where the inferred answers could be drawn from, or whether they did not have the ability to make the inference themselves. It was thus decided that during this task, the text would be removed after the allocated reading time, and participants would not have access to the text when they were presented with the comprehension questions. Furthermore, it was hypothesised that removing the text while answering the questions would eliminate the possible ceiling effects demonstrated in the results for text one. Although it was recognised that this design would place larger demands on participants' working memory, this was noted, and the subtest was subsequently amended so that the text would no longer be present once the questions were presented to the participants. In light of the removal of the text for this task, it was decided to increase the amount of time permitted for the participants to read through the text, whilst retaining the same time period allowed in which to answer the questions. The time allowed to read through the first text was subsequently changed to three minutes and thirty seconds, while participants were permitted five minutes to read through the second (longer and more complex) text.

3.4.1.3. Knowledge of Language Structure

3.4.1.3.1. Results from the pilot study.

Table 3.6. illustrates the item analysis for this subtest, providing the mean, range, and frequencies of scores across the four subsections for both modalities. Table 3.7. provides the frequency of scores obtained for each task across the two modalities, and the total score for each of the tasks (highlighted in grey).

Table 3.6. *Mean scores obtained on knowledge of language structure measures*

Target Area (max score)	Face-to-face (<i>n</i> = 21)		Online (<i>n</i> = 21)	
	Mean (<i>SD</i>)	Range	Mean (<i>SD</i>)	Range
Phoneme Knowledge (7)	4.0 (1.7)	1 – 7	3.3 (2.1)	0 – 7
Syllable Knowledge (7)	6.3 (1.3)	2 – 7	5.9 (1.9)	0 – 7
Morpheme Knowledge (7)	1.1 (1.6)	0 – 5	3.0 (1.5)	0 – 6
Orthotactic Knowledge (6)	2.6 (1.1)	1 – 5	2.5 (1.1)	1 – 6
Total Score (27)	14.0 (2.7)	9 – 19	14.6 (2.9)	11 – 23

Table 3.7. *Frequency of scores obtained in knowledge of language structure tasks*

Score	Face-to-face (n=21)				Online (n=21)				Total Frequency Scores			
	Number of Participants				Number of Participants				Number of Participants			
	PK	SK	MK	OK	PK	SK	MK	OK	PK	SK	MK	OK
0	0	0	12	0	2	1	1	0	2	1	13	0
1	2	0	3	4	4	0	3	4	6	0	6	8
2	3	1	1	6	2	1	4	7	5	2	5	13
3	2	0	2	7	3	0	5	8	5	0	7	15
4	5	1	2	3	3	2	6	1	8	3	8	4
5	5	3	1	1	2	1	2	0	7	4	3	1
6	2	1	0	0	4	4	0	1	6	5	0	1
7	2	15	0	0	1	12	0	0	3	27	0	0

PK = Phoneme knowledge, SK = Syllable knowledge, MK = Morpheme knowledge, OK = Orthotactic knowledge

3.4.1.3.2. *Changes made to the finalised assessment.*

Following item analysis of the questions and variability obtained, this subtest was deemed appropriate for the given population in its original form. The range and variance demonstrated by the results for each of the subsections remained large, with maximum and minimum scores achieved in almost all subsections. The variability for the measure of morpheme knowledge was skewed towards the lower end of the distribution suggesting that participants found this task difficult. This task was however retained in its original form, as

the knowledge of language structure measures of the finalised assessment were designed to be administered pre- and post-intervention (teaching that related to this topic area), and used to assess the effectiveness of the teaching intervention (Study Four, Chapter Seven). Thus, it was necessary that this measure allowed for potential change in participants' scores to be detected in response to the teaching.

3.4.1.4. Inferencing

3.4.1.4.1. Results from the pilot study.

This subtest consisted of two tasks for which analysis was completed separately. The scores for the first task (Listening Comprehension) demonstrated that many participants achieved the maximum score, suggesting that this task was relatively easy for this population. The marking rubric of the TLC-E (Wiig & Secord, 1993) suggested awarding a score for each response correct (there were two possible responses for each question, therefore two possible marks per question), which was given in the scope of the pilot study. Despite the relatively high mean score for the group (see Table 3.8.), this task did provide some interesting responses when analysis was conducted at an individual response level. The second task, (Ambiguous Sentences) again demonstrated a high mean score at a group level, but presented greater variability of responses (again see Table 3.8.). Scores were summed from the two tasks to provide an overall total score out of 24, with an even distribution of marks between the two inferencing tasks.

Table 3.8. *Descriptive statistics across both modalities for the two inferencing tasks*

Task (max score)	Face-to-face (<i>n</i> = 21)		Online (<i>n</i> = 21)	
	Mean Score (<i>SD</i>)	Range	Mean Score (<i>SD</i>)	Range
Listening Comprehension (12)	10.9 (1.4)	8–12	10.6 (1.4)	8– 2
Ambiguous Sentences (12)	9.5 (2.5)	3–12	8.8 (2.4)	3–12
Total Score (24)	20.3 (3.6)	12–24	19.4 (3.5)	12–24

3.4.1.4.2. *Changes made to the finalised assessment.*

After reviewing the results obtained by the pilot participants for both of these inferencing tasks, some changes were made to the subtest. In light of the lack of variability in the scores in the Listening Comprehension task, it was decided that the scoring would only allow for a maximum total score of six possible marks, rather than the initial 12 included in the pilot study. Thus, in the finalised assessment, each question would only be marked as correct if both multiple choice responses were accurate. Furthermore, this task was relatively short in its administration duration, so it was decided to retain it in the scope of the assessment battery, with the revised marking rubric. The Ambiguous Sentences task was more easily expanded than the Listening Comprehension task. It was therefore decided to increase the length of the Ambiguous Sentences task by adding three more questions (considered to be at a slightly higher level of complexity). This resulted in a total of nine items, and with each item being awarded two possible marks (one for each correctly outlined sentence) a total of 18 possible marks were available. Therefore the revised inferencing sub

test for the finalised assessment consisted of six questions (scoring a possible six marks) for the Listening Comprehension task, and nine questions (scoring a possible 18 marks) for the Ambiguous Sentences task. Hence the total revised inferencing subtest resulted in two tasks providing a total possible maximum score of 24.

3.4.1.5. Working Memory Task

3.4.1.5.1. Results from the pilot study.

During piloting, there were no participants who attempted a question with eight rows, or even seven rows of numbers. Therefore this task was scored out of the attempted eight questions (two at three row level, two at four row level, two at five row level, and two at six row level). It was necessary to ascertain whether marking responses by question (i.e. the mark was given only if the participant correctly recalled all the numbers in that question), or by item (i.e. a mark was given per number that was correctly recalled; a mark per correct response for each row) was most appropriate. The constraints of the online environment restricted the use of this task to the face-to-face modality only. Analysis shown in Table 3.9. therefore demonstrates the results obtained in this modality alone, and provides scores for the 20 responses that were eligible for marking. The scores from the remaining participant were not included due to their self-professed misunderstanding of the task, and providing unclear responses for all of the questions.

Table 3.9. *Descriptive statistics for the working memory subtest (face-to-face modality)*

Face-to-face ($n = 20$)			
Working Memory Task	Mean Score (maximum score)	SD	Range
Question analysis	2.8 (8)	1.7	0 – 6
Item analysis (by row)	20.1 (36)	6.7	10 – 32

3.4.1.5.2. Changes made to the finalised assessment.

The assessment battery was revised to contain only eight questions (with a maximum of six rows of numbers) due to participants not attempting the questions after this point during the piloting process. It was concluded that marking this subtest using item analysis (whereby each individual response was allocated a mark) provided the greatest level of accuracy, and most variance in scores. Hence this was utilised in the finalised version of the assessment.

3.4.1.5.3. Validation of the working memory task.

The working memory task was designed to be administered as part of the large assessment battery, thus requiring administration to many participants at one time point. To examine the validity of this group administration compared to individual administration, the task was re-administered to a subgroup of participants (those who completed the intervention outlined in Chapter Five) from the large cohort. This allowed for comparisons to be made between participants' performance in a large group and individual assessment administration.

Fifteen participants repeated the same working memory task from the original large scale assessment. The period of time that had elapsed between the initial assessment and this

second validation assessment, ranged from three to four weeks. The exact same items from the large cohort study (Chapter Four) and pilot study above were presented to each student. The same PowerPoint presentation was used, but this time in an individually administered environment. Instead of being presented on a large overhead screen in front of the participant, the presentation was administered using a laptop, whereby participants were asked to watch the numbers as they were displayed on the computer screen. Following presentation of the total number of rows for each item, they were asked to write their responses down on the response sheet provided. Participants were asked to adhere to the same procedure undertaken in the large scale assessment, and this was outlined to them again to provide clarification prior to beginning the validity assessment.

To ascertain whether a difference existed between the scores obtained by participants in the two different environments (large group compared to individual administration), paired samples *t*-tests were conducted. Results demonstrated no significant difference between the two administration conditions, regardless of which method of marking was used (see Table 3.10.). These results suggest that there was no significant difference in performance on this measure of working memory regardless of the condition under which the assessment was delivered. The results also support the previous conclusion that marking this task using item analysis was a more appropriate method (due to the lower level of significant difference between the two conditions, compared to the significance obtained when using the question analysis). Given the comparability of performance across administration modalities, it was decided to include the experimental group-administered measure.

Table 3.10. *Results of paired samples t-tests to determine level of significance between large scale and individual administration of the working memory task*

	Question Analysis (6)		Item Analysis (24)	
	Large Scale	Individual	Large Scale	Individual
	Assessment	Assessment	Assessment	Assessment
Mean (<i>M</i>)	2.00	2.40	15.53	16.07
Standard deviation (<i>SD</i>)	1.13	1.24	3.11	3.17
Range	0 – 4	0 – 5	9 – 22	9 – 21
Significance		$p = .111$		$p = .502$

3.4.2. Comparison between Modalities

Paired-samples *t*-tests were conducted to compare the scores obtained within face-to-face and online administration formats across all measures (See Tables 3.11. and 3.12.).

3.4.2.1. Measures for which there was No Difference between Modalities

No significant differences between the two modalities of assessment were found on measures of spelling, reading comprehension text one, reading comprehension text two, reading comprehension total score, knowledge of language structure – orthotactic knowledge, knowledge of language structure total score, inferencing – listening comprehension, inferencing – ambiguous sentences, and inferencing total score. See Table 3.11. for further details of the results for these comparisons.

Table 3.11. *Presentation of data for assessment measures with no significant differences between face-to-face (FTF) and online (O) modalities*

	Spelling		RC 1		RC 2		RC Total		KLS-OK		KLS Total		Inf. LC		Inf. AS		Inf. Total	
	FTF	O	FTF	O	FTF	O	FTF	O	FTF	O	FTF	O	FTF	O	FTF	O	FTF	O
<i>M</i>	24.10	24.10	7.67	7.00	6.89	6.29	14.48	13.29	2.57	2.48	14.06	14.62	10.86	10.62	9.48	8.76	20.33	19.38
<i>SD</i>	3.85	4.53	1.65	2.37	1.54	2.03	2.84	4.04	1.12	1.17	2.80	2.99	1.39	1.43	2.52	2.49	3.72	3.60
Sig.	$p = 1.000$		$p = .105$		$p = .102$		$p = .074$		$p = .649$		$p = .387$		$p = .135$		$p = .105$		$p = .071$	
Effect size	$d = 0.000$		$d = 0.328$		$d = 0.333$		$d = 0.341$		$d = 0.079$		$d = -0.193$		$d = 0.170$		$d = 0.287$		$d = 0.260$	

RC 1 = reading comprehension text 1; RC 2 = reading comprehension text 2; RC Total = reading comprehension measures combined total; KLS OK = Knowledge of Language Structure (orthotactic knowledge); KLS Total = total score for all four combined scores on KLS measures; Inf. LC = Inferencing Listening Comprehension subtest; Inf. AS = Inferencing Ambiguous Sentences subtest; Inf. Total = combined score for both inferencing subtests.

3.4.2.2. Measures for which there was a Significant Difference between Modalities

There was a significant difference in scores on the measure of phoneme knowledge between the paper based presentation ($M = 4.05$, $SD = 1.77$), and online presentation ($M = 3.33$, $SD = 2.20$) [$t(20) = 2.152$, $p = .044$, $d = 0.360$], thus indicating a stronger performance in the face-to-face modality. This was also true for the measure of syllable knowledge, where there was a significant difference found between the paper based presentation ($M = 6.29$, $SD = 1.35$), and online presentation ($M = 5.86$, $SD = 1.91$) [$t(20) = 2.423$, $p = .025$, $d = 0.261$]. Conversely, the opposite was true for scores on the measure of morpheme knowledge, where performance on the online, computer based presentation yielded a stronger performance, and a significant difference was found between the paper based presentation ($M = 2.95$, $SD = 1.56$), and online presentation ($M = 1.14$, $SD = 1.65$) [$t(20) = -3.882$, $p = .001$, $d = 1.125$]. See Table 3.12. for values.

Table 3.12. *Presentation of data for assessment measures with significant differences between face-to-face (FTF) and online (O) modalities*

	Phoneme Knowledge		Syllable Knowledge		Morpheme Knowledge	
	FTF	O	FTF	O	FTF	O
<i>M</i>	4.05	3.33	6.29	5.86	2.95	1.14
<i>SD</i>	1.77	2.20	1.35	1.91	1.56	1.65
Sig.	$p = .044$		$p = .025$		$p = .001$	
Effect size	$d = 0.360$		$d = 0.261$		$d = 1.125$	

3.5. Limitations of Including Data from the Online Administration Procedure

The comparisons made between the face-to-face presentation of the assessment and online administration of the assessment demonstrated significant differences between the two modalities on three of the subtests, but not in the remaining nine calculated subtests or totals. It was decided that while the online format of the assessment would be provided for distance students within the targeted university course (with the outlined amendments), this would provide an insight into the literacy skills for university, rather than research, purposes alone. The online data collected would not be used in the later chapters of this thesis. Instead, the face-to-face data alone would be utilised and reported (see Chapter Four). This decision was made due to the consideration of a number of limitations of the online version which are outlined below:

3.5.1. Timing

The finalised assessment was to be completed by all face-to-face participants at one time point, and was constrained to a total time of approximately ninety minutes. The in-person administration of the face-to-face assessment allowed the timing of individual subtests and tasks to be controlled by the examiner, or by timing included on individual PowerPoint slides. Consistency of administration procedure would be ensured through all participants receiving the assessment at one time. The nature of the online environment through which the assessment was delivered in the pilot study did not allow for individual timing of each question. Although best efforts were undertaken to ensure consistency of overall timing per subtest within the pilot study, it was impossible to unequivocally guarantee that the timing remained the same between the face-to-face administration and the online administration. Furthermore, participants who completed the online version of the assessment were able to progress through the questions at their own desired rate (although limited in the maximum

amount of time spent on a question or task). This may have resulted in participants moving through the assessment quicker than their counterparts who undertook the assessment in the face-to-face environment, in which they were controlled by the examiner's timing.

3.5.2. Layout

The online learning environment platform in which the online assessment was presented allowed for individual questions to be created, but not multiple sections (subtests). This resulted in the assessment being presented in a quiz format, whereby each subtest formed a separate section of the quiz, with participants being required to click on a link to access the subsequent section. Whereas in the face-to-face environment it was possible to present questions individually and in isolation, this was not possible in the online version. Hence, the spelling subtest was presented in three sections of ten items in the online version, compared to individual presentation in the face-to-face format. Similarly, both the knowledge of language structure, and inferencing subtests were required to have all the questions presented in one page with an overall time limit for the subtest, whereas the face-to-face format allowed for individual question presentation and timing.

3.5.3. Reliability of Responses

Again, as outlined in the previous limitation points, the main advantage to using the face-to-face format of the assessment was that all participants would complete the assessment at the same time, thus reliability and consistency would be ensured as much as possible. The nature of the online task resulted in participants choosing a time within which they wished to complete the assessment, as well as the location. It was recognised that this exposed the online participants to environmental and outside factors, as well as presenting the opportunity

for participants to complete the assessment with outside help. These factors may influence the reliability of the results obtained in the online environment.

3.5.4. Completion

The online learning environment did not allow all the subtests to be translated into the online format. Notably, the working memory subtest was omitted from the online version of the assessment in the pilot study as it was deemed to be impossible to provide a version of the task that would allow for administration in the online learning environment. The assessment battery was therefore incomplete in the online presented format. The other aspect of incompleteness that the online format exposed itself to was that of participant incompleteness. Whilst the pilot study was created to ensure that each participant provided their responses before moving to the subsequent subtest, it remained possible to abandon the assessment completely, or provide incomplete answers and move on. Clearly it would be possible to do so in the face-to-face environment also. However, the use of technology in the online format assessment opened it up to user difficulties with navigation or technology in general, preventing complete responses being obtained.

Furthermore, responses in the online version of the assessment required completion via keyboard typing rather than handwriting (as was the case in the face-to-face format). There is a large variance in the abilities of individuals not only in their technological prowess, but also in their typing speed and ability. Answers provided may have been incomplete due to difficulties with typing ability or speed (within the time constraints of the tasks) that may not have been present had they completed the assessment using pen and paper, (as in the face-to-face administration).

3.5.5. Diversity of the Distance Learning Population

Institutional data showed that students who choose to complete their study via distance learning are a more diverse population. For example, distance cohorts from the university are typically older and more varied in their academic backgrounds than students who study on campus. If participants who embark upon the online version of the assessment are older, this may result in them being less familiar with online learning and technology, thus being more limited in completing an assessment in an online format compared to a face-to-face, paper administrated format. Similarly, if students who study by distance learning have more varied academic backgrounds this could result in negatively skewed data at a group level.

3.5.6. Summary

While the results of the pilot study demonstrated no significant differences in many of the subtests of this literacy assessment, the limitations outlined above were deemed too great in number, and too influential, to be able to combine data obtained from both online and face-to-face participants. It was therefore decided that participants included in the studies of this thesis would only report the results and findings of students from the on campus, face-to-face learning environment.

3.6. Finalised Assessment Battery for the full-scale assessment (Study One and Study Four)

Following the administration and analysis of the assessment pilot study the following assessment battery was determined for use in Study One (broad scale assessment of literacy skills) and Study Four (knowledge of language structure assessment).

Table 3.13. *Full assessment battery as used in the studies of this thesis*

Subtest target area	Task within subtest	Number of questions / items	Timing	Max score
Spelling	None	24 stimuli words	20 seconds per word (total time)	24
Reading comprehension	Lower level text (grade level of 11.8)	1 text, 10 questions	3.5 mins (text), 5 mins (questions)	10
	Higher level text (grade level of 15.1)	1 text, 10 questions	5 mins (text), 5 mins (questions)	10
Knowledge of language structure	Phoneme knowledge	7 stimuli items	2 mins total for task (all items)	7
	Syllable knowledge	7 stimuli items	1.5 mins total for task all items)	7
	Morpheme knowledge	7 stimuli items	2 mins total for task (all items)	7
	Orthotactic knowledge	6 multiple choice questions	45 secs per question (total time)	6
Inferencing	Listening comprehension	6 questions (2 answers each)	45 seconds (total time)	6
	Ambiguous sentences	12 questions (2 answers each)	45 seconds (total time)	12
Working memory	None	6 rows, 24 numbers to recall in total	5 secs presentation per number, 15 secs time allowed for response	24

Please note – when ‘total time’ is referred to in the ‘timing’ column, this refers to the total time taken for both presentation (written and verbal) of the question / item, and the time allowed for participants to respond.

CHAPTER FOUR

STUDY ONE – ASSESSING SELECTED LITERACY SKILLS OF UNDERGRADUATE PRE-SERVICE TEACHERS ON ENTRY INTO HIGHER EDUCATION

4.1. Introduction

The assessment of the pre-service teaching population's literacy skills has been addressed somewhat within existing literature, but this has been confined to relatively isolated components of literacy. The research pertaining to this population in the area of literacy has predominantly focussed on the language structure knowledge that these individuals possess, in light of the subsequent influence it is likely to have on their ability to provide reading instruction for their students (e.g., Fielding-Barnsley, 2010; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003). Research relating to this area has reported deficits in the metalinguistic knowledge of the pre-service teacher population, but despite these findings, there is a paucity of research exploring the broader literacy skills of these individuals.

Assessment of these adults within higher education is necessary for a number of reasons. Firstly, greater knowledge about the literacy skills of these individuals can provide important information to their institution about areas in which they may perform well or need extra support. Thus, the information can be used to provide a more suitable targeted level of education for the cohort of students. Secondly, accurate assessment of the literacy skills of pre-service teachers enables individuals who present with difficulties (both apparent and transparent in nature) to be identified. Finally, assessment provides the opportunity to

monitor progress made by individuals throughout their education, regardless of their level of attainment (Williams et al., 2011).

Existing research has highlighted the importance of literacy in higher education, with regard to the level of skill an individual possesses on entry, and as an outcome of higher education (Bray, Pascarella, & Pierson, 2004). Many students in higher education, however, do not meet expected reading comprehension benchmarks for adult literacy (Reder, 2000). Assessment of the literacy skills of various groups of adults has demonstrated deficits in lower level literacy skills such as word decoding (e.g., MacArthur et al., 2010; Sabatini et al., 2010), and higher level literacy skills such as inferencing (Hannon & Daneman, 1998; Long et al., 1994; Rapp et al., 2007). Deficits in areas of word decoding have typically been identified amongst adults who access basic education services. However, research has also identified decoding difficulties within the pre-service teacher population (Apel & Swank, 1999). Apel and Swank (1999) hypothesise that students who experience reading difficulties in childhood (specifically in word decoding) have fewer subsequent reading experiences, which further compounds their reading comprehension ability in later life.

While evidence has demonstrated the presence of word decoding difficulties in the adult population, it appears that such a profile is more prevalent in children. Linguistic comprehension, rather than word decoding, has been considered to become the dominant variable in reading comprehension by approximately grade eight (Catts, Hogan, et al., 2005). Thus, it is argued that the reading comprehension difficulties experienced amongst adults are more likely to be attributable to deficits in linguistic comprehension. Examination of the reading comprehension abilities of higher education students has supported this proposition, demonstrating at the very minimum, a basic level of word decoding skill amongst adults with poor reading ability (Jackson, 2005; Landi, 2010; Macaruso & Shankweiler, 2010). This

suggests that their poor reading ability may be more heavily influenced by difficulties within the component skills of linguistic comprehension than word decoding.

Many studies have used the Simple View of Reading (SVR; Gough & Tunmer, 1986; Hoover & Gough, 1990) to provide a framework with which to explain the component skills that influence and contribute to reading comprehension. Such studies have demonstrated a broad range of results in the level of variance in reading comprehension that was explainable using the SVR. Hoover and Gough (1990) initially tested its validity with elementary school-aged bilingual children, demonstrating that the SVR accounted for 72 to 85 percent of the variance in their reading comprehension. Other research with children has demonstrated that the SVR accounts for anything between 40 percent and 80 percent of the variance in reading comprehension (Catts, Adlof, et al., 2005; Dreyer & Katz, 1992; Joshi & Aaron, 2000). Research with the adult population has demonstrated that the word decoding and linguistic comprehension components of the SVR accounted for anything from 34 percent (Macaruso & Shankweiler, 2010), to 47 percent (Landi, 2010), to 62.5 percent (Sabatini et al., 2010). Studies involving adults have typically been able to explain a much lower degree of reading comprehension variance relative to those conducted with children. Further research is required to identify whether the SVR is an appropriate model of reading comprehension to use with a highly skilled adult population.

The evidence base supporting the application of the SVR framework (Gough & Tunmer, 1986; Hoover & Gough, 1990) in assessment is strong. Deficits in both bottom-up skills such as word decoding (Adams, 1990; Torgesen, 2000) and top-down skills such as linguistic comprehension (Catts, Fey, Zhang, & Tomblin, 1999; Nation, 2005) can result in poor reading comprehension. Without knowledge of where the deficit lies, instruction or intervention is not well-informed. Further, without an understanding of the literacy skills of

the students entering into higher education, the level of knowledge assumed is at risk of being either too great or too small.

It is necessary to have an understanding of the level of literacy attainment with which this population presents to address these areas of need within the higher education context. An increased number of students are being admitted to university with greater needs, yet it is questionable whether the level of support provided for them is adequate (Caruana & Ploner, 2010; Devlin & Samarawickrema, 2010). Without adequate understanding of their level of knowledge and skill, it remains difficult to address these needs and provide future intervention for this population.

4.1.1. Research Questions and Hypotheses

The aims of this study were to establish the range of skill within selected areas of literacy with which students in their initial undergraduate year of pre-service teaching present. In particular the following research questions were identified:

1. Which of the selected measures of literacy can be identified as strengths or weaknesses amongst students who are granted admission onto an undergraduate pre-service teaching course?
2. Which of the selected literacy skills assessed contribute towards reading comprehension, and what are the strengths of these relationships?

4.2. Method

4.2.1. Participants

A first year cohort of undergraduate pre-service teaching students ($n = 147$) was invited to participate in the study. Students who agreed to participate ($n = 131$) completed a language and literacy assessment administered via group testing that included measures of

reading comprehension, spelling, inferencing ability, knowledge of language structure and working memory. All participants were full-time undergraduate students enrolled in a university course that, on successful completion, resulted in their qualification as primary school teachers. Each of the students had undergone a competitive selection process prior to their acceptance onto the course. Of the 131 pre-service teachers who participated, 103 were female, and 28 were male. The participants were not selected utilising a selection criteria beyond the requirement that they must have been enrolled for the specified course and in their first year of this degree. This ensured that the cohort of participants was representative of this group of adult students.

4.2.2. Procedure

This study was conducted at the beginning of the second semester within the academic year, and formed part of a module that focussed on literacy teaching over a period of nine weeks. The students had not previously completed literacy coursework in the first semester of study. Participants were asked to complete a previously developed and piloted assessment comprised of several different measures of literacy (see Chapter Three), which was presented to them in a lecture format. The assessment was undertaken in a large lecture theatre, with tiered seating, and a double screen at the front of the room. Assessment content was presented using PowerPoint to display slides on the screen, and all instructions and explanations were given verbally and visually. Test conditions were assumed, with all students being encouraged to remain silent and focus on their responses and response booklet alone. Three invigilators were present to monitor student behaviour during the process and answer any administration questions, thus keeping distractions in the lecture theatre to a minimum.

Each participant was given a response booklet prior to beginning the assessment but was asked not to look at it until the assessment began. Once the examiner began the assessment, participants followed the prompts within the presentation to use the correct page in their response booklet. The duration of the assessment was approximately 70 minutes.

4.2.3. Measures

The measures included in this study are outlined in detail in Chapter Three of this thesis. The requirement of administering the assessments within a large group setting (due to the number of participants) meant that many existing measures were unsuitable. Thus, the measures used were designed specifically for this population, and were piloted and amended prior to administration within this study (the details of which were outlined in Chapter Three). Subtests within the assessment battery were designed to measure spelling ability, level of reading comprehension, knowledge of language structure, inferencing skills, and working memory capacity (all within the English language). The assessment battery was the same for each participant due to the large scale administration required. The order was as show in Table 4.1. below.

Table 4.1. *An index of the subtests comprising the full assessment battery and order of administration*

Target Area of Literacy	Sub-test
Spelling	1. Spelling dictation
Reading Comprehension	Comprehension passages and questions 2. Lower level text 3. Higher level text
Knowledge of Language Structure	4. Phoneme knowledge 5. Syllable knowledge 6. Morpheme knowledge 7. Orthotactic knowledge
Inferencing (higher level language)	8. Listening Comprehension 9. Ambiguous Sentences
Working Memory	10. Processing and storage of digits

4.2.4. Reliability

Inter-rater reliability was completed for twenty percent of participants' response booklets. The rater was a qualified Speech-Language Pathologist, independent to the research project and was provided with a clear marking protocol. Reliability was established through scoring responses and either marking them correct or incorrect. The level of inter-rater agreement on the scoring of these assessments was 94.2 percent, with discrepancies identified predominantly on the subtests of reading comprehension, and inferencing. These inter-rater discrepancies were resolved by consensus after re-scoring the raw data. Prior to data entry, all data were rechecked, rescored, and any errors were corrected.

4.3. Results

The introduction to this study outlined two objectives. To answer the research questions posed at the outset of this study, the following analyses were conducted using SPSS (Version 20.0):

1. Descriptive statistics were examined to ascertain the level of presenting knowledge at pre-assessment amongst the group as a whole.
2. Correlations were calculated to determine the relationship between scores on the measure of reading comprehension, and other measures included in this large scale assessment battery.
3. Multiple regression analyses were performed (using the data obtained from the whole cohort) to assess the level of reading comprehension prediction provided by combinations of measures included in the assessment battery.

4.3.1. Assessment Scores for the Whole Cohort of Pre-service Teachers

Descriptive statistics for the whole group are presented in Table 4.2.

Table 4.2. Scores for the whole cohort of first year undergraduate pre-service teachers ($n = 131$) for all measures included within the large scale assessment battery

Subtest (maximum obtainable score)	Mean (<i>M</i>)	Standard Deviation (<i>SD</i>)	Range
Spelling (24)	15.07	3.45	7 – 22
Reading comprehension – Text 1 (10)	5.82	1.79	2 – 10
Reading comprehension – Text 2 (10)	5.13	2.04	1 – 10
Reading comprehension – Total (20)	10.94	3.26	4 – 19
Phoneme knowledge (7)	3.63	1.52	0 – 7
Syllable knowledge (7)	6.17	1.44	0 – 7
Morpheme knowledge (7)	1.66	1.46	0 – 5
Orthotactic knowledge (6)	2.33	1.17	0 – 6
Knowledge of Language Structure – Total (27)	13.79	3.14	4 – 21
Inferencing – Listening Comprehension (12)	11.10	1.15	6 – 12
Inferencing – Ambiguous Sentences (18)	12.34	3.34	2 – 18
Inferencing – Total (30)	23.44	3.77	12 – 30
Working Memory (24)	16.73	3.46	6 – 23

The spelling measure indicated that participants responded to a mean of 62.8% of items correctly. The standard deviation and the range, however, were relatively large, with scores spanning from a minimum of seven to a maximum score of twenty-two. No participants obtained a ceiling score on this subtest.

Scores for the reading comprehension subtests indicated a mean performance of between 50% and 60% for each of the individual tasks as well as the combined total score of reading comprehension. The range of scores for these tasks was large, with scores ranging from two out of a possible ten to ceiling on the first reading comprehension task, and one out of ten to ceiling on the second reading comprehension task. Combining the scores for these two subtests provided a total score for reading comprehension, which was used to determine subgroups of participants in the subsequent study (Study Two within this thesis). This total reading comprehension score produced a large range of scores (between four and nineteen out of a possible twenty), which was also evident in the resulting large standard deviation ($SD = 3.26$). Despite several participants scoring at ceiling on one of the two reading comprehension tasks, no individual participants reported a ceiling score when both tasks were combined in the total score.

Results for all subtests targeting participants' knowledge of language structure and the measure in its entirety are discussed in more detail in Chapter Seven of this thesis; however these subtests are included within the scope of this study so as to provide a more comprehensive profile of literacy skills. All four measures of language structure knowledge were analysed individually, as well as being combined to provide an overall summary of each participant's knowledge of language structure. The first three subtests (phoneme, syllable, and morpheme knowledge) presented questions in a similar manner and each had a maximum score of seven. The cohort demonstrated their strongest knowledge in the area of syllable identification with scores of $M = 6.17$, $SD = 1.43$. Despite the relatively strong syllable

awareness performance, there was still a wide range of scores produced, with participants obtaining both the minimum (zero) and maximum (seven) scores possible. The subtest exploring phoneme knowledge demonstrated the next highest mean score for the cohort ($M = 3.63$, $SD = 1.521$), again with a wide range of scores from minimum to maximum (zero to seven) achieved by the participants. Morpheme knowledge revealed the lowest mean of these three subtests ($M = 1.66$, $SD = 1.455$), with the minimum score obtained by participants being zero and the maximum only reaching five, compared to seven (ceiling) for both syllable and phoneme knowledge subtests. The remaining subtest, exploring participants' orthotactic knowledge demonstrated a mean of 38.83% of questions answered correctly ($M = 2.33$, $SD = 1.168$). These four subtests combined provided a total score for knowledge of language structure which was calculated by totalling each participant's raw score for the four subtests outlined above. This resulted in a maximum possible combined score of twenty-seven. The calculated mean for the cohort was just over half, at 51.07%, ($M = 13.79$ $SD = 3.139$), whereby no participants reached ceiling score (the maximum score achieved was 21 out of a possible 27), nor did any of the participants produce a score of zero (the minimum score obtained was four).

Of the two inferencing subtests administered, almost ceiling performance was demonstrated on the listening comprehension subtest. The maximum possible score obtainable on this subtest was 12, and a mean score of 11.10 ($SD = 1.151$) was calculated. The variability of the second inferencing subtest (ambiguous sentences) was much greater despite the mean still being close to ceiling ($M = 12.34$, $SD = 3.344$), with participants scoring between two and 18 (out of a possible 18). The combined score of these two subtests resulted a total inferencing score that demonstrated a mean of 23.44 ($SD = 3.769$) and a large degree of variability amongst the scores, with a minimum score reported of 12, and a maximum score of 30 (ceiling).

Following the pilot study, it was decided that the subtest of working memory would be scored by awarding a mark to each correct number given (in order) within each question. This resulted in a maximum possible score of 24. The scores presented in Table 4.2. display the wide range of scores achieved on this task (from a minimum score of six, to a maximum score of 23). The mean calculated for this subtest was 16.73 ($SD = 3.46$).

4.3.2. Correlations between Measures Included within the Assessment Battery

4.3.2.1. Correlations between Reading Comprehension and Other Measures of Literacy

To assess the relationships between the measures of reading comprehension and all other measures within this study, correlations were conducted using Pearson product-moment correlation coefficients. Relationships were found between similar measures assessing the same area of literacy. For example, between the two reading comprehension measures ($r = .498, n = 131, p < .001$), and reading comprehension text one, reading comprehension text two, and the total reading comprehension score ($r = .863, n = 131, p < .001$; and $r = .868, n = 131, p < .001$ respectively). These results are displayed in Table 4.3. below.

Table 4.3. *Pearson product-moment correlations between the two reading comprehension measures and their combined total*

	1.	2.	3.
1. Reading Comprehension – Text 1	-	.498**	.863**
2. Reading Comprehension – Text 2		-	.868**
3. Reading Comprehension – Total			-

* $p < .05$. ** $p < .01$.

Other measures that demonstrated a significant relationship with reading comprehension (total score of both reading comprehension texts) included spelling ($r = .350$, $n = 131$, $p < .001$); phoneme knowledge ($r = .293$, $n = 131$, $p = .001$); orthotactic knowledge ($r = .191$, $n = 131$, $p = .029$); total knowledge of language structure ($r = .253$, $n = 131$, $p = .004$); inferencing – listening comprehension ($r = .209$, $n = 131$, $p = .017$); inferencing – ambiguous sentences ($r = .456$, $n = 131$, $p < .001$) inferencing – total ($r = .466$, $n = 131$, $p < .001$); and working memory ($r = .376$, $n = 131$, $p < .001$). The results for analyses of all the measures included in the assessment battery (both those demonstrating a significant relationship with reading comprehension, and those without) are presented in Table 4.4.

Table 4.4. *Pearson product-moment correlations between reading comprehension score and all other measures used in the study*

	1. Reading Comprehension
1. Reading Comprehension	-
2. Spelling	.350**
3. Phoneme knowledge	.293**
4. Syllable knowledge	.121
5. Morpheme knowledge	-.037
6. Orthotactic knowledge	.191*
7. Knowledge of Language Structure - Total	.253**
8. Inferencing – Listening Comprehension	.209*
9. Inferencing – Ambiguous Sentences	.456**
10. Inferencing – Total	.466**
11. Working Memory	.376**

* $p < .05$. ** $p < .01$.

4.3.2.2. *Correlations between Other Measures of Literacy*

In addition to the relationships demonstrated between reading comprehension and the other measures of the assessment battery, further relationships were demonstrated between several of the other literacy measures (see Table 4.5.). Spelling was significantly positively correlated with performance on phoneme knowledge ($r = .282, n = 131, p = .001$); syllable knowledge ($r = .278, n = 131, p = .001$); total knowledge of language structure ($r = .303, n = 131, p < .001$); inferencing – ambiguous sentences ($r = .376, n = 131, p < .001$); and inferencing – total score ($r = .327, n = 131, p < .001$). Phoneme knowledge was significantly positively correlated with performance on spelling, (as above); total knowledge of language structure ($r = .520, n = 131, p < .001$); inferencing – ambiguous sentences ($r = .409, n = 131, p < .001$); inferencing – total score ($r = .381, n = 131, p < .001$); and working memory ($r = .214, n = 131, p = .015$). Scores achieved of the syllable knowledge measures were significantly positively correlated with scores obtained on the spelling measure (as above); orthotactic knowledge ($r = .221, n = 131, p = .011$); and total knowledge of language structure ($r = .657, n = 131, p < .001$). Morpheme knowledge was significantly positively correlated with phoneme knowledge (as outlined previously); total knowledge of language structure ($r = .538, n = 131, p < .001$); and working memory ($r = .188, n = 131, p = .034$). Performance in the measure of orthotactic knowledge demonstrated strong positive correlations with performance on measures of syllable knowledge (as above); and total knowledge of language structure ($r = .513, n = 131, p < .001$). The scores obtained on the total knowledge of language structure measure were strongly positively correlated with spelling, phoneme knowledge, syllable knowledge, morpheme knowledge, orthotactic knowledge (all outlined above); inferencing – ambiguous sentences ($r = .356, n = 131, p < .001$); inferencing – total score ($r = .350, n = 131, p < .001$); and working memory ($r = .330, n = 131, p < .001$). Inferencing – listening comprehension demonstrated significant positive

correlations with scores obtained on the other inferencing measure (inferencing ambiguous sentences; $r = .227, n = 131, p = .009$); and total inferencing score ($r = .509, n = 131, p < .001$). The inferencing – ambiguous sentences measure was strongly positively correlated with spelling, phoneme knowledge, total knowledge of language structure, and inferencing – listening comprehension (all outlined previously); inferencing total score ($r = .954, n = 131, p < .001$); and working memory ($r = .375, n = 131, p < .001$). Finally, the total score obtained for inferencing demonstrated significant positive correlations with measures of spelling, phoneme knowledge, total knowledge of language structure, inferencing – listening comprehension, inferencing – ambiguous sentences (all outlined above), and working memory ($r = .364, n = 131, p < .001$)

Table 4.5. *Pearson product-moment correlations between other literacy measures assessed*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Spelling	-	.282**	.278**	-.026	.132	.303**	-.017	.376**	.327**	.132
2. Phoneme knowledge		-	.124	-.039	-.017	.520**	.063	.409**	.381**	.214*
3. Syllable knowledge			-	.117	.221*	.657*	.130	.144	.168	.152
4. Morpheme knowledge				-	.092	.538**	.060	.075	.085	.188*
5. Orthotactic knowledge					-	.513**	-.012	.147	.126	.172
6. Knowledge of language structure - total						-	.114	.356**	.350**	.330**
7. Inferencing – Listening comprehension							-	.227**	.509**	.103
8. Inferencing – Ambiguous sentences								-	.954**	.375**
9. Inferencing - total									-	.364**
10. Working memory										-

* $p < .05$. ** $p < .01$.

4.3.3. Predictors of Reading Comprehension within the Cohort (using literacy assessment measures included in this assessment battery)

Results from the correlations demonstrated strong relationships between reading comprehension and the following measures: spelling, phoneme knowledge, orthotactic knowledge, total knowledge of language structure, all inferencing measures, and working memory. Standard multiple regression was undertaken using the results from the whole cohort on the assessment measures included. This determined the total amount of variance in reading comprehension that could be explained by the assessment measures in their entirety. Hierarchical multiple regression analyses were then conducted to assess the ability of individual measures to predict reading comprehension.

The SVR (Gough & Tunmer, 1986; Hoover & Gough, 1990) was used as a framework to guide the theoretical rationale for the variables used and ordering of the literacy measures. The reading comprehension (total score) was used as the dependent variable, while the measures of spelling, language structure knowledge, inferencing, and working memory were utilised as predictor (independent) variables. The measure of reading comprehension was used throughout the regression analyses as the dependent variable, as it is widely accepted that reading comprehension is the ultimate goal of reading (Nation, 2005; Paris & Hamilton, 2009).

4.3.3.1. Standard multiple regression analysis

A control variable of gender was entered into the model first. Following this, the individual measures of spelling, phoneme knowledge, syllable knowledge, morpheme knowledge, orthotactic knowledge, inferencing – listening comprehension, inferencing – ambiguous sentences, and working memory were forced into the model. No measures that were created by summing other measures (e.g., inferencing – total score, and knowledge of

language structure - total score) were included in the analyses due to the components of these being included in their original form. Table 4.6. presents the results of this standard multiple regression analysis for the measure of reading comprehension.

Table 4.6. *Results of a standard multiple regression analysis to investigate the total contribution made to reading comprehension by the assessment measures*

Steps	R ²	R ² Change	Sig. R ² Change	Final β
1 (control)	.004	.004	$F = .51, p = .475$	Gender .050
2 (forced)	.318	.314	$F = 6.72, p < .001$	Spelling .200
				Phoneme knowledge .094
				Syllable knowledge -.056
				Morpheme knowledge .099
				Orthotactic knowledge .119
				Inferencing – LC .133
				Inferencing – AS .204
				Working memory .231

The total variance in reading comprehension explained by the model as a whole after controlling for gender, was 31.4%, $F(9, 117) = 6.05, p < .001$.

4.3.3.2. Hierarchical multiple regression analyses

The standard regression analysis was followed by hierarchical regression analyses to assess the level of prediction of reading comprehension provided by various combinations of the measures in the assessment battery. Again, the reading comprehension (total score) was used as the dependent variable, while the spelling measure was considered to be

representative of the word decoding component of the SVR, and the inferencing measures were considered to be representative of the linguistic comprehension component of the SVR. Measures of working memory and language structure knowledge were added in as additional variables due to their strong relationship with reading comprehension. Gender was entered into the model each time in the first step to act as a control. The predictor variables of spelling and inferencing (both listening comprehension and ambiguous sentences subtests), knowledge of language structure (phoneme, morpheme, syllable, and orthotactic knowledge), and working memory were entered into the model in various different combinations to investigate the role of each in predicting reading comprehension. Table 4.7. presents the results of the initial hierarchical regression analysis when entering the measures of spelling (representing word decoding) and inferencing – listening comprehension and ambiguous sentences (representing linguistic comprehension) alone.

Table 4.7. *Results of a hierarchical regression analysis to investigate predictors of reading comprehension among the assessment measures administered*

Variables	R ²	R ² Change	Sig. R ² Change	Final β
1 Gender	.004	.004	$F = .53, p = .470$	Gender .045
Model A				
2 Inferencing	.205	.201	$F = 15.91, p < .001$	Listening comprehension .119 Ambiguous sentences .331**
3 Spelling	.243	.038	$F = 6.31, p = .013$	Spelling .213*
Model B				
2 Spelling	.117	.113	$F = 16.29, p < .001$	Spelling .213*
3 Inferencing	.243	.126	$F = 10.39, p < .001$	Listening comprehension .119 Ambiguous sentences .331**

* $p < .05$. ** $p < .01$.

Results obtained from this analysis indicated that gender was not statistically significant. Model A demonstrates the results when the two inferencing variables were entered first, followed by spelling. This model (Model A) was statistically significant at both step two and three, with inferencing explaining approximately 21 percent of variance in reading comprehension, and spelling explaining an additional 4 percent of variance above and beyond that of inferencing. Model B demonstrates the results when these two variables of spelling and inferencing were entered in the reverse order, spelling at step two, and inferencing at step three. Again, the model was statistically significant at both steps subsequent to gender, with spelling explaining approximately 12 percent of variance in

reading comprehension, and inferencing explaining an additional 13 percent above and beyond spelling. The results from these two models demonstrate that the variables of spelling and inferencing (both measures) share approximately 9 percent of variance. Two of the four variables in this final model, inferencing – ambiguous sentences, and spelling – were statistically significant, with inferencing – ambiguous sentences recording a higher Beta value ($\beta = .331, p < .001$) than spelling ($\beta = .213, p = .013$).

This initial analysis (Table 4.7.) demonstrated that inferencing made the largest significant contribution to reading comprehension. To investigate the influence of other variables upon inferencing, working memory and the knowledge of language structure variables were entered into the model. The spelling variable was entered at step two to assume the role of a constant throughout the analysis. Results of this analysis first investigating the influence of working memory on inferencing are presented in Table 4.8 below.

Table 4.8. *Results of a hierarchical regression analysis to investigate the influence of working memory on inferencing in predicting reading comprehension*

Variables	R ²	R ²	Sig. R ² Change	Final β
		Change		
1 Gender	.004	.004	$F = .51, p = .475$	Gender .047
2 Spelling	.117	.113	$F = 15.91, p < .001$	Spelling .215*
Model A				
3 Working memory	.220	.102	$F = 16.12, p < .001$	Working memory .230**
4 Inferencing	.289	.069	$F = 5.87, p = .004$	Listening comprehension .115 Ambiguous sentences .245**
Model B				
3 Inferencing	.243	.126	$F = 10.14, p < .001$	Listening comprehension .115 Ambiguous sentences .245**
4 Working memory	.289	.045	$F = 7.73, p = .006$	Working memory .230**

* $p < .05$. ** $p < .01$.

Within this analysis, Model A demonstrates the results when the working memory was entered first, followed by the inferencing variables. This model was statistically significant at both step three and four, with working memory explaining approximately 10 percent of variance in reading comprehension, and inferencing explaining an additional 7 percent above that of spelling and working memory. Model B demonstrates the results when these two variables of working memory and inferencing entered into the model in the reverse

order, inferencing at step three, and working memory at step four. Again, the model was statistically significant at both steps, with inferencing explaining approximately 13 percent of variance in reading comprehension, and working memory explaining an additional 5 percent above and beyond both spelling and inferencing. The results from these two models demonstrate that the variables of working memory and inferencing share approximately 2 percent of variance. In this final model, three of the five variables were statistically significant, with inferencing – ambiguous sentences recording the highest Beta value ($\beta = .245, p = .009$), then working memory ($\beta = .230, p = .006$), and finally spelling ($\beta = .215, p = .011$).

Next, the knowledge of language structure variables were entered into the model to investigate whether they influence inferencing in predicting reading comprehension. These results are presented in Table 4.9. below.

Table 4.9. Results of a hierarchical regression analysis to investigate the influence of language structure knowledge on inferencing in predicting reading comprehension

Variables	R ²	R ² Change	Sig. R ² Change	Final β
1 Gender	.004	.004	$F = .51, p = .475$	Gender .050
2 Spelling	.117	.113	$F = 15.91, p < .001$	Spelling .200*
3 Working memory	.220	.102	$F = 16.12, p < .001$	Working memory .231**
4 Language structure knowledge	.262	.043	$F = 1.72, p = .149$	Phoneme knowledge .094 Syllable knowledge -.056 Morpheme knowledge -.099 Orthotactic knowledge .119
5 Inferencing	.318	.055	$F = 4.75, p = .010$	Listening comprehension .133 Ambiguous sentences .204*

* $p < .05$. ** $p < .01$.

In this analysis, gender was entered into the model as a control. Spelling and working memory were entered into the model at step two and three, acting as constants throughout the subsequent steps. The addition of the four language structure measures at step four did not result in statistical significance. Furthermore, in this model (step four), only the initial two variables were statistically significant, spelling and working memory. None of the Beta values obtained for the language structure measures at this point were significant.

Next, influences on the variable of spelling were investigated. It was hypothesised that inferencing, as a higher level skill, would be unlikely to influence the lower level skill of spelling, therefore inferencing was not included in this analysis. First, the influence of

language structure knowledge on spelling was investigated. The results of this analysis are presented in Table 4.10. below.

Table 4.10. *Results of a hierarchical regression analysis to investigate the influence of language structure knowledge on spelling in predicting reading comprehension*

Variables	R ²	R ² Change	Sig. R ² Change	Final β
1 Gender	.004	.004	$F = .53, p = .470$	Gender .057
Model A				
2 Language structure knowledge	.131	.128	$F = 4.56, p = .002$	Phoneme knowledge .218* Syllable knowledge -.004 Morpheme knowledge -.043 Orthotactic knowledge .158
3 Spelling	.193	.062	$F = 9.47, p = .003$	Spelling .270**
Model B				
2 Spelling	.127	.124	$F = 18.12, p < .001$	Spelling .270**
3 Language structure knowledge	.193	.066	$F = 2.50, p = .046$	Phoneme knowledge .218* Syllable knowledge -.004 Morpheme knowledge -.043 Orthotactic knowledge .158

* $p < .05$. ** $p < .01$.

Within this analysis, Model A demonstrates the results when the language structure knowledge variables were entered into the model first, succeeded by the spelling variable. This model was statistically significant at both step two and three, with the knowledge of

language structure variables explaining approximately 13 percent of variance in reading comprehension, and spelling explaining an additional 6 percent above that of the language structure variables. Model B demonstrates the results when these two variables were entered into the model in the reverse order, spelling at step two, and the knowledge of language structure measures at step three. Again, the model was statistically significant at both steps, but with step three at a much lower level of significance than step two. Model B found that spelling explained approximately 12 percent of variance in reading comprehension, and the knowledge of language structure variables explaining an additional 7 percent above and beyond spelling. The results from these two models demonstrate that the variables of spelling and knowledge of language structure share approximately 6 percent of variance. In this final model, only two of the variables were statistically significant: spelling ($\beta = .270, p = .003$), and only phoneme knowledge of the language structure measures ($\beta = .218, p = .011$).

Finally, the working memory variable was investigated to determine whether it influenced spelling in predicting reading comprehension. The results of this are presented in Table 4.11. below.

Table 4.11. *Results of a hierarchical regression analysis to investigate the influence of working memory on spelling in predicting reading comprehension*

Variables	R ²	R ² Change	Sig. R ² Change		Final β
1 Gender	.002	.002	$F = .30, p = .583$	Gender	.054
<hr/> Model A					
2 Working memory	.142	.140	$F = 20.25, p < .001$	Working memory	.331**
3 Spelling	.248	.106	$F = 17.29, p < .001$	Spelling	.328**
<hr/> Model B					
2 Spelling	.141	.138	$F = 19.93, p < .001$	Spelling	.328**
3 Working memory	.248	.108	$F = 17.61, p < .001$	Working memory	.331**

* $p < .05$. ** $p < .01$.

Model A of this analysis demonstrates the results when the working memory variable was entered into the model at step two, and spelling at step three. This model was statistically significant at both steps, with the working memory variables explaining approximately 14 percent of variance in reading comprehension, and spelling explaining an additional 11 percent above that of working memory. Model B demonstrates the results when these two variables were entered into the model in the reverse order, spelling at step two, and working memory at step three. Again, the model was statistically significant at both steps, whereby spelling explained approximately 14 percent of variance in reading comprehension, and the working memory variable explaining a further 11 percent above and beyond spelling. The

results from these two models demonstrated that the variables of spelling and working memory share approximately 3 percent of variance. In this final model, both variables were statistically significant: spelling ($\beta = .328, p < .001$), and working memory ($\beta = .331, p < .001$).

4.4. Discussion

The first objective of this study was to investigate the component literacy skills of a large cohort of first year undergraduate pre-service teachers. The assessment comprised of selected underlying literacy skills covering both aspects of word decoding and linguistic comprehension. An outcome measure of reading comprehension was also included in this large scale assessment battery. The framework adopted to design and interpret the results from this study was the SVR (Gough & Tunmer, 1986; Hoover & Gough, 1990).

4.4.1. Diversity of Literacy Skills within the Pre-service Teacher Population on Entry into Higher Education

The measures used for this large assessment were not standardised assessments. Therefore it is not possible to compare the performance of this group to normative data. It is, however, possible to comment on the performance of this group of students as a whole and examine the literacy skills that demonstrated areas of strength and weakness amongst this population. Typically, each of the included measures demonstrated a broad range of performance among the participants, but some areas were identifiable as areas of strength or weakness within the whole population.

Results from the assessment of spelling skill reported a mean of almost 63 percent of items answered correctly. The range of scores however demonstrated the diversity of ability amongst the participants. A similar trend was apparent in reading comprehension and

knowledge of language structure performance, whereby the range of scores was vast. Analysis of the individual skills comprising the total knowledge of language structure score demonstrated much stronger skill ability in the area of syllable knowledge, whilst a particularly low level of skill was apparent in the scores obtained on the morpheme knowledge subtest. Again, similar findings were shown in the scores of each of these measures of a wide range of presenting ability amongst this population.

The two inferencing measures demonstrated relatively high means amongst this cohort. Although overall, the group demonstrated good ability in the inferencing subtest of listening comprehension, the range of scores demonstrated more variance than is immediately apparent from the mean. Furthermore, the inferencing subtest of ambiguous sentences shows a much broader range of responses and a much larger standard deviation. These scores demonstrated similar findings to those of the pilot study (see Chapter Three for details), but the variance for these scores (particularly the ambiguous sentences subtest) are much greater. This suggests that although a large proportion of participants presented with strong inferencing skills (hence the high mean), an isolated group of individuals presented with difficulties in this skill. Finally, working memory skill demonstrated diversity in score presentation, with a very large range of scores identified.

These descriptive scores suggest that the literacy abilities of pre-service teachers are extremely diverse on entry to the higher education environment, supporting the argument that universities are accepting candidates of much wider ranges of academic ability (Buckingham, 2014), and with increased language and learning difficulties (Heiman & Precel, 2003; Henderson, 1999).

Reading comprehension ability was found to be strongly correlated with spelling, phoneme knowledge, total knowledge of language structure, total inferencing ability (as well as the ambiguous sentences task in isolation), and working memory. In each case, the greater

the score obtained on the measure of reading comprehension, the better the performance in the other measures. This suggests that the component skills that strongly correlated with reading comprehension may be required underlying skills for strong reading comprehension ability. This is consistent with the SVR framework, where in this assessment, spelling ability (word decoding) is strongly correlated with reading comprehension ability; and inferencing (linguistic comprehension) is also strongly correlated with reading comprehension ability.

4.4.2. Predictors of Reading Comprehension – An Argument both for and against the use of the SVR Framework with the Pre-service Teacher Population

The role of these component literacy skills in predicting reading comprehension was investigated through a series of regression analyses. When considered together, all aspects of literacy that were assessed were found to account for approximately 31 percent of the total variance in reading comprehension. While this percentage still leaves a high level of unexplained variance, it is recognised that much lower levels of variance have been accounted for in the adult population than with children (e.g., Landi, 2010; Macaruso & Shankweiler, 2010; Savage & Wolforth, 2007).

The skills of spelling, inferencing, and working memory were each found to make unique contributions to explaining the variance in reading comprehension, with inferencing demonstrating the highest level of contribution. This is consistent with previous findings arguing that linguistic comprehension skills demonstrate much greater influence on reading comprehension than word decoding skills within the adult population (Jackson, 2005; Landi, 2010; Macaruso & Shankweiler, 2010). Language structure knowledge was shown to influence spelling, but only the measure of phoneme knowledge was found to be significant. This is particularly surprising because the spelling task was comprised of morphologically derived pairs of words, rather than a task of independent and regular words. It might have

therefore been expected for morpheme knowledge to be significant in influencing spelling ability. However, the overall scores demonstrated on the morpheme task were low, and it is possible that the low mean score for the group did not demonstrate enough variance to be influential within the analyses performed.

In addition to making a direct unique contribution to reading comprehension, working memory was found to be influential in the level of variance that spelling contributed to reading comprehension. The contribution of working memory to reading comprehension has been strongly debated across the child and adult literature. Macaruso and Shankweiler (2010) found that working memory made a unique contribution in their assessment of community college students, and further reported verbal working memory to be one of the best predictors in distinguishing between less skilled, and average readers. Braze et al. (2007) also found that working memory made a significant contribution to reading comprehension in adult students, but its unique contribution disappeared once vocabulary and decoding skills had been accounted for. As the current study did not include a vocabulary measure, it was not possible to replicate the analysis used by Braze et al. (2007). However, the influence that working memory demonstrated, both as a unique contribution and through the variables of inferencing and spelling, indicates its relevance to reading comprehension.

Inferencing not only demonstrated the strongest unique contribution to reading comprehension, but also influenced all of the remaining variables. Previous research has suggested that the skills of linguistic comprehension may have a greater role in the reading comprehension abilities of adults than skills required for word decoding (Jackson, 2005; Macaruso & Shankweiler, 2010). Furthermore, skills described as higher level language (Hogan et al., 2011) have been reported to be better predictors of reading comprehension than lower level skills within the population of skilled adult readers (Landi, 2010). Inferencing is considered to be a higher level language skill. The results therefore support this finding that

higher level language skills make a strong contribution to reading comprehension. The results from the inferencing measure demonstrated a particular disparity in the scores of participants who had strong versus weak, inferencing skills. This may be related to the studies of pre-service teachers' that have demonstrated distinct differences in the frequency and enthusiasm for reading held by pre-services teachers (Applegate & Applegate, 2004; Nathanson et al., 2008). If individuals who have little enthusiasm or motivation to read subsequently read much less frequently, this will provide them with a reduced prior knowledge base from which to draw inferences. Furthermore, these individuals will likely be less practiced in making inferences both within, and between texts, thus impacting upon their reading comprehension.

While the unique influence demonstrated by inferencing is not particularly unexpected, its influence on the variable of spelling is somewhat surprising. The spelling task utilised in this large scale assessment was not a regular spelling task, and required participants to write down orally dictated words comprised of morphologically derived pairs. Arguably, it may be possible that participants used skills of inferencing to identify that the spelling task was requiring them to think beyond the straightforward spelling of an individual word. Awareness of this fact may also have resulted in them recalling prior knowledge about a word, thus demonstrating an aspect of inferencing that is called frequently called upon in reading comprehension (Franks, 1998). Finally, individuals with larger working memory capacity, or listening comprehension skill have been found to maintain inferences better than those with weaker skills in these two areas (Lehman-Blake & Tompkins, 2001), thus demonstrating the complex interactions that occur between many of the skills assessed in the current study.

The complex, interactive nature of the skills included within this assessment argue against the application of a simple model of reading comprehension such as the SVR for this population. While the results obtained do demonstrate the contribution of the skills

representing components of word decoding and linguistic comprehension, the interaction between them alongside the additional role of working memory argue for the application of more interactive models of reading comprehension. It seems plausible that the construction-integration model (Kintsch, 1998) might provide a better fit with the data from this study. Application of the construction-integration model would begin to explain the strong role of inferencing amongst this population of more highly skilled readers. The construction-integration model posits that both top-down and bottom-up processing skills are involved in reading comprehension. The significantly larger role of inferencing in the current study could be explained using this model as the facilitation between top-down and bottom-up processes that is required in reading comprehension. Further research is required to explore the application of the construction-integration model to this population of adults with higher levels of literacy skill.

4.4.3. Future Directions and Conclusions

Time limitations and administration requirements inherent in the current study meant that potentially relevant skills were not included in the assessment. The exploratory assessment measures used allow for interpretation of the performance of these individuals in relation to their within-group peers, but do not allow for generalisations to be made outside of this group. Of similar note, is that the measures used to represent the two SVR components of word decoding and linguistic comprehension, were not measures considered to be all-encompassing assessments for these skills. However inclusion of more measures would have resulted in a lengthy assessment, which was not feasible within the time constraints of this study. In addition to the included measures, future use of this assessment should include an additional measure of listening comprehension to assist in explaining the skills of linguistic comprehension. Examples of other word decoding measures that could be considered for use

with this population and administrable to a large group would be: 1) a timed non-word decoding task, 2) a pseudo-word spelling task, or 3) a lexical decision task. In addition to these supplementary measures of word decoding and linguistic comprehension, assessment of vocabulary, fluency, and prior / background knowledge may also have augmented the proportion of variance explained by assessment amongst this population as demonstrated in existing research (Braze et al., 2007; Hirsch, 2003; Joshi & Aaron, 2000; Tunmer & Chapman, 2012).

This study (Study One) investigated selected literacy skills within an entire cohort of first-year pre-service teachers, attempting to understand the strengths and weaknesses of their literacy profile. In order to further investigate the literacy needs of this population, an additional study (Study Two) was undertaken. This second study sought to examine the skills and responsiveness to intervention of a subgroup of pre-service teachers who presented with reading comprehension difficulties, as identified using the assessment results from Study One.

CHAPTER FIVE

STUDY TWO – AN INVESTIGATION OF THE EFFECTIVENESS OF READING COMPREHENSION STRATEGIES FOR PRE-SERVICE TEACHERS WITH DIFFICULTIES UNDERSTANDING WRITTEN TEXT

5.1. Introduction

There is a paucity of research examining the effectiveness of interventions to support and increase reading comprehension ability amongst adults. Additionally, there is little known about the underlying literacy skills of pre-service teachers who demonstrate reading comprehension difficulties, despite the increase in research in response to the high prevalence of reading impairment within the adult population as a whole (Scarborough et al., 2013).

The limited research that does exist examining the effectiveness of reading comprehension intervention for adults has predominantly focussed on ABE students (Alamprese et al., 2011; Greenberg et al., 2011; Sabatini et al., 2011). These studies have demonstrated limited gains in both participants' component skills of literacy, and overall reading comprehension ability, despite the large number of intervention hours provided (ranging from 43.75 to 94 hours). Results from these studies demonstrate the difficulty in identifying effective methods of intervention with the ABE population. However, there is also a large group of adults who experience some degree of literacy weakness who do not access such services, and are therefore not as easily identified as the ABE population. Many adults with literacy weaknesses only demonstrate difficulties understanding written text when the cognitive demands of their environment increase. An example of these individuals are those within the early stages of higher education where the demands placed on reading comprehension have become much greater (Cogmena & Saracaloglub, 2009). Many higher

education courses require students to read larger or more complicated texts than they have previously encountered, taxing the skill of reading comprehension to a much greater degree (Fidler & Everatt, 2012). This knowledge, coupled with the additional knowledge that an increasing number of students with a broader range of skills, language, and learning disabilities are being admitted to higher education (Heiman & Precel, 2003; Henderson, 1999) suggests that there is a greater requirement for support to be provided to such students.

The literacy skills and attitudes of pre-service teachers have been examined at a broad level, demonstrating a wide range of achievement on reading comprehension, poor levels of habitual reading, and many individuals lacking an interest in reading (Applegate & Applegate, 2004; Benevides & Peterson, 2010; Nathanson et al., 2008). Such findings suggest that there is a need to improve our understanding of the underlying literacy skills of pre-service teachers who may demonstrate difficulties understanding written text.

Although there is limited research into the use and effectiveness of strategies to improve reading comprehension amongst adults with higher levels of literacy skill, (Kruidenier, 2002), those that have been reported describe a wide range of strategies. Individuals who present with difficulties in the area of word decoding have often been recommended to use a strategy that focusses on reading the words aloud to the reader, to decode them for the individual. This typically requires the use of text-to-speech software and has had positive feedback amongst students in higher education (Draffan et al., 2007). One further strategy employed to aid reading comprehension amongst adults is prediction, or looking at aspects of a text prior to presentation of the entire text. Studies have reported mixed findings regarding the usefulness of prediction, with some reporting it to be a successful strategy for adults (Thiede et al., 2003), and others reporting that it is not significant in enhancing reading comprehension (Hock & Mellard, 2011). Strategies that require individuals to think about the text that they are reading as they are reading it

(metacognitive strategies) have also been found to be successful with the adult population (Eilers & Pinkley, 2006; Hock & Mellard, 2005; Hong-Nam & Leavell, 2011; Sheorey & Mokhtari, 2001; Thiede et al., 2003). Such strategies include the use of evaluating content, mind mapping, highlighting text, and summarising.

One study that demonstrated the effectiveness of strategies to increase reading comprehension among the higher education population included the use of both metacognitive and non-metacognitive strategies (Fidler, 2009). Various strategies were employed in an attempt to meet the needs of each individual student, regardless of their differing strengths and weaknesses. Fidler (2009) employed five different strategies with university students who had a prior diagnosis of dyslexia, and who presented with deficits in reading comprehension. Results demonstrated that strategies that allowed for more time to be spent reviewing the text, and that required metacognition, were more beneficial to this group of participants than those that focussed on word decoding alone. These results support previous research recommending the use of metacognitive strategies with adults with higher levels of literacy ability (Thiede et al., 2003). Fidler (2009) did not, however, include a comparison of this data to a control group (participants who did not partake in the intervention strategies), thus it cannot be discounted that the gains made in reading comprehension were not attributable to a practice effect alone. Further, this research focussed purely on students who had previously received a diagnosis of dyslexia, and who were therefore more likely to experience difficulties in areas of similar underlying skills.

Reading comprehension difficulties amongst the pre-service teaching population are troubling, because not only will these deficits impact on their own studies, but if left unaddressed, they will subsequently impact on their future students. Without addressing these difficulties in the higher education population, many children will not fully achieve the ultimate goal of reading (Nation, 2005; Paris & Hamilton, 2009); reading comprehension.

5.1.1. Research Questions and Hypotheses

The aims of this study were to identify the differences between the skills of students who demonstrated relative difficulty understanding written text, compared to their peers who did not. For clarity of expression throughout this chapter and the remainder of this thesis, the terminology of ‘difficulties understanding written text’, or reading comprehension ‘difficulties’, refers to difficulties experienced by students in the area of reading comprehension relative to their peers. The reading comprehension scores from the ART measure were used to determine the cohort mean, and subsequently to identify individuals who presented with difficulties in the measure relative to the mean score (as explained in section 5.2.1. below).

In addition to identifying whether differences were present between students of differing reading comprehension ability, this study sought to ascertain the effectiveness of an intervention for students presenting with difficulties understanding written text. Four different intervention strategies with the aim to increase reading comprehension were provided to ascertain whether or not they were beneficial for these individuals. Furthermore, the following research questions were devised:

1. How do the literacy skills of pre-service teachers with difficulties understanding written text differ from their peers without reading comprehension difficulties on selected measures of literacy?
2. How effective is an intervention consisting of four reading comprehension strategies to improve reading comprehension amongst pre-service teachers?
3. Which of four reading comprehension strategies (if any) elicits the greatest improvements in participants’ reading comprehension ability?

The theoretical framework of the Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) was applied throughout this study and the thesis as a whole. Consequently, it was hypothesised that weaknesses in the literacy skills of pre-service teachers with reading comprehension difficulties would present within the area of word decoding, linguistic comprehension, or be distributed across both of these areas. It was hypothesised that the intervention provided consisting of four different strategies designed to aid reading comprehension would improve performance on the measure of reading comprehension. The four strategies included within this intervention were: text-to-speech (strategy one), key words (strategy two), mind maps (strategy three), and highlighting and summarising techniques (strategy four). A proposed hypothesis as to the extent of the improvement made by participants, however, is not stated due to the lack of existing research with this specific, more highly skilled, population. Based on existing studies that examined the effectiveness of reading comprehension intervention, it was hypothesised that strategies utilising metacognitive techniques (mind maps, and highlighting and summarising) would yield the best results of the four strategies provided.

5.2. Method

5.2.1. Participants

Participants for this second study were identified from the literacy assessment outlined in Study One (Chapter Four). This first year cohort of undergraduate pre-service teaching students ($n = 147$) was invited to participate in the initial assessment, with participants who consented ($n = 131$) completing a literacy assessment administered via group testing. This assessment was outlined in detail in Study One (Chapter Four), and the measures used were outlined in Chapter Three. Students who scored one standard deviation or more below the cohort mean score on the reading comprehension measure ($M = 11.97$, SD

= 3.54) were deemed eligible for participation in the intervention. Consequently, twenty-six students (21 female and 5 male) were invited to participate in the research intervention (Study Two) based on this criteria. Seventeen students (15 female and 2 male), aged between 18 and 22 years, consented to participate and formed the experimental group (referred to throughout as group IN). The remaining nine students (6 female and 3 male) who had been identified as eligible for participation in the research intervention were highlighted as a no-treatment comparison group (referred to throughout as group NT). Students who scored within one standard deviation of the mean on reading comprehension were identified as a control group ($n = 105$) (referred to throughout as group CN).

5.2.2. Measures

5.2.2.1. Pre-Intervention Measures

5.2.2.1.1. Large cohort assessment (Study One).

Participants from all three CN, NT, and IN groups ($n = 131$) completed the pre-intervention assessment as outlined in Study One (Chapter Four of this thesis). This included measures of reading comprehension (two texts of different abilities), spelling, inferencing (two subtests), and working memory.

5.2.2.1.2. Additional assessment measures completed by the IN group.

Participants in the IN group ($n = 17$) completed several further individually administered assessments following agreement to participate in the study, and prior to completing any of the intervention sessions. This initial session also outlined the research study in more detail and involved an informal discussion. The discussion allowed both the students and the researcher to become more comfortable working together, and provided some background and base-line information about each participant. Topics covered in

discussion included literacy experience during school, literacy experience in the home, attitudes towards reading texts in the education environment, and reading for pleasure, as well as discussing any particular strengths and weaknesses the participants felt that they may have. Following this, the additional pre-intervention assessment measures were conducted with each participant and included the following:

Peabody Picture Vocabulary Test – 4 (PPVT-4) (Dunn & Dunn, 2007)

The PPVT-4 is a standardised test that measures receptive vocabulary without requiring demand to be placed on participants' reading or writing. Each participant was presented with a series of pages, each displaying four pictures. The researcher concurrently stated a word that described one of the pictures, and asked the participant to point to, or say the number of, the picture that was best described by the word. Raw scores were collected and converted to standardised scores to allow for comparison to standardised normative data according to the participant's age. A score of between 85 of 115 is considered to be within average range, with a score of 100 reflecting the overall mean.

Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel, Wiig, & Secord, 2003)

Word Classes – Receptive

This subtest was taken from the CELF-4, which comprises many different subtests designed to evaluate an individual's language performance. This particular subtest was chosen as it, coupled with the subtest below, provides an evaluation of both receptive and expressive language skills. Each participant was presented with four individual words from which they were asked to identify the two words that were related. Raw scores were collected and converted to standardised scores to allow for comparison to standardised normative data

according to the participant's age. A score of between 7 and 13 is considered to be within average range, with a score of 10 reflecting the overall mean.

Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel et al., 2003)

Word Classes – Expressive

This subtest was performed in conjunction with the subtest above (Word Classes-Receptive), whereby on selecting the two related words from four options, the participant was then asked to describe the relationship between the two words. Again, raw scores were collected and converted to standardised scores to allow for comparison to standardised normative data according to the participant's age. A score of between 7 and 13 is considered to be within average range, with a score of 10 reflecting the overall mean.

Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel et al., 2003)

Understanding Spoken Paragraphs

The third of three subtests selected from the CELF-4, this subtest targeted assessment of an individual's listening comprehension. Participants were provided with an orally presented paragraph of approximately five to six sentences in length. Prior to the presentation of the paragraph participants were informed that they would subsequently be asked questions relating to the content of the paragraph, and that no aspect of the paragraph could be repeated. On conclusion of the researcher's oral presentation of the paragraph participants were asked five questions relating to the text. These questions ranged from targeting the main idea of the text, to details, and inferential and predictive information. Raw scores were collected and converted to standardised scores to allow for comparison to standardised normative data according to the participant's age. A score of between 7 and 13 is considered to be within average range, with a score of 10 reflecting the overall mean.

Raven's Advanced Progressive Matrices (short form) (Raven, Raven, & Court, 2003)

The Raven's Advanced Progressive Matrices (APM) is a nonverbal test to identify an individual's intellectual capacity, thinking ability, and high-level observation skills. The questions are presented in a multiple choice style, and in each item individuals are asked to identify the missing element that completes a pattern (the pattern is presented in the form of a matrix). The score obtained from the APM can typically be compared to a norm group to determine the individual's skills when compared to their peers. A shortened version of this assessment was utilised due to time constraints, and items were scored proportionally to the time provided for the task. There were twelve items, with a maximum score of twelve obtainable, and one minute was allocated to participants to complete each item.

Metacognitive Awareness of Reading Strategies Inventory (MARSİ) (Mokhtari & Reichard, 2002)

The MARSİ is a questionnaire that was designed to assess the metacognitive awareness and perceived use of reading strategies amongst adults and adolescents. The questionnaire is comprised of 30 statements, for each of which the individual is asked to rate the statement based on their likelihood of doing it when reading academic related materials. The ratings are from one to five, with a score of one reflecting that the individual never does the statement, and five reflecting that the individual always, or almost always does it. The questionnaire is scored, with the scores for specific questions grouped together to provide sub scores under the headings of 'Global Reading Strategies' (involves pre reading activities), 'Problem-Solving Strategies' (involves actions to understand what is being read), and 'Support Reading Strategies' (creating reference materials that are separate from the text itself). For the purposes of this research, the MARSİ was utilised to ascertain whether participants were aware of any reading strategies that they were already using in their daily

reading activities, and if so, to get a sense of what these might be. Participants were asked to complete the MARSII themselves as part of this session containing further assessment measures. It was then scored by the researcher rather than the participants (the latter being the recommendation in the written instructions), due to time constraints.

5.2.2.2. *Post-Intervention Measures*

Following the period of intervention (within two weeks of completion), all three groups completed the following measures of post-intervention assessment:

5.2.2.2.1. Reading comprehension measure.

This was the same measure as was utilised in the pre-intervention assessment (Study One) using two passages of text from the ART (P. Brooks et al., 2004). The exact same administration procedure was followed, however, to control for practice effects two different texts and corresponding questions were used, previously matched to the initial texts used in the pre-intervention assessment for readability and level (see Appendix E for the texts used at the post-intervention assessment point). The same time allowances were provided for this reading comprehension assessment at pre- and post-intervention (details of which are reiterated in Table 5.2.). Details of the pre- and post-intervention assessment texts used are demonstrated in Table 5.1., and the full texts for the pre- and post-intervention assessments are included in Appendices A and E respectively.

Table 5.1. *Flesch-Kincaid readability scores for paired texts used to determine level of reading comprehension*

	Pre-intervention assessment (grade level)	Post-intervention assessment (grade level)
Text 1 (ART – level three)	11.8	12.3
Text 2 (ART – level four)	15.1	14.6
Mean of two texts	13.45	13.45

Table 5.2. *Time allocated for pre- and post-intervention reading comprehension texts*

	Reading Time (minutes)	Question Responses (minutes)
Text 1 (both pre and post)	3.5 minutes	5 minutes
Text 2 (both pre and post)	5 minutes	5 minutes

Scores were again summed together from both passages to provide a total score out of 20 for reading comprehension for this post-intervention assessment.

5.2.2.2.2. *Informal spelling task.*

The same informal spelling task that was used in the pre-intervention assessment was re-administered to the participants. The exact same procedure was followed as per the pre-intervention administration with a raw score out of a possible 24.

5.2.3. Intervention

5.2.3.1. Procedure

Each participant completed the intervention on an individual basis to ensure that confidentiality was maintained. Each of the intervention sessions within Study Two were delivered by the author of this thesis, a qualified Speech-Language Pathologist. The first session completed by the participants included the additional pre-intervention measures as outlined in section 5.2.2.1.2. above. The remaining four sessions consisted of the reading comprehension intervention of approximately one hour each, and occurred over a period of five weeks.

The participants identified for inclusion in this intervention study presented with a wide range of different profiles, with strengths and weaknesses across each of the varying areas assessed. It was therefore impossible to identify which strategy would benefit which participant, and the research was designed as such that each participant would partake in each of the strategies. The strategies were delivered in the same order to each participant as outlined in Table 5.3. The duration of each session was structured so that it would be similar (approximately 50-60 minutes) for each of the strategies, i.e. the intervention weeks (two to five).

Table 5.3. *Details and format of the sessions for the intervention group*

Week	Assessment / Strategy	Duration
1	Informal semi-structured interview PPVT CELF (3 subtests) Working Memory Task Raven's Matrices (Shortened Version) MARSI Questionnaire	60 minutes
2	Text-to-speech	50-60 minutes
3	Pre-learning words	50-60 minutes
4	Mind maps	50-60 minutes
5	Highlighting and summarising	50-60 minutes

5.2.3.1.1. Order of intervention.

Each strategy session was administered in the same order to each participant and organised so that each strategy would have the least impact on the successive one. The text-to-speech strategy was placed first in the order of intervention sessions as it was deemed unlikely to affect performance in successive intervention sessions, due to the technique being specific to the text utilised at the time. Similarly, the key words strategy was specific to the texts that were used for the particular session, therefore having little impact upon the strategies that occurred in the subsequent weeks. The mind map strategy was taught in the third session, being the first of two meta-cognitive strategies requiring the individual to think about what they were reading as they were reading it. This was placed third because even though it was a strategy that the individual could carry forward to the next week, it would be

evident if they had done so through the production of a mind map. Lastly, the highlighting and summarising strategy was taught. Again, this strategy required individuals to think about what they were reading as they read it. It was unlikely, however, that the text-to-speech or key words strategy could influence this, and if anyone attempted to carry over their knowledge of the mind map strategy to the next week it was quickly and easily identifiable as such.

5.2.3.1.2. Session structure.

Where possible, each intervention session was completed one week apart, allowing for one additional week for rescheduling sessions if necessary. All 17 participants completed all four sessions within the time period allowed. Each session was administered to the participant on an individual basis in a quiet setting within the university campus where students were enrolled. Each intervention session taught a different intervention strategy: text-to-speech (strategy one), key words (strategy two), mind maps (strategy three), and highlighting and summarising techniques (strategy four). The structure of each intervention session can be viewed in Table 5.4. Practice texts and texts utilised for the summarising assessment were sourced from course texts that would be encountered by the participants throughout the semester. This ensured that the intervention was particularly pertinent for the participants involved.

Table 5.4. *Generic structure of all intervention sessions*

Step 1	Strategy discussed with the participant to outline rationale for use.
Step 2	Strategy modelled to demonstrate using the strategy.
Step 3	Participant given time to practice using the strategy on course texts provided.
Step 4	Time provided for questions and clarification of strategy use.
Step 5	<p>Assessment 1: Summarising</p> <p style="padding-left: 40px;">Participant given a new course text and asked to read through it using the designated strategy.</p> <p style="padding-left: 40px;">Text was then removed.</p> <p style="padding-left: 40px;">Participant asked to write a summary of the text without any additional tools or feedback.</p>
Step 6	<p>Assessment 2: Reading Comprehension</p> <p style="padding-left: 40px;">Participants given a comprehension passage of text and asked to read through it using the designated strategy.</p> <p style="padding-left: 40px;">Text was removed.</p> <p style="padding-left: 40px;">Participants asked to answer ten questions relating the text without access to it.</p>
Step 7	Opportunity for participants to ask questions and provide their feedback about the session and the strategy utilised.

5.2.3.1.3. Session assessment.

Each intervention session contained two methods of assessment to determine the effectiveness of the specific strategy used in the session on reading comprehension (see Table 5.4.). The first method of assessment was a summarising task, in which participants were

provided with an unfamiliar text taken from their forthcoming course reading, and asked to read through it using the designated strategy. The texts used were all of the same approximate length (between 352 and 372 words), and were all extracts from readings included in the participants' course materials (see Appendix D for text extracts). Prior to beginning this task, participants were reminded of what constituted a good summary, as well as being reminded that the text and any notes made while reading would be removed prior to completing their summary. The text was then removed, as were any notes that had been made by the participants throughout this time. They were then asked to write a summary of the text they had just read without any additional tools or feedback. Scores collected included the time taken to read the summary using the strategy, number of words written, and time taken to write the summary, with words per minute, and analysis of content produced calculated post-session. An outline of the development of a coding schema for the content produced within the summaries is provided below.

Development of Coding Schema – Summarising Task

Development of the coding schema for the summarising task was based upon a coding structure for analysing a large summarising task in research by Kwiatkowska-White (2012). Whereas her schema included three levels of details (details, main ideas, and themes), the smaller passages of text used in these assessment measures meant that the identification of only details within the texts was appropriate. Details were defined as requiring little integration across the text units and being explicitly stated within the text (Kwiatkowska-White, 2012). The details were identified by the primary researcher for each of the four texts used (one per intervention session), with each one being discussed and refined with an independent coder. During this process of coding, additional examples were added to the coding schema to ensure a high level of reliability between the two coders. Texts one and two were identified as containing 18 details, while texts three and four contained 20 details.

Following the establishment of the coding schema via consensus of the two independent coders, each participant's written response to the summarising task (for each intervention session) was marked by the primary researcher and reviewed by an independent reviewer.

The second assessment used throughout the intervention sessions was a reading comprehension task that followed the same procedure as was undertaken during the initial assessment. Participants were given a passage of text of the same matched level (Fidler, 2009) and asked to read it using the designated intervention strategy. A different matched text was provided for the assessment of the use of each of the four strategies (see Appendix C for these texts). The text was removed and any notes produced during this time were also removed. Participants were then asked to answer ten questions relating the text without access to either it or their notes. The number of questions answered correctly was collected as a raw score for subsequent analysis.

5.2.3.2. Reading Comprehension Strategies

The intervention and procedure followed in this study was adapted from a previous study examining the effectiveness of strategies to assist reading comprehension amongst a cohort of higher education students with dyslexia (Fidler, 2009). The four strategies utilised were based on those outlined in Fidler's unpublished doctoral thesis, and a similar procedure was followed for assessment throughout the course of the intervention. The strategies included with the current population (IN group) are outlined below:

5.2.3.2.1. Strategy: Text-to-speech (session one).

Rationale: This strategy removes the element of word decoding from the process of reading comprehension, therefore it was hypothesised that individuals who experience

difficulties in the word decoding component of reading comprehension may benefit from the use of this strategy.

The first strategy taught participants to utilise text-to-speech software, more specifically *Read & Write Gold* (TextHelp). This software has a number of different features, but for the purposes of this research the focus was placed on the ‘reading features’, whereby the text-to-speech software is utilised to electronically read the material to the individual. This particular software was chosen because it is available to all students at the university where the research was undertaken, and is encouraged as a specific support tool for students who may be experiencing difficulties with written text. Furthermore, the *Read & Write Gold* software would be available for use not only by the students participating in the intervention, but also by any of the students from the wider cohort, thus making it an ecologically valid tool. Text-to-speech software is often recommended to assist students with literacy learning difficulties in the university and/or workplace settings internationally (Draffan et al., 2007; Kennedy, 2000). The nature of this software naturally adopts a multi-sensory approach to reading, as the user is able to both see and hear the text simultaneously.

Participants were introduced to the software and allowed time to familiarise themselves with the different features and toolbars. They were then introduced to the concept of using the software to read text to them electronically, and were given time to customise the speaker (or voice) to their liking using the voice options menu. Participants were able to adjust the volume, speed, pitch, gender, and accent (either American or Australian) of the voice until their preferred options were obtained. All texts utilised for this session were pre-tested to ensure that the pronunciation of all words and grammar were accurate. The practice texts, and text used for the summarising aspect of this strategy were taken from course related readings listed on the participants’ reading lists and recommended for use in this research by other members of the academic faculty. Participants were given the choice of reading the text

on the computer screen or reading the text from a photocopy / print out. During the session, participants were allowed to use the software as they would in a typical situation (i.e., they could pause the text, or re-listening to small parts of the text as they wished). They were not permitted to re-listen to the whole text.

5.2.3.2.2. Strategy: Pre-learning words (session two).

Rationale: This strategy should reduce the need to rely on context surrounding unfamiliar words, thus reducing the recruitment of inferencing and word decoding resources. It was hypothesised that this strategy may also benefit individuals who experience word decoding difficulties as the reduced demand on word decoding resources should free up other resources to be used in text comprehension, as well as increasing fluency due to the decrease in unknown content.

This strategy sought to pre-teach participants words that they may find difficult (in pronunciation and / or meaning) in the text. Participants were provided with a list of words which were then read aloud with their associated definitions by the main author. For each word identified, the list provided the word, a pronunciation guide, and a definition. The participant then had time to read through the list at their own speed and retained the word list while they were given a passage of text. The session followed the step by step outline shown in Table 5.4. (above), with a key words list provided for the participant for each text prior to them reading the text itself.

5.2.3.2.3. Strategy: Mind maps (session three).

Rationale: This strategy was consistent with metacognitive methods used for reading comprehension methods with adults and individuals who present with higher levels of literacy. Metacognitive strategies require the individual to think about what they are reading

as they are reading it, thus engaging with the text in a more in-depth process. It was hypothesised that this strategy would benefit individuals who present with difficulties in the component of linguistic comprehension, who present fewer word decoding difficulties, but still lack comprehension of the overall text.

The third strategy taught participants to use mind maps to help interpret text. Participants were introduced to the concept of mind mapping through description and examples of mind maps, culminating in a demonstration of the process of mind mapping by the researcher. This mind map demonstration was performed using a sample of text taken from a course related reading and, on completion, colour and highlighters were used to review the key information from the mind map itself rather than the text. The session followed the step by step outline shown in Table 5.4., as per the other strategies.

5.2.3.2.4. Strategy: Highlighting and summarising (session four).

Rationale: This strategy was considered to be similar to that of strategy three, engaging in metacognitive awareness of reading while engaging in the process. Thus, it was also hypothesised that this strategy would benefit individuals who present with difficulties in the component of linguistic comprehension, who present fewer word decoding difficulties, but still lack comprehension of the overall text.

The final strategy that was targeted was highlighting and summarising which was the second of the two metacognitive strategies. This was considered to be a typical study skills strategy, but when taught to the participants it transpired that many of the students did not know how to undertake this strategy. In this session, the researcher demonstrated how to break the text down into sections (usually sentences), read through the section, and highlight any pertinent information. The highlighted text was reviewed, and a summary was written in the margin of the page. The process of writing a short summary in the individual's own

words requires the individual to monitor what they have understood by reading the text. The session then followed the step by step outline shown in Table 5.4., as per the other strategies.

5.2.3.3. *Intervention Fidelity*

All intervention sessions were audio recorded (using a digital voice recorder) to ensure that sessions were uniformly, and effectively administered to each participant. A qualified Speech-Language Pathologist (and author of this thesis) administered and subsequently scored all sessions. Twenty percent of all the audio recordings were checked by an independent researcher to ascertain whether the implementation of the session was concurrent with the written session plan (i.e., exhibited the seven steps outlined in Table 5.4. and focused solely on the appropriate intervention strategy within the session). Inter-rater agreement on the implementation of sessions was 100%.

5.2.3.4. *Reliability*

Twenty percent of the assessments undertaken within the intervention sessions (reading comprehension measures, and summarising tasks) were checked and scored by an additional independent researcher to ensure consistency of marking. Responses from the summarising task (assessment measure one) resulted in the marking of 64 summaries for the 17 participants in the IN group. Twenty percent of these responses were then checked and scored by an additional independent researcher to ensure consistency of marking. Inter-rater agreement on the scoring of these assessments was 92.1%. The inter-rater discrepancies were resolved by consensus, and all the raw data summaries were rescored. Furthermore, all the data were rechecked and any errors were corrected prior to data entry. Inter-rater agreement on the scoring of the reading comprehension assessments (assessment measure two) was

96.4%. Any inter-rater discrepancies were resolved by consensus after re-scoring the raw data. Prior to data entry, all data were rechecked and any errors were corrected.

5.3. Results

Three research questions were identified at the outset of this second study. To answer these research questions the following analyses were conducted using SPSS (Version 20.0):

1. Descriptive statistics were examined to ascertain the level of presenting knowledge amongst the groups of participants who presented with difficulties understanding written text (combined IN and NT groups). Between-group comparisons were made to compare the scores obtained on each subtest by the combined IN and NT groups to those obtained by the CN group. Results were also analysed to determine whether students in the combined NT and IN groups presented with difficulties in other areas of literacy, compared to the students in the CN group.
2. Comparisons were made between pre- and post-intervention assessment scores of the whole cohort to determine whether change had occurred within the IN group over the period of intervention. Between-group comparisons were undertaken to identify how the changes made by the IN group compared to the CN and NT groups of participants who had not received the intervention.
3. Several one-way analyses of variance (ANOVA) were conducted to determine the effectiveness of the intervention over time, and to examine the individual effectiveness of the four reading comprehension strategies using the two assessment methods (reading comprehension and summarising) undertaken throughout the intervention.

5.3.1. Between-group Comparisons

5.3.1.1. Comparison of Literacy Skills of Students with Difficulties Understanding Written Text (combined IN and NT groups) Compared to those who do not (CN group)

The number of students who met the criteria for inclusion in the intervention group was 26, and this figure represents both the students who agreed to participate ($n = 17$; the IN group) and those who declined to participate in the intervention ($n = 9$; the NT group). The performances of these two groups combined were compared to the remaining students (the CN group; $n = 105$). Independent samples t -tests were undertaken to determine whether any differences existed between the literacy skills of pre-service teachers who demonstrated difficulties understanding written text, and those who did not.

5.3.1.1.1. Group comparisons for the measure of reading comprehension.

The following t -test results were obtained on the measure of reading comprehension (used to determine the two groups): reading comprehension subtest one [$t(129) = 10.06, p < .001, d = 1.928$], reading comprehension subtest two [$t(128) = 8.53, p < .001, d = 1.981$], and reading comprehension total score [$t(128) = 14.90, p < .001, d = 2.689$]. The effect size for this final analysis ($d = 2.69$) was found to greatly exceed Cohen's (1988) convention for a large effect. Consistent with selection processes to identify the groups, students who did not present with difficulties understanding written text ($M = 11.98, SD = 2.61$) obtained significantly higher scores in a combined measure of reading comprehension than students who had been identified as presenting with difficulties understanding written text ($M = 6.31, SD = 1.44$).

5.3.1.1.2. *Group comparisons on additional literacy measures.*

Scores were obtained for comparisons made between the two identified groups on the other literacy measures that had been included in the initial large scale assessment battery (Study One). Significant differences were found between the two groups on all additional measures of literacy: spelling [$t(129) = 2.26, p = .026, d = 0.515$]; inferencing (listening comprehension) [$t(129) = 2.27, p = .025, d = 0.480$]; inferencing (ambiguous sentences) [$t(129) = 5.08, p < .001, d = 1.041$]; total inferencing score [$t(129) = 5.28, p < .001, d = 1.083$]; and working memory [$t(126) = 3.22, p = .002, d = 0.733$]. In each case, the CN group demonstrated greater scores than the combined NT and IN group. The effect size for inferencing (listening comprehension) met the criteria as outlined by J. W. Cohen (1988) to be deemed a small effect size. Measures of spelling and working memory demonstrated moderate effect sizes, while the measures of inferencing (ambiguous sentences), and total inferencing score produced scores that met Cohen's criteria for large effect sizes.

5.3.1.1.3. *Group comparisons across the whole assessment battery – whole group.*

Analysis was conducted to ascertain whether students in the combined NT and IN group who scored one standard deviation (SD) or more below the mean in the measure of reading comprehension, also scored one SD (or more) below the mean in other measures of literacy assessed. The mean (M) and SD were calculated for each subtest included as part of the large assessment battery as outlined in Chapter Three (inclusive of language structure assessment tasks). This was then applied to each student's score for each subtest to ascertain whether they performed one SD or more below the mean on each particular subtest. A total score was then obtained by calculating the number of subtests for which each student had scored at least one SD below the mean. For the 131 students who completed the assessment battery, the mean number of subtests upon which scores at least one SD below the mean were

obtained was 2.54 (i.e., on average each student within the assessed cohort ($n = 131$) scored at least one SD below the mean on 2.54 of 13 subtests). The SD (2.43) was also calculated for the total number of subtests. To ascertain how many students scored poorly across the entirety of the assessment battery a criteria of $M + 1SD$ ($2.54 + 2.43 = 4.97$) was used. Any students who scored one SD (or more) below the mean on 5 or more subtests of the 13 were therefore identified as presenting with difficulties with literacy in comparison to the rest of the cohort. Table 5.5. displays the total number of students and the corresponding number of subtests in which they scored one SD or more below the mean.

Table 5.5. *Number of subtests for which students performed 1SD below the mean across the whole assessment battery*

Number of Subtests 1SD Below the Mean	Number of Students	Percentage of Students (%)
0	27	20.61
1	31	23.66
2	20	15.27
3	11	8.40
4	16	12.21
5	8	6.11
6	5	3.82
7	4	3.05
8	5	3.82
9	3	2.27
10	1	0.76
Total	131	100.00

5.3.1.1.4. Group comparisons across the whole assessment battery – combined NT and IN group.

The total number of students within the whole cohort ($n = 131$) who were identified as presenting with difficulties in the entirety of the literacy assessment was 26 (those who presented with a score of 5 or higher in the number of subtests for which they obtained a score at least 1SD below the mean). Of these 26 students, 18 had previously been identified as presenting with difficulties understanding written text through the criteria selection used to identify the intervention group (i.e. 18 of the 26 (69.23%) identified for participation in the intervention group were also identified as presenting with all round difficulties in the entirety of the assessment (see Table 5.6.)). The combined NT and IN group comprised 26 participants in total, 18 of whom were also identified as performing at least 1SD below the mean across the assessment battery as a whole. This suggests that 62.23% of the students in this group have difficulties across literacy in general, and not limited to reading comprehension alone.

Table 5.6. *Performance of students in the combined IN and NT group who also scored 1SD or more below the mean across the entirety of the assessment battery*

Number of subtests 1SD or more below the mean	Number of students	Percentage of Students (%) from IN and NT groups ($n = 26$)
5	4	15.38
6	3	11.54
7	2	7.69
8	5	19.23
9	3	11.54
10	1	3.85
Total	18	69.23

The remaining eight students (30.77% of the combined NT and IN group) exhibited performances across the assessment battery varying between two and four subtests at least 1SD below the mean (see Table 5.7.), which was considered to be typical for the large cohort, based on the mean and SD calculated for this data. These eight students were within the expected range (i.e. within 1SD of the mean) based on the statistics calculated for this cohort, which therefore suggests that their difficulties are limited predominantly to reading comprehension only.

Table 5.7. *Performance of students in the combined IN and NT group who scored within 1SD of the mean across the entirety of the assessment battery*

Number of subtests 1SD or more below the mean	Number of students	Percentage of Students (%) from NT and IN groups ($n = 26$)
0	0	0.00
1	0	0.00
2	1	3.85
3	3	11.54
4	4	15.38
Total	8	30.77

5.3.2. Literacy Abilities of Intervention Group Participants

5.3.2.1. Standardised Assessment Measures

The IN group of participants ($n = 17$) undertook several additional measures of language and literacy in the first week of the intervention period. These assessment measures were designed to provide both the examiner and the participant with further information about their literacy skills to assist in better understanding their strengths and weaknesses. The scores obtained for standardised assessments were compared to the norms provided and are shown in Table 5.8.

Table 5.8. Scores obtained by the IN group on standardised assessment measures

	Raw Scores		Standardised Scores	
	Mean (<i>SD</i>)	Range	Mean (<i>SD</i>)	Range
PPVT-4	194 (8.46)	173 – 205	95.17 (6.84)	79 – 104
CELF-4 WC-R	19.88 (2.30)	17 – 24	9.76 (1.96)	8 – 14
CELF-4 WC-E	18.47 (2.35)	15 – 24	12.18 (1.50)	10 – 16
CELF-4 WC Total	38.35 (4.42)	34 – 48	10.88 (1.91)	9 – 15
CELF-4 USP	9.24 (1.44)	7 – 11	7.24 (1.44)	5 – 9
RAPM	5.53 (2.03)	1 – 9		

PPVT-4 Peabody Picture Vocabulary Test – 4 (PPVT-4)(Dunn & Dunn, 2007); CELF-4 WC-R Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel, Wiig, & Secord, 2003) Word Classes – Receptive subtest; CELF-4 WC-E Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel, Wiig, & Secord, 2003) Word Classes – Expressive subtest; CELF-4 WC-R Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel, Wiig, & Secord, 2003) Word Classes – Total combined score for both receptive and expressive subtests; CELF-4 WC-R Clinical Evaluation of Language Fundamentals -4 (CELF-4) (Semel, Wiig, & Secord, 2003) Understanding Spoken Paragraphs; RAPM Raven’s Advanced Progressive Matrices (raw score short form) (Raven, Raven & Court, 2003)

The expected range for participants in the PPVT-4 is a standard score between 85 and 115. All but one of the participants scored within this range, indicating that their receptive vocabulary skills were within the expected range for their age. The expected range for participants on the CELF-4 is between 7 and 13. For the Word Classes-Receptive (WC-R) subtest there were no participants who scored below the expected range for their age, with one participant scoring higher than the expected range. This result is consistent with the group’s PPVT performance by again showing age-appropriate receptive vocabulary knowledge. Similarly, there were no participants scoring below the expected range for the corresponding subtest Word Classes-Expressive, with two participants scoring above the expected range (one of whom achieved a higher than expected score for the WC-R subtest). Scores for these two subtests combined resulted in all participants scoring within the

expected range for their age, with the exception of the two participants outlined in the latter subtest, who achieved a score above the expected range overall for the combined score of the two subtests. The scores for all participants in these standardised vocabulary measures demonstrated strong performances, well within range, and predominantly towards the top end of the range expected when compared to the normative data. This indicated that this group of individuals were competent in their receptive and expressive vocabulary.

The final subtest utilised from the CELF-4 was the Understanding Spoken Paragraphs subtest which provided an assessment of each participant's listening comprehension. In contrast to the measure of expressive and receptive vocabulary, the scores obtained for this subtest placed this group of individuals towards the lower end of the expected range. Five of the 17 participants scored below the expected range on this subtest with standard scores only ranging from five to nine, indicating that no one within this group obtained the mean score of 10. This was in contrast to the measure of expressive vocabulary whereby all participants obtained a score at the mean or higher (and a range of 10 to 16).

The Raven's Advanced Progressive Matrices (RAPM) were administered to examine each participant's level of intellectual capacity, thinking ability, and high-level observation skills. As outlined in the method section of this chapter, a shortened version of this assessment was utilised due to time constraints. Scoring for this task was based upon the full version of the assessment and amended as per the time allowed for the shortened version. For the purposes of this study, results were compared between participants rather than to pre-determined normative data. The range of scores obtained was large (between one and nine out of a possible twelve correct), but most (15 of 17) participants scored within 1SD of the mean ($M = 5.53$, $SD = 2.03$) with two participants obtaining scores below the calculated mean for this group.

5.3.2.2. Questionnaire

The Metacognitive Awareness of Reading Strategies Inventory (MARSI) (Mokhtari & Reichard, 2002) questionnaire was administered to ascertain whether participants within the intervention group had any pre-existing perceived use of reading strategies prior to beginning the course of intervention. The responses given for this questionnaire (Table 5.9.) indicated that, as a group, the participants demonstrated a medium level of use of all of the reading strategies. The order of use data indicated that problem solving strategies were most prevalent followed by reading strategies and global reading strategies respectively. Overall, participants demonstrated a medium use of reading strategies in general. The range of scores for each strategy type, however, suggests that there were widely varying scores reported within this questionnaire, with several students reporting low use of reading strategies, and other reporting high use, despite the mean.

Table 5.9. Average self-rated scores by participants using the MARSI questionnaire

	Global Reading Strategies	Problem Solving Strategies	Support Reading Strategies	Total Reading Strategy Use
<i>M</i>	2.78	3.45	3.02	3.02
<i>SD</i>	0.54	0.53	0.69	0.49
Range	1.5 – 3.6	2.4 – 4.4	1.7 – 3.9	1.8 – 3.7

High Strategy Use = A score of 3.5 or higher; Medium Strategy Use = A score of 2.5 – 3.4; and Low Strategy Use = A score of 2.4 or lower.

5.3.3. Pre- and Post-intervention Assessment Scores for Reading Comprehension

The three groups (IN, NT, and CN) were included in the analysis to determine the effectiveness of the intervention from pre- to post-assessment. Only participants who

completed both the pre- and post-intervention assessments were included in the analysis, resulting in the following numbers of participants: IN group ($n = 15$); NT group ($n = 6$); CN group ($n = 83$). Paired samples t -tests were performed for all three groups of participants with participant numbers as outlined, with independent samples t -tests completed to compare performance between groups both in the pre- and post-intervention assessments.

5.3.3.1. Pre-intervention Assessment Scores

The percentage of questions answered correctly in the reading comprehension task by the three groups at the pre-intervention assessment is presented in Figure 5.1. Independent samples t -tests were carried out to obtain the level of between-groups significance for the pre-intervention assessment scores. Results are outlined in Table 5.10., whereby significant differences were found between the CN and IN groups [$t(96) = 8.74, p < .001, d = 2.71$], and the CN and NT groups [$t(87) = 5.02, p < .001, d = 2.76$], but no significant difference between the IN and NT groups [$t(19) = -0.95, p = .356, d = -0.52$]. These results suggest that the CN group significantly outperformed both the IN group and the NT group on measures of reading comprehension at pre-intervention; however the latter two groups' results did not differ significantly from each other.

Figure 5.1. Reading comprehension means for pre-intervention assessment for the IN, NT, and CN group

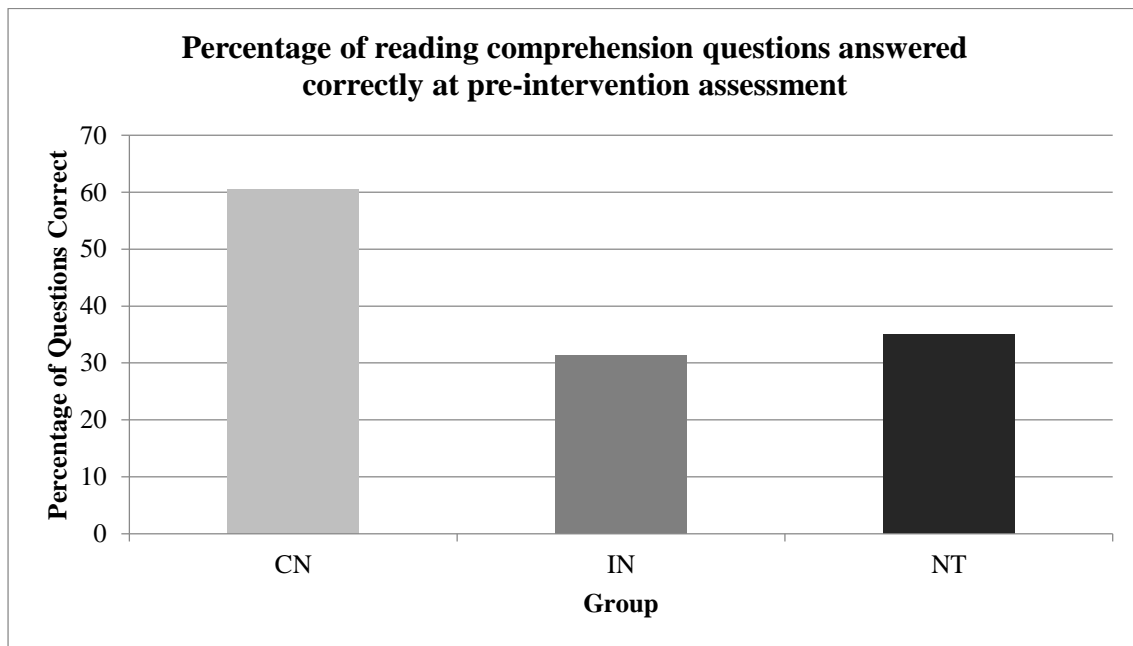


Table 5.10. Pre-intervention assessment comparisons between IN, NT, and CN groups on measure of reading comprehension

	CN	IN	CN	NT	IN	NT
<i>M</i>	12.10	6.27	12.10	7.00	6.27	7.00
<i>SD</i>	2.46	1.79	2.46	0.89	1.79	0.89
Range	8 - 17	3 - 10	8 - 17	6 - 8	3 - 10	6 - 8
Significance		$p < .001$		$p < .001$		$p = .356$
Effect Size		$d = 2.71$		$d = 2.76$		$d = -0.52$

5.3.3.2. Post-intervention Assessment Scores

Following the intervention period, a matched assessment of reading comprehension (in terms of the level of the pre-intervention text passage) was administered. Mean scores

were calculated and converted into percentage of questions answered correctly by each of the three groups. These scores are shown in Figure 5.2. Again, independent samples *t*-tests were carried out between all three groups to determine differences at this point in time for post intervention assessment scores. Results are outlined in Table 5.11., whereby significant differences were found between the CN and NT groups [$t(87) = 3.09, p = .003, d = 1.35$], and the IN and NT groups [$t(19) = 2.13, p < .047, d = 1.06$], but no significant difference between the CN and IN groups [$t(96) = 0.943, p = .348, d = 0.26$].

Figure 5.2. Reading comprehension means for post-intervention assessment for the IN, NT, and CN group

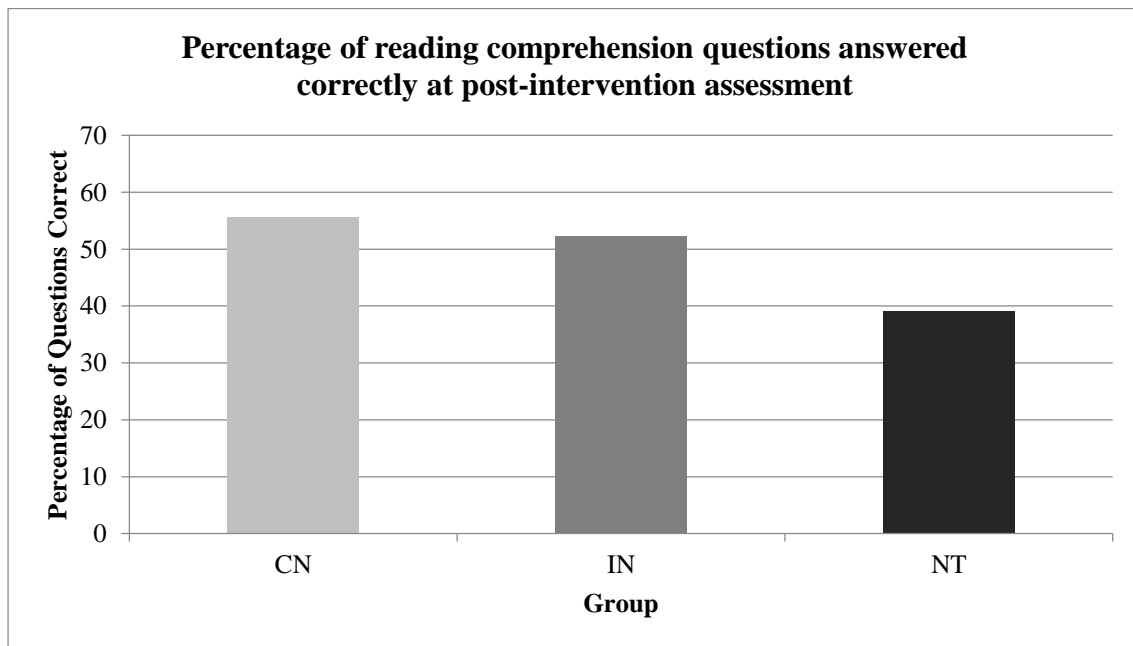


Table 5.11. *Post-intervention assessment comparisons between IN, NT, and CN group, on measure of reading comprehension*

	CN	IN	CN	NT	IN	NT
<i>M</i>	11.14	10.47	11.14	7.83	10.47	7.83
<i>SD</i>	2.59	2.64	2.59	2.32	2.64	2.64
Range	4 - 17	4 - 14	4 - 17	4 - 10	4 - 14	4 - 10
Significance		$p = .348$		$p = .003$		$p = .047$
Effect Size		$d = 0.26$		$d = 1.35$		$d = 1.06$

5.3.3.3. Change in Score from Pre- to Post-intervention Assessment

In order to ascertain the effectiveness of the reading comprehension intervention within groups, a paired samples *t*-test was conducted using pre- and post-intervention assessment measures of reading comprehension for the IN group ($n = 15$). This test was found to be statistically significant in the group's scores for reading comprehension at pre- ($M = 6.27$, $SD = 1.79$) and post-assessment ($M = 10.47$, $SD = 2.64$); [$t(14) = -6.79$, $p < .001$, $d = 1.86$]. These results indicated that the intervention group's performance on the measure of reading comprehension improved significantly over the period of intervention (i.e., from pre- to post-intervention assessment).

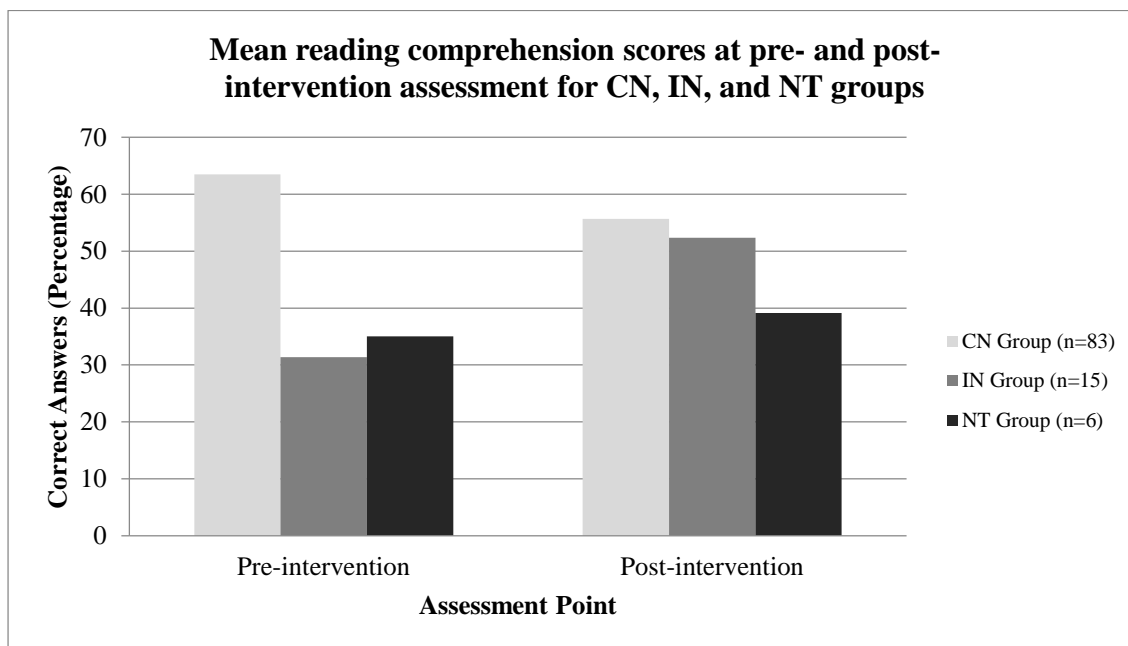
Paired samples *t*-tests were also conducted for pre- to post-intervention assessment scores for the remaining two (CN and NT) groups. The results were not significantly different between pre- ($M = 7.00$, $SD = 0.90$) and post- ($M = 7.83$, $SD = 2.32$) assessment for the NT group [$t(5) = -7.32$, $p = .497$, $d = 0.472$]. A significant difference however was found between the pre- and post- scores for the CN group [$t(82) = 3.33$, $p < .001$, $d = -0.376$]. This statistical difference is likely due to the difference in population numbers between the two

groups, with a large number of individuals in the control group ($n = 83$) and small number in the non-intervention group ($n = 6$), as the effect sizes demonstrate a larger change in the scores of the non-intervention group from pre to post, than the control group. Results for all paired samples t -tests performed are presented in Table 5.12., while mean scores at pre- and post-intervention assessment points for all three groups are presented in Figure 5.3.

Table 5.12. *Pre- and post-intervention assessment scores on measure of reading comprehension for the IN, NT, and CN groups*

	CN Group		IN Group		NT Group	
	Pre	Post	Pre	Post	Pre	Post
<i>M</i>	12.10	11.15	6.27	10.47	7.00	7.83
<i>SD</i>	2.46	2.59	1.79	2.64	0.89	2.32
Range	8 - 17	4 - 17	3 - 10	4 - 14	6 - 8	4 - 10
Significance	$p = .001$		$p = .000$		$p = .497$	
Effect Size	$d = -0.376$		$d = 1.862$		$d = 0.472$	

Figure 5.3. Mean percentage of answers correct on measure of reading comprehension for all three groups from pre- to post-intervention assessment



5.3.4. Pre- and Post-intervention Assessment Scores for Spelling

Spelling performance at pre- and post-intervention was also examined to monitor growth in an untargeted area of literacy development for the IN group. Independent samples *t*-tests were conducted to identify differences between the three groups at pre- and post-intervention assessment points, while paired samples *t*-tests were performed to identify any within group changes over the period of intervention.

5.3.4.1. Pre-intervention Assessment Scores

Independent samples *t*-tests were performed and calculations are presented in Table 5.13. for scores obtained at the pre-intervention assessment point. There was no significant difference, but a moderate effect size between the CN ($M = 15.76$, $SD = 3.40$) and IN groups ($M = 14.00$, $SD = 2.85$); [$t(96) = 1.886$, $p = .620$, $d = 0.561$]. There was also no significant difference and a moderate effect size found to exist between the CN group ($M = 15.76$, $SD =$

3.40) and the NT ($M = 14.00$, $SD = 3.41$) where [$t(87) = 1.224$, $p = .224$, $d = 0.52$]. Finally, there was no significant difference, and zero effect size found between the IN ($M = 14.00$, $SD = 2.85$) and NT group ($M = 14.00$, $SD = 3.41$) where [$t(19) = .000$, $p = 1.000$, $d = 0.000$].

Table 5.13. *Pre-intervention assessment comparisons between IN, NT, and CN groups on measure of spelling*

	CN	IN	CN	NT	IN	NT
<i>M</i>	15.76	14.00	15.76	14.00	14.00	14.00
<i>SD</i>	3.40	2.85	3.40	3.41	2.85	3.41
Range	8 - 21	8 - 20	8 - 21	10 - 20	8 - 20	10 - 20
Significance		$p = .620$		$p = .224$		$p = 1.000$
Effect Size		$d = 0.561$		$d = 0.517$		$d = 0.000$

5.3.4.2. *Post-intervention Assessment Scores*

Analysis conducted using the scores obtained during the post-assessment measure of spelling utilising independent samples *t*-tests found a significant difference, and a moderate effect size between the CN ($M = 16.54$, $SD = 3.28$) and IN groups ($M = 14.67$, $SD = 2.77$); [$t(96) = 2.084$, $p = .040$, $d = 0.616$]. There was no significant difference, but a moderate effect size found to exist between the CN group ($M = 16.54$, $SD = 3.28$) and the NT group ($M = 14.00$, $SD = 3.41$); [$t(87) = 1.831$, $p = .071$, $d = 0.760$]. Finally, there was no significance difference, and a low effect size found between the IN ($M = 14.67$, $SD = 2.77$) and NT group ($M = 14.00$, $SD = 3.41$); [$t(19) = 0.426$, $p = .681$, $d = 0.216$]. Calculations are displayed in Table 5.14.

Table 5.14. *Post-intervention assessment comparisons between IN, NT, and CN groups on measure of spelling*

	CN	IN	CN	NT	IN	NT
<i>M</i>	16.54	14.67	16.54	14.00	14.67	14.00
<i>SD</i>	3.28	2.77	3.28	3.41	2.77	3.41
Range	9 - 23	11 - 20	9 - 23	10 - 20	11 - 20	10 - 20
Significance		$p = .040$		$p = .071$		$p = .681$
Effect Size		$d = 0.616$		$d = 0.760$		$d = 0.216$

5.3.4.3. *Change in Score from Pre- to Post-intervention Assessment*

Comparisons made between the groups at pre- and post-intervention assessment utilising paired samples *t*-tests demonstrated a significant difference between the spelling ability of the CN group, but neither the IN nor the NT groups at pre- and post-intervention assessment (see Table 5.15.). The effect size calculated for the CN group was however small [$t(82) = 3.524, p = .001, d = 0.233$], and was similar to the effect size of the IN group [$t(14) = 1.099, p = .290, d = 0.238$]. There was no significant difference or effect size for the pre- and post-intervention measures calculated for the NT group [$t(5) = 0.000, p = 1.000, d = 0.000$].

Table 5.15. *Pre- and post-intervention assessment scores on measure of spelling for the IN, NT, and CN groups*

	CN Group		IN Group		NT Group	
	Pre	Post	Pre	Post	Pre	Post
<i>M</i>	15.76	16.54	14.00	14.67	14.00	14.00
<i>SD</i>	3.40	3.28	2.85	2.77	3.41	3.41
Range	8 - 21	9 - 23	8 - 20	11 - 20	10 - 20	10 - 20
Significance	$p = .001$		$p = .290$		$p = 1.000$	
Effect Size	$d = -0.233$		$d = -0.238$		$d = 0.000$	

5.3.5. Effectiveness of the Four Different Reading Comprehension Strategies

Repeated measures analysis of variance (ANOVA) was used to compare the performance of the IN group across the four different reading comprehension strategies. In addition to these four assessment points, the pre- and post-intervention reading comprehension measures were included in the analysis. Thus, six assessments were completed by the participants at six different time points. Analysis using ANOVA was also carried out to compare the performance of participants in their ability to produce summaries of text. Calculations were made using the same six assessment time points to determine the difference in time taken and number of words produced for the four different strategies used. In addition, the content of the text summaries produced by participants were examined using an experimental marking rubric to identify themes, main ideas, and details, within each summary passage.

5.3.5.1. Comparison of Each of the Four Intervention Strategies – Reading Comprehension Assessment

A one-way repeated measures ANOVA, (with Bonferroni adjustment) was conducted to compare scores obtained on the paired reading comprehension measure administered at the end of each intervention session. This allowed for group performance to be compared on the reading comprehension assessment when using each of the four intervention strategies.

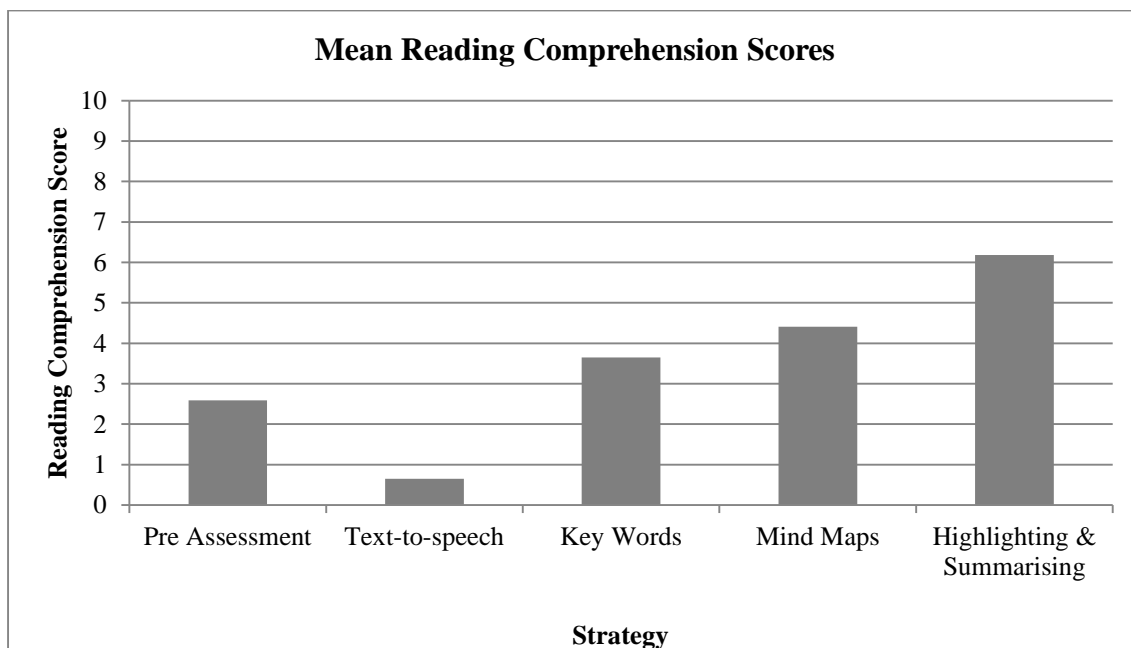
Scores were compared using scores taken from reading comprehension assessments administered at time one (pre-intervention assessment), time two (text-to-speech strategy), time three (key words strategy), time four (mind map strategy), time five (highlighting and summarising strategy), and time six (post-intervention assessment). The total number of participants who completed assessment at all six time points was 15 (the remaining two completed all the intervention but did not complete the final post assessment). The means and standard deviations are presented in Table 5.16.

Table 5.16. *Descriptive statistics for reading comprehension scores across six time points*

Assessment Time Point	Number of Participants (<i>n</i>)	Mean (<i>M</i>)	Standard Deviation (<i>SD</i>)
Time 1 (Pre-intervention assessment)	15	2.53	1.30
Time 2 (Text-to-Speech)	15	0.67	0.98
Time 3 (Key Words)	15	3.53	2.03
Time 4 (Mind Map)	15	4.00	2.14
Time 5 (Highlighting & Summarising)	15	6.13	1.60
Time 6 (Post-intervention assessment)	15	4.00	1.36

When considering the six assessment points (pre- and post-, and the four strategies), there was a significant effect for time, Wilks' Lambda = .086, $F(5, 10) = 21.32$, $p < .001$, multivariate partial eta squared = .914. A significant effect for time was also demonstrated when reading comprehension scores were considered for the four strategies alone (i.e., at four assessment time points without the pre- and post- measures), Wilks' Lambda = .088, $F(3, 14) = 48.09$, $p < .001$, multivariate partial eta squared = .914). All participants involved in the intervention completed assessment across all intervention assessment points ($n = 17$). An overview of scores achieved from the pre-intervention assessment and at each of the intervention strategy assessment points can be viewed in Figure 5.4. Paired samples t -tests were subsequently calculated to identify any significant differences between the individual assessment points and strategies utilised.

Figure 5.4. Graph to show the mean scores of the IN group on the reading comprehension measure using four different strategies



Text-to-speech Strategy

There was a statistically significant decrease in reading comprehension scores from the pre-intervention assessment point ($M = 2.59, SD = 1.42$) to the text-to-speech time point ($M = 0.65, SD = 0.93$), [$t(16) = -5.27, p < .001, d = -1.62$]. Furthermore, participants demonstrated significantly lower reading comprehension scores when using the text-to-speech strategy than any other strategy.

Key Words Strategy

There was a statistically significant increase in reading comprehension scores when using the key words strategy ($M = 3.65, SD = 1.94$), from the text-to-speech strategy ($M = 0.65, SD = 0.93$), [$t(16) = 5.83, p < .001, d = 1.98$]. Conversely, there was a statistically significant decrease in reading comprehension scores between the assessment point when using the key words strategy ($M = 3.65, SD = 1.94$), and the highlighting and summarising strategy ($M = 6.18, SD = 1.51$), [$t(16) = -4.17, p = .001, d = -1.46$].

Mind Maps Strategy

The mind map strategy ($M = 4.41, SD = 2.32$) demonstrated a significant increase in scores from the pre-intervention assessment point ($M = 2.59, SD = 1.42$), [$t(16) = 3.09, p = .007, d = 0.947$]. As outlined above, there were statistically significant differences identified between scores obtained when using the text-to-speech strategy, and the mind map strategy. Using the mind maps strategy ($M = 4.41, SD = 2.32$) showed a significant decrease in score between this time point and scores obtained when using the highlighting and summarising strategy ($M = 6.18, SD = 1.51$), [$t(16) = 3.55, p = .003, d = 0.904$].

Highlighting and Summarising Strategy

The use of the highlighting and summarising strategy ($M = 6.18$, $SD = 1.51$) demonstrated a significant increase in scores from the pre-intervention assessment point ($M = 2.59$, $SD = 1.42$), [$t(16) = 8.36$, $p < .001$, $d = 2.449$]. Furthermore, the use of this strategy resulted in statistically significantly increased scores compared to any of the other time points and strategies utilised.

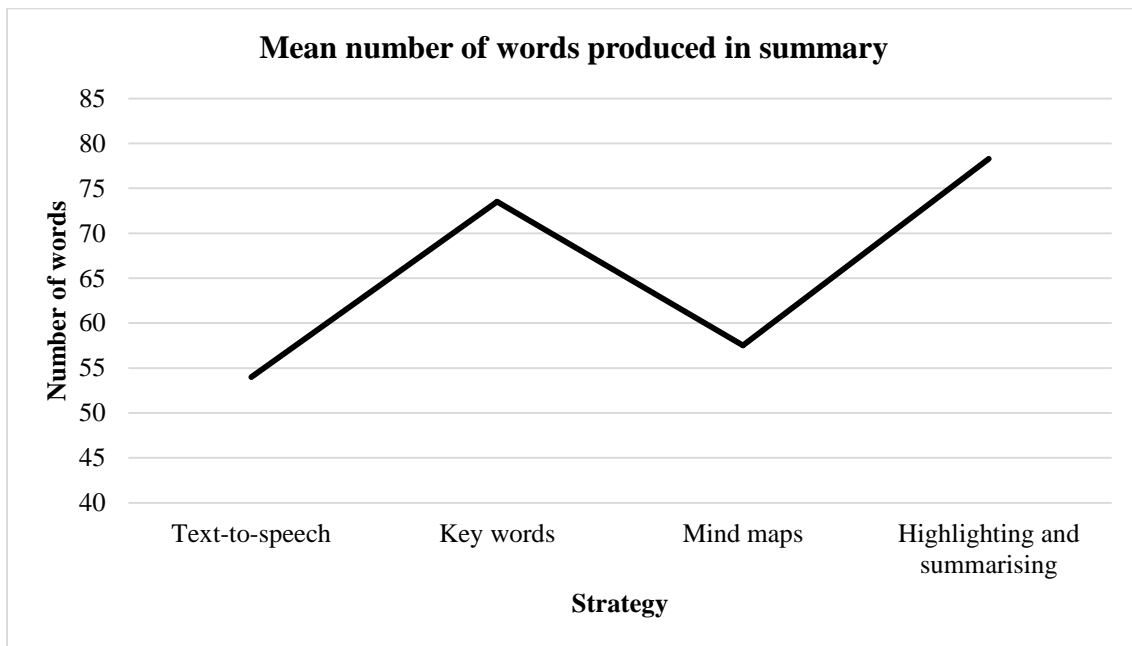
5.3.5.2. Comparison of Each of the Four Intervention Strategies – Summarising Assessment

One-way repeated measures ANOVA (using Bonferroni adjustment) were conducted to compare participants' performance across the four intervention strategies used, focusing on assessment using the summarising task. Comparisons were made between number of words produced in their summary, time taken to produce their summary, and words per minute in their summary production. All participants involved in the intervention completed assessment across all intervention assessment points ($n = 17$).

5.3.5.2.1. Comparison of the four intervention strategies by number of words produced on summarising task.

Analysis determined that there was a significant effect found for strategy used over time, Wilks' Lambda = .416, $F(3, 11) = 5.15$, $p = .018$, multivariate partial eta squared = .584. The ANOVA demonstrated significant differences between assessments undertaken at the following time points: text-to-speech and key words ($p = .010$); and text-to-speech and highlighting and summarising ($p = .040$). The mean number of words produced when using each strategy is displayed in Figure 5.5.

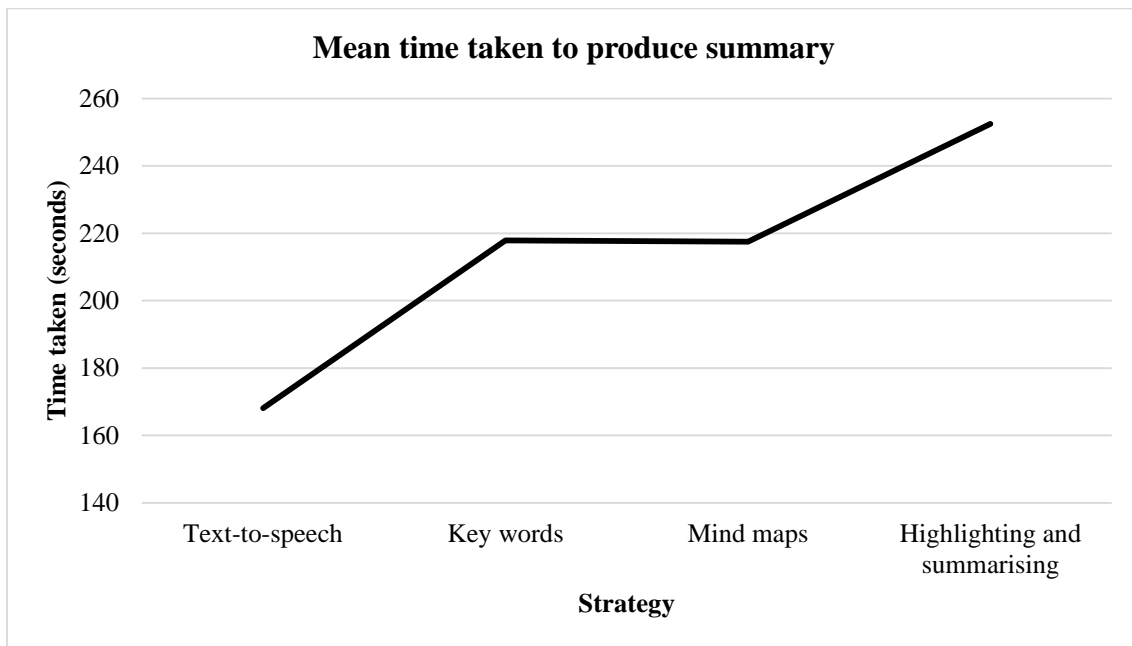
Figure 5.5. Graph to show the mean number of words produced in the summaries of the IN group when using four different strategies



5.3.5.2.2. Comparison of the four intervention strategies by time taken on summarising task.

There was a significant effect found for strategy used over time, Wilks' Lambda = .244, $F(3, 11) = 11.37$, $p = .001$, multivariate partial eta squared = .756. The ANOVA demonstrated significant differences found between assessments undertaken at the following time points: text-to-speech and key words ($p = .003$); text-to-speech and mind maps ($p = .010$); and text-to-speech and highlighting and summarising ($p = .009$). The mean number of words produced when using each strategy is displayed in Figure 5.6.

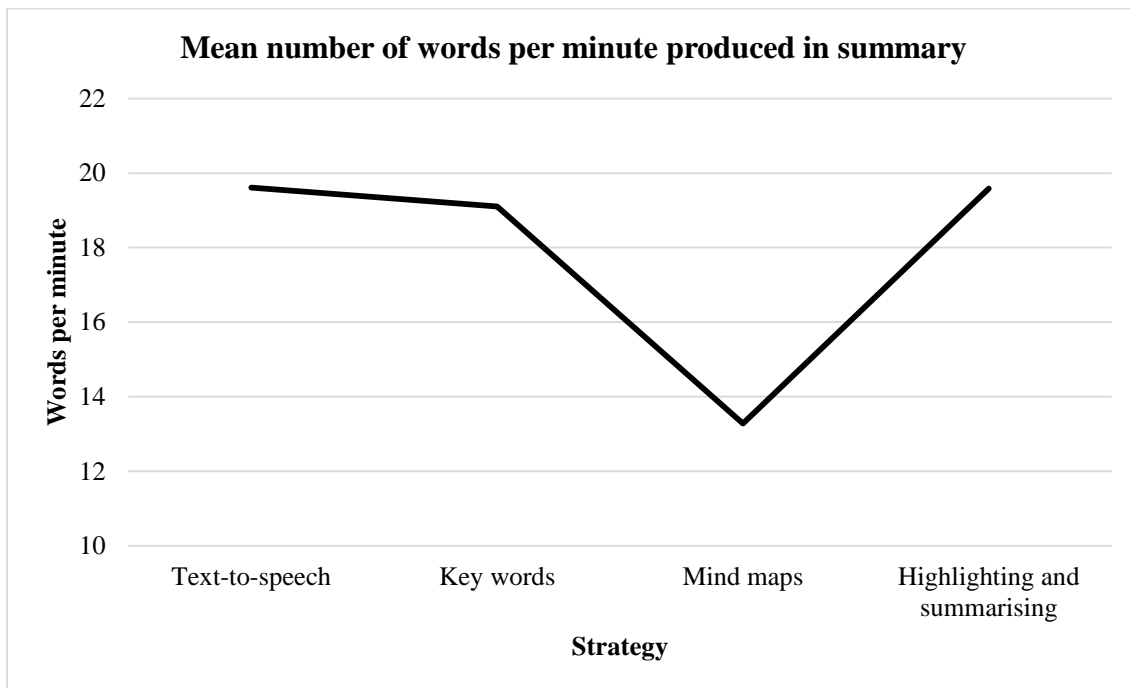
Figure 5.6. Graph to show the mean time taken to produce the summary in the IN group when using four different strategies



5.3.5.2.3. *Comparison of the four intervention strategies by words per minute on summarising task.*

Results from a one-way repeated measures ANOVA did not demonstrate any significance for performance on the summarising task when comparing words per minute using the four different intervention strategies. These scores are depicted on the graph in Figure 5.7.

Figure 5.7. Graph to show the mean number of words per minute produced in the summaries of the IN group when using four different strategies



5.3.5.2.4. *Comparison of the four intervention strategies by content produced on summarising task.*

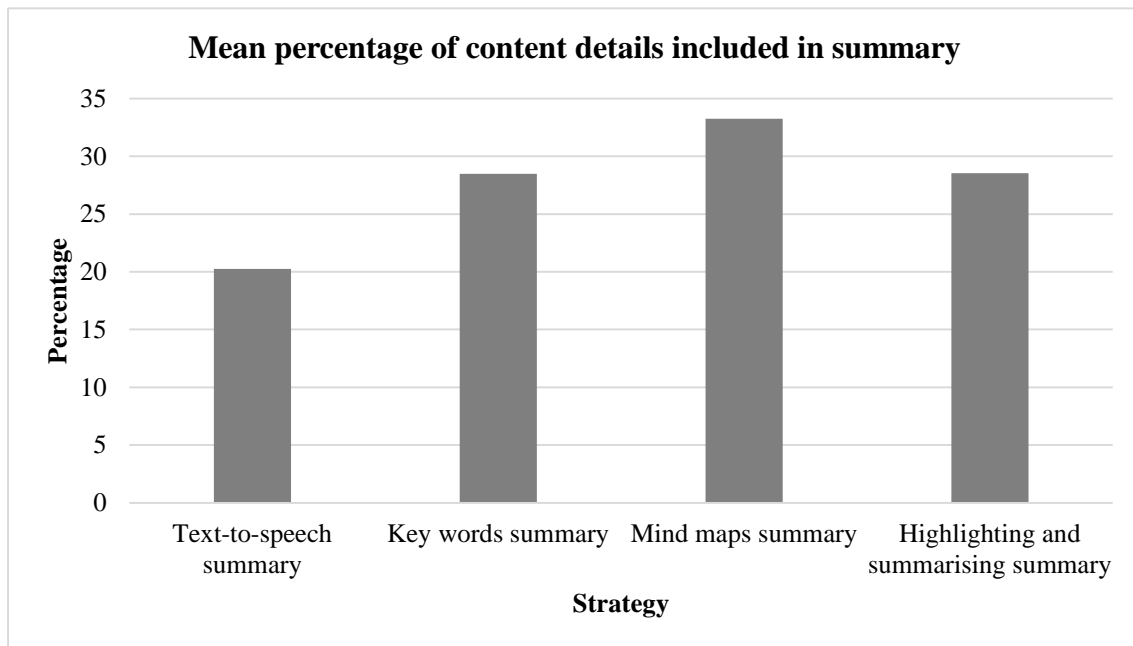
In addition to the measures of time, number of words produced, and words per minute, the content of the summarising tasks were examined to determine the accuracy of the summary in relation to the original text. This scoring method was experimental, with the development of a specific scoring schema, as outlined in section 5.2.3.1.3. (Development of Coding Schema – Summarising Task). The number of details identified in each summary was recorded, with results presented in Table 5.17. below.

Table 5.17. *Descriptive statistics for content identified (details) within each summarising text produced*

Strategy (max details score)	Mean (<i>SD</i>)	Range	Mean percentage details identified
1. Text-to-speech (18)	3.65 (1.41)	2 – 7	20.26
2. Key words (18)	5.13 (1.63)	3 – 8	28.47
3. Mind maps (20)	6.65 (3.69)	0 – 12	33.24
4. Highlighting and Summarising (20)	5.71 (1.80)	3 – 9	28.53

The raw scores obtained for each of the strategies were not directly comparable between the strategies due to texts one and two containing 18 details, and texts three and four containing 20 details. The percentage of details correctly identified was therefore also calculated (see Table 5.17.), whereby 100 percent would require to participant to include every detail from the original text (hence why the mean percentage scores reported appear to be low). Furthermore, not only were the details required to be included in the summary, they also had to be correct in their representation of the original text which decreased the scores further. Comparisons were made between the scores obtained at each of the four assessment points, using the measure of percentage of details correctly included. These scores (mean percentage of content details included in the summary) are presented in Figure 5.8. below.

Figure 5.8. Mean percentage of details included in summary produced using four different strategies to read text



Paired samples *t*-tests were used to compare the number of details correctly identified within each of the summarising texts when using the four strategies. Significant differences were found between the content included in participants' summary when using the text-to-speech strategy, compared to the other three strategies. Content included in summaries when using the key words strategy ($M = 28.47$, $SD = 9.04$) was significantly higher than using the text-to-speech strategy ($M = 20.83$, $SD = 7.72$), [$t(15) = 3.08$, $p = .008$, $d = 0.909$]. Similarly, the percentage of content included in summaries when using the mind maps strategy ($M = 33.24$, $SD = 18.45$) was significantly higher than using the text-to-speech strategy ($M = 20.83$, $SD = 7.72$), [$t(16) = 2.73$, $p = .015$, $d = 0.878$]. Finally, there was a significant difference in the percentage of content included in the summaries when using the highlighting and summarising strategy ($M = 28.53$, $SD = 8.97$) than using the text-to-speech strategy ($M = 20.83$, $SD = 7.72$), [$t(16) = 2.68$, $p = .016$, $d = 0.920$]. Each of these results

reflects a large effect size. There were no other significant differences between the content of the summaries produced when using the other strategies.

5.4. Discussion

This study investigated the differences in literacy skills between participants who were identified as presenting with difficulties understanding written text (IN and NT groups), compared to a control group of participants who did not demonstrate deficits in reading comprehension (CN group). The overall effectiveness of a reading comprehension intervention of four strategies was examined, with subsequent analysis determining the effectiveness of individual strategies. Data were analysed to examine: a.) between-groups differences in measures of literacy in two groups of students, those with difficulties understanding written text, and those without; b.) the literacy skills of students who presented with difficulties understanding written text; c.) pre- to post-intervention change within and between three groups (IN, NT, CN) in measures of reading comprehension and spelling; d.) the effectiveness of the total intervention on group change (IN group) from pre- to post-intervention assessment; and e.) the effectiveness of individual intervention strategies amongst the IN group.

5.4.1. Weaknesses in the Literacy Skills of Pre-service Teachers with Difficulties

Understanding Written Text Compared to those without Reading Comprehension

Difficulties

Results calculated between the group of participants who presented with difficulties understanding written text (combined IN and NT groups) and the CN group of participants who did not demonstrate significant differences in all the areas of literacy assessed. This suggests that group level deficits are not confined to reading comprehension, but extend to

areas of spelling, inferencing, and working memory in the NT and IN group. Furthermore, participants from the NT and IN group were over-represented in the individuals identified who presented with difficulties in the entirety of the literacy assessment administered. Pre-service teachers who were identified with difficulties understanding written text accounted for almost 70 percent of the individuals who presented with all-round literacy deficits. This supports the notion that a measure of reading comprehension is a strong indicator of individuals who present with general literacy difficulties.

5.4.2. Deficits in Specific Literacy Skills in Pre-service Teachers with Difficulties

Understanding Written Text

Some further deficits were identified in the IN group of participants on standardised language measures. The IN group presented with typical receptive and expressive vocabulary knowledge when compared to normative data. Conversely, this group was found to have relatively low levels of listening comprehension, with 5 of the 17 participants falling below the expected range, and none of the IN group achieving scores about the normative mean.

5.4.3. Improvement in Reading Comprehension made by the IN Group Following

Intervention

Participants of the IN group demonstrated a significant increase (reflecting a very large effect size) in mean score from pre- to post-intervention on reading comprehension. In comparison, the CN and NT groups did not demonstrate any improvements in score. The increase in mean score was such that the IN group raised their reading comprehension score so that it was no longer statistically significantly different from the score obtained by the CN group at post-intervention assessment. A significant difference remained between the IN and NT group in reading comprehension score, suggesting that the gains made by the IN group

could be attributed to the intervention they received. Neither could these gains be attributed to a practice effect, due to the use of different texts (matched for level of reading comprehension) at each assessment point during, and pre- and post-intervention. Furthermore, there were no significant differences in the spelling scores of the IN group from pre- to post-intervention, again supporting the notion that the change in reading comprehension scores were attributable to the intervention received rather than overall improvement in ability in the time elapsed.

Results indicated that the performance for the measure of reading comprehension of the IN group increased significantly from pre- to post-intervention ($d = 1.862$) suggesting that the intervention was effective with this group. Their post-intervention assessment scores increased to be within range of the CN group, in contrast to their performance as a group at the initial assessment point. The scores of the NT group did not differ significantly from pre- to post-assessment, and still remained significantly different to the CN group at post-assessment. The CN group demonstrated significantly different results (decrease in scores) from pre- to post-assessment, but the effect sizes depict only small comparable changes for both CN ($d = -0.376$) and NT ($d = 0.472$) groups.

5.4.4. Metacognitive Strategies Most Beneficial for Pre-service Teachers with Difficulties

Understanding Written Text

The effectiveness of four different reading comprehension strategies were examined in the following areas: reading comprehension, number of words produced in a summary, time taken to produce a summary, words per minute in a summary, and content of the summary produced. Results demonstrated that greatest gains were made in reading comprehension scores when strategies utilising metacognitive skills were employed, reflecting the findings of previous research (Fidler, 2009; Hock & Mellard, 2005; Hong-Nam

& Leavell, 2011; Thiede et al., 2003). Mind maps and highlighting and summarising were the most effective strategies, with the latter producing the largest increase in scores in reading comprehension and reflecting a very large effect size ($d = 2.449$). Similarly, the strategy of highlighting and summarising produced the greatest gains of the four strategies in the number of words produced in the participants' summary. Conversely, when using the highlighting and summarising strategy, participants spent the most time producing their summary. This finding suggests a positive relationship between time taken and number of words produced. Thus, while the highlighting and summarising strategy was the most effective in the size of the summary, it also took participants the longest to complete. This was in stark contrast to the text-to-speech strategy whereby participants produced the least number of words in their summary, but also took the least amount of time to complete it. There was therefore no significant effect found amongst the four strategies for words produced per minute. These findings outlining the specific effectiveness of the individual strategies are consistent with those obtained by Fidler (2009) in his work with higher education students with dyslexia.

Content analysis of the summaries produced by the participants at each assessment point (i.e., following each strategy implementation) again found that the text-to-speech strategy was the least effective, with participants being able to include the least amount of details from the text they read in the summaries they produced. The poor results produced in all aspects of assessment when using the text-to-speech strategy are particularly concerning, given the high percentage of students provided with this strategy in the higher education context (Draffan et al., 2007). Although university students have typically reported positive comments about the use of text-to-speech software, the results from the current study suggest that the widespread provision of this strategy to support reading comprehension may not be well-founded particularly for students with text-level, rather than word-level, reading comprehension difficulties.

Differences in the content of participant summaries across the remaining strategies were identified. However, there were no further significant differences at a group level between these three strategies (key words, mind maps, highlighting and summarising). This suggests that either these three strategies were equally beneficial, or the variation in individual scores accounted for the similarities. To understand this further, the performance of individual participants would need to be examined more closely, rather than simply at the group level.

5.4.5. Limitations and Future Directions

One limitation of the current research was that all of the participants of the IN group received the intervention strategies in the same order. With this sample size ($n = 17$), it was not possible to randomly assign participants to different groups to receive the intervention in different orders. Furthermore, it was recognised that techniques from some strategies were likely to carry over into subsequent strategies. The study was therefore designed so that the order would have as little impact as possible on the subsequent strategies received. A randomised control trial with a large number of participants would be the ideal study design for this intervention.

The study design of weekly strategy teaching exposes itself to the possibility of a practice effect, with an argument that the improvement in scores over time is observed due to practice only. While this remains a possibility, two factors provide an argument that the change in score demonstrated is unlikely to be solely attributable to the presence of a practice effect. Firstly, reading comprehension scores using the text-to-speech strategy were lower than at the pre-intervention assessment point. Secondly, the effect size for the IN group for the change made from pre- to post-intervention assessment was very large ($d = 1.862$).

The texts used at each of the assessment points may also have impacted on the results obtained. The texts and questions used for the reading comprehension measures had been standardised and were matched for level to allow for comparisons to be made between each performance (see Fidler, 2009). The texts used for the summarising task, however, were more experimental, with a view to including texts that would be encountered by participants on their course and ensuring that they gained further benefit from participating in this study. While the texts were controlled for length, the stipulation that each had to be a succinct passage of text that could stand alone resulted in potential differences in the level of difficulty of the four text extracts.

5.4.6. Conclusions

The results from this study demonstrated that pre-service teachers who present with difficulties understanding written text can make improvements in their reading comprehension ability (to within range of a group of their peers who do not present with reading comprehension difficulties), following a period of intervention. This change was observed at the group level with the most significant changes in score resulting from the assessment point corresponding to the highlighting and summarising strategy. While these results imply that this strategy was the most effective at the group level, what remains unknown is whether this strategy was the most beneficial for all participants, or whether this was simply representative of the group as a whole (with variances within the group). Chapter Six examines the individual skills and response to intervention of smaller groups of participants from the IN group based on their underlying component literacy skills. Furthermore, four case studies are presented and discussed to identify whether individuals who present with different literacy profiles respond more favourably to different reading comprehension strategies.

CHAPTER SIX

STUDY THREE – ANALYSIS OF THE RESPONSIVENESS OF SUBGROUPS AND INDIVIDUAL CASE STUDIES TO FOUR READING COMPREHENSION INTERVENTIONS

6.1. Introduction

The examination of the effectiveness of the four strategies in the previous chapter (Study Two) considered the group of students who received the intervention as one homogenous cohort. Thus, the change observed from pre- to post-intervention was representative of the mean increase in score of the whole group. Furthermore, analysis indicated that, as a group, pre-service teachers identified as presenting with reading comprehension difficulties made the greatest gains in reading comprehension when using a highlighting and summarising strategy whilst reading text. Although significant differences were observed on the reading comprehension task from the pre-assessment to the assessment undertaken when using each of the other strategies (significant decrease in scores for the text-to-speech strategy, and significant increases in score when using any of the other strategies), within group variability was apparent in the results for each of the strategies used.

Difficulties in reading comprehension can arise due to deficits in several different core skills. Application of a framework such as the Simple View of Reading (SVR; (Gough & Tunmer, 1986; Hoover & Gough, 1990)) enables specific areas of difficulties to be identified and appropriate intervention subsequently applied. For example, adults with dyslexia typically experience difficulties in the word decoding component of the SVR, such as slower and less accurate word recognition (Miller-Shaul, 2005). The reading comprehension of these individuals is consequently affected by their predominant difficulty

in the word decoding component of the SVR. Further, adults with dyslexia have been found to be significantly poorer than their non-dyslexic peers in reading speed and accuracy, non-word reading speed and accuracy, spelling, and phonology (Ramus et al., 2003). Conversely, reading comprehension difficulties in adults can also be driven by difficulties in the linguistic comprehension component of the SVR. As a greater proportion of the variance in reading comprehension in adults has been found to come from this component, it is possible that there are a greater number of deficits present in skills such as inferencing, listening comprehension, comprehension monitoring, vocabulary etc. Individuals who have difficulties with the influencing skills in linguistic comprehension have been termed 'poor comprehenders' in research with children (e.g., Cain & Oakhill, 2006b; Catts et al., 2006; Nation et al., 2004).

The adult population of readers is more complex than children, in that adult learners may have adopted successful and / or unsuccessful strategies to aid their reading. Within the higher education context, adults who experience reading comprehension difficulties are likely to benefit from targeted intervention to improve these skills (Fidler & Everatt, 2012). However, it is important to consider both an individual's underlying literacy skills, and any strategies that they may have developed when designing an intervention. Participants may respond to a particular strategy used depending on the strengths and weaknesses within their literacy profile. The rationale behind the current study was to identify whether any particular strategies may be more effective for a specific cognitive profile within individual students, or groups of students. The analysis of several case studies was implemented to explore this hypothesis.

Case studies have been frequently used to describe the profiles of readers. Yeh, McTigue, and Joshi (2012) reported the results of an intervention programme targeting inferential comprehension via a case study format. They provided details about the responsiveness of a middle school student who received individual intervention targeting

specific deficits in the area of inferencing. The case study allowed them to describe the specific profile of the student and his response to the intervention. In addition, the authors provided practical information for teachers, and placed their research findings in the context of an educational environment. A further study, conducted with adult readers adopted a multiple case study format. Ramus et al. (2003) reported case studies of sixteen university students with dyslexia as part of a study assessing theories of dyslexia. This format allowed the authors to create a comprehensive profile of each individual participant, and subsequently identify which individuals presented with which disorders. Finally, a case study was used to describe the responsiveness of a twelfth-grade student to an intensive programme of reading comprehension strategy instruction (J. Cohen, 2007). The case study reports both the quantitative and qualitative changes observed in the student from pre- to post-intervention. By focussing on one individual, the author was able to provide an in-depth account of the factors that attributed to the student's reading difficulties, as well as the broad range of changes that occurred at the post-intervention point. This allowed for a more personal, and practical account of the effectiveness of the intervention to be portrayed.

The identification of sub-groups of adults with reading comprehension difficulties has important benefits for research, and for application within the education system. For example, if individuals with word decoding difficulties are identified as requiring different intervention to those with linguistic comprehension difficulties, this has practical implications for the support given to adults within higher education. It is unknown whether it is possible to identify whether different intervention strategies may be better suited to individuals presenting with a specific 'literacy profile'. This chapter therefore focussed firstly on identifying subgroups of participants (within the intervention group of participants) based on underlying literacy skills. Analysis of the assessment and intervention results of the subgroups was undertaken to identify whether differences in response to the different

intervention strategies across these groups were present. Subsequently, four individual case studies were examined to investigate potential relationships between assessment results and response to intervention on an individual basis.

6.1.1. Research Questions and Hypotheses

The primary aim of this study was to identify whether it was possible to use the literacy profiles of individuals to determine successful intervention strategies to improve reading comprehension. Responses to the intervention were investigated by examining small subgroups of participants and individual case studies. The following research questions were identified:

1. Is it possible to identify differences in the responsiveness of adults (with difficulties understanding written text) to a reading comprehension intervention when grouped according to their underlying literacy skills?
2. Can a relationship between an individual's literacy profile and their response to four different reading comprehension strategies be identified?
3. Based on the analysis of both subgroups and individual case studies, is it possible to recommend a particular reading comprehension strategy for adults in higher education according to their literacy profile of strengths and weaknesses?

6.2. Examining Subgroups of Participants

The Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) was used as a framework to identify four subgroups from the original group of seventeen students who participated in the research intervention (Study Two). The results from the initial large scale assessment of the entire cohort of students (as outlined in Chapter Four) and the additional assessment measures undertaken for each of the intervention participants (see

Chapter Five) were used to group participants. Two measures were used for these purposes. The measure of spelling served as a measure of word decoding, while the measure of listening comprehension (i.e., the Understanding Spoken Paragraphs measure from the CELF-4) served as a measure of linguistic comprehension. Thus four groups were created, students with reading comprehension difficulties demonstrating:

1. Poor spelling (scored significantly below the cohort mean on the spelling measure, but had typical listening comprehension).
2. Poor listening comprehension (scored significantly below the mean on the listening comprehension measure, but scored within the cohort mean range on the spelling measure).
3. Poor spelling and poor listening comprehension (scored significantly below the cohort mean on the spelling measure and below the expected level on the listening comprehension measure).
4. Neither poor spelling nor poor comprehension (scored within the cohort mean range on the spelling measure and presented with typical listening comprehension measures).

Students who had scores that were at least one standard deviation below the whole cohort (as outlined in Study One, see Chapter Four) on the measure of spelling were identified. Three of the seventeen participants met this criterion. Students whose scores were at least one standard deviation below the mean (using standardised scores) on the measure of listening comprehension were subsequently identified. Five of the 17 participants met this criterion. One participant had low scores on both measures used for identification. The remaining ten participants presented with low reading comprehension scores (and met the criterion for inclusion in the intervention), but did not demonstrate scores more than one

standard deviation below the mean on the other two measures. Analysis of these results enabled the identification of four subgroups within the larger intervention group. These four groups are outlined in Table 6.1. below.

Table 6.1. *Distribution of intervention participants amongst groups*

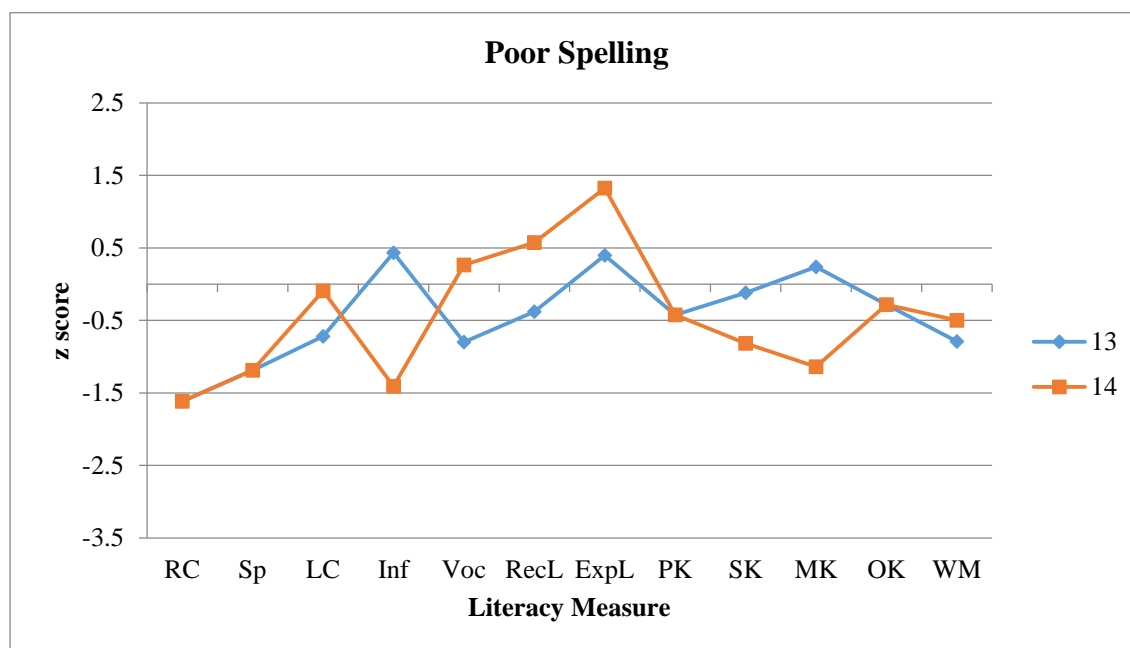
Group	Number of Participants
Group 1 (poor spelling, typical listening comprehension)	2
Group 2 (poor listening comprehension, typical spelling)	4
Group 3 (poor spelling and poor listening comprehension)	1
Group 4 (neither poor spelling nor listening comprehension)	10
Total	17

6.2.1. Profiles of Subgroups of Participants

6.2.1.1. Group 1 – Poor Spelling

The two participants who were identified within this group had poor spelling, but typical listening comprehension skills. Figure 6.1. demonstrates the profiles of these two individuals on measures obtained through the large scale and individual assessments. Both participants presented with skills within the average range for most of the additional literacy measures undertaken. Participant 14 did demonstrate a difficulty (more than one standard deviation below the mean) in inferencing ability, however. Self-reported strategy use when reading (using the MARS questionnaire) differed greatly between these two participants. Participant 14 reported a high use of all metacognitive strategies, while participant 13 reported low and medium strategy use.

Figure 6.1. Graph to show z scores of participants with poor spelling

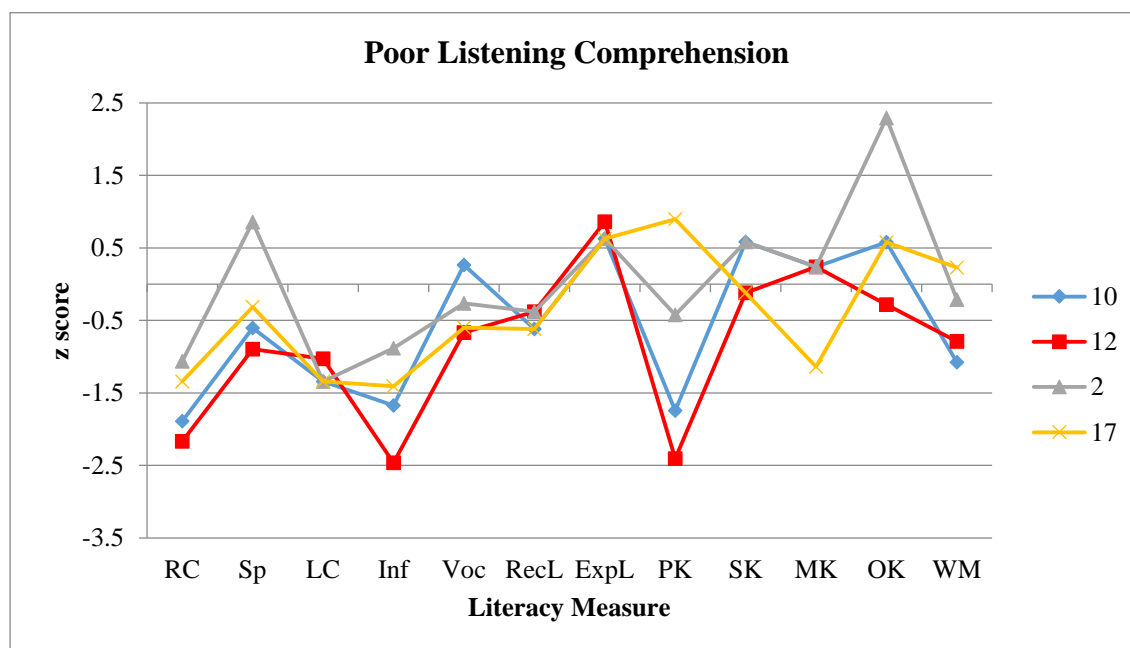


RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.2. Group 2 – Poor Listening Comprehension

Four participants were identified with profiles of poor listening comprehension, but typical spelling ability. Beyond these two measures, and reading comprehension, there were no other identifiable trends amongst the profiles of all four participants. Participants 10 and 12 both showed similar profiles characterised by weak inferencing, phoneme knowledge, and working memory. Participant 2 demonstrated very strong spelling skills, likely supported by her apparent competent metalinguistic ability. There was a wide range of self-reported strategy use, with participants reporting low to high use for various different categories of strategy. All four students, however, reported a medium overall use of metacognitive strategies in their reading comprehension prior to intervention. Figure 6.2. depicts the scores obtained on the literacy measures undertaken for all four participants included in this group.

Figure 6.2. Graph to show z scores of participants with poor listening comprehension



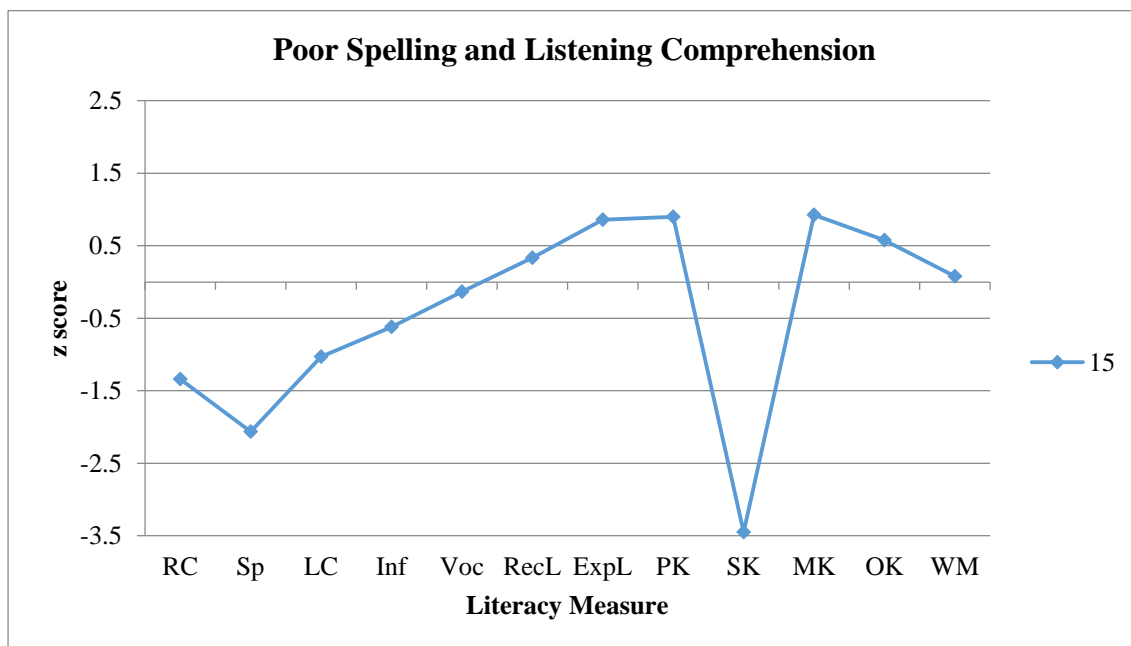
RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.3. Group 3 – Poor Spelling and Poor Listening Comprehension

Only one participant met the criteria for inclusion in this group characterised by poor spelling and listening comprehension ability. All other literacy measures were within average range except syllable knowledge (see Figure 6.3.). This measure was one area in which participants in the large scale assessment performed well, with many reaching ceiling. Given that participant 15's scores for the other metalinguistic tasks were within the average range, it is possible that the syllable knowledge score is not representative of her level of knowledge. Therefore, there may be an alternative explanation as to why this score was so low. For example, her performance in the syllable awareness task could be attributed to her simply misinterpreting the question due to the more stressful context of an assessment situation. This

participant reported medium to high use of metacognitive strategies in her reading (as measured at the pre-intervention assessment point).

Figure 6.3. Graph to show z scores of participants with poor spelling and listening comprehension



RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.4. Group 4 – Neither Poor Spelling nor Poor Listening Comprehension

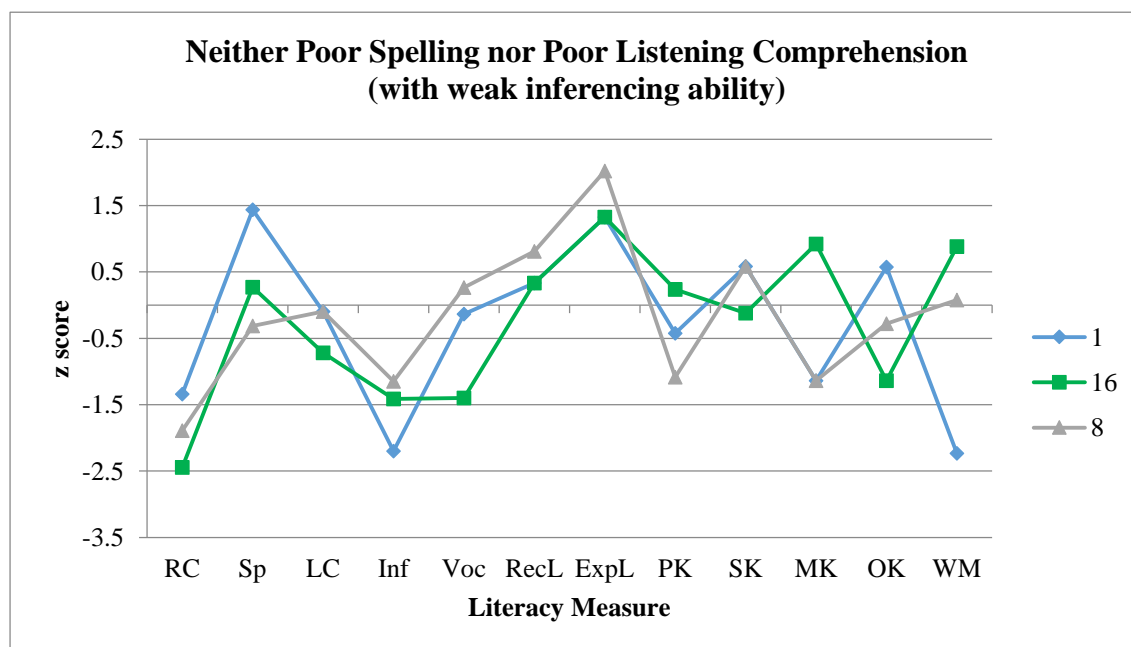
Ten participants met the criteria for inclusion in this group, with no apparent difficulty in either the skills of spelling or listening comprehension. Additionally, there were no apparent similarities between the ten participants in their reported use of strategies during reading. Responses included low, medium, and high, for each strategy category, and participants' overall strategy use. Despite this, their reading comprehension remained low (as

was the criteria for inclusion in the intervention). To try to identify other possible explanations as to what might be contributing to their reading comprehension difficulty (beyond spelling and listening comprehension), these ten participants were divided into three smaller subgroups.

6.2.1.4.1. Group 4 – Poor inferencing ability.

Three participants within group 4 presented with inferencing skills that were more than one standard deviation below the mean of the whole cohort. The scores for these three participants on all measures are presented in Figure 6.4. below.

Figure 6.4. Graph to show z scores of participants with neither poor spelling nor listening comprehension (with weak inferencing ability)

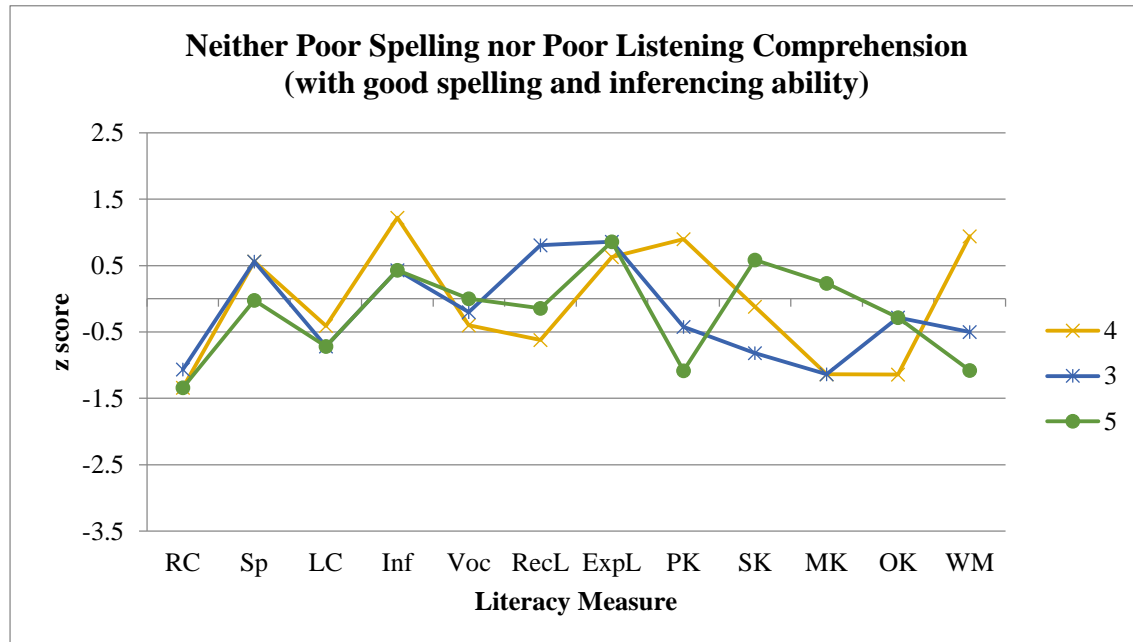


RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.4.2. Group 4 – Good spelling and inferencing ability.

Although presenting with difficulties in reading comprehension, three participants did not demonstrate weaknesses in linguistic comprehension or spelling, but in fact had relatively strong spelling and inferencing skills. Each participant was at or above the mean score on these two measures, and had scores within the expected range in their listening comprehension. There were some identified weaknesses amongst the three participants in their metalinguistic knowledge and working memory ability, however, there were no consistencies in the three profiles. The full profiles of each individual participant are shown in Figure 6.5.

Figure 6.5. Graph to show z scores of participants with neither poor spelling nor listening comprehension (with average or strong spelling and inferencing skills)

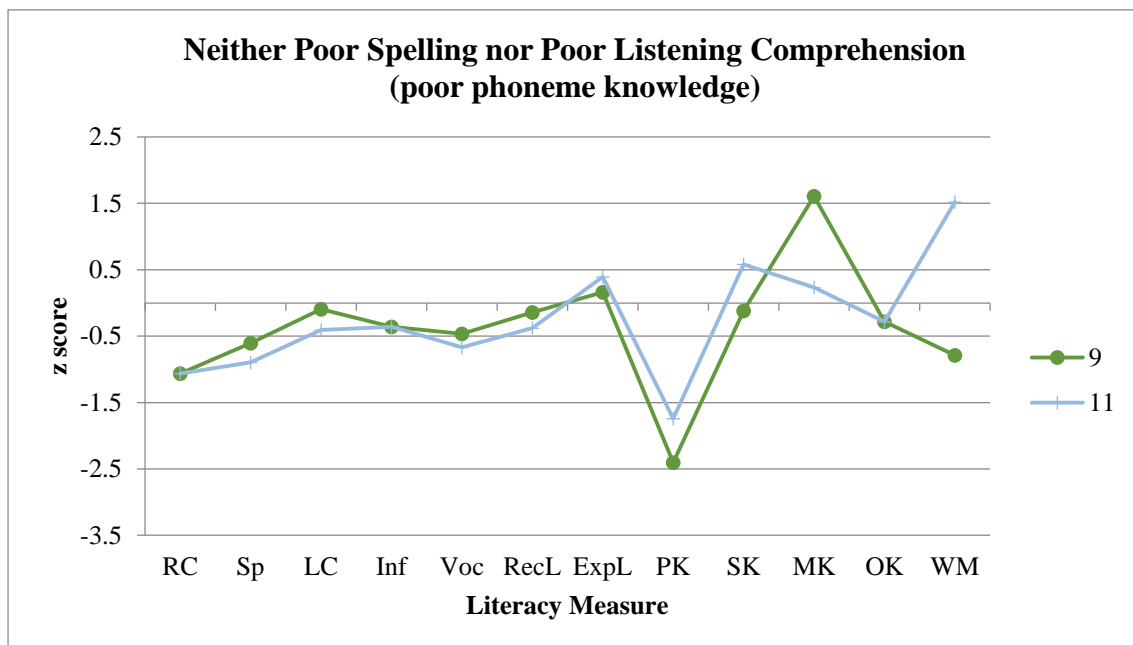


RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.4.3. Group 4 – Poor phoneme knowledge.

Two participants within Group 4 (no identified difficulties in either spelling or listening comprehension) presented with difficulties in one area of literacy alone – phoneme knowledge. Their profiles were very similar (see Figure 6.6.), with the exception of participant 9 demonstrating weaker working memory skills than participant 11, while the opposite was true for the measure of morpheme knowledge.

Figure 6.6. Graph to show z scores of participants with neither poor spelling nor listening comprehension (with poor phoneme knowledge)

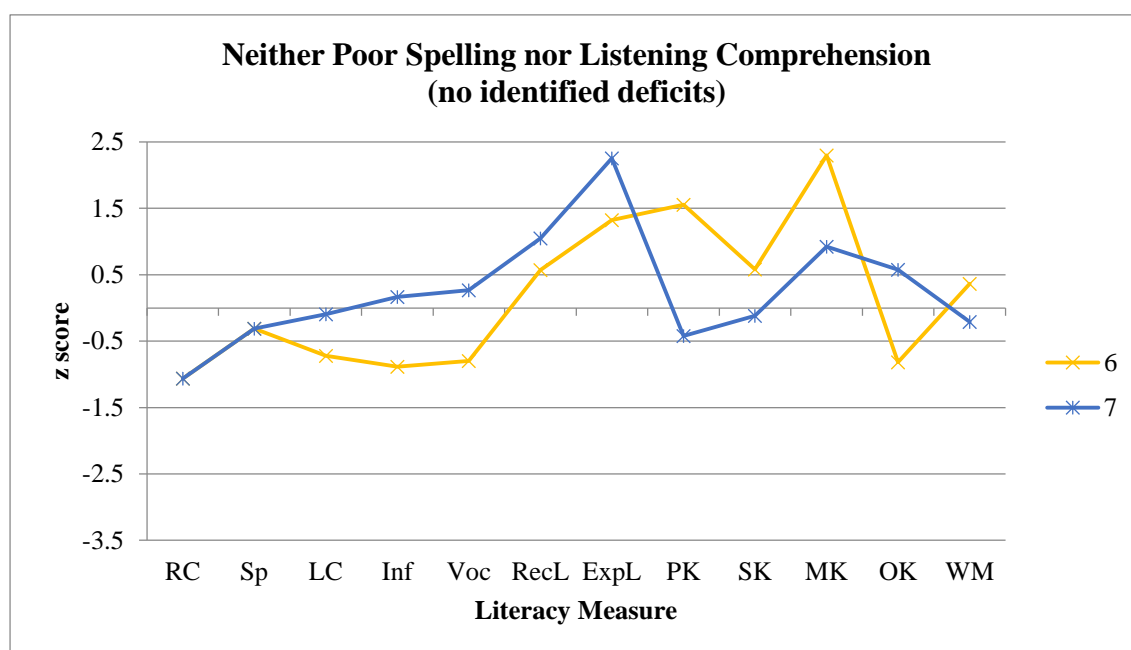


RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.1.4.4. Group 4 – No identified deficits.

The final subgroup of participants identified from Group 4 was those who presented with no identifiable deficits in the literacy measures assessed beyond that of reading comprehension. While participant 7 presented with very strong expressive vocabulary and participant 6 presented with strong phoneme and morpheme knowledge, there were no other clear strengths and weaknesses. Scores for these two participants are shown in Figure 6.7.

Figure 6.7. Graph to show z scores of participants with neither poor spelling nor listening comprehension (with no identified deficits)



RC = Reading comprehension; Sp = Spelling; LC = Listening comprehension; Inf = Inferencing (total score); Voc = Vocabulary (PPVT); RecL = Receptive language (CELF-Word classes receptive); ExpL = Expressive language (CELF-Word classes expressive); PK = Phoneme knowledge; SK = Syllable knowledge; MK = Morpheme knowledge; OK = Orthotactic knowledge; WM = Working memory

6.2.2. Between Group Comparisons for Response to Intervention

A Kruskal-Wallis Test was undertaken for each of the four reading comprehension strategies to explore whether any significant differences presented between the four subgroups in the mean reading comprehension scores obtained. There were no significant differences identified between the four groups (1-4 outlined above: Gp1, $n = 2$; Gp 2, $n = 4$; Gp 3, $n = 1$; Gp 4, $n = 10$) when using the text-to-speech strategy $\chi^2(3, n = 17) = 1.094, p = .779$; the key words strategy $\chi^2(3, n = 17) = .875, p = .831$; the mind map strategy $\chi^2(3, n = 17) = 3.319, p = .345$; or the highlighting and summarising strategy $\chi^2(3, n = 17) = 2.892, p = .409$. A lack of differences in the performance of the sub groups suggested that it was not possible to link a specific literacy profile with a specific reading comprehension strategy at a group level.

6.3. Individual Responsiveness to Differing Intervention

As there were no clearly identifiable links between the responsiveness of the subgroups of participants to the different intervention strategies, the literacy profiles of individual participants were subsequently examined. First, the responsiveness of each of the seventeen individuals to the four intervention strategies was investigated.

6.3.1. Examining the responsiveness of individual participants to the four reading comprehension strategies

Individual results obtained on the reading comprehension assessment when using the four reading comprehension strategies were examined. The baseline score (obtained at the initial pre-intervention assessment point) was plotted alongside the scores obtained for each participant at each subsequent assessment point. Figures 6.8. – 6.11. display these findings.

Figure 6.8. Graph depicting the individual scores of each participant at the pre-intervention assessment, and when using the text-to-speech strategy

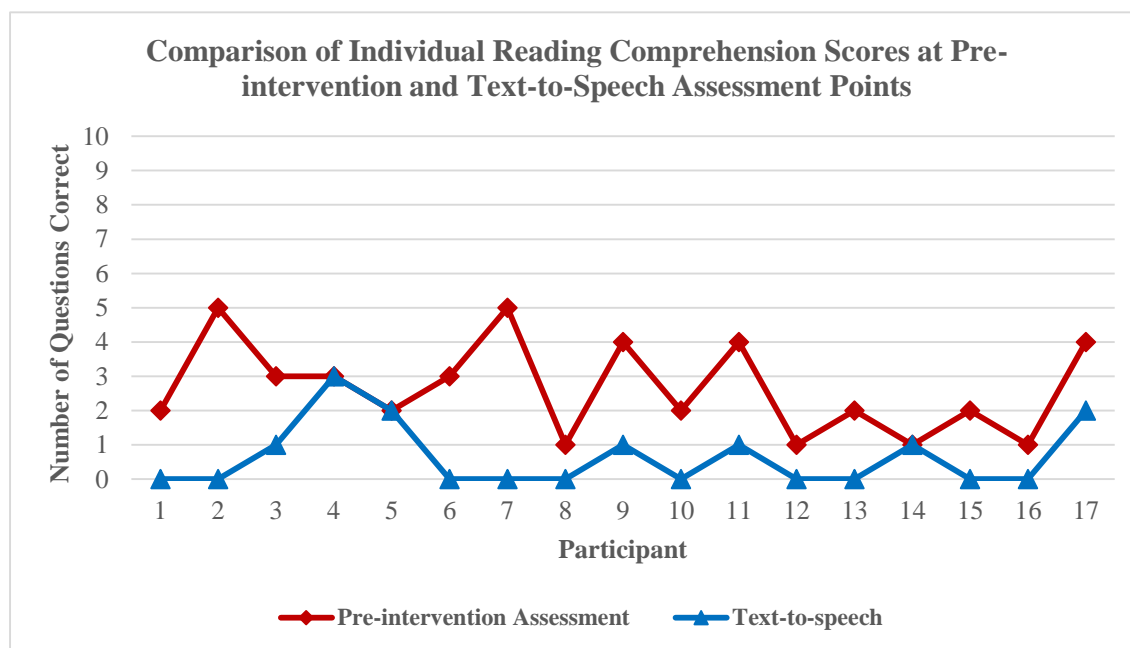
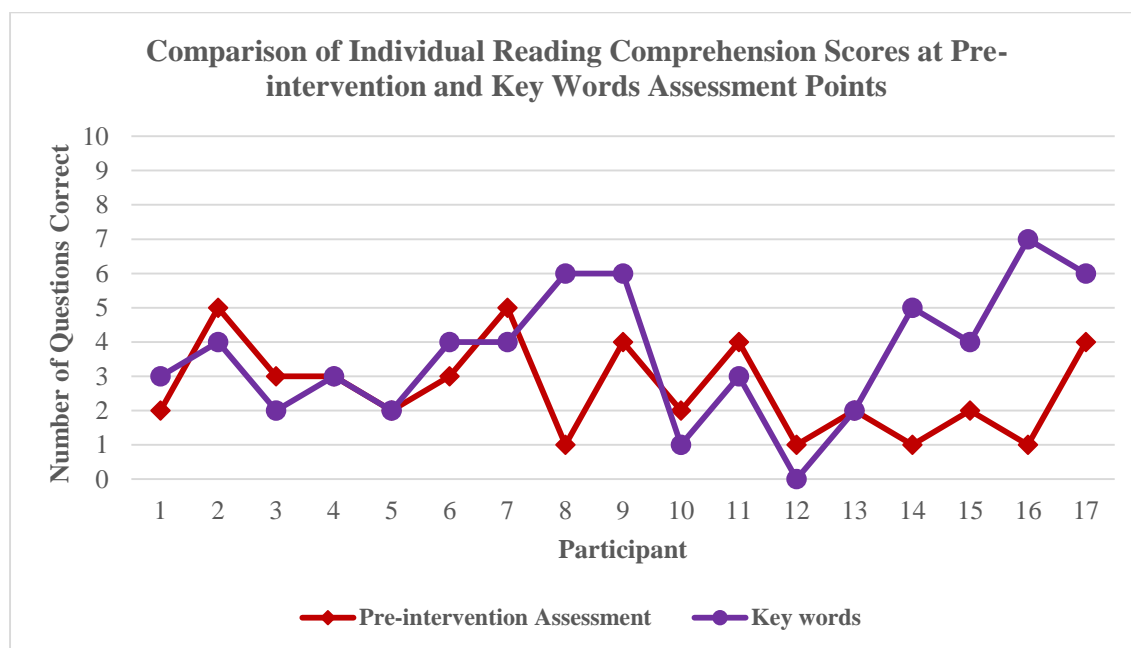


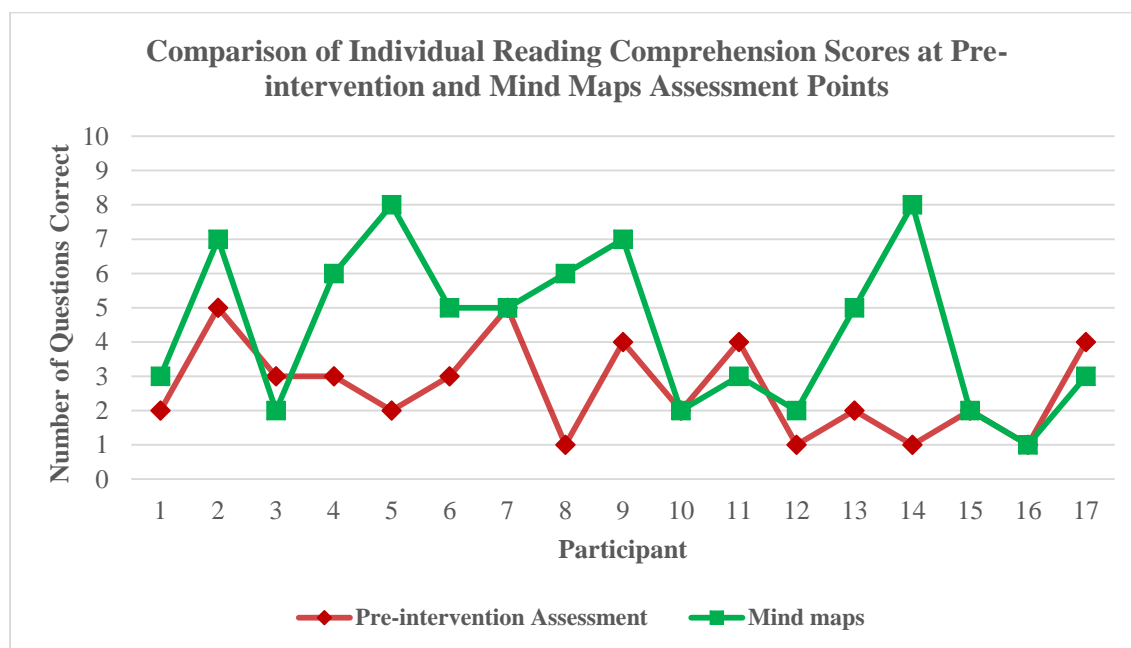
Figure 6.8. demonstrates that 16 of the 17 participants achieved lower scores when using the text-to-speech strategy than at the pre-assessment. None of the participants increased their performance from the initial assessment point when using this strategy. The analysis completed in the previous study (Chapter Five) showed that, as a group, the scores of the participants who completed the intervention decreased when using the text-to-speech strategy. There was a mixed response to the reading comprehension intervention of key words. When the mean group change in score from the pre-assessment point to the key words assessment point was examined, results demonstrated a significant increase in mean score. Figure 6.9. demonstrates that while eight participants' scores did increase using the key words strategy, this was not the case for them all, with some scores decreasing or remaining approximately the same.

Figure 6.9. Graph depicting the individual scores of each participant at the pre-intervention assessment, and when using the key words strategy



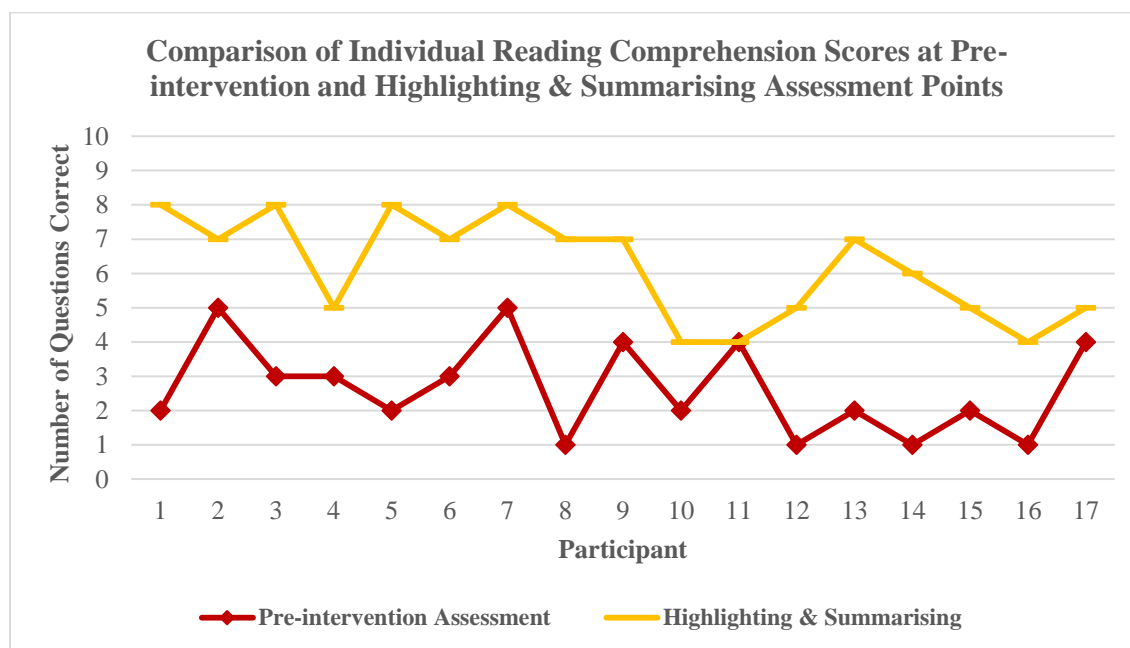
The mean group change from the pre-assessment to the assessment point using the mind map strategy demonstrated a significant increase. While the majority of participants performed better at the assessment point when using the mind map strategy, this was not true of all participants who completed the intervention (see Figure 6.10.). Four of the seventeen participants produced the same score when using this strategy compared to the pre-assessment point, and the score for three of the individuals decreased when using the mind map strategy. As per the key words reading comprehension strategy, examination of the individual response to intervention demonstrated that not all participants responded favourably to this intervention. These results are displayed in Figure 6.10.

Figure 6.10. Graph depicting the individual scores of each participant at the pre-intervention assessment, and when using the mind maps strategy



Finally, individual participants' responses were examined at the highlighting and summarising assessment point, and compared to the initial assessment point. These results are visible in Figure 6.11. (below), whereby sixteen of the seventeen participants improved their score when using the highlighting and summarising strategy. This strategy, in addition to demonstrating the most significant increase in score at the whole group level, appears to result in gains in score at the individual level.

Figure 6.11. Graph depicting the individual scores of each participant at the pre-intervention assessment, and when using the highlighting and summarising strategy



While there are clear group trends in two of the strategies (use of the text-to-speech strategy decreased participant score, and using the highlighting and summarising increased participant scores) the results argue for an individualised response to the strategies. The results of four individuals were therefore examined in more detail to try to identify the relationship between the strengths and weaknesses of a participant's literacy profile and their response to the reading comprehension intervention. One participant was selected from each of the four groups identified and reported in section 6.2. These four participants' profiles are outlined and described below; each in the form of a case study.

6.4. Individual Profiles (Case Studies)

The four adults selected as case studies for analysis were Sarah, Kate, Jen, and Anna (pseudonyms). One participant from each of the four groups was selected as a case study.

These four individuals were determined due to them representing the most 'extreme' case within each of group. For example, within the poor spelling group (group 1), the participant with the lowest spelling score was selected for further examination. Additional rationale for the selection of each individual, as well as hypotheses, are outlined below:

1. Case study 1 – Sarah: Sarah's literacy profile was characterised by typical listening comprehension skill (within the range expected compared to normative data), and weak spelling skill (compared to the mean obtained from peer performance). It was hypothesised that a reading comprehension strategy that focussed on the word decoding element of reading (such as the text-to-speech, or key words strategies) may be the most beneficial for Sarah.
2. Case study 2 – Kate: Kate's literacy profile was characterised by listening comprehension skill below the expected range for her age, yet spelling skills within one standard deviation of the group mean. It was therefore hypothesised that strategies focussing on the linguistic comprehension aspect of reading comprehension (such as the two metacognitive strategies of mind maps and highlighting and summarising) would result in the greatest gains in reading comprehension.
3. Case study 3 – Jen: Jen's literacy profile was characterised by difficulties in both spelling and listening comprehension measures. Jen's scores for these two subtests were below the expected range for her age, or more than one standard deviation below the mean of her peers. Due to presenting weaknesses in both word decoding and linguistic comprehension elements, a focus on reading comprehension as a whole or a combination of more than one strategy may be most suited to her literacy profile.
4. Case study 4 – Anna: Anna's literacy profile was characterised by very low reading comprehension ability, yet demonstrated typical performance on the measures of listening comprehension and spelling. Again, as with Jen's profile it was difficult to

develop a hypothesis for any particular strategy, but a clear focus on reading comprehension in general was required.

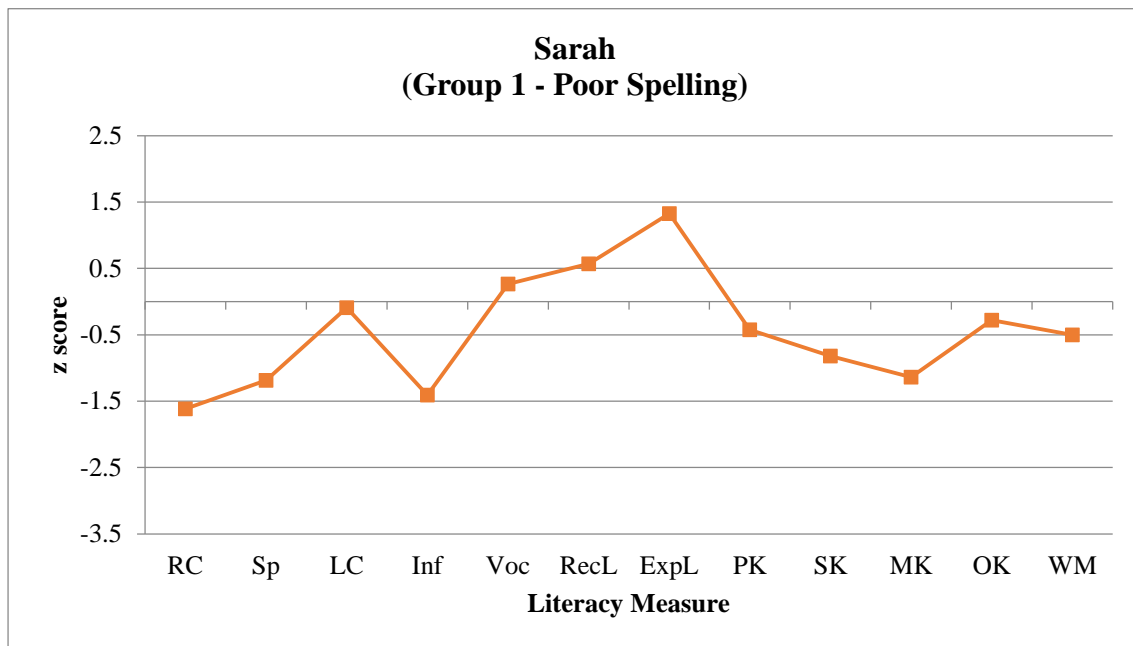
6.4.1. Case Study One – Sarah

Sarah (participant 14 from Group 1 above) presented with weak spelling ability (relative to listening comprehension).

6.4.1.1. Literacy Profile – Pre-intervention Assessment Scores

Sarah's reading comprehension scores on both texts were significantly below the cohort mean at the pre-intervention assessment. As identified as part of the criteria for her grouping into Group 1, her spelling ability was low. Metalinguistic tasks such as morpheme and phoneme knowledge were also below the mean, which is likely to be related to her low spelling performance. While her listening comprehension was within the expected range for her age, she demonstrated a weakness in inferencing ability which may have also contributed to her reading comprehension difficulty. No other deficits were identifiable from her profile (see Figure 6.12.), but a particular strength in expressive vocabulary was also evident.

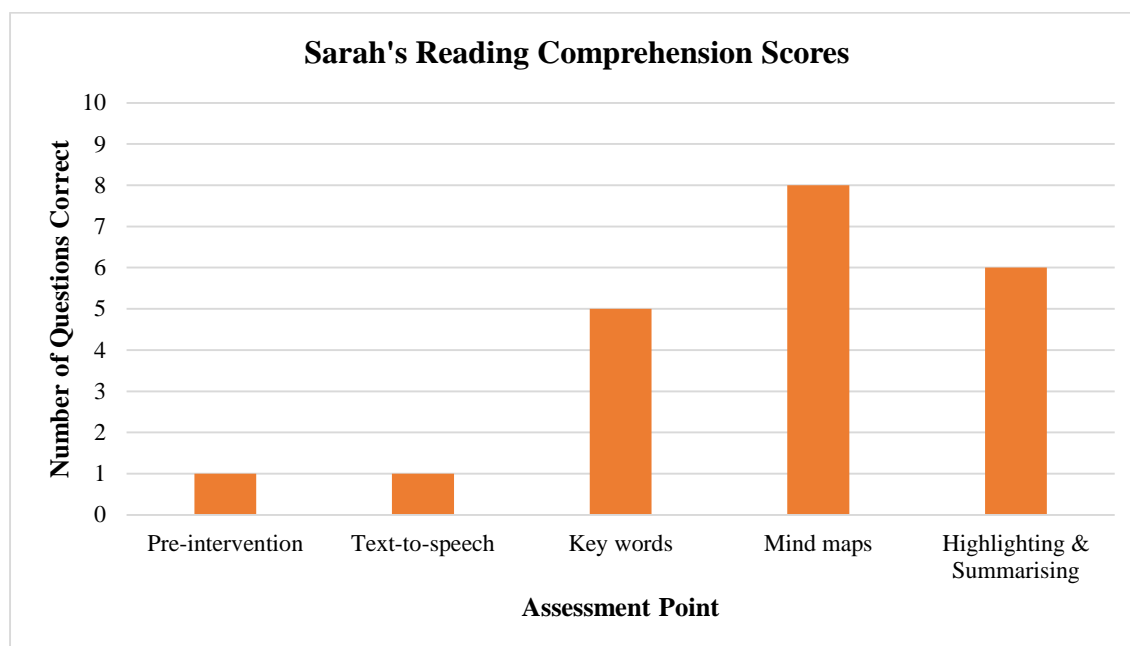
Figure 6.12. Profile of Sarah's literacy scores on included measures



6.4.1.2. Response to Reading Comprehension Intervention

Sarah responded most favourably to the mind map strategy. Her reading comprehension score obtained when using this strategy was seven times that obtained at the pre-intervention assessment or when using the text-to-speech strategy. Positive results were also noted when using the highlighting and summarising strategy, and key words strategy (although to a lesser extent for the latter). Conversely, her recall of the text allowing her to produce a summary when using the mind map technique was low and time consuming. Her scores on the reading comprehension task at each assessment point are presented in Figure 6.13.

Figure 6.13. Reading comprehension scores obtained by Sarah at each assessment point



Closer examination of Sarah's profile does not provide any clear explanation as to why using mind maps was most facilitative for her reading comprehension. Her difficulties with spelling suggested that the text-to-speech or key words strategies might be most beneficial. Sarah's difficulties with inferencing, however, were also likely to contribute to her poor reading comprehension performance. It is possible that the use of mind maps, a metacognitive strategy, aided her ability to draw connections and inferences between aspects of the text. It is unlikely that a straightforward decoding strategy would have allowed her to do this.

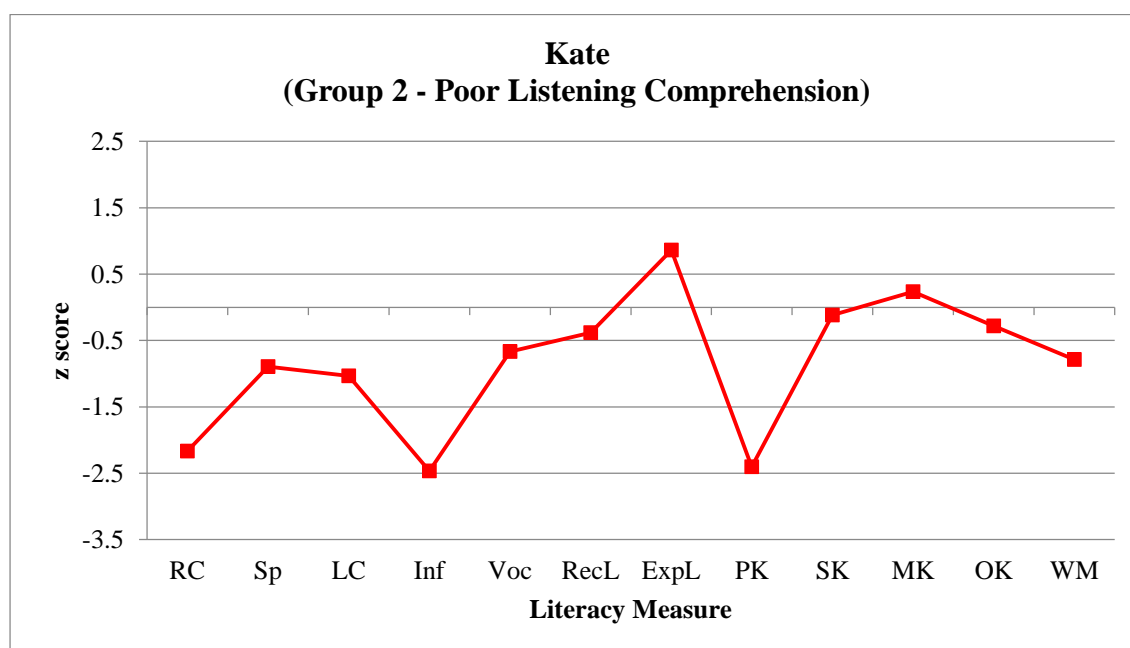
6.4.2. Case Study Two – Kate

Kate (participant 12 in Group 2 of this chapter) presented with weak listening comprehension skills (and relatively strong spelling skills).

6.4.2.1. Literacy Profile – Pre-intervention Assessment Scores

Kate presented with several areas of weakness in her overall literacy profile (see Figure 6.14.). She was more than two standard deviations below the mean on the reading comprehension assessment at pre-intervention. Although allocated to the poor listening comprehension group, Kate’s spelling skills were also below the cohort mean, but not significantly enough to be identified as a deficit. Kate also presented with very low inferencing ability, suggesting that difficulties in the linguistic comprehension component of the SVR was the largest contributor to her low reading comprehension. An additional difficulty was identified in her phoneme knowledge, although it is important to remember that the metalinguistic tasks were limited in their items, and many individuals struggled in particular with phoneme and morpheme knowledge tasks at the pre-intervention assessment point. Lastly, Kate’s profile shows a low working memory score (although within one standard deviation of the group mean).

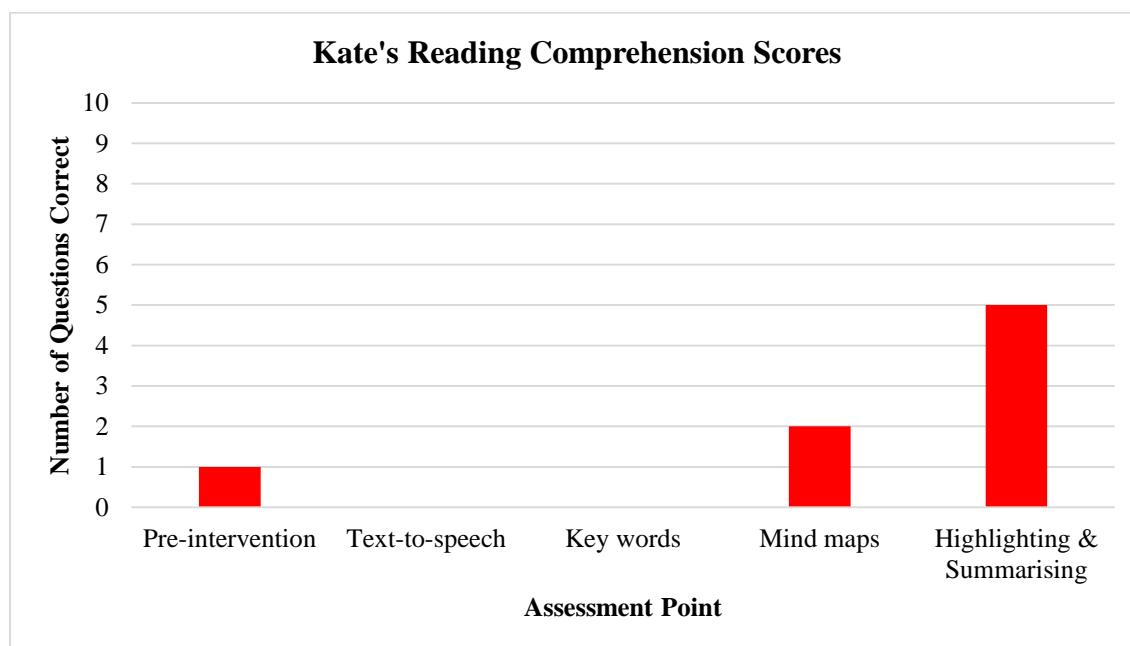
Figure 6.14. Profile of Kate’s literacy scores on included measures



6.4.2.2. Reading Comprehension Intervention

Kate's response to the reading comprehension assessments at each point during the intervention demonstrated zero benefit when using the text-to-speech or key words strategies, limited benefit using the mind map strategy, and a clear benefit when using the highlighting and summarising strategy. Furthermore, the use of this strategy also provided the greatest score in the summarising strategy with regard to words per minute produced. Her specific difficulties in listening comprehension and inferencing may have been aided by the metacognitive strategy of highlighting and summarising. This metacognitive strategy allowed her to think about the text that she had read and draw connections between words and phrases. Furthermore, it is arguable that translating the text into her own words (the summarising element of this strategy) may have aided her working memory recall, hence her strong reading comprehension and summarising scores relative to using the other strategies). It is possible that the mind map strategy did not produce the same level of gain as the highlighting and summarising strategy due to Kate's low level of inferencing ability. The strategy of mind mapping requires links to be made between elements of the text to create grouped content areas within the mind map. A low level of inferencing ability may have made it difficult for Kate to make these connections between elements of similar text and thus create an effective mind map.

Figure 6.15. Reading comprehension scores obtained by Kate at each assessment point



Kate's literacy profile demonstrated several areas of weakness that may have benefitted from the use of any strategy in her reading. This, however, was not the case, with only one strategy demonstrating significant gains comparatively to the pre-intervention assessment scores, and those obtained using other strategies. Despite a low spelling score (although still within range of the mean), strategies focussing on decoding the text were not beneficial at all in aiding her reading comprehension. Highlighting and summarising appeared to combine the necessary elements to provide an increase in score for Kate.

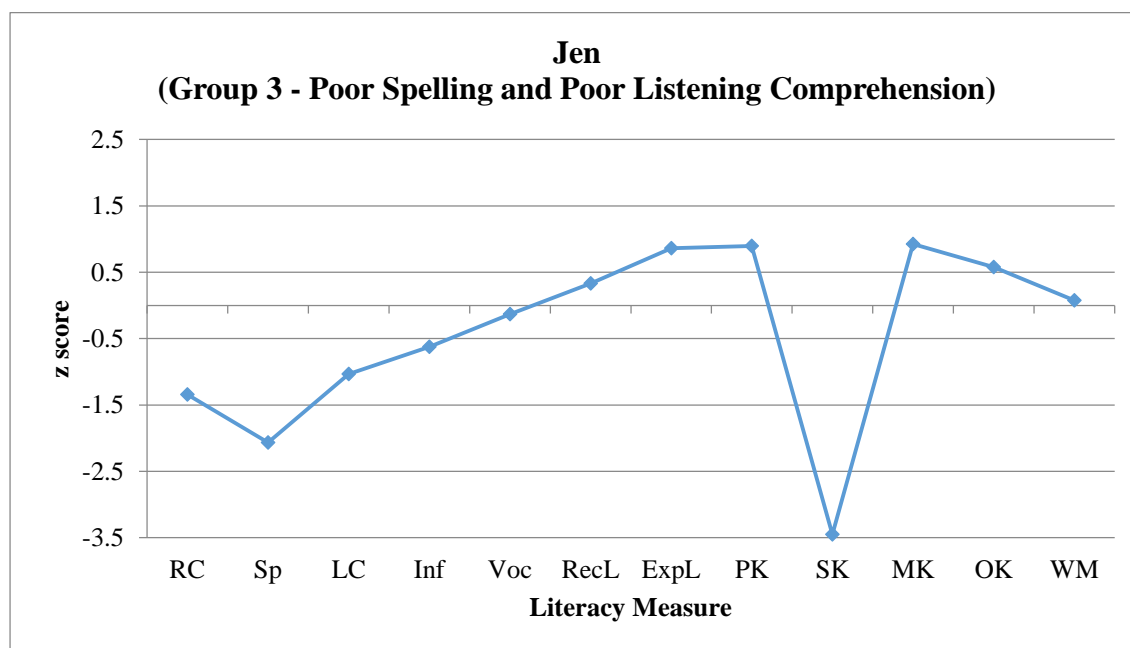
6.4.3. Case Study Three – Jen

Jen (participant 15 from Group 3 above), presented with weaknesses in spelling and listening comprehension ability.

6.4.3.1. Literacy Profile – Pre-intervention Assessment Scores

Jen presented with low reading comprehension, spelling, and listening comprehension. Jen demonstrated the most difficulty with spelling where she scored more than two standard deviations below the cohort mean. Jen scored within the mean of the cohort's performance on all measures except spelling, listening comprehension, and syllable knowledge. As outlined in section 6.2.1.3. it is possible that Jen's syllable knowledge score may not be representative of her ability (based on the scores obtained by the whole cohort on this measure and her scores on other language structure subtests). Prior to the intervention, Jen described her strategy use in reading comprehension as medium. Her literacy profile is shown in Figure 6.16.

Figure 6.16. Profile of Jen's literacy scores on included measures

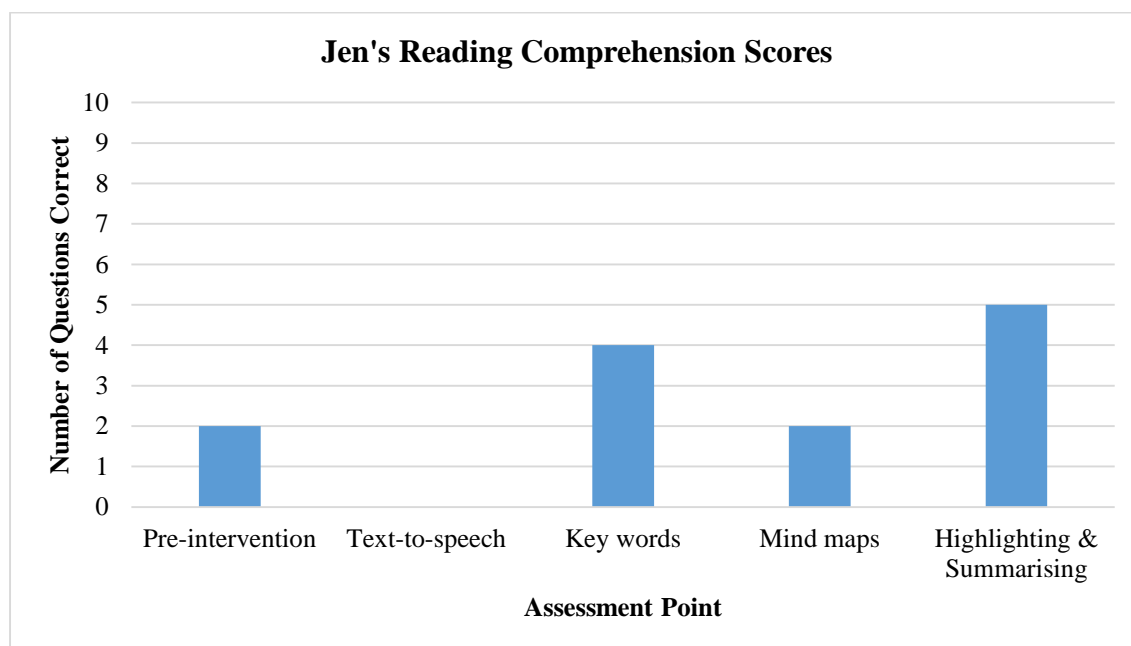


6.4.3.2. Reading Comprehension Intervention

The reading comprehension scores obtained by Jen at each assessment point are displayed in Figure 6.17. Her responsiveness to the different strategies are not as diversely

grouped as Sarah and Kate, with the key words and highlighting and summarising strategies both indicating benefits for Jen. Due to presenting difficulties in both spelling and listening comprehension, it is possible that the key words strategy assisted Jen's word decoding of difficult words (thus increasing her reading comprehension), and highlighting and summarising assisted her reading comprehension through the linguistic comprehension element. Although the latter strategy has been outlined as requiring the reader to take a greater amount of time to read the text, this was not the case for Jen. The time taken to read the text applying the highlighting and summarising strategy was less than when using any other strategy. Despite this, her recall of the text when producing a summary was low, as was the case when using all three other strategies. Although the highlighting and summarising strategy allowed Jen to read through the text in less time, the use of this strategy did not increase the amount of words she was able to recall relative to any of the other three strategies used.

Figure 6.17. Reading comprehension scores obtained by Jen at each assessment point



Although Jen's literacy profile was within the average range on many of the measures, the key areas of spelling and listening comprehension indicated difficulties that would likely contribute to her reading comprehension difficulties. As with Kate, the highlighting and summarising strategy appeared to help compensate for the diverse areas of difficulty in her literacy profile. It is plausible that a combination of the key words strategy and the highlighting and summarising strategy would produce optimum results for Jen, given her difficulties in word decoding and linguistic comprehension.

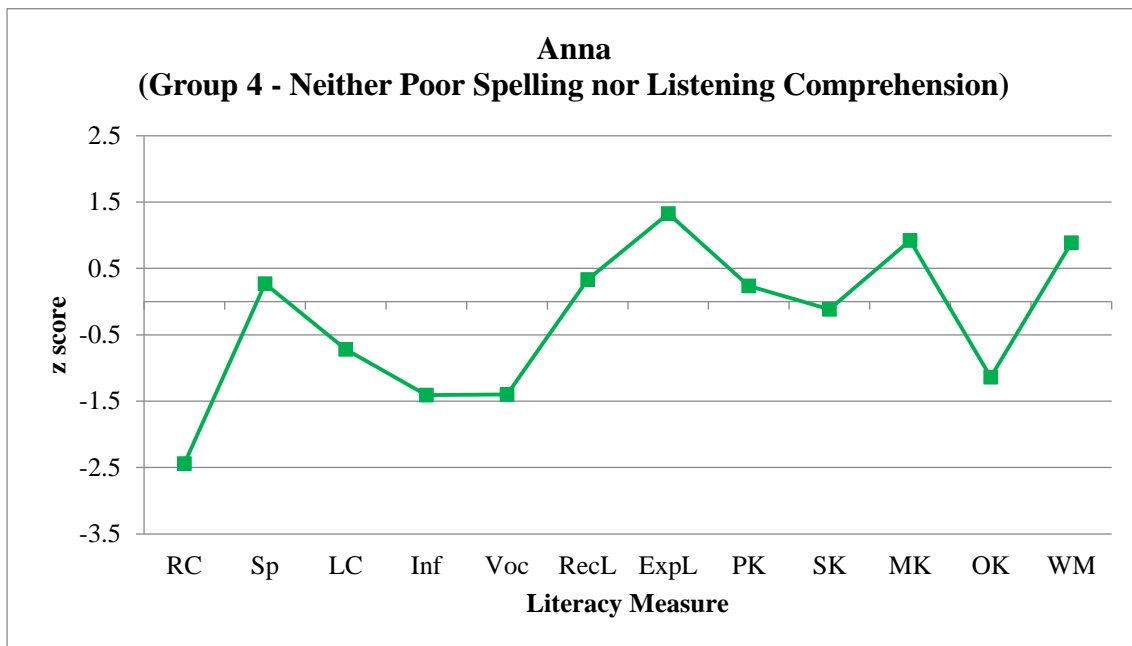
6.4.4. Case Study Four – Anna

Anna (participant 16 from Group 4 above) did not present with weaknesses in spelling or listening comprehension, but presented with weak inferencing ability.

6.4.4.1. Literacy Profile – Pre-intervention Assessment Scores

Anna displayed the lowest reading comprehension score of any of the case studies presented. However, the remainder of her literacy profile was mixed (see Figure 6.18.). Anna's spelling and listening comprehension scores were within the average range of her peers, or that expected for her age. Her inferencing ability and vocabulary were, however, below the range expected for her age. The remaining literacy skills were within or above the mean range, with the exception of orthotactic knowledge. At the pre-intervention assessment Anna self-reported a medium to high use of reading comprehension strategies.

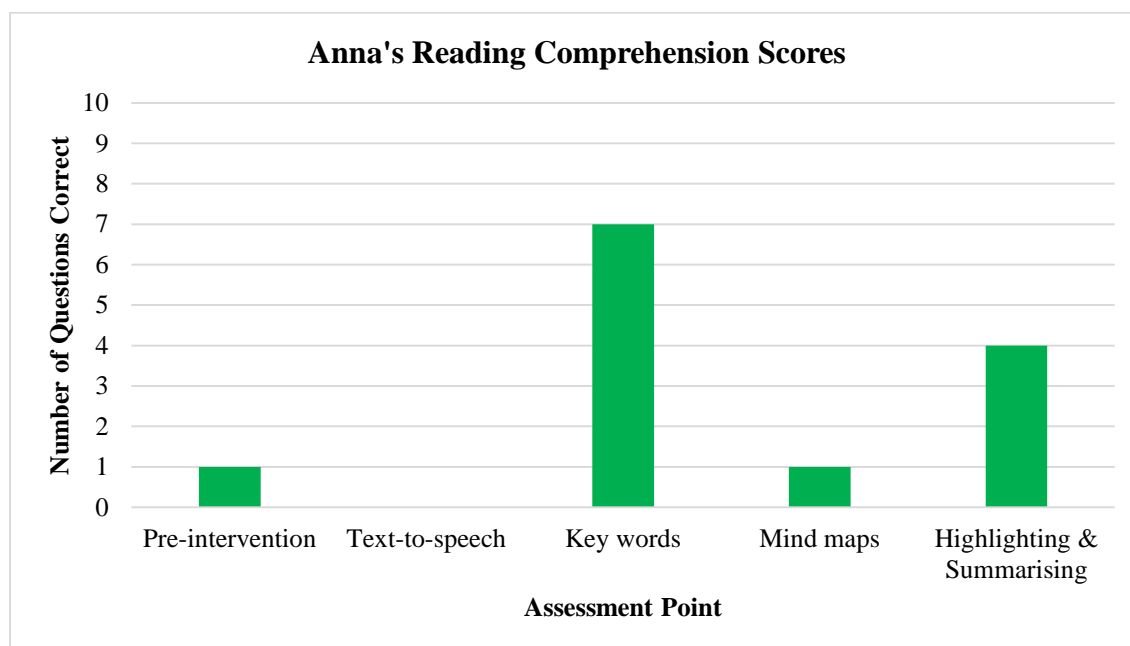
Figure 6.18. Profile of Anna's literacy scores on included measures



6.4.4.2. Reading Comprehension Intervention

Figure 6.19. displays the reading comprehension scores obtained by Anna at each assessment point. This clearly shows that the strategy of key words resulted in the most benefit for Anna. The metacognitive strategy of highlighting and summarising was beneficial for her compared to her scores at the pre-intervention assessment point, but not to the same extent as the key words strategy. Despite this, Anna spent the most time reading the text using the key words strategy (for the summarising assessment) compared to the other three strategies.

Figure 6.19. Reading comprehension scores obtained by Anna at each assessment point



It is hypothesised that the key words strategy showed strong results for Anna in reading comprehension due to her identified vocabulary weakness. The key words strategy provided a list of possible problematic words for her prior to, and alongside, reading the text. This would allow her to access some of the content of the text that may have otherwise been inaccessible to her during reading. The highlighting and summarising strategy may have also been beneficial for Anna by encouraging her to think about the text during the process of reading. This would enable her to draw connections between words and phrases in the text thus assisting her in the area of inferencing. Again, as with Kate and Jen, the strategy of highlighting and summarising was beneficial for Anna compared to her score at the pre-intervention point, despite the pattern of difficulties in her literacy profile.

6.5. Discussion

This chapter attempted to determine successful reading comprehension intervention for individuals based on their presenting literacy profiles. Four different core groups were

identified based on the Simple View of Reading framework. Individual responses to each of the four interventions were then examined. Four case studies were subsequently identified based on their diverse strengths and weaknesses within the subgroups identified and their responsiveness to the different reading comprehension intervention strategies. The profiles of these individuals were examined in greater detail in an attempt to determine whether different intervention strategies could be matched to a literacy profile and specific strengths and weaknesses.

6.5.1. No Identifiable Differences between Subgroups of Participants in their Responsiveness to Four Reading Comprehension Strategies

There was no straightforward correlation between the underlying literacy skills of these individuals and a specific type of strategy, at either a group or individual level. This inability to link particular strategies with differing literacy profiles reflects the findings of those outlined by Fidler (2009) in his examination of the cognitive profiles of adult students with dyslexia. Fidler's participants all shared the commonality of a prior diagnosis of dyslexia and would therefore likely present with weaknesses within the area of word decoding. This provides a potential explanation as to why there were no significant differences found in the application of different strategies. Participants of the current research were identified by their reading comprehension and therefore had scope to present with a much wider range of literacy profiles. These findings not only extended the findings of Fidler's study (with adults in higher education with dyslexia) to the broader higher education population, but also indicated the complexity of the reading process within this context.

Closer examination of the four subgroups identified within the intervention group did not reveal any consistent similarities between the individuals beyond the measures used for the subgrouping criteria. Moreover, although a score of more than one standard deviation

below the mean in measures of spelling and listening comprehension were used to group participants, weaknesses were also apparent in individuals which were not quite low enough to meet the criteria. This complicated the profiles of these individuals and made it difficult to hypothesise which strategies might suit particular profiles best. Additionally, the measures used may not have best categorised participants, and it is possible that performance on several measures should be considered together, such as listening comprehension and inferencing. Similarly, the combined measures of literacy from the large assessment and the additional assessment are still only selective and do not provide an exhaustive literacy profile for these individuals.

6.5.2. No Identifiable Relationship between the Literacy Profile of Individuals and their Response to Four Reading Comprehension Strategies

The use of case studies to further examine individual profiles and their responsiveness to the intervention did demonstrate some correspondence between their strengths and weaknesses and the effectiveness of a particular profile. For others, however, it was not possible to identify any relationship between the two, reflecting the conclusions drawn from the subgroups. For example, Jen's profile of weak spelling and listening comprehension mirrored her strong response when using a word decoding strategy (key words) and a metacognitive strategy (highlighting and summarising). Similarly, Anna's strong response to the key words strategy appeared to be closely linked to her low vocabulary score. Conversely, Sarah's reading comprehension ability did not appear to benefit from word decoding strategies, despite presenting with difficulties within this area (both spelling and metalinguistic knowledge). The findings from this study contradict prior recommendations within both the higher education and the ABE contexts, for the inclusion of differentiated

instruction determined by individuals' relative strengths and weaknesses (Mellard et al., 2012; Miller et al., 2010; Savage & Wolforth, 2007).

The findings from this study do however provide some interesting results. Despite the heterogeneity of the literacy profiles of this intervention group, all but one of the participants appeared to benefit from the application of the highlighting and summarising strategy when reading. The remaining participant did not drop in score, but obtained the same score as at the pre-intervention assessment. It is posited that this strategy was most beneficial for all (despite the large variance in the literacy profiles of participants), due to it requiring the students to engage metacognitively with the text (Cartwright, 2009; Rich & Shepherd, 1993).

Furthermore, it allowed for students to be able to make connections between different aspects of the text as they read, possibly facilitating the inferencing process. The skill of inferencing was found to play a strong role in explaining the variance in reading comprehension amongst this population (see Chapter Four), therefore if this skill was supported by the highlighting and summarising strategy it may help to explain the effectiveness of this strategy for all students.

In an opposite response to that of the highlighting and summarising strategy, the text-to-speech strategy (focussing on word decoding) was not found to benefit anyone even though several participants demonstrated difficulties in the skills associated with word decoding. Thus, the current study argues against the use of this strategy with this population, despite it being a prevalent support tool within higher education environments (Draffan et al., 2007). Furthermore, the findings from the current study add support to both those outlined in Study Three and in previous research (Cromley, 2005; Thiede et al., 2003), that the use of metacognitive techniques can be beneficial in improving reading comprehension skills amongst adults, and in particular those in higher education.

6.5.3. Conclusions

In conclusion, the results from this study argue against the ability to recommend specific reading comprehension strategies for individuals in higher education based on their literacy profiles. Between-group differences were not apparent in students' responsiveness to the four different strategies, when groups were determined by performance in assessment of the component elements of the SVR. Neither the results from subgroups nor the case studies were able to provide support for a relationship between different strategies and a particular pattern of literacy strengths and weaknesses. Following examination of individual responses to the four strategies, findings reflected those of Study Two (Chapter Five), advocating for the use of a highlighting and summarising strategy for pre-service teachers who present with difficulties understanding written text. Although this strategy might not provide an all-encompassing solution for these individuals it appears that, regardless of the originating areas of underlying difficulty, it is a well-supported starting point for intervention.

Studies Two and Three have reported a reading comprehension intervention for subgroup of individuals presenting with difficulties understanding written text within a large cohort of pre-service teachers. It is recognised, however, that Study One also identified weaknesses in the skills of the cohort as a whole, particularly within the area of metalinguistic knowledge. Moreover, existing research has highlighted pre-service teachers as a group of individuals for whom population-wide difficulties exist. The final study of this thesis reports the findings of a cohort-wide teaching intervention focusing on raising the metalinguistic knowledge of this population.

CHAPTER SEVEN

STUDY FOUR – EXPLICIT TEACHING OF METALINGUISTIC KNOWLEDGE WITHIN A LITERACY COURSE FOR PRE-SERVICE TEACHERS

7.1. Introduction

Research worldwide has documented the importance of explicit instruction in metalinguistic knowledge in reading instruction within the early years (see the following for a review: National Inquiry into the Teaching of Literacy, 2005; National Reading Panel, 2000; Rose, 2006). A lack of knowledge about the underlying constructs of language structure may result in teachers inadvertently providing inappropriate feedback, misinterpreting assessments, or ultimately providing confusing instruction when teaching reading (Moats, 2000). Despite such strong evidence advocating the inclusion of explicit teaching of language structure constructs to emergent readers, increasing international literature has reported low personal metalinguistic skills amongst the teaching profession (Fielding-Barnsley, 2010; Mather et al., 2001; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003; Washburn, Joshi, & Binks-Cantrell, 2011). Poor language structure knowledge in the pre-service and in-service teaching populations has led to recommendations that a greater focus on the explicit teaching of such constructs is required within initial teacher preparation (Fielding-Barnsley, 2010; Harper & Rennie, 2008; Washburn, Joshi, & Binks-Cantrell, 2011).

Despite the recommendation that literacy coursework for pre-service teachers should include a focus on building students' metalinguistic knowledge, there is little known about what this teaching may comprise, and its effectiveness (Fielding-Barnsley & Purdie, 2005; Loudon & Rohl, 2006; Mather et al., 2001; Spear-Swerling & Brucker, 2003). The few intervention studies that have been undertaken with the teaching population (including both

pre-service and in-service teachers) have reported mixed results. Stainthorp (2004) provided explicit instruction about language structure and its importance in teaching reading and spelling to pre-service teachers in the United Kingdom. The length and content of instruction were not specifically outlined by the author. Results demonstrated a significant change in students' phoneme awareness following the intervention. Similarly, Spear-Swerling and Brucker (2003) examined the effects of instruction in word structure knowledge in both pre-service and in-service teachers. Results showed that participants who received intervention improved significantly on two of three measures when compared to a control group. Again, the specific elements of the intervention was not provided in enough detail to allow for replication. Both studies found that despite improvements over the intervention, participants still presented with difficulties in word structure knowledge once the teaching was completed. Post-intervention phoneme identification scores from Stainthorp's (2004) study reported a mean of less than fifty percent, which was approximately the level identified in in-service teachers examined in assessment undertaken by Carroll et al. (2012) (albeit using different items). Such gains still remain low despite intervention, with suggestions that more intensive or specific intervention may be needed.

It is impossible to ascertain from these language structure intervention studies whether improvements made are restricted to specific groups of students within the cohorts examined (Spear-Swerling & Brucker, 2003; Stainthorp, 2004). It is possible that group mean scores are skewed by stronger and weaker performances within the large group. It is important that teaching focussed on building pre-service teachers' language structure knowledge enables all students to build the linguistic awareness required to deliver evidence-based literacy instruction. Furthermore, individuals with increasingly diverse levels of literacy and academic ability are being admitted to university (Heiman & Precel, 2003; Henderson, 1999), and more specifically to pre-service teaching programmes (Buckingham,

2014). Despite the diverse nature of the linguistic skills of pre-service teachers entering higher education, existing research has focussed primarily on examining intervention effects at a group level. Spear-Swerling and Brucker (2006) examined the relationship between some areas of pre-service teachers' literacy ability, and their performance on measures of word-structure knowledge. Regardless of an overall improvement at the group level following instruction on word structure knowledge, individual differences in reading abilities were shown to relate to performance on measures of word structure knowledge. The two predominant areas of literacy with the most consistent relationships to word structure knowledge were basic reading and spelling skills. Although these two component skills were found to influence acquisition of knowledge during a period of intervention, even participants with strong underlying literacy skills performed poorly on assessment of their knowledge of language structure, supporting previous research outlining the weak metalinguistic skills of teaching professionals. Therefore, in addition to the necessity for increased knowledge about the type of teaching intervention that is effective for pre-service teachers as a whole, there is a highlighted need for research addressing how specific groups of individuals react to the same teaching intervention.

7.1.1. Research Questions and Hypotheses

The aims of this study was to ascertain the language structure knowledge of first year undergraduate pre-service teachers, and, examine the effectiveness of building this knowledge within a literacy education course. Furthermore, the following research questions were devised:

1. What level of knowledge relating to the structure of language do undergraduate pre-service teachers present with in their initial year of their university degree?

2. Does knowledge of language structure differ according to underlying ability in areas of reading comprehension and spelling? That is, are there significant differences in the metalinguistic knowledge of pre-service teachers who have strong spelling ability compared to those who have poor spelling ability, and pre-service teachers who present with difficulties understanding written text compared to those who do not?
3. Is it possible to build on pre-service teachers' knowledge of language structure within an undergraduate literacy education course, and if so, what gains can be made at a group level?
4. How do the changes in scores from pre- to post-assessment differ between pre-service teachers who present with strong spelling ability and weak spelling ability; and difficulties understanding written text and typical reading comprehension ability? Are gains or reductions in score performance made by these groups proportionate to the gains / reductions made at a group level?

It was hypothesised that results from the pre-assessment of metalinguistic knowledge of these pre-service teachers would reflect previous findings, demonstrating relatively poor skills. It was also hypothesised that pre-service teachers with spelling difficulties would present with weaker language structure knowledge than those with strong spelling ability. Similarly, it was hypothesised that pre-service teachers who had been identified with low reading comprehension abilities (those in the intervention group in Chapter Five) would demonstrate poorer knowledge of language structure concepts than their typically performing peers. A further hypothesis proposed that intervention providing explicit teaching of language structure knowledge and skills would result in improved performance on the assessment administered post-intervention. While it was hypothesised that improvements would be made, the extent (or significance) of the improvement remained unknown due to the lack of detail

provided about the content and duration of previous intervention undertaken with this population. Finally, it was hypothesised that pre-service teachers with weaker underlying literacy skills such as spelling and reading comprehension, would demonstrate improvements to a lesser extent than their peers with strong or typical spelling and reading comprehension skills.

7.2. Method

7.2.1. Participants

The same first year cohort of undergraduate pre-service teaching students from Study One (as outlined in Chapter Five) participated in this study ($n = 121$). All participants completed an assessment of their knowledge of language structure administered via group testing, that included measures of phoneme knowledge; syllable knowledge; morpheme knowledge; and orthotactic knowledge. This assessment was administered as part of the wider literacy battery outlined in Study One. As is typical of this degree, the cohort was female dominated, resulting in 93 female and 28 male participants. There was no selection criteria for this study beyond the requirement of enrolment for the undergraduate degree and being in the initial year of education at the time. There were therefore no students excluded from the study, which consequently ensured that the cohort of participants was, as much as possible, representative of this group of adults.

7.2.1.1. Subgroups of Participants Determined by Spelling Ability

Amongst the 121 students who completed the assessment, two subgroups were identified based on performance on the spelling measure (see Chapters Three and Four for details). The highest scoring 20 percent of participants on this measure were identified as a group of ‘good spellers’ ($n = 24$), and comprised 4 male and 20 female participants. The

lowest scoring 20 percent of participants were identified as a group ‘poor spellers’ ($n = 24$), and this group contained 6 male and 18 female participants. The performances of these two groups on the included measures are outlined in Table 7.1.

Table 7.1. *Scores obtained at pre-intervention assessment by the subgroup of poor spellers and the subgroup of good spellers*

	Poor Spellers ($n = 24$)	Good Spellers ($n = 24$)
	<i>M (SD)</i>	<i>M (SD)</i>
Spelling (24)	10.79 (1.48)	19.88 (0.91)
Reading Comprehension (20)	9.50 (2.59)	12.46 (2.86)
Phoneme Knowledge (7)	3.21 (1.59)	4.33 (1.27)
Syllable Knowledge (7)	5.79 (1.91)	6.79 (0.59)
Morpheme Knowledge (7)	1.88 (1.62)	1.75 (1.42)
Orthotactic Knowledge (6)	1.96 (1.20)	2.42 (0.97)
Total (27)	12.83 (3.20)	15.29 (2.31)

7.2.1.2. Subgroups of Participants Determined by Reading Comprehension Ability

A further subgroup of participants were identified based on performance on the measure of reading comprehension (total score of both texts from the initial assessment outlined in Study One). Students with scores that were one standard deviation (or more) below the mean on the measure of reading comprehension and who completed the current assessment of language structure knowledge, formed a subgroup who presented with difficulties understanding written text. This group ($n = 22$; henceforth referred to as the Difficulties with Written Text group - DWT) comprised 18 female, and 4 male participants.

The remaining participants who all performed within one standard deviation of the mean on the reading comprehension subtest ($n = 99$) formed the Typical Reading Comprehension group (referred to as TRC group). This group comprised of the remaining 75 female and 24 male participants. The performances of these two groups on the included measures are outlined in Table 7.2.

Table 7.2. Scores obtained at pre-intervention assessment by the subgroup of those with poor reading comprehension (DWT) and those with typical reading comprehension (TRC)

	DWT ($n = 22$)	TRC ($n = 99$)
	<i>M (SD)</i>	<i>M (SD)</i>
Reading Comprehension (20)	6.32 (1.52)	11.79 (2.59)
Spelling (24)	14.18 (2.99)	15.32 (3.43)
Phoneme Knowledge (7)	2.91 (1.66)	3.79 (1.45)
Syllable Knowledge (7)	5.86 (1.52)	6.23 (1.46)
Morpheme Knowledge (7)	1.59 (1.44)	1.74 (1.45)
Orthotactic Knowledge (6)	2.18 (1.01)	2.38 (1.22)
Total (27)	11.00 (3.18)	11.64 (3.52)

7.3. Procedure

This research study was undertaken throughout the second semester of the participants' initial undergraduate academic year. A pre-test / post-test experimental design was employed to determine the change in knowledge during the semester in which the intervention occurred. Pre-testing was undertaken during the first week of the semester, and post-testing during the last week of the semester. There was a period of seven weeks between

the two assessment points, during which seven hours of teaching instruction took place as part of the participants' literacy education paper.

7.3.1. Pre-testing

All students who were present in their initial lecture of their literacy education course in the second semester were asked to complete an assessment that was comprised of several different measures of literacy, including those relating to knowledge of language structure. This assessment was presented in lecture format, with the questions displayed using slides, and participant responses being self-recorded in an individual response booklet. The questions were read aloud in addition to their visual presentation on the large screens. Test conditions were assumed for the duration of the assessment, and participants were prompted to focus on their own work alone and were monitored by a group of supervisors.

Participants were asked questions relating to four different areas of language structure (see Appendix B for the full assessment battery utilised). All items within the phoneme, syllable, and morpheme tasks were taken from the Basic Language Constructs survey designed and employed by Binks-Cantrell, Joshi, et al. (2012). Items included in the orthotactic knowledge section were selected from three different sources, the same Basic Language Constructs survey (Binks-Cantrell, Joshi, et al., 2012), and two teacher knowledge assessments (Mather et al., 2001; Moats, 2000). For a comprehensive outline of the assessment measures and their derivation, please refer to Chapter Three of this thesis.

The first section of this assessment comprised seven items that examined phonemic awareness. Participants were asked to identify the number of phonemes in given stimuli words, from questions presented verbally and in written format. They were allowed two minutes to complete this task. The following two sections - the syllable knowledge task and morpheme knowledge task - utilised the same seven words, but required participants to

identify different elements. Questions were posed verbally and in written format (by slide presentation), with participants being asked to identify and write down how many syllables and then morphemes each of the stimuli words contained. Participants had three minutes to complete this task. Finally, participants were asked a series of six different multiple choice questions pertaining to orthotactic knowledge of the English language. Participants were presented with each question (and four or five optional multiple choice responses) both verbally and in written format (via slides). They were asked to mark their choice of answer in their response booklet, and had a total of four minutes and thirty seconds (forty-five seconds per question) to respond following the question presentation.

7.3.2. Intervention - Teaching

Participants were all enrolled on a literacy education course and received seven hours of direct teaching time specifically related to language structure over the course of the eight week teaching period. Attendance was not taken for these sessions therefore it was not possible to obtain attrition rates or calculate the exact level of absenteeism during this time. The course however was a requirement of the participants' degree which had a minimum attendance requirement. Further, lectures were recorded and available to students within an online learning environment (i.e., where students can 'catch up' if they have missed a session). It is thus anticipated that the majority of participants would have accessed the taught material during this period

The course teaching was divided as is outlined in Table 7.3. and included seven hours of direct, face-to-face teaching instruction, delivered by a tertiary educator and qualified Speech-Language Pathologist (please note that this was not the author of this thesis). It was ensured that the content of the teaching intervention did not include any of the items utilised within the pre- and post-intervention assessment measures.

Table 7.3. *Outline of teaching content delivered during the semester*

Number of Teaching Hours	Course Content Covered
1.5 hours	Orthotactic knowledge
1.5 hours	Morphological awareness / morphological relationships
4 hours	Phonological awareness / phonological knowledge

7.3.2.1. Teaching of Orthotactic Knowledge

A total of approximately one hour and thirty minutes was spent providing instruction including content relating to orthotactic knowledge. Spelling instruction included learning the principles required for understanding English orthography, such as phoneme-grapheme correspondence, letter order and sequence patterns, and orthographic conventions. Additionally, participants were taught common rules of the English language. Tasks completed by the participants included sorting words into different groups based on their orthographies and rules; analysing children's spelling examples and identifying the types of errors made (e.g., phonological; morphological; orthographic).

7.3.2.2. Teaching of Morphological Awareness and Morphological Relationships

Approximately one hour and thirty minutes of teaching time was dedicated to providing instruction covering content relating to morphological awareness and morphological relationships. Instruction included an in-depth explanation of the definition of a morpheme as well as examples of deconstructing words into their separate morphemes. Tasks completed by the participants throughout the period of teaching included identifying base (root) words and suffixes, as well as sorting words according to the orthographic change

made to the base word. Students were also introduced to teaching strategies aimed at building children's morphological awareness and spelling knowledge.

7.3.2.3. Teaching of Phonological Awareness

Approximately four hours was dedicated to teaching phonological awareness. Instruction included defining terms, providing context to explain the importance of this knowledge area in relation to literacy, and explanations of how to incorporate it into classroom teaching. Examples of tasks completed by the participants included breaking a word down into elements of onset and rime, (and subsequently identifying the phonemes within the word); activities involving phoneme identity, phoneme segmentation, and phoneme blending; and print to speech activities.

7.3.2.4. Teaching of Syllable Awareness and Syllable Knowledge

There was no time allocated to explicitly teach syllable knowledge as it was anticipated that most students would have a solid grounding in this area.

7.3.2.5. Additional Resources

It is impossible to quantify exactly how much time was allocated to various different areas of teaching, as in addition to the time outlined above, key teaching points were reiterated and emphasised as required throughout the course of the semester. Furthermore, all the teaching outlined above was supplemented by activities provided in an online learning environment that was available to all students enrolled on this course (i.e., all participants in this study). It is therefore impossible to determine how much additional time (or indeed, if any) individual participants spent using this outside the allocated lecture time.

7.3.3. Post-testing

Following the period of intervention (teaching), the language structure survey was re-administered. All participants who completed the survey at pre-assessment also completed the survey at post-assessment. Due to the conditions of the post-assessment being those of a structured examination, questions were presented in written format as part of the examination paper only (rather than via PowerPoint slides and verbal administration, as was the case in the pre-assessment). Furthermore, participants were confined by the overall time constraints of the examination, rather than the individual tasks themselves. That said, this section of the examination paper was included in the middle of the paper in its entirety, and it is anticipated that the majority of participants would have attempted these questions well within the time given.

7.3.4. Reliability

Inter-rater reliability was completed for twenty percent of participants' response sheets at both pre- and post-assessment points. The rater was a qualified Speech-Language Pathologist, independent to the research project and provided with a clear marking schedule. Reliability was established through scoring responses and either marking them correct or incorrect. A level of inter-rater agreements on the scoring of these assessments was 98.7 percent, with errors identified as human error in marking rather than disagreement in inter-rater opinion. These errors were amended and the responses rechecked and scored. All remaining response sheets were checked for accuracy of marking and scoring to ensure that prior to data entry, all data were rechecked and any errors were corrected.

7.4. Results

Four research questions were identified at the outset of this study, with the overall question of how effective teaching intervention focussing on the components of language structure required for the teaching of reading. To answer the four research questions outlined in the introduction of this study the following analyses were conducted using SPSS (Version 20.0):

1. Descriptive statistics were examined to ascertain the level of presenting knowledge at pre-assessment amongst the group as a whole.
2. Between-group comparisons were made between the group of poor spellers and the group of good spellers to ascertain whether difference existed in their pre-intervention assessment scores in each of the language structure subtests. Similarly, between-group comparisons were made between the DWT group and the TRC group to determine whether differences existed in the knowledge of these two groups at pre-intervention assessment.
3. Comparisons were made between pre- and post-intervention assessment scores of the whole cohort to determine whether change had occurred at a group level.
4. The changes made over the period of intervention by the two groups of poor / good spellers were compared to identify whether differences existed in the type and volume of change made. The same analyses were conducted with the two groups with varying reading comprehension ability (DWT and TRC groups).

7.4.1. Pre-intervention Assessment Findings

7.4.1.1. Pre-service Teachers' Knowledge of Language Structure – Whole Cohort

The initial research question sought to identify the level of knowledge relating to language structure with which first year undergraduate pre-service teachers present. The

means, standard deviations, and ranges of scores were calculated for the whole cohort ($n = 121$) and are presented in Table 7.4. below.

Table 7.4. *Pre-intervention assessment scores of language structure knowledge for the whole cohort*

	Mean (<i>M</i>)	Standard deviation (<i>SD</i>)	Range
Phoneme Knowledge (7)	3.63	1.52	0 – 7
Syllable Knowledge (7)	6.17	1.47	0 – 7
Morpheme Knowledge (7)	1.71	1.45	0 – 5
Orthotactic Knowledge (6)	2.35	1.18	0 – 6
Total (27)	11.52	3.46	3 – 20

Participants demonstrated strongest knowledge in their ability to identify syllables, for which the mean cohort was reported to be almost at ceiling, at 88.1 percent. Phoneme knowledge was found to be next, with participants identifying the number of phonemes in a little over half of the items correctly (51.9 percent). The next strongest knowledge area was reported to be in the area relating to orthotactic knowledge, whereby participants responded to the multiple choice questions correctly for approximately 39.2 percent of the stimuli. Finally, the weakest knowledge area amongst this group was identified as morpheme knowledge, with participants correctly identifying the number of morphemes in a word for less than two of the seven stimuli words presented (24.4 percent). The range of scores for each of these knowledge areas assessed varied greatly, with scores spanning across the full range in phoneme, syllable, and orthotactic knowledge, but no participants obtained the

maximum score achievable on the morpheme knowledge questions, which appears to reflect the lower mean score. The total score outlined in Table 7.4. shows a score calculated by summing the scores for each individual across each of the four assessment areas, and then calculating the mean for the cohort. The mean for the total score was reported to be slightly under half (42.7 percent) of the questions answered correctly, but again the range was large spanning from a minimum of three, and a maximum of twenty correct responses across all of the four language structure measures.

7.4.1.2. Pre-service Teachers' Knowledge of Language Structure – Poor Spellers Compared to Good Spellers

Descriptive statistics were calculated for the two subgroups of spellers identified, namely, poor spellers ($n = 24$), and good spellers ($n = 24$), as were previously outlined in the method and in Table 7.1. The calculated difference in spelling ability between these two groups was highly significant [$t(46) = 25.6, p < .001, d = 7.391$] and reflected a very large effect size. Independent samples t -tests were performed to identify whether any differences existed between the language structure knowledge of the poor spellers and good spellers. Significant differences were identified between the scores obtained by the two groups at the pre-assessment point the areas of phoneme knowledge [$t(46) = 2.71, p = .009, d = 0.778$]; syllable knowledge [$t(46) = 2.45, p = .021, d = 0.707$]; and total language structure score [$t(46) = 3.05, p = .004, d = 0.881$]. This presents a medium effect size for phoneme and syllable knowledge, and a large effect size between the total language structure knowledge scores of the two groups (J. W. Cohen, 1988). In all cases, the group of good spellers outperformed the group of poor spellers. There were no significant differences identified at this pre-intervention assessment point in the remaining two subtests of morpheme knowledge and orthotactic knowledge.

7.4.1.3. Pre-service Teachers' Knowledge of Language Structure – DWT group compared to TRC group

Descriptive statistics were calculated for the two subgroups of participants; those with poor reading comprehension (DWT group; $n = 22$) and individuals who scored within one standard deviation of the whole cohort mean on the reading comprehension ability assessment task (TRC group; $n = 99$). These values have been presented previously in this chapter in Table 7.2. The calculated difference in reading comprehension ability between these two groups was highly significant [$t(119) = 52.4, p < .001, d = 2.584$] and reflected a very large effect size. Independent samples t -tests were performed to identify whether any differences existed between the language structure knowledge of the DWT when compared to the TRC group. A significant difference was identified between the two groups at this pre-assessment point in the area of phoneme knowledge [$t(119) = 2.51, p = .014, d = 0.564$] whereby the participants included in the TRC obtained higher scores than the participants of the DWT group. This reflects a medium effect size for this difference. No other significant differences were found between the two groups in the other subtests of language structure assessed at this pre-intervention time point.

7.4.2. Pre- to Post-intervention Assessment Findings

Descriptive statistics were calculated for the whole cohort's performance at post assessment, and these are shown in Table 7.5.

Table 7.5. *Post-intervention assessment scores of language structure knowledge for whole cohort*

	Mean (<i>M</i>)	Standard deviation (<i>SD</i>)	Range
Phoneme Knowledge (7)	5.10	1.30	1 – 7
Syllable Knowledge (7)	6.26	1.41	0 – 7
Morpheme Knowledge (7)	3.51	1.57	0 – 7
Orthotactic Knowledge (6)	3.93	1.27	0 – 6
Total (27)	18.80	3.76	1 – 25

7.4.2.1. Changes Made by the Whole Cohort

To identify whether any change had been made to knowledge of language structure over the period of teaching (intervention), paired samples *t*-tests were conducted to compare the pre-intervention and post-intervention assessment data for the whole group ($n = 121$). Each measure of language structure was analysed separately and outlined below under the relevant headings.

7.4.2.1.1. Phoneme knowledge.

Participants' knowledge of phonemes and their ability to identify them within words demonstrated a significant increase in score from pre-assessment ($M = 3.63$, $SD = 1.52$) to post-assessment ($M = 5.10$, $SD = 1.30$) [$t(120) = 9.47$, $p < .001$, $d = 1.04$]. The mean increase in scores was 1.47, and the effect size reported for this change ($d = 1.04$) indicated that it was large.

7.4.2.1.2. Syllable knowledge.

There was no significant difference in mean scores obtained by the cohort of participants in their ability to identify syllables in words. There was a marginal increase in mean score from pre-assessment ($M = 6.17$, $SD = 1.47$) to post-assessment ($M = 6.26$, $SD = 1.41$), however this was not found to be significant, [$t(120) = 0.603$, $p = .548$, $d = 0.06$].

7.4.2.1.3. Morpheme knowledge.

Participants' knowledge of morphemes and their ability to identify them within words demonstrated a significant increase in score from pre-assessment ($M = 1.71$, $SD = 1.45$) to post-assessment ($M = 3.51$, $SD = 1.57$), [$t(120) = 10.92$, $p < .001$, $d = 1.19$]. The mean increase in scores was 1.80, and the effect size reported for this change ($d = 1.19$) indicated that it was large.

7.4.2.1.4. Orthotactic knowledge.

The final area of knowledge for which pre- and post-assessment scores were compared was the area of orthotactic knowledge. Participants' knowledge across this area also demonstrated a significant increase in mean score for the cohort from pre-assessment ($M = 2.35$, $SD = 1.18$) to post-assessment ($M = 3.93$, $SD = 1.27$), [$t(120) = 11.20$, $p < .001$, $d = 1.29$]. The mean increase in scores was 1.58, and the effect size reported for this change ($d = 1.29$) indicated that it was large.

7.4.2.1.5. Total scores for knowledge of language structure.

One final paired samples t -test was conducted comparing the mean score across all measures of language structure for the entire cohort at pre- and post-assessment. Results demonstrated a significant difference from pre-assessment ($M = 11.52$, $SD = 3.46$) to post-

assessment ($M = 18.80$, $SD = 3.76$), [$t(120) = 29.37$, $p < .001$, $d = 2.01$]. The mean increase in scores was 1.58, and the effect size reported for this change ($d = 2.01$) indicated that scores had increased by over two standard deviations, which is considered to be very large.

The mean scores for each measure of language structure knowledge can be viewed as the percentage of items answered correctly, at pre- and post-intervention assessment points, in Figure 7.1. below. Figure 7.2. displays these scores as a percentage change for the whole cohort from pre- to post-intervention assessment points.

Figure 7.1. Scores obtained by the whole cohort on measures of language structure at pre- and post- intervention, expressed as percentage of items answered correctly

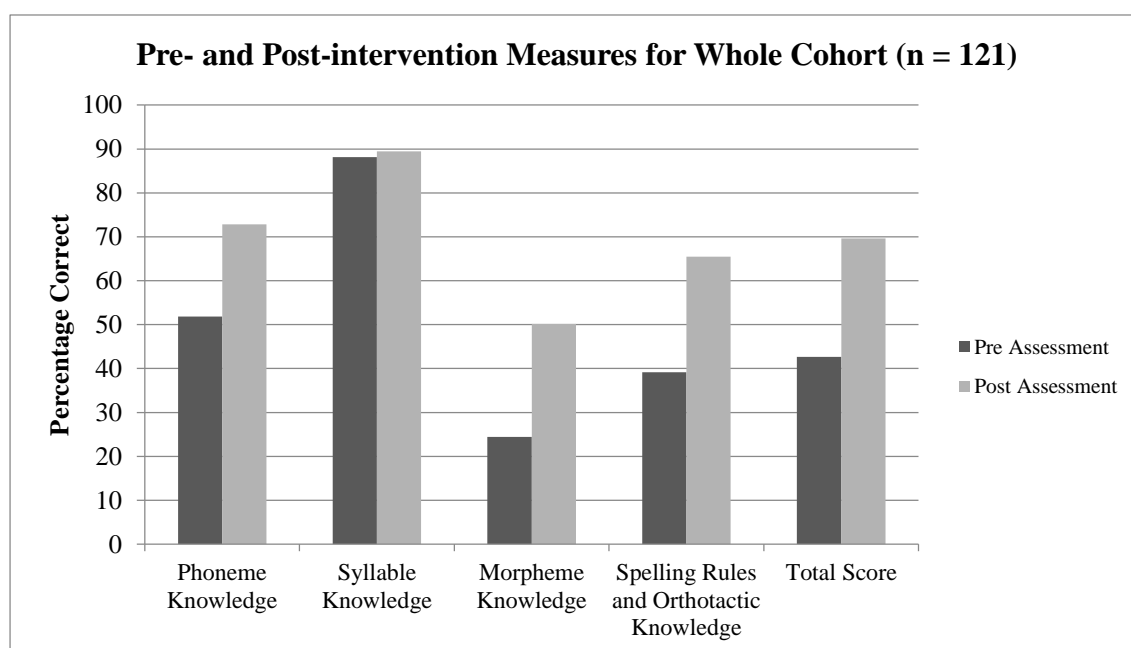
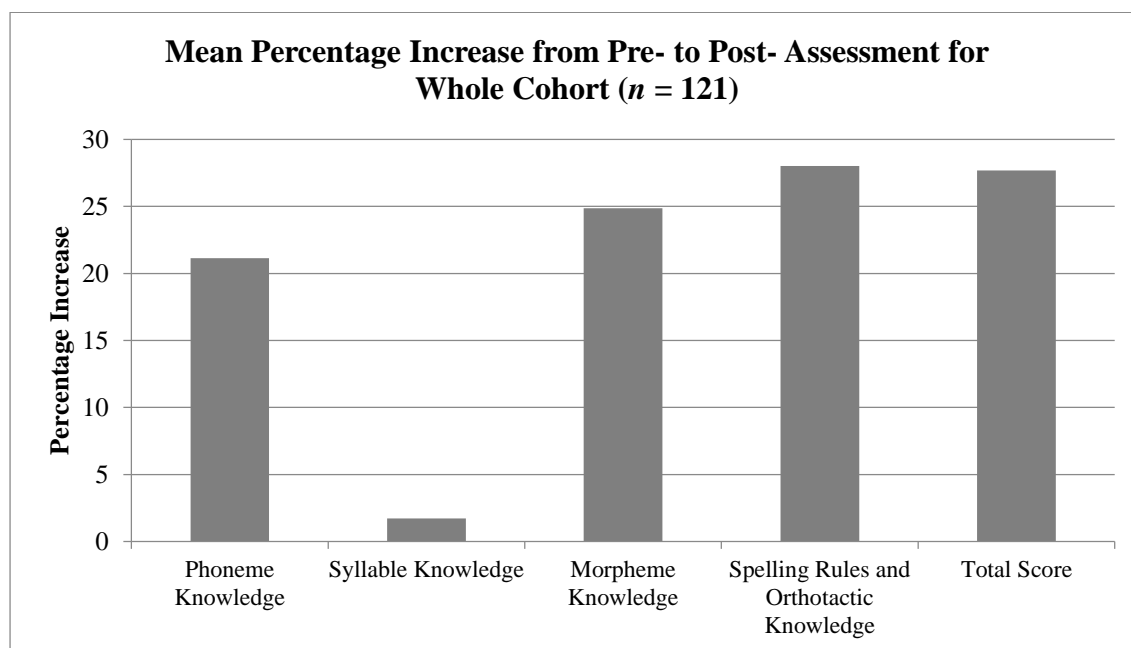


Figure 7.2. Scores for the whole cohort shown as percentage increase on all measures of language structure knowledge from pre- to post- intervention assessment



7.4.2.2. Changes Made from Pre- to Post-intervention by Poor Spellers Compared to Good Spellers

Descriptive statistics described the post-intervention assessment scores for the group of poor spellers and the group of good spellers (see Table 7.6.).

Table 7.6. Scores obtained at post-intervention assessment by poor and good spellers

	Poor Spellers (n = 24)	Good Spellers (n = 24)
	M (SD)	M (SD)
Phoneme Knowledge (7)	4.33 (1.61)	5.83 (0.48)
Syllable Knowledge (7)	5.54 (2.15)	6.71 (0.55)
Morpheme Knowledge (7)	2.54 (2.09)	4.00 (1.32)
Orthotactic Knowledge (6)	3.54 (1.50)	4.46 (1.10)
Total (27)	15.96 (5.57)	21.00 (2.02)

Analysis was then conducted for the two subgroups of poor and good spellers to identify the effectiveness of the teaching intervention for these two subgroups. A one-way between groups analysis of covariance (ANCOVA) was conducted to compare the effectiveness of the intervention, using the pre-intervention assessment scores as covariates. This enabled the differences in group scores at the pre-intervention assessment to be taken into account. The results of each ANOVA have been outlined under the relevant headings below.

7.4.2.2.1. Phoneme knowledge.

Both the poor spellers and good spellers demonstrated significant improvements in their scores on this measure following the period of intervention. Results from paired samples *t*-tests demonstrated a significant increase in score amongst the poor spellers from pre-intervention assessment ($M = 3.21$, $SD = 1.59$) to post-intervention assessment ($M = 4.33$, $SD = 1.61$), [$t(23) = 3.06$, $p = .006$, $d = 0.70$]; while the good spellers demonstrated a significant increase from pre-intervention assessment ($M = 4.33$, $SD = 1.27$) to post-intervention assessment ($M = 5.83$, $SD = 0.48$), [$t(23) = 5.57$, $p < .001$, $d = 1.56$].

Analysis using a one-way ANCOVA comparing the effectiveness of the intervention on the phoneme knowledge scores of poor spellers and good spellers, found a significant difference between the two groups on post-intervention assessment scores, $F(1, 45) = 11.93$, $p = .001$, partial eta squared = .210. This reported effect size indicates that the difference between the two groups was large.

7.4.2.2.2. Syllable knowledge.

Neither the poor spellers nor the good spellers demonstrated any significant difference in their syllable knowledge scores following the intervention. Furthermore, there was no

significant difference identified between the poor spellers and good spellers on this measure.

7.4.2.2.3. Morpheme knowledge.

Although they did demonstrate some improvement in their mean scores for the measure of morpheme knowledge, the subgroup of poor spellers did not demonstrate any significant change from pre- intervention assessment to post- intervention assessment. Paired samples *t*-tests performed using the scores from the subgroup of good spellers however demonstrated a significant increase in score in morpheme knowledge following the period of intervention. Results showed an increase from pre- intervention assessment ($M = 1.75$, $SD = 1.42$) to post- intervention assessment ($M = 4.00$, $SD = 1.32$), [$t(23) = 5.75$, $p < .001$, $d = 1.64$], indicating a large effect size for this change.

A significant difference was found between the poor spellers and the good spellers in their post-intervention assessment scores, $F(1, 45) = 10.70$, $p = .002$, partial eta squared = .192. This reported effect size indicates that the difference between the two groups was large.

7.4.2.2.4. Orthotactic knowledge.

Results from paired samples *t*-tests for each subgroup demonstrated a significant increase in scores on orthotactic knowledge following the intervention. The poor spellers demonstrated a significant increase from pre- intervention assessment ($M = 1.96$, $SD = 1.20$) to post- intervention assessment ($M = 3.54$, $SD = 1.50$), [$t(23) = 4.33$, $p < .001$, $d = 1.16$]; while the good spellers demonstrated a significant increase from pre- intervention assessment ($M = 2.42$, $SD = 0.97$) to post- intervention assessment ($M = 4.46$, $SD = 1.10$), [$t(23) = 7.89$, $p < .001$, $d = 1.97$].

Results from the one-way ANCOVA used for analysis of the effectiveness of the intervention on the orthotactic knowledge of the two subgroups found a significant difference

between the two groups on post-intervention assessment scores, $F(1, 45) = 4.45, p = .040$, partial eta squared = .090. This effect size indicates that the difference between the two groups was moderate.

7.4.2.2.5. Total scores for knowledge of language structure.

A final analysis comparing the effectiveness of the intervention on the total scores obtained for all knowledge of language structure tasks demonstrated a significant difference between the two groups on post-intervention assessment scores, $F(1, 45) = 8.19, p = .006$, partial eta squared = .154. This reported effect size indicates that the difference between the two groups was large.

7.4.2.3. Changes Made from Pre- to Post-intervention by the DWT Group Compared to the TRC Group

Descriptive statistics described the post-intervention assessment scores for the DWT group and the TRC group (see Table 7.7.).

Table 7.7. Scores obtained at post-intervention assessment by the DWT and TRC groups

	DWT group ($n = 22$)	TRC ($n = 99$)
	$M (SD)$	$M (SD)$
Phoneme Knowledge (7)	4.41 (1.22)	5.25 (1.27)
Syllable Knowledge (7)	5.82 (1.82)	6.35 (1.30)
Morpheme Knowledge (7)	3.95 (1.40)	3.41 (1.60)
Orthotactic Knowledge (6)	3.18 (1.40)	4.10 (1.18)
Total (27)	17.36 (3.29)	19.12 (3.79)

Analysis was conducted to investigate whether the students with poorer reading comprehension abilities (DWT group) responded in similar ways to the teaching intervention as their peers who presented with typical reading comprehension ability (TRC group). That is, would the teaching received be as effective (or ineffective) for all individuals whether or not they presented with reading comprehension difficulties at the outset? To determine this, independent samples *t*-tests were conducted to compare the mean knowledge of language structure scores for both the TRC and DWT groups at pre- and post-intervention assessment points, to determine potential change in score. A one-way between groups analysis of covariance (ANCOVA) was conducted to compare the effectiveness of the intervention, using the pre-intervention assessment scores as covariates. These are outlined under the relevant headings below.

7.4.2.3.1. Phoneme knowledge.

Both groups determined by reading comprehension ability demonstrated significant improvements in their scores on this measure following the period of intervention. Results from paired samples *t*-tests showed a significant increase in score amongst the DWT group from pre-intervention assessment ($M = 2.91, SD = 1.66$) to post-intervention assessment ($M = 4.41, SD = 1.22$), [$t(21) = 4.11, p < .001, d = 1.02$]; while the TRC group demonstrated a significant increase from pre-intervention assessment ($M = 3.79, SD = 1.45$) to post-intervention assessment ($M = 5.25, SD = 1.27$), [$t(98) = 8.49, p < .001, d = 1.07$]. These two effect sizes reflect similar changes by both groups on this measure.

Analysis using a one-way ANCOVA comparing the effectiveness of the intervention on the phoneme knowledge scores of those with poor reading comprehension (DWT group) and those with typical reading comprehension (TRC group) found a significant difference between the two groups on post-intervention assessment scores, $F(1, 118) = 5.04, p = .027$,

partial eta squared = .041. This reported effect size indicates that the difference between the two groups was small.

7.4.2.3.2. Syllable knowledge.

There was no significant difference in the syllable scores of either group (DWT or TRC) following the teaching intervention.

7.4.2.3.3. Morpheme knowledge.

Significant changes were evident in the analyses of both groups of participants (both DWT and TRC) from pre- intervention assessment to post- intervention assessment. Paired samples *t*-tests performed using the scores from the DWT group demonstrated a significant increase in morpheme knowledge score from pre-intervention assessment ($M = 1.59$, $SD = 1.43$) to post- intervention assessment ($M = 3.95$, $SD = 1.40$), [$t(21) = 5.94$, $p < .001$, $d = 1.67$], indicating a large effect size for this change. There was also a significant increase in the scores of the TRC group following the teaching intervention from pre-intervention assessment ($M = 1.74$, $SD = 1.45$) to post- intervention assessment ($M = 3.41$, $SD = 1.60$), [$t(98) = 9.32$, $p < .001$, $d = 1.09$], again, indicating a large effect size for this change. Although both groups demonstrated a significantly large increase in morpheme knowledge score following the period of intervention, the DWT group demonstrated a greater amount of change.

Although both groups made significant increases in their scores from pre-intervention to post-intervention assessment, analysis using a one-way ANCOVA did not find any differences between the groups when including the pre-intervention assessment scores as a covariate.

7.4.2.3.4. *Orthotactic knowledge.*

Results from paired samples *t*-tests for each subgroup demonstrated a significant increase in scores on orthotactic knowledge in both groups following the intervention. The DWT group demonstrated a significant increase from pre-intervention assessment ($M = 2.18$, $SD = 1.01$) to post-intervention assessment ($M = 3.18$, $SD = 1.40$), [$t(21) = 2.98$, $p = .007$, $d = 0.82$]; while the TRC group demonstrated a significant increase from pre-intervention assessment ($M = 2.38$, $SD = 1.22$) to post-intervention assessment ($M = 4.10$, $SD = 1.18$), of [$t(98) = 11.15$, $p < .001$, $d = 1.43$]. While both changes reported reflect a large effect size, the change made by the TRC was almost twice as large as the change made as the DWT on this morpheme measure.

Results from the one-way ANCOVA used for analysis of the effectiveness of the intervention on the orthotactic knowledge of the two subgroups found a significant difference between the two groups on post-intervention assessment scores, $F(1, 118) = 9.53$, $p = .003$, partial eta squared = .075. This effect size indicates that the difference between the two groups was moderate.

7.4.2.3.5. *Total scores for knowledge of language structure.*

Final paired samples *t*-tests were undertaken using the combined totals of all subtests from pre-intervention and post-intervention assessment scores for each group. The DWT group demonstrated a significant increase from pre-intervention assessment ($M = 11.00$, $SD = 3.12$) to post-intervention assessment ($M = 17.36$, $SD = 3.29$), [$t(21) = 9.37$, $p < .001$, $d = 1.98$], reflecting a very large effect size for this total change in score. The TRC group demonstrated a significant increase from pre-intervention assessment ($M = 11.64$, $SD = 3.52$) to post-intervention assessment ($M = 19.12$, $SD = 3.79$), [$t(98) = 28.77$, $p < .001$, $d = 2.05$] reflecting almost the same effect size as was shown by the DWT group.

A final analysis comparing the effectiveness of the intervention on the total scores obtained for all knowledge of language structure tasks demonstrated a significant difference between the two groups on post-intervention assessment scores, $F(1, 118) = 4.23, p = .041$, partial eta squared = .035. This reported effect size indicates that the difference between the two groups was small.

7.5. Discussion

This study investigated the metalinguistic knowledge of pre-service teachers during their first year of undergraduate study, and the effect of explicit teaching instruction on this language structure knowledge. The total number of participants who participated in this pre- and post-intervention assessment design was 121, with further subgroups of good spellers ($n = 24$), poor spellers ($n = 24$), participants with difficulties understanding written text ($n = 22$), and participants with typical reading comprehension skills ($n = 98$), identified for analyses. Data were analysed to examine: a.) pre-intervention scores of language structure knowledge for the whole cohort; b.) between-groups differences in pre-intervention knowledge of language structure amongst poor and good spellers, and participants with poor and typical reading comprehension skills; c.) pre- to post-intervention change in language structure knowledge for the whole cohort; and d.) between-groups differences in pre- to post-intervention change in knowledge of language structure amongst poor and good spellers, and participants with poor and typical reading comprehension skills.

7.5.1. Weaknesses in the Language Structure Knowledge of Pre-service Teachers

The first hypothesis of this study proposed that results from the pre-assessment of metalinguistic knowledge of this cohort of pre-service teachers would reflect previous findings, demonstrating relatively poor skills. This hypothesis was supported by descriptive

analysis of the data from the whole cohort of participants demonstrating weak knowledge in the subtests of phoneme knowledge, morpheme knowledge, and orthotactic knowledge. The only subtest in which the whole cohort demonstrated a consistently high level of knowledge was the subtest requiring identification of the number of syllables in seven individual stimuli words. Participants' overall combined scores (from all four subtests) reflected a mean cohort score of just over forty percent of the total items answered correctly.

The findings reported in this study are concurrent with findings from previous research outlining the poor metalinguistic knowledge of pre-service teachers both internationally (Fielding-Barnsley, 2010; Mather et al., 2001; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003; Washburn, Joshi, & Binks-Cantrell, 2011), and in New Zealand (Carroll et al., 2012). These findings add further weight to the call for explicit teaching in higher education of the language constructs required in reading instruction.

7.5.2. Disparity between the Language Structure Knowledge of Participants with and without Weaknesses in their Underlying Literacy Skills

When examining the language structure knowledge of pre-service teachers, it was considered that different groups of participants may present with different levels of knowledge and ability. The second hypothesis outlined in this study proposed that pre-service teachers with either spelling or reading comprehension difficulties would present with weaker language structure knowledge than their peers with strong / typical spelling or reading comprehension ability. This hypothesis was well supported by the results from the two groups of spellers. There were significant differences outlined between the good and poor spellers, with participants who had good underlying spelling ability demonstrating significantly higher scores in areas of phoneme knowledge, syllable knowledge, and on their overall combined score, than the group of poor spellers. The lack of significant difference

between the two groups on the morpheme measure was unexpected, however scores for all groups were very low, which may have prevented the identification of any level of significance. This hypothesis was not strongly supported by the groups determined by reading comprehension ability (DWT and TRC groups), whereby a significant difference was only found in performance on the measure of phoneme knowledge. The TRC demonstrated significantly higher scores than the DWT group on this measure.

These findings suggest that reading comprehension ability does not influence the knowledge of language structure that pre-service teachers present with (with the exception of phoneme knowledge), whereas spelling ability influences participants' knowledge of language structure on a greater number of measures. This supports the findings of Spear-Swerling and Brucker (2006) who demonstrated that both reading and spelling skills have strong relationships with word structure knowledge.

7.5.3. Improvement in the Language Structure Knowledge of Pre-service Teachers

Following a Period of Explicit Teaching Specifically Targeting these Skills

The third hypothesis held that intervention providing explicit teaching of language structure knowledge and skills would result in improved performance on the assessment administered post-intervention. Post-intervention assessment scores demonstrated significant improvement by the whole cohort on all measures targeted in the teaching intervention received (phoneme knowledge, morpheme knowledge, orthotactic knowledge, and total combined score). Effect sizes were very large for changes made in each of these measures (figures of $d = 1.04-1.29$ for subtests, and 2.01 for change in total combined score). The one measure that did not demonstrate any significant improvement was that of syllable knowledge, which was not included in the teaching instruction received by participants.

Results supporting this hypothesis demonstrated that change can be made within a relatively short period of time (seven weeks), with small levels of teaching input (a total of seven hours of intervention). Although there are limitations in comparison gains across studies given the difference in the language structure assessments used, the gains made by the whole cohort were larger than those reported in previous research (e.g., Spear-Swerling & Brucker, 2003; Stainthorp, 2004). Furthermore, these gains were made across three different knowledge areas – phoneme knowledge, morpheme knowledge, and orthotactic knowledge – rather than being limited to only one.

7.5.4. Variance in the Responses to Teaching Intervention Depending on Underlying Component Literacy Skills of Spelling and Reading Comprehension

Finally, it was hypothesised that pre-service teachers with weaker underlying literacy performance in spelling and reading comprehension would demonstrate improvements to a lesser extent than their peers with strong or typical spelling and reading comprehension skills. Two analyses were undertaken to determine whether this hypothesis held true or not. The first examined the pre- to post-intervention change made by a group of poor spellers compared to a group of good spellers. When performance at the initial pre-intervention assessment was controlled for, significant differences were found between the two groups determined by spelling ability. Differences demonstrated large effect sizes between the groups on phoneme knowledge, morpheme knowledge, and total score (partial eta squared = 0.154-0.210), with a moderate effect size (partial eta squared = .090) between the two groups on orthotactic knowledge. In each case, the group of good spellers outperformed the group of poor speller, even when accounting for their initial level of knowledge. These results suggest that pre-service teachers who possessed good underlying spelling ability made larger

improvements following the teaching intervention than their peers with poor spelling ability at the outset.

The second analysis examined the effectiveness of the teaching intervention with a group of participants with difficulties understanding written text (DWT group) compared to the remainder of the whole cohort who presented with reading comprehension skills within one standard deviation of the cohort mean. When performance at the initial pre-intervention assessment was controlled for, significant differences were found between these two groups. Differences demonstrated small effect sizes between the groups on phoneme knowledge, and total score, with a moderate effect size between the two groups on orthotactic knowledge. In each case, the TRC outperformed the DWT group. These results suggest that pre-service teachers who possess typical or good underlying reading comprehension ability made larger improvements following the teaching intervention than their peers with poorer reading comprehension. These improvements were more isolated to specific areas than the improvements identified according to spelling ability. Furthermore, the relationship between reading comprehension ability and knowledge of language structure is not as strong as the relationship between underlying spelling ability and knowledge of language structure.

7.5.5. Limitations

It is important to interpret the outcomes from this study with additional consideration to the limitations. First, the pre- and post-assessment study design called for two assessment points to determine the effectiveness of the teaching intervention. A period of approximately 10 weeks passed between these two assessment points, however the same assessment was used at each time point. It is recognised that there is the possibility that scores at pre-intervention assessment may have been influenced by the experience of the initial administration of the assessment, thus possibly demonstrating a practice effect. The enormity

of the effect sizes from pre- to post-intervention, however, suggest that even if a practice effect was observed, the change cannot solely be attributed to that alone. Furthermore, the differentiated response to intervention exhibited by the subgroups of participants provides evidence for some of the change being in response to the teaching intervention. If the change in score was only attributable to a pre-test, post-test practice effect the gain in score made by participants would be expected to be similar for each individual. Ideally, a matched pre- and post-assessment would have been delivered, but this was not possible within the context of this research. Such considerations should be addressed within future research.

Secondly, the number of items included in the individual knowledge tasks were limited (due to time constraints), with only six or seven items per knowledge area. A small number of items limited the variance of the results, which may have subsequently impacted upon the statistical findings. A more comprehensive and larger assessment would have been ideal and should be included in further iterations of this assessment.

One further point of note is that the groups determined by reading comprehension ability did have slightly different teaching experiences throughout the period of intervention. Although the teaching specific to language structure constructs received was the same for each group, the DWT group also received intervention that focussed on teaching them reading comprehension strategies (as outlined in Chapter Five). While it is not anticipated that this directly influenced participants' knowledge in areas of language structure, it may have influenced the statistical analysis investigating the relationship of reading comprehension and language structure knowledge over the language structure intervention period. Although the DWT group were significantly different in their reading comprehension scores to the TRC group at the outset of this study, their mean group scores improved to within average by the post-intervention assessment point of this study.

Finally, these findings have implications for the ability of the pre-service teachers to transfer their knowledge into the classroom environment, in their reading instruction to students. Two further aspects of research would be pertinent: firstly a follow-up assessment at a later point in time to confirm whether the reported gains have been retained over time; and secondly further investigation is required to ascertain participants' ability to transfer and integrate their knowledge of language structure into their own teaching of reading within the classroom context.

7.5.6. Conclusions

The results from this study indicate that a group of pre-service teachers (comprising only undergraduate first year students) present with relatively low levels of language structure knowledge. A short teaching intervention (i.e. seven hours, over seven weeks), demonstrated the ability to create significant changes in all knowledge areas at the whole cohort level. Moreover, while the intervention was found to be beneficial for all participants, the relative gains made in knowledge appeared to be dependent on underlying skills in areas of literacy, and most predominantly influenced by spelling ability.

CHAPTER EIGHT

GENERAL DISCUSSION

8.1. Introduction

Adults entering into higher education have been assumed to possess strong literacy abilities. The findings from this thesis add to the literature calling this assumption into question, depicting the broad range of skills that adults, such as pre-service teachers, present with in higher education (Benevides & Peterson, 2010; Coltheart & Prior, 2006; Fielding-Barnsley, 2010; Milton et al., 2007; Moats, 1994). Difficulties in areas of literacy, such as reading comprehension, can negatively impact educational achievement in higher education, where the linguistic and cognitive demands placed on individuals become much greater than in primary or secondary education (Cogmen & Saracalolub, 2009; Fidler & Everatt, 2012). Furthermore, for pre-service teachers, not only may difficulties with literacy adversely affect their own attainment, a lack of knowledge or skill may also impact on their ability to provide effective reading instruction to their future students (Applegate & Applegate, 2004; Binks-Cantrell, Washburn, et al., 2012).

The assessment and intervention of children's literacy skills has been investigated and discussed in numerous studies spanning decades. In contrast, there has been limited research examining the literacy abilities of adults, and in particular, a paucity of research with adults who present with literacy proficiency above the eighth-grade level (e.g., those in higher education). An understanding of the literacy skills that adults exhibit when entering higher education and the benefits of intervention aimed to improve weaker skills in individuals, could provide tertiary institutions with valuable information to support adults within this environment. To achieve this, studies in this thesis assessed a broad range of literacy skills

within a cohort of initial year undergraduate pre-service teachers, and implemented two different intervention programmes: 1) a reading comprehension intervention comprised of four different strategies for individuals with identified difficulties relative to their peers, and 2) an intervention integrated into an existing literacy course, comprising explicit teaching of language structure concepts for the whole cohort. More specifically, the following research questions were addressed:

1. What range of skills and knowledge within selected aspects of literacy is present in undergraduate pre-service teachers on entry into higher education?
2. Using measures to assess areas of hypothesised potential literacy difficulty amongst skilled adult readers, which specific skills contribute to reading comprehension? Can the findings be placed within a theoretical framework, or model, of reading comprehension?
3. Do pre-service teachers who present with difficulties understanding written text differ on additional measures of literacy, to their peers without difficulties? Is there an identifiable pattern of difficulties for adults with difficulties understanding written text within this population?
4. How effective are four different interventions aiming to increase reading comprehension ability for adults who present with difficulties understanding written text?
5. Is explicit teaching of language structure concepts for pre-service teachers effective in increasing their knowledge in areas of phoneme knowledge, morpheme knowledge, and orthotactic knowledge?

In order to answer these questions, a series of four studies were undertaken. The following section (8.2.) briefly examines each research question in turn, and how the current

research has addressed them. A discussion of the overarching conclusions drawn from this thesis as a whole is subsequently presented (section 8.3. onwards).

8.2. Summary of Findings

8.2.1. Identification of the range of literacy skills and knowledge of pre-service teachers on entry into higher education

The first study investigated the literacy abilities of pre-service teachers in their initial year of undergraduate education. Several measures were included in the assessment, based on areas of hypothesised potential difficulty. Results from a cohort of 131 participants identified a very broad range of performance across all the measures (spelling, reading comprehension, inferencing, language structure knowledge, and working memory). These results demonstrated the overall diversity of this particular pre-service teacher cohort, supporting prior postulations that pre-service teachers present with a wide range of literacy skills (e.g., Coltheart & Prior, 2006; Fielding-Barnsley, 2010).

The largest range in scores were demonstrated in measures of reading comprehension, spelling, working memory, and language structure knowledge. Weaknesses were identified for the whole cohort in knowledge related to morpheme awareness, phoneme awareness, and orthotactic knowledge, consistent with existing research reporting low metalinguistic knowledge amongst pre-service teachers (Moats, 1994; Washburn, Joshi, & Binks-Cantrell, 2011). Inferencing ability displayed a distinct disparity amongst participants, with many scoring at, or close to, ceiling on this measure, yet a discrete group of individuals scoring well below the cohort mean. These findings are concurrent with earlier adult research, suggesting that performance on inferencing tasks allow for the differentiation between skilled and less skilled readers (Hannon & Daneman, 1998; Long et al., 1994).

The overall findings from this research argue for higher education institutions to recognise that pre-service teachers present with a wide range of literacy abilities and knowledge. While research has typically focussed on the identification of areas of support for ABE students, the current research proposes that this is also required for individuals with a greater degree of literacy competence.

8.2.2. Skills contributing to reading comprehension from the measures assessed, and their place in a theoretical framework

Following assessment of the large cohort of pre-service teachers, predictors of reading comprehension were identified from the results of the selected literacy measures. When considered in its entirety, the assessment battery accounted for approximately 31 per cent of the total variance in reading comprehension. The skills of spelling, inferencing, and working memory were each found to make unique contributions to reading comprehension, with inferencing demonstrating the highest level of contribution. It is possible that the addition of further measures in the assessment battery would have augmented the level of variance explained in reading comprehension. Conversely, however, it is also possible that these individuals present with such complex interactive profiles, and a large degree of compensatory technique, that the total level of explainable variance may remain low.

It has been hypothesised that inferencing assumes a much larger role in reading comprehension as an individual progresses through education (Cartwright, 2009). Findings from the current research, not only provide support for this hypothesis in reading comprehension, but also demonstrate the influence of inferencing upon other component literacy skills such as working memory and spelling.

Analysis of the data from Study One demonstrated a complex, interactive approach to reading comprehension, and suggested that the SVR might not be the most appropriate model

of reading comprehension to describe the abilities of this population. Further, the findings from this research suggests that models with a greater degree of interaction between components (such as the construction-integration or the compensatory integration model) may be more fitting.

8.2.3. Difference in literacy skills between pre-service teachers with and without difficulties understanding written text

Study Two used the results from the reading comprehension measure in large scale assessment (Study One), to identify individuals who presented with difficulties understanding written text compared to their peers. Significant differences were found between the two groups (those with, and those without difficulties understanding written text) on all included additional measures of literacy. Furthermore, individuals with difficulties understanding written text were over-represented in the group of individuals who presented with difficulties across the entirety of the literacy assessment battery administered. Results from standardised assessment of individuals with difficulties understanding written text demonstrated a mean cohort score below the expected range in listening comprehension. Other measures, including expressive and receptive vocabulary, demonstrated a wider range of scores but the majority of individuals scored within the expected range.

The findings from this group of participants who were identified as presenting with difficulties understanding written text are consistent with the existing research describing reading comprehension as the goal of reading (Nation, 2005; Paris & Hamilton, 2009). Moreover, they support the notion that assessment of reading comprehension ability provides a strong indication of individuals who present with general literacy difficulties.

8.2.4. The effectiveness of strategies as a reading comprehension intervention for pre-service teachers presenting with difficulties understanding written text

Studies Two and Three examined the effectiveness of four different strategies used as an intervention designed to increase reading comprehension. Results were analysed at both the whole group, subgroup, and individual level, and scores achieved at the pre- and post-intervention assessments were compared to two groups who did not undertake the intervention. Results demonstrated a highly significant change in the mean reading comprehension scores of the intervention group from pre- to post-intervention. Comparison groups did not display any significant changes in their mean reading comprehension score throughout the duration of the intervention. Of the four strategies included in this intervention, text-to-speech was detrimental to the reading comprehension abilities of almost all participants. While this strategy has been frequently advocated for use in higher education for individuals who have a diagnosis of dyslexia (Draffan et al., 2007), it is possible that the word decoding difficulties in the current population were not low enough for this strategy to be beneficial (Higgins & Zvi, 1995). Conversely, a strategy utilising a technique of highlighting and summarising produced the largest increase in score amongst the participants who completed the intervention. This adds weight to studies that advocate for the use of metacognitive strategies with adults with weaker reading comprehension (e.g., Mellard et al., 2010; Thiede et al., 2003).

Study Three investigated the response to the reading comprehension intervention of smaller subgroups and individual participants, through the examination of underlying literacy skills. It was not possible to identify any differences in the response to the intervention made at a subgroup level (grouped according to underlying literacy difficulties). Further, examination of the literacy profiles of four participants did not allow for any clear conclusions to be made, in consensus with the examination of the subgroups. These results

argued against the practicality of providing specific reading comprehension strategies to individuals based on their literacy profile, thus reflecting the conclusions made by Fidler (2009).

8.2.5. Effectiveness of explicit teaching of language structure concepts for pre-service teachers as an integrated part of all students' learning

The final study (Study Four) sought to identify the response of the whole cohort of pre-service teachers to a teaching intervention, with the objective of increasing their metalinguistic knowledge. Results obtained following the period of teaching intervention demonstrated a significant change in whole cohort score in each of the measures targeted (phoneme, morpheme, and orthotactic knowledge). This builds on the existing literature calling for the inclusion of explicit teaching of metalinguistic concepts (e.g., Moats & Foorman, 2003) by demonstrating the successful application of this within an existing pre-service teacher literacy course.

Analysis of the results obtained by several subgroups of participants demonstrated differences in the responsiveness of individuals to the teaching intervention. This therefore argues that the provision of the same teaching to all students does not necessarily provide them with an adequate level of knowledge to subsequently provide reading instruction to children within the classroom. Results from the current study argued that despite the increase in mean scores of the whole cohort, individuals who presented with stronger spelling skills at the outset of intervention responded more favourably. This echoes similar results portrayed by Stainthorp (2004) and Spear-Swerling and Brucker (2003) following intervention targeting metalinguistic knowledge, whereby although several participants still demonstrated difficulties, several presented with near ceiling scores. The findings from Study Four of this

thesis allude to the specific strengths that may be present in students who respond positively to this type of teaching intervention.

8.3. Theoretical Implications

8.3.1. Literacy skills of Pre-service Teachers in Higher Education

Research examining adults' literacy skills has reported the high prevalence of literacy difficulties within the broader adult population (Baer, Kutner, & Sabatini, 2009; Kutner et al., 2007; Satherley et al., 2008). The existing research indicates that adults do not automatically acquire proficient literacy skills with age and development. Despite such findings, it is typically assumed that pre-service teachers who enter into higher education programmes possess an adequate level of literacy ability (Conaway et al., 2003). The results of the large scale assessment (Study One) indicated that the diversity and range of ability amongst this pre-service teaching population on entering higher education was extremely vast. Although these individuals had successfully completed examinations within compulsory schooling and demonstrated an adequate level of proficiency prior to their acceptance into university, a large degree of variance remained in their underlying literacy skills. Thus, a predetermined level of literacy ability cannot be assumed for all individuals within this population.

Analyses of the results obtained from the large scale assessment found several relationships between the literacy measures assessed. Three of these skills (spelling, inferencing, and working memory) made a direct contribution to reading comprehension, while the remaining skills assessed (phoneme, morpheme, syllable, and orthotactic knowledge) had less direct influence. The selected literacy skills included in the assessment were highly interactive between each other (not simply towards reading comprehension), thus demonstrating a complex process of reading comprehension amongst this skilled adult population. This is in contrast to earlier literature which suggested that the SVR is an

appropriate framework to explain the reading comprehension of higher education students (Macaruso & Shankweiler, 2010; Savage & Wolforth, 2007). The findings from these analyses are discussed below.

8.3.1.1. The Role of Spelling in Predicting Reading Comprehension

The word decoding constituent of reading comprehension, as outlined in the SVR (Gough & Tunmer, 1986; Hoover & Gough, 1990) was represented in this research by an individual's spelling ability. Spelling was found to make a significant unique contribution to explaining the variance in reading comprehension within this population. Although spelling reflects an individual's encoding skill, rather than direct decoding ability, spelling tasks call upon the same underlying skills as word decoding tasks, including knowledge of the sound system (phonology), letter patterns (orthography), and representation of meanings in the formulation of words (morphology) (Wolf & Kennedy, 2003). Furthermore, the spellings of 96 percent of words conform to phonological, morphological and orthographic rules (Masterson & Apel, 2007), thus necessitating individuals to develop phonological, morphological, and orthographic awareness (Wolter & Apel, 2010). Spelling was therefore selected as an indicator of participants' word level literacy within the context of the SVR to be evaluated within the group testing format.

Spelling contributes to reading comprehension through word level processes that create a mental representation of a word. Moreover, both spelling and reading comprehension share an important major commonality of language proficiency, which results in a very strong correlation between these two processes (Joshi, Treiman, Carreker, & Moats, 2008). Proficiency in the knowledge of the spelling of a word (using the metalinguistic knowledge outlined above) therefore creates a strong mental representation, thus resulting in increased word decoding ability (Moats, 2009). The unique contribution made to reading

comprehension by spelling in this study is therefore concurrent with existing hypotheses and is expected. The shared variance between spelling and inferencing, however, was unexpected. Accordingly, the following section discusses the interaction between spelling and inferencing in greater detail.

8.3.1.2. The Role of Inferencing in Predicting Reading Comprehension

In addition to word decoding, the other component of the SVR that contributes to reading comprehension is that of linguistic comprehension. This component has been considered to be a more significant predictor of reading comprehension ability in older readers than word decoding (Catts et al., 2006; Gough, Hoover, & Peterson, 1996). This is likely due to the skill of word decoding becoming increasingly fast and more automated with age and ability, freeing up processing resources that can be allocated to the component of linguistic comprehension. The skill assessed within the large scale study (Study One) that was considered to be representative of the linguistic comprehension component was that of inferencing. The inferencing measures used within the assessment were presented orally and visually to eliminate the possibility of a decoding difficulty influencing this measure. Inferencing was found to be the most significant predictor of reading comprehension in this particular assessment of the literacy skills of pre-service teachers. This stronger role of inferencing in older, more skilled readers, is consistent with existing literature suggesting that inferencing develops with age and maturity enabling the reader to make greater inferences and predictions about text (Cain, Oakhill, & Bryant, 2004). Furthermore, this increased inferencing ability allows individuals to access and apply their increasing background knowledge to assist in text comprehension in what has been described as strategic reading (Paris, Wasik, & Turner, 1991). Strategies of reading that apply inferencing have been deemed to be critical for higher level text comprehension, with a lack of this development

resulting in lower reading comprehension (Kozminsky & Kozminsky, 2001; Paris et al., 1991). These findings suggest that if the skill of inferencing does not develop as proposed throughout adolescence, then this will subsequently impact on reading comprehension of more complex texts; a view that is consistent with the strong role of inferencing in the current research.

Not only did inferencing make the strongest unique contribution to reading comprehension, it also had a direct influence on the other skills of spelling and working memory. The influence of inferencing on spelling is somewhat unexpected. There are a number of arguments that may explain the relationship between these two variables within the current study. Firstly, it is important to consider the stimuli used in the spelling task, which were comprised of twelve sets of morphologically derived pairs of words. It may therefore be possible that participants made inferences about the task to identify that there was a connection between various words (that it was not simply series of unrelated words) thus increasing the cognitive demand used for the task beyond that of word decoding skills alone. Additionally, if a participant became aware that the task was composed of randomly presented morphological pairs, this may have also resulted on them recalling their own prior knowledge about the morphological relationships between words (Franks, 1998). Prior knowledge of words is considered to be an essential component of reading comprehension (Hirsch, 2003), and making inferences about those words by connecting prior knowledge to them is undertaken during the process of reading comprehension.

8.3.1.3. The Role of Working Memory in Predicting Reading Comprehension

In addition to the skills identified within the word decoding and linguistic comprehension components of the SVR, working memory was also found to make a unique contribution to explaining the variance in reading comprehension amongst this population.

Although the role working memory has to play in reading comprehension is the focus of ongoing debate in existing literature, it has been demonstrated that it can be a key determinant of typical adult readers and less skilled readers (Hatcher et al., 2002; Macaruso & Shankweiler, 2010). This was true of the current research as outlined in Study Two (see Chapter Five), whereby a significantly greater score was found in the working memory abilities of students who presented with typical reading comprehension scores, compared to students who were identified with lower reading comprehension.

It is important to consider that the reading comprehension task utilised in this large scale assessment required participants to respond to questions about the text once the text had been removed. This likely increased the demand placed on participants' memory, requiring them to recall information in order to perform well on the comprehension task. It is not therefore possible to differentiate between the aspect of working memory that was required to comprehend the text at the time, and the aspect of memory used to recall the information when answering the questions. Furthermore, it is possible that additional measures of literacy such as fluency and vocabulary, that were not included in the assessment, may subsume the contribution made by working memory, as has been demonstrated in a previous study of adults (Braze et al., 2007). Without inclusion of these additional measures, it is not possible to make conclusive statements that generalise to the broader population. However, the results from the current study suggest both the importance of working memory in the process of reading comprehension in adults and in assisting in the identification of adults with difficulties in reading comprehension.

Working memory not only served as a predictor of reading comprehension, but also demonstrated a significant interaction with the skill of inferencing. This is not particularly surprising as working memory has been thought of as the 'work space' in which integration and inference occur in the reading process (Cain, Oakhill, & Bryant, 2004). Existing

literature has hypothesised that individual differences in the working memory ability of children might help to explain differences of inference making in reading comprehension (Seigneuric et al., 2000), as well as demonstrating strong correlations between these two skills (Cain, Oakhill, & Bryant, 2004). It is therefore feasible that this relationship continues to present within the adult population. Finally, it is pertinent to note that the specific nature of one of the inferencing tasks included in this assessment (the listening comprehension inferencing task) resulted in participants storing a sentence in their memory while selecting their response. Hence, this engaged aspects of working memory to allow the individual to compete the task accurately.

The higher education environment is understood to place increased demand on the skills of reading comprehension, requiring individuals to read a large number of texts, of much greater complexity than typically would have previously been encountered (Cogmena & Saracaloglub, 2009; Fidler & Everatt, 2012). The increased demands placed on reading comprehension may lead to an increased demand on the use of working memory, by requiring individuals to call upon prior knowledge, monitor their comprehension, hold onto aspects of information while comprehending others, and integrate across texts and sentences. This seems plausible, and thus would attempt to further explain the relationship between working memory and inferencing ability reported in Study One.

8.3.1.4. The Role of Metalinguistic Skills in Predicting Reading Comprehension

The metalinguistic skills of phoneme, syllable, morpheme, and orthotactic knowledge were not found to make a unique contribution to reading comprehension. Phoneme knowledge did however significantly influence both spelling and inferencing ability, thus demonstrating contribution to both the word decoding and linguistic comprehension components of the SVR, and indirectly contributing to reading comprehension.

The findings from the large scale assessment were consistent with those from previous studies conducted with pre-service teachers (Fielding-Barnsley, 2010; Moats, 1994; Spear-Swerling & Brucker, 2006; Washburn, Joshi, & Binks-Cantrell, 2011), in that the mean level of skill in the areas of phoneme, morpheme, and orthotactic knowledge was low. Further, consistent with previous research, the cohort's syllable awareness was relatively high compared to the other constructs assessed (Mather et al., 2001; Washburn, Joshi, & Binks-Cantrell, 2011). This suggests that pre-service teachers are most successful in tasks that require basic and implicit knowledge and skill. To be able to provide effective literacy instruction and teach children recognition of the written word, however, requires an understanding and grasp of the more complex constructs of the English orthography such as phonological, morphological, and orthographic components (Moats, 2014) .

Morphological knowledge did not play a significant role in predicting spelling or inferencing ability. In contrast to the syllable measure, participants demonstrated consistently poor performance on this task, reflecting findings from previous research examining the morpheme skill of pre-service teachers (Washburn, Joshi, & Binks-Cantrell, 2011). Neither syllable nor morpheme knowledge were found to contribute to the skills of spelling or inferencing. The lack of influence on spelling by the morphology task is particularly surprising, given the nature of the spelling task (comprising morphologically related pairs of words), and the strong link between morphological awareness and spelling ability within the literature (e.g., Apel, Wilson-Fowler, Brimo, & Perrin, 2012). It may be that the lack of contribution from either syllable or morpheme knowledge was due to the low levels of variance in the scores of both of these measures (consistently high scores for the syllable task, and consistently low scores for the morpheme task), rather than lack of influence on these skills. It would be expected that morpheme knowledge in particular would be predictive of

spelling ability (Masterson & Apel, 2007; Shankweiler et al., 1996), and the lack of score variance may have limited the power of the data analysis in the current study.

Phoneme knowledge, and orthotactic knowledge were found to provide significant contributions to spelling and inferencing. Participants' phoneme knowledge was generally poor, echoing the findings of previous studies amongst the pre-service teacher population (Carroll et al., 2012; McCutchen et al., 2002; Moats, 1994; Stainthorp, 2004). Phonological awareness is widely accepted as a crucial component of instruction within the development of spelling and reading ability (Goswami & Bryant, 1990; Stanovich, 1986), and its incorporation into early literacy instruction has been stressed (National Reading Panel, 2000; Rose, 2006). Phonological awareness has also been reported as a powerful predictor of reading comprehension amongst children (Al Otaiba et al., 2012; Gillon, 2004; Goswami, 2000), therefore it is unsurprising that it demonstrated a significant contribution above that of the other metalinguistic constructs.

Orthotactic knowledge (i.e., knowledge about the spelling rules of the English language) is also crucial for reading and spelling instruction (Moats, 2009; Snow et al., 2005). It is therefore important that pre-service teachers possess this knowledge, not only for their own reading and spelling ability, but to enable them to provide explicit instruction across these areas in the classroom. The findings from this thesis present evidence that basic metalinguistic skills are required to support both word-level and understanding-level skills even amongst highly skilled adult readers.

8.3.2. Models of Reading Comprehension for the Adult Population

The Simple View of Reading (SVR) was used as a framework for reading comprehension throughout this thesis. Investigation of the role of the literacy skills selected and assessed in predicting reading comprehension within this skilled adult population did not

provide clear support for the SVR. It is recognised that reading comprehension is determined by a large range of component skills (Kendeou et al., 2009; Vellutino, Tunmer, Jaccard, & Chen, 2007), and it is not possible to argue that the included measures were exhaustive. The included measures accounted for 31 percent of the variance in reading comprehension. Macaruso and Shankweiler (2010) obtained a similar figure of 34 percent in their study of university students with typical reading ability, when only including measures of word decoding and linguistic comprehension. When they included additional measures (vocabulary, fluency, nonverbal reasoning, phonological awareness, and working memory) their model accounted for approximately 48 percent of the variance in reading comprehension. In a further study investigating the applicability of the SVR (as an additive or multiplicative model) to the higher education population, Savage and Wolforth (2007) were able to explain approximately 42-44 percent of the variance in reading comprehension. Again, this study included many more measures of both word decoding and linguistic comprehension than the current research. It is therefore likely that the inclusion of additional measures of literacy skill in the current research may have augmented the variance explained beyond the figure obtained. Despite the inclusion of a broader range of measures than utilised in the current study, these studies (Macaruso & Shankweiler, 2010; Savage & Wolforth, 2007), still only accounted for less than half of the variance in reading comprehension using the SVR. These figures are much lower than the up to 85 percent reported in studies of children (e.g., Hoover & Gough, 1990). It is recognised, however, that it is more difficult to explain the variance in reading comprehension amongst adults than children, due to additional influences on adults such as background knowledge, experience, and probable application of compensatory techniques.

Savage and Wolforth (2007) suggested that the SVR is adequate in explaining the variability present in the reading comprehension of students in higher education. The results

of the current research question this due to the interactive nature of component skills, and the strong role of working memory and linguistic comprehension. The findings contradict those of Savage and Wolforth who demonstrated a much larger contribution to reading comprehension by decoding skills. It is pertinent to note, however, that their cohort of 60 participants was comprised of two thirds of individuals with identified reading disabilities. It may therefore be that because the participants of the current study did not present with identified reading disabilities, and possibly less severe literacy difficulties, the findings and implications made by Savage and Wolforth (2007) cannot be extended to a broader university population. Caution therefore must be observed when encompassing results to different study participants, even within the same broad population (higher education). The results of the current study have led to the consideration of alternative models of reading comprehension to better describe the variability of these students.

The SVR is somewhat rigid and static in its explanation of the process of reading comprehension, with a simple multiplicative process of the two components (word decoding and linguistic comprehension) resulting in reading comprehension. When investigating the contribution of the assessed skills to reading comprehension within a skilled adult population (in the current study), the results demonstrated multiple interactions between these skills. This argues for the possible application of models of reading comprehension that are more interactive in nature than the SVR.

The construction-integration model (Kintsch, 1988) has proved popular in its application to the adult population (Paris & Hamilton, 2009) and offers a more interactive description of the reading comprehension process. This model argues that to achieve a competent level of reading comprehension, the reader must simultaneously recruit and integrate bottom-up processing and top-down processing skills. Drawing relationships and inferences from the text facilitates the integration process, which would begin to explain the

strong role of inferencing found in the current data. The construction-integration model also demonstrates the influence of background knowledge, vocabulary, and working memory on reading comprehension, requiring these skills in the construction of the situation model. As neither background knowledge nor vocabulary knowledge were included in the current assessment battery, this may explain why there was a relatively large amount of variance left unexplained. Working memory, however, was assessed, and demonstrated unique contribution to reading comprehension. This would support the application of the construction-integration model to this population, proposing that the participants relied on their working memory ability to link several parts of the text, store information about prior knowledge, and create a mental representation of the text. Validation of the construction-integration model through its ability to explain the variance in reading comprehension would be key to better describing the reading comprehension process in adults with higher levels of literacy skill.

One further interactive model that might better explain the reading comprehension process within this population is the interactive-compensatory model (Stanovich, 1980, 1984). This model suggests that if an individual experiences a difficulty or deficit in one particular area or process of reading, they will compensate for this by recruiting stronger skills from another area (Paris & Hamilton, 2009; Stanovich, 1980). All the individuals included in the current research had completed their schooling and obtained the required level of reading proficiency to enter into higher education. Thus, the interactive-compensatory model could be applied to the individuals who were identified as presenting with difficulties understanding written text relative to their peers. These adults successfully transitioned through their school education without presenting with identifiable literacy difficulties, yet when assessed within the higher education environment they demonstrated difficulties in their ability to fully comprehend text at this level. Although the data obtained within the

current study cannot conclusively demonstrate this compensatory process, it is likely that these individuals have used compensatory techniques to allow them to achieve an adequate level of reading comprehension to complete their schooling.

The notion of 'compensation' is further echoed in the results obtained following the intervention utilising reading comprehension strategies. Although the use of strategies did not directly advance participants' cognitive ability or knowledge, the use of metacognitive strategies appeared to allow them to compensate for lower levels of ability and knowledge, resulting in improved reading comprehension ability. The complex nature of compensatory strategies, as well as the experiences and influences that set adults apart from children, makes it difficult to assert that any model will be able to provide a comprehensive explanation of the process of reading comprehension in adults. Interactive models of reading comprehension such as the construction-integration, and the interactive-compensatory models appear to provide a better fit for the results obtained from this adult population, than the hypothesised more basic model of the SVR. However, while they provide a suitable hypothesis about participants' previous reading comprehension experience, neither model adequately explains the process of reading comprehension itself and the component skills required to achieve proficiency. This is problematic in that it is difficult to identify the specific areas of deficit and subsequently determine targeted intervention. Interestingly, however, the results of Studies Three and Four demonstrated that this may not be particularly relevant for this population, with one strategy proving effective for all participants' despite their vast differences in underlying literacy skills.

To the author's knowledge there have been no studies that have validated the application of the construction-integration, or the interactive-compensatory model of reading comprehension with adults with higher levels of literacy skill (e.g., those engaged in higher education). While the current research suggests that these interactive models may be more

appropriate for the higher education population than basic models of reading comprehension, further research is required to examine this new hypothesis. The current research adds to the adult literature proposing that models of reading comprehension are more complex in the adult population and specific to the level of skill, knowledge, and context within which these individuals present (Mellard & Fall, 2012; Mellard et al., 2010).

8.3.3. Profile of Pre-service Teachers in Higher Education with Difficulties Understanding

Written Text

Study One allowed for individuals who presented with difficulties understanding written text relative to their peers to be identified within the larger cohort of participants. Not only did this identified group of participants have low reading comprehension (relative to the whole cohort), but there were also between-group differences noted in measures of spelling, inferencing, and working memory (whereby the group with significantly lower reading comprehension scores were also significantly lower on other measures).

The additional measures collected for participants who participated in the reading comprehension intervention demonstrated typical scores on receptive and expressive vocabulary, but below the expected mean for their age on a listening comprehension task. Five of the 17 participants had listening comprehension scores below the expected range for their age, and all 17 of the participants obtained scores below the mean. These findings, coupled with those from the large scale assessment, indicated that the linguistic comprehension elements of reading comprehension may be more problematic for these students than skills related to word decoding and / or lower level language skills. Furthermore, the low performance on this standardised measure of listening comprehension coupled with the strong role of the linguistic comprehension components, suggests that some of the students within this intervention group may have presented with reading

comprehension deficits on a standardised measure of reading comprehension. The findings of low listening comprehension add support to existing research reporting a shift from a larger proportion of difficulties with word decoding experienced by children, to greater prominence of difficulties in linguistic comprehension in older children and adults (Catts, Hogan, et al., 2005; Landi, 2010; Perfetti, Landi, & Oakhill, 2005). Moreover, approximately 70 percent of the individual participants identified as presenting with difficulties understanding written text relative to their peers, scored more than one standard deviation below the mean across the assessment battery as a whole. This suggests that this group's reading comprehension difficulties are part of a pattern of difficulties, and are not isolated to one aspect of literacy alone.

Although there were significant differences at a group level in the scores of those who scored more than one standard deviation below the mean in the reading comprehension measure compared to the remainder of the cohort, the individual profiles of the former group of participants also displayed many within-group differences (see Chapter Six). Despite this group being relatively homogenous in their reading comprehension ability, the SVR framework implicated that there may be various differences in the component skills of these individuals. The intervention strategies were compiled so that they would support deficits in both word decoding and linguistic comprehension. It was hypothesised that different strategies may be beneficial for different individuals depending on their underlying skills, concurrent with the notion that poorer readers within higher education will benefit from differentiated support depending on underlying strengths and weaknesses (Savage & Wolforth, 2007). The findings from Study Four (Chapter Six), however, did not provide support for this hypothesis. There was no apparent correlation between an individual's literacy profile (of strengths and weaknesses), and their responsiveness to a specific strategy. This finding suggests that intervention targeting contributory elements of reading

comprehension is not as effective as intervention that simply targets the outcome measure (i.e., reading comprehension). This lack of effectiveness of intervention targeting specific contributory skills may be attributable to the complex and interactive nature of these individuals' underlying literacy skills, as found in Study One. It is also consistent with the research undertaken with the ABE population whereby differentiated intervention (focussing on different underlying literacy skills) did not demonstrate any significant differences between-groups in the gains made in reading comprehension (Alamprese et al., 2011; Greenberg et al., 2011; Sabatini et al., 2011).

At group and individual levels, the most effective reading comprehension strategy was the highlighting and summarising strategy. Reported assessment of metacognitive skills and metacognitive strategy use in the adult population has been relatively sparse (Cromley, 2005). A measure of metacognitive strategy use (the MARSI) was therefore incorporated within the current research. Unfortunately this measure provided very little variance in score amongst the pre-service teacher participants, and did not deliver results that provided insight into any of their initial reading comprehension ability or responsiveness to intervention. The highlighting and summarising was one of the two metacognitive strategies employed as part of the intervention, requiring individuals to think about what they were reading during the process of reading. Typically, metacognitive strategies have been considered to be used more frequently by readers with higher skill level than those with lower reading skill (Cartwright, 2009; Pressley & Gaskins, 2006). The current research adds to the growing body of literature that has documented the successful application of, metacognitive strategies to improve reading comprehension in the adult population (Hock & Mellard, 2005; Hong-Nam & Leavell, 2011; Sheorey & Mokhtari, 2001; Thiede et al., 2003). Furthermore, the results extend the findings of Fidler's (2009) study describing the effectiveness of metacognitive strategies for adults in higher education with dyslexia to the broader university population.

The current research showed that by using the provided reading comprehension strategies, individuals were able to increase their scores to within range of their peers. This was the first intervention study of this kind to include a control group of peers with reading comprehension within average range, in addition to a control group of participants with low reading comprehension who did not complete the intervention. Thus, these findings argue that the use of a highlighting and summarising strategy does not simply improve reading comprehension, but that it is a suitable tool for adults in higher education to bring their ability to within that of their peers.

The strategy of highlighting and summarising requires individuals to incorporate several complex tasks including: decoding, reflecting on what had been read, deleting and condensing information, and paraphrasing information; all tasks that engage metacognition (Rich & Shepherd, 1993). Although the questionnaire used to assess individuals' use of metacognitive strategies (MARSI; Mokhtari & Reichard, 2002) reported a mean moderate level of use for the participants of the intervention, many students reported never having applied such strategies to the process of reading. Rather, they had only utilised these kinds of metacognitive strategies when studying for examinations. It is plausible that despite having knowledge of metacognitive strategies, participants may not have been sure about suitable contexts and times at which to use such strategies, concurrent with existing hypotheses (Pressley, 2000).

While the metacognitive strategy of highlighting and summarising was found to be beneficial for almost all participants, conversely the text-to-speech strategy was detrimental to almost everyone. Text-to-speech software focusses on the word decoding element of reading comprehension, and thus has typically demonstrated success with adults who present with weak word decoding skills, such as individuals with a diagnosis of dyslexia (Higgins & Zvi, 1995). It was hypothesised that the intervention group would comprise several adults

who had difficulties with aspects of word-level literacy, hence the inclusion of this strategy. It is possible, however, that the participants of Study Two who completed the reading comprehension strategy intervention did not have a large enough difficulty within their word decoding skill to benefit from the text-to-speech strategy. This adds support to previous research demonstrating that the higher the word decoding score amongst adults with reading difficulties, the more a strategy of text-to-speech decreased reading performance (Higgins & Raskind, 1997; Higgins & Zvi, 1995; Lindstrom, 2007). Further, these results caution against such widespread provision of text-to-speech software for students with literacy difficulties (Draffan et al., 2007), and question whether it is ethical for higher education environments to be promoting this tool (as is the case at the university where the current research was undertaken).

Reading research involving ABE students has advocated for consideration to be paid to individuals' particular strengths and weaknesses (Miller et al., 2010), as well as provision of different instructional treatment depending on relative skills and difficulties (Mellard et al., 2012). One study has also proposed this notion of differentiated intervention for poor readers within the higher education population (Savage & Wolforth, 2007). The findings from the current research refute this suggestion, however, and propose that this may not be as pertinent for adults with higher levels of literacy skill. An approach of assessment to identify individuals with weaknesses in reading comprehension, followed by intervention targeting the outcome measure of reading comprehension was successful for all participants. The most appropriate and beneficial tool found to aid reading comprehension across a wide range of presenting profiles was concluded to be a metacognitive strategy involving the highlighting and summarising of text. These findings therefore argue that the provision of one strategy alone (regardless of their literacy profile) can be effective in raising the reading

comprehension of individuals with low levels, to within range of that of their peers within higher education.

8.3.4. Metalinguistic Knowledge and its Relationship to Spelling and Reading

Comprehension

Since the first publication proposing that teaching professionals lack the required knowledge of language structure to provide appropriate reading instruction (Moats, 1994), many studies have continued to reinforce this within the pre-service teacher population, internationally (Fielding-Barnsley, 2010; Mather et al., 2001; Moats, 1994; Moats & Foorman, 2003; Spear-Swerling & Brucker, 2003, 2006; Stainthorp, 2004; Washburn, Joshi, & Binks-Cantrell, 2011), and in New Zealand (Carroll et al., 2012). The current research echoed these findings of low metalinguistic knowledge (see Chapters Four and Seven) indicating that despite many of the pre-service teachers possessing a proficient level of skill in areas such as reading comprehension and spelling, their explicit knowledge of the component skills required to perform these tasks were poor.

Participants with poor spelling ability were found to possess significantly lower skill in phoneme, syllable, and overall metalinguistic knowledge than those with good spelling ability. This suggests that explicit knowledge of syllables, phonemes, and overall metalinguistic knowledge contribute to stronger spelling ability, and that these skills are more explicitly understood by individuals with good spelling ability compared to those with poor spelling ability. This finding is concurrent with research conducted with children demonstrating that those with language difficulties and poorer knowledge about the structure of a word will have poorer spelling (Kamhi & Hinton, 2000; Lennox & Siegel, 1998).

Subgroups comprised of individuals with poor and typical reading comprehension ability did not present such a distinct difference in metalinguistic knowledge as those grouped by spelling ability. The greater level of metalinguistic knowledge held by participants with

stronger spelling ability argues for the view that explicit knowledge of these constructs (phoneme, morpheme, and orthotactic knowledge) are closely related to spelling. This relationship was not as clear when participants were grouped by reading comprehension ability, suggesting that the response to intervention was related to a much lesser extent to underlying reading comprehension ability than to spelling ability.

The responsiveness of the whole cohort of pre-service teachers to an intervention explicitly teaching metalinguistic constructs demonstrated differences in the gains made dependent on the underlying skills with which participants presented at the outset of intervention. Although strong and weak spellers demonstrated gains from pre- to post-intervention assessment, there were distinct differences in the size of the change, whereby the strong spellers exhibited a much larger change in scores on all measures than the weaker spellers. This suggests that the intervention was much more effective for those with strong spelling skills at the outset of intervention, than those with weak spelling ability. Furthermore, the differences observed between the responsiveness of the different groups to the intervention, argues for its effectiveness above and beyond a practice effect (from pre- to post-intervention assessment).

The whole-cohort teaching intervention (see Chapter Seven) was deemed to be beneficial at a group level, and increased participants' scores in all three areas targeted (phoneme, morpheme, and orthotactic knowledge). The post-intervention scores of the whole cohort demonstrated a mean score of approximately 73 percent of items answered correctly on the phoneme knowledge task. This score is much higher than has been reported in previous studies of pre-service and in-service teachers. For example, following an intervention to increase phonological awareness, Stainthorp (2004) reported scores of under 50 percent amongst pre-service teachers; while Carroll et al. (2012) highlighted a mean correct score of approximately 44 percent in a phoneme counting task amongst in-service

teachers. These comparisons demonstrate the effectiveness of the teaching intervention provided in the current research to raise phoneme knowledge. It is arguable, however, that despite these excellent gains relative to the previous literature, a post-intervention mean score of 73 percent may still not be enough to fully prepare pre-service teachers for the demands of the classroom. Further, this score is still less than that obtained on the syllable awareness task, whereby pre-service teachers demonstrated strong explicit knowledge at the outset of the intervention.

Literature reporting the effectiveness of intervention targeting morpheme knowledge or orthotactic knowledge for pre-service teachers is sparse, therefore comparisons to the existing data cannot be made. The current research suggests that while significant gains in morphological and orthotactic knowledge were made during the intervention, the post-intervention mean scores of approximately 50 percent and 65 percent respectively, would be unlikely to provide an adequate level of knowledge to pre-service teachers, given the extent to which these skills impact on word-level reading (Apel et al., 2012; Roman, Kirby, Parrila, Wade-Woolley, & Deacon, 2009). Further research is required to ascertain the appropriate level of metalinguistic knowledge required for teachers to implement explicit language structure teaching in the classroom. This is a complex issue given that the items utilised to examine the metalinguistic skills of pre-service teachers are typically more demanding than those tasks teachers use regularly when providing early literacy instruction (e.g., the morpheme identification task used in the current study). Nevertheless, the current study shows a strong intervention effect in comparison to previous studies of pre-service teachers.

Strong gains were demonstrated amongst the whole group of pre-service teachers. The largest gains, however, were achieved by participants with strong underlying spelling skill, even when accounting for their initial level of knowledge. Results from the subgroup of good spellers indicate that these participants may have had better implicit knowledge about

language structure constructs (and in particular, morpheme knowledge) than their peers with poor spelling ability. The seven hours of teaching intervention may have provided the good spellers with the information they required to make this implicit knowledge explicit (hence their greater gains than the poor spellers in all measures, particularly morpheme knowledge). Although the subgroup of poor spellers made improvements in their overall knowledge of language structure, it is hypothesised that the amount of intervention, the duration of intervention, or both, may not have allowed the poor spellers to both build their knowledge and make it explicit. While earlier research has called for the inclusion of explicit teaching for pre-service teachers, there has been little suggestion about what this might look like. This was the first study to examine the effectiveness of a blanket intervention for students with different underlying literacy skills. Whilst the results demonstrate significant gains at both the whole-cohort and subgroup level, the greater improvements made by individuals with stronger word-level (spelling) skills suggest that the provision of the same explicit teaching to all students may not be appropriate.

8.4. Practical Implications

8.4.1. Expectations of Pre-service Teachers in Higher Education with Regard to Literacy

Throughout this thesis the importance of not making assumptions about the literacy skills of pre-service teachers has been highlighted. Additionally, research has argued that higher education worldwide has seen students from a greater range of backgrounds (Devlin & Samarawickrema, 2010; Parry, 2009), and with increasing language and learning disabilities (Heiman & Precel, 2003; Henderson, 1999; Vogel et al., 1998) access higher education. Yet despite this knowledge, the expectations of these students, and level of support provided, appears to remain unchanged.

One recurring theme throughout this thesis has been that in order for children in the classroom to become successful in their literacy practices, they must be taught by teachers who themselves are proficient readers and writers (G. W. Brooks, 2007). This belief has been echoed in the specific area of the teaching of metalinguistic knowledge to pre-service teachers and has been termed the Peter Effect (Applegate & Applegate, 2004). This thesis has extended the application of the Peter Effect from attitudes of teachers towards reading (Applegate & Applegate, 2004), and teacher educators own knowledge (Binks-Cantrell, Washburn, et al., 2012) to the pre-service teachers themselves in two ways. The first argues for the Peter Effect in relation to pre-service teachers' reading comprehension. If individuals do not possess strong reading comprehension themselves, and / or cannot personally use reading comprehension strategies to aid their reading, it is hypothesised that they will be unable to provide adequate literacy instruction to their students in their professional practice. Secondly, it is arguable that the Peter Effect can apply to pre-service teachers' ability to provide reading instruction to early readers. If pre-service teachers do not have strong metalinguistic skills, then the Peter Effect would hypothesise that they will be unable to pass this knowledge to provide adequate reading instruction to their students. Although further research is required to examine the relationship between pre-service teachers' own literacy skill and their teaching, it is hypothesised that individuals who have difficulties in areas of literacy will not be able to provide the same high level of instruction to their students as individuals who have proficient skills in all areas of literacy.

In addition to providing information about the level of literacy functioning with which pre-service teachers enter into higher education, the findings from this thesis further imply that individuals who have lower literacy skills may respond less favourably to coursework in initial teacher preparation focusing on metalinguistic knowledge than their peers with higher levels of literacy skill. This has implications within the higher education environment, where

each student typically participates in the same courses in order to achieve their qualification. Existing research reporting the low levels of metalinguistic knowledge of pre-service teachers has advocated for the inclusion of direct instruction of language structure concepts for this population (Moats & Foorman, 2003). The findings from the current research (Study Four) demonstrate the complexities and reality of this application, and that a 'one size fits all' approach may not be appropriate for a population of such heterogeneity in literacy skill. It is postulated that for each individual to reach an adequate level of metalinguistic knowledge and skill, differentiated teaching may be required so as to meet each student's individual need. Students who responded most favourably to this teaching intervention demonstrated a post-intervention mean phoneme knowledge score of over 80 percent; a level of knowledge higher than that identified amongst Resource Teachers of Literacy (who provide specialised literacy support in the New Zealand school context) at approximately 77 percent (Carroll et al., 2012). It is therefore arguable that the scores obtained by the strong spelling group of pre-service teachers in the current research may provide them with an adequate level of metalinguistic knowledge with which to provide reading instruction to children. It is important to highlight that these gains were made in the initial year of pre-service teacher training. It is also anticipated that individuals' scores would continue to rise (rather than fall) over the next two years, as demonstrated within an assessment of this same higher education degree previously (Carroll et al., 2012). Further research is required to determine whether this hypothesis is true, as well as if pre-service teachers are able to implement this knowledge within their professional practice.

The administration and completion of the large scale assessment (Study One) enabled students who presented with difficulties understanding written text in comparison to their peers to be identified. As reading comprehension is considered to be both the goal of reading (Nation, 2005; Paris & Hamilton, 2009) and a necessary skill and outcome of higher

education (Holder et al., 1999), gains in score were examined in this skill area. The subsequent intervention (Studies Two and Three) argued against a relationship between underlying skill and response to intervention, thus suggesting that an approach of identification (assessment), and intervention targeting the outcome measure of reading comprehension was suitable for this population.

The findings from these studies suggest that the expectation that all pre-service teachers will qualify as teachers with an equivalent level of knowledge and skill may be unfounded. Furthermore, the standards expected of these individuals may be unobtainable for some students without the provision of support, specifically in the area of reading comprehension.

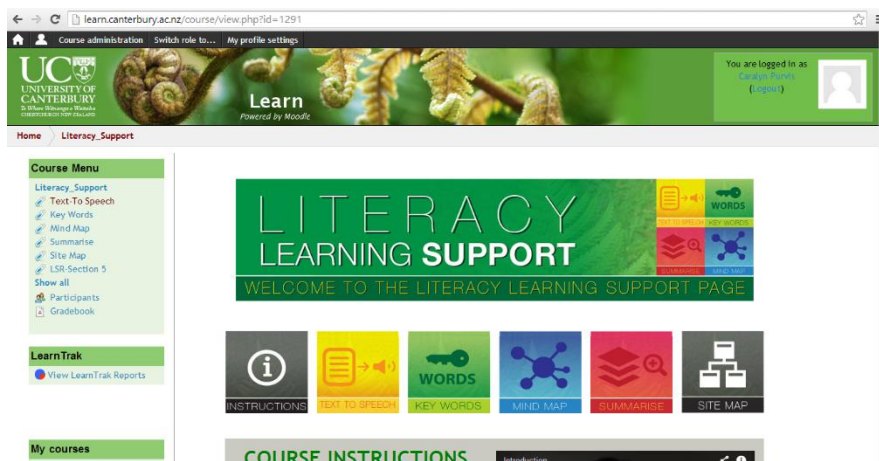
8.4.2. Support for Adults in the Higher Education Environment

The current findings have demonstrated that a number of pre-service teachers entering into the higher education environment present with literacy difficulties that prevent them from fully engaging with the level of text material required in this environment. This raises the question of whether higher education institutions have a duty of care to provide support for these students so that their subsequent education, and ultimately their subsequent teaching of future students, is optimal. It was therefore proposed that the inclusion of a reading comprehension measure in the students' entrance requirements (prior to acceptance into higher education), would allow for individuals who may require further support in literacy to be identified. The two passages of text and questions used in Study One (and included in Appendix A) were given to individuals completing existing pre-course requirements, as a trial method for the following year's intake. Students who performed poorly on these two texts, but who fulfilled all other requirements for acceptance onto the degree, were highlighted as students who required further support.

The reading comprehension intervention included within this thesis (see Chapters Five and Six) demonstrated that strong gains can be made in reading comprehension with the implementation of a relatively low intensity programme. Despite this low level of intensity, the intervention provided in the current research required individual one-to-one instruction, a resource that many universities have neither the money nor resources to provide.

One alternative method of delivering intervention content is through the use of an online learning environment. This is a cost effective method that would allow for the inclusion of each of the various different strategies, as well as providing support to students both on campus, and those learning by distance. Through the use of the university's existing online learning environment, this method is currently being trialled by a small group of current initial year pre-service teachers. The following year's cohort of students were required to complete the same initial reading comprehension assessment utilised in Study One, prior to their acceptance onto the university course. Participants who were successful in the additional entrance requirements, yet who demonstrated poor performance on the reading comprehension measure, were provided with access to the reading comprehension strategy intervention via the online learning environment. A screenshot of this online intervention resource is shown in Figure 8.1.

Figure 8.1. Screenshot of the homepage for the online reading comprehension resource



The aim of the support tool was that by allowing students to interact with, and complete the activities within this resource, gains would be made in individuals' reading comprehension, similar to those observed within Study Two and Three of this thesis. Future data collection and analysis will provide insight into the effectiveness of this medium of intervention compared to the face-to-face method used throughout this research. However, despite the provision of this online tool, it is pertinent to recall that overall, one strategy was found to be beneficial for almost all students. Whilst the provision of individual support is not feasible, if only one strategy was used as a reading comprehension intervention this could be administered at a group level. This is the first study to demonstrate the effectiveness of one strategy alone for a group of individuals with different underlying literacy skills.

The current findings argue for the provision of support for students in two ways. The first relates to improving the metalinguistic skills of all pre-service teachers, while the second relates to providing targeted support for individuals only with identified weaknesses in reading comprehension. Previous literature reporting findings from the assessment of pre-service teachers' language structure knowledge has advocated for the inclusion of explicit teaching (Buckingham et al., 2013; Coltheart & Prior, 2006; Moats, 2009; National Reading Panel, 2000; Stainthorp, 2004). Results from Studies One and Four of this thesis support this proposition, and build on the very limited existing research demonstrating the practicality of providing explicit teaching into the pre-service teaching curriculum. Knowledge relating to language structure appears to have become implicit within this adult population, and for them to be able to teach these skills as part of their professional practice, these pre-service teachers require explicit re-teaching of such skills. This practice reflects the teaching practice of Speech-Language Pathologists within higher education, who are explicitly re-taught skills that have become implicit (Stainthorp, 2004).

The second element of support for this group of adults follows the design of assessment and subsequent targeted intervention. Conversely, the findings of this thesis did not argue for intervention for the whole group of students, but the provision of support for those identified with difficulties understanding written text. Assessment allowed for the identification of students who may require additional support, while the intervention outlined that intervention targeting the outcome measure (reading comprehension) was successful for all students, rather than addressing the underlying component skills. Key elements of the most successful strategy (highlighting and summarising) included: reducing the rate of reading; encouraging the reader to think about the reading material during the process of reading; actively engaging with the text; breaking the text down into smaller, more manageable chunks; and paraphrasing the text in their own words. The provision of this strategy for identified students within higher education would raise their reading comprehension abilities to within range of their peers, thus resulting in a cohort who are homogenous in their literacy skill.

8.5. Limitations and Directions for Future Research

These results must be considered and interpreted within the context of several limitations. One basic limitation that is evident across each of the studies reported is the number of participants included, particularly within the intervention study (reported in Chapters Five and Six). Although the sample size reported for Studies One and Four (see Chapters Four and Seven) was relatively large, a greater sample size would have provided additional power when carrying out analyses. Increased samples sizes also allow for findings to be generalised to the broader population with greater confidence (Portney & Watkins, 2009). Future replication of the studies reported in this thesis with larger sample sizes will allow for these limitations to be addressed and overcome. An example of how this limitation

was taken into account is the inclusion of control groups within the intervention study. Despite the small number of the intervention group, two control groups of individuals who did not complete the intervention (one of individuals within range of the reading comprehension mean, and one comprised of individuals who were identified as presenting with difficulties) were also used to allow for comparisons to be made. This enabled statistically significant differences to be detected, despite the small group sizes, and points to the strength of the intervention's impact. The reading comprehension intervention study built on the work of Fidler (2009) to demonstrate not only that significant gains can be made, but also that participants' reading comprehension was enhanced to within the mean score obtained by their peers.

There are also several limitations to consider within the assessment battery included in the thesis. As outlined previously, the assessment battery was designed to be group-administered within a lecture format to ensure a large sample size and to enable the inclusion of participants across the range of abilities in the cohort. Thus, an exhaustive battery of assessment measures was not utilised, which may likely explain why only 31 percent of the variance in reading comprehension was explained. A lower level of variance has typically been accounted for in adults' reading comprehension, compared to children, therefore this number is not particularly uncommon (e.g., Macaruso & Shankweiler, 2010; Savage & Wolforth, 2007). To begin to further address the remaining, unexplained variance, several considerations need to be made. The use of alternative or additional measures of assessment in the areas already included in the large scale assessment (Study One) may be pertinent. Different assessment choices have been shown to measure different aspects of the reading process, both in the assessment of reading comprehension itself (Cain & Oakhill, 2006a), and component skills of reading (Hurry & Doctor, 2007; Nation & Snowling, 1997). It has been argued that some standardised measures of reading comprehension result in a greater focus

on either the linguistic comprehension elements, or the word decoding elements. Cain and Oakhill (2006a) therefore recommend the use of two different measures of this skill to provide a more reliable measure. However, the lack of available assessment that is suitable for the adult population, in addition to the results not being compared to normative data, suggests that this may not be achievable or necessary.

The inclusion of additional measures of assessment may augment the amount of variance in reading comprehension explained by the assessment as a whole. Should time and method of assessment allow, it may be pertinent to consider further assessment in the areas of fluency and vocabulary, two skills that have reportedly been significant in describing the variance in reading comprehension in children (Adlof et al., 2006; Tunmer & Chapman, 2012). Reading fluency has been defined in various different ways, but broadly denotes a time-based measure of accurate word reading (Jenkins, Fuchs, Van den Broek, Espin, & Deno, 2003). Further, a relationship between reading comprehension and reading fluency has been demonstrated at both the word-level and passage-level of text (Klauda & Guthrie, 2008). Assessment of the contribution made by fluency to reading comprehension amongst the adult population attributed approximately 5 percent of explainable variance to this skill, above and beyond word skills, language comprehension, and memory (Mellard & Fall, 2012). Assessment of reading fluency for adults, however, remains problematic. While Mellard et al. (2012) demonstrated the usefulness of an oral reading fluency task to differentiate between different groups of adult students, Greenberg et al. (2009) warn against the direct application of children's standardised tests for adults with low levels of literacy skill. It therefore appears appropriate to consider the assessment of reading fluency within a group of individuals to establish their skill level relative to each other. It may not be practical to consider utilising a reading fluency assessment as a standardised measure.

The relationship between vocabulary and reading comprehension is irrefutable yet complex (Baumann, 2009). Knowledge of vocabulary reflects the meaning and relations of words, however the separation of the two elements of vocabulary knowledge and reading comprehension has proved challenging. Vocabulary knowledge has been found to influence reading comprehension through both word decoding and linguistic comprehension elements (Tunmer & Chapman, 2012), thus presenting a greater rationale as to why it may be appropriate to include assessment of this skill within the adult population. Furthermore, vocabulary has been found to make a unique contribution to reading comprehension above and beyond either of these two elements, when included in assessment for young adults (Braze et al., 2007). The construction-integration model (Kintsch, 1988) also outlines vocabulary as a direct contributor to reading comprehension. Given the complex and interactive nature of the literacy skills assessed in Study One and their possible fit with this model; it seems highly plausible that vocabulary knowledge may augment the explainable variance in reading comprehension within this skilled adult population.

It may also be pertinent to consider the inclusion of several other additional areas of assessment that may result in augmented explainable reading comprehension variance with this population. A measure of listening comprehension could be administered to the whole cohort to provide a more direct measure of linguistic comprehension. Examples of word decoding measures that would provide the level of complexity required to produce variance in this group of participants could be: a timed non-word decoding task; a pseudo-word spelling task; or a lexical decision task. Finally, assessment of prior / background knowledge would likely account for a significant proportion of the variance in reading comprehension (Hirsch, 2003). Tasks that enable this knowledge to be assessed, however, are extremely limited, and are not suitable for administration to a large cohort of individuals.

One further limitation present in the large scale assessment was that due to the overall time restriction of the assessment, the reading comprehension measure was time constrained. Although consistency was ensured in the pre- to post-intervention assessment (whereby both assessments were timed and matched reading comprehension measures were used; see Chapter Five), the intermediary reading comprehension assessments used throughout the intervention were not timed. This may have constrained participants' decisions to use, or not to use, strategies in the final post-intervention assessment, suggesting perhaps that decoding words within text may not be the prominent difficulty for students with weaknesses understanding written text. Rather, it may be the time required to employ compensatory strategies as the complexity of texts increases. Nonetheless, regardless of the factor of time, the direct comparison made between the pre- and post-intervention assessments demonstrated a very large effect size in the increase in reading comprehension score. Further research should be undertaken to examine the impact of timed assessment versus untimed assessment on the reading comprehension performance of this specific population.

Similarly, the reading comprehension assessment design required participants to answer questions after their exposure to the text (i.e., the text was removed prior to the questions being asked). This form of administration was deemed the most reliable following its administration in the pilot study (refer to Chapter Three for details). However, administering the task in this way would have likely placed a greater demand on participants' working memory, and subsequently impact on their recall of the text. It is therefore challenging to separate the answers that may have been restricted due to working memory difficulties, from a difficulty that arose purely from comprehension of the text. Replication of this assessment should consider this and perhaps include assessment that allows access to the text, comparing to responses without access to the text. However, while such an approach should be considered, it is important to note that the results demonstrated inferencing skill to

be the strongest predictor of reading comprehension. Variance in participants' performance in reading comprehension was therefore driven more strongly by language skill (inferencing), than working memory ability, and the comparison of text present versus text absent may be irrelevant.

The design of the intervention phase of this research resulted in each participant receiving each of the intervention strategies in the same order. Although the order of the intervention was carefully considered so that each would have the least impact on the subsequent one, it could not be absolutely guaranteed that there was no carryover from one to the next. Additionally, it is possible that a practice effect may have occurred in the responses of the participants over time, as they gained experience in completing the matched reading comprehension assessments. Although it is recognised that this is possible, it seems unlikely that a practice effect could account for all the increase in score from the pre- to post-intervention assessment due to the large effect size obtained. Furthermore, the decrease in reading comprehension score from the pre-assessment to the score obtained when using the first (text-to-speech) strategy contradicts this assumption. The application of a randomised control trial design to this research would be the most appropriate method to determine the effectiveness of these reading comprehension strategies, and would eliminate these concerns. This would however, require a much a larger sample size of participants, and the additional difficulty of ensuring that each group comprises participants of comparable skill (both in the outcome measure of reading comprehension, and underlying skills) arise with the application of this study design.

Future research regarding the effectiveness of the reading comprehension intervention for individuals who present with difficulties understanding written text should consider the long term gains made by these individuals. Although the participants in the current study made significant gains in their reading comprehension in a short period of time, two

questions arise from this that require future research. The first question addresses the importance of whether participants are able to maintain these gains in reading comprehension ability over time. Longitudinal assessment data following participants throughout the remainder of their pre-service teacher education would provide information about the long-term effectiveness of the intervention, as well as participants' use of strategies following the conclusion of the intervention period. The second question relates to how the gains made by the participants themselves are subsequently transferred into their teaching practice. Further research might address this by following participants of the intervention on their pre-service teaching practice placements, as assessing both their teaching practice, and their level of reading comprehension within this context.

The final study reported in this thesis (see Chapter Seven) discussed the metalinguistic knowledge of pre-service teachers, and the effectiveness of explicit teaching to raise their knowledge of language structure. The pre-test, post-test study design lends itself to criticism regarding the possibility of a practice effect, especially given the period of time within which the assessment was re-administered. In defence of this, the results outlined demonstrated the difference in response to the intervention by participants with differences in their underlying literacy ability. If the gains made from pre- to post-intervention assessment were solely attributable to a practice effect it would have been expected that all participants would have made proportionate gains. Secondly, there would not have been such a large degree of variance remaining at the post-intervention assessment point in the scores of morpheme knowledge or orthotactic knowledge. Thirdly, participants' syllable knowledge scores did not change significantly; the only area of language structure that was not targeted in the intervention. Finally, it was ensured that the items used in the assessments were not included in the teaching intervention, thus participants' had not received explicit teaching or further exposure to these items.

Future research in the area of metalinguistic knowledge calls for the development of a matched pre- and post-assessment to eliminate any remaining possibility of a practice effect when measuring scores at pre- and post-intervention. Furthermore, differentiated intervention (dependent on individuals' underlying literacy ability) would be appropriate to address the needs of the whole cohort, and identify the level of interventions required for individuals who present with weaker underlying skills.

8.6. Conclusions

Addressing the literacy skills and abilities of the individuals with whom we trust to adequately teach future generations of readers is crucial. An increasing body of research has demonstrated that assumptions cannot be made about the level of literacy skill amongst the broader adult population (Baer et al., 2009; Kutner et al., 2007; Satherley et al., 2008), and the research presented in this thesis expands this from the general adult population and adults with lower-levels of literacy skill, to adults with comparatively higher-levels of literacy skill.

The suggestion that the Peter Effect (Applegate & Applegate, 2004) (whereby one cannot give what one does not possess) can be extended to the literacy skills and knowledge of pre-service teachers seems plausible. Teacher education programmes typically assume that individuals possess an adequate level of literacy ability prior to university entry (Conaway et al., 2003). The current research however has demonstrated the broad range of literacy skills with which initial year pre-service teachers present, and has further demonstrated that the underlying constructs required to provide reading instruction vary widely. If these individuals do not have strong literacy skills themselves, it seems unlikely that they will subsequently be able to provide a strong level of instruction to future readers. Additionally, the application of these findings to the theoretical understanding of reading comprehension in adults, suggests

that this process is complex and interactive in nature, and cannot be explained by simple models alone.

A short period of intervention directly targeting reading comprehension produced strong gains amongst a group of pre-service teachers with previously unidentified reading comprehension difficulties. The strategy of highlighting and summarising was found to be the most effective in improving reading comprehension scores, having been compared to three differing strategies. The current research suggests that incorporation of this strategy into additional support provided for individuals with reading comprehension difficulties may be a simple, effective and efficient way to raise the reading comprehension ability of this population. Further, the integration of a short and relatively low intensity intervention within existing teaching for all pre-service teachers demonstrated significant gains in their metalinguistic knowledge. Equipping pre-service teachers with the literacy knowledge and ability they require to provide effective reading instruction in their classrooms is of importance both to themselves, and as a preventative measure in raising the achievement of young readers.

REFERENCES

- Aaron, P. G., Joshi, R. M., Gooden, R., & Bentum, K. E. (2008). Diagnosis and treatment of reading disabilities based on the component model of reading: An alternative to the discrepancy model of LD. *Journal of learning disabilities, 41*(1), 67-84.
- Adams, M. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.
- Adlof, S. M., Catts, H. W., & Little, T. (2006). Should the simple view of reading include a fluency component? *Reading and Writing, 19*, 933-958.
- AITSL. (2014). Initial Teacher Education Programs - Literacy and Numeracy Standards. Retrieved 10th August, 2014, from <http://www.aitsl.edu.au/docs/default-source/initial-teacher-education-resources/ite-standards-literacy-numeracy-nsw.pdf>
- Al Otaiba, S., Kosanovich, M. L., & Torgesen, J. K. (2012). Assessment and instruction in phonemic awareness and word recognition skills. In A. G. Kamhi & H. W. Catts (Eds.), *Language and reading disabilities* (3rd ed., pp. 112-145). Upper Saddle River, NJ: Pearson Education Inc.
- Alamprese, J. A., MacArthur, C. A., Price, C., & Knight, D. (2011). Effects of a Structured Decoding Curriculum on Adult Literacy Learners' Reading Development. *Journal of research on educational effectiveness, 4*, 154-172.
- Alvermann, D. E. (2002). Effective literacy instruction for adolescents. *Journal of Literacy Research, 34*(2), 189-208.
- Alvermann, D. E., Unrau, N. J., & Ruddell, R. B. (Eds.). (2013). *Theoretical Models and Processes of Reading*: International Reading Association.
- Apel, K., & Swank, L. K. (1999). Second Chances: Improving Decoding Skills in the Older Student. *Language, Speech, and Hearing Services in Schools, 30*, 231-242.
- Apel, K., Wilson-Fowler, E. B., Brimo, D., & Perrin, N. A. (2012). Metalinguistic contributions to reading and spelling in second and third grade students. *Reading & Writing, 25*, 1283-1305.
- Applegate, A. J., & Applegate, M. D. (2004). The Peter effect: Reading habits and attitudes of preservice teachers. *Reading Teacher, 57*(6), 554-565.
- Archer, D. (2005). *Writing the Wrongs. International Benchmarks on Adult Literacy*. Johannesburg, SA: Global Campaign for Education.

- Armbruster, B., Anderson, T., Armstrong, J., Wise, M., Janisch, C., & Meyer, L. (1991). Reading and questioning in content area lessons. *Journal of Reading Behavior*, 23(7), 35-58.
- Baddeley, A. D. (2012). Working memory: theories, models, and controversies. *Annual review of psychology*, 63, 1-29.
- Baer, J., Kutner, M., & Sabatini, J. P. (2009). Basic Reading Skills and the Literacy of America's Least Literate Adults: Results from the 2003 National Assessment of Adult Literacy (NAAL) Supplemental Studies (NCES 2009-481). Washington, DC.: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. .
- Baker, L., & Beall, L. C. (2009). Metacognitive processes and reading comprehension. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 373-388). New York, NY: Routledge.
- Baumann, J. F. (2009). Vocabulary and Reading Comprehension. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 323-346). New York, NY: Routledge.
- Benevides, T., & Peterson, S. S. (2010). Literacy attitudes, habits and achievements of future teachers. *Journal of Education for Teaching: International research and pedagogy*, 36(3), 291-302.
- Biancarosa, G., & Snow, C. E. (2004). Reading next: A vision for action and research in middle and high school literacy. Washington, DC: Alliance for Excellent Education.
- Binks-Cantrell, E., Joshi, R. M., & Washburn, E. K. (2012). Validation of an instrument for assessing teacher knowledge of basic language constructs of literacy. *Annals of dyslexia*, 62(3), 153-171.
- Binks-Cantrell, E., Washburn, E. K., Joshi, R. M., & Hougen, M. (2012). Peter effect in the preparation of reading teachers. *Scientific studies of reading*, 16(6), 526-536.
- Bray, G. B., Pascarella, E. T., & Pierson, C. T. (2004). Postsecondary education and some dimensions of literacy development: An exploration of longitudinal evidence. *Reading Research Quarterly*, 39(3), 306-330.
- Braze, D., Tabor, W., Shankweiler, D. P., & Mencl, W. E. (2007). Speaking Up for Vocabulary: Reading Skill Differences in Young Adults. *Journal of learning disabilities*, 40(3), 226-243.
- Brooks, G. W. (2007). Teachers as Readers and Writers and as Teachers of Reading and Writing. *The Journal of Educational Research*, 100(3), 177-191.

- Brooks, P., Everatt, J., & Fidler, R. (2004). *Adult Reading Test (ART)*. Roehampton: Roehampton University of Surrey.
- Buckingham, J. (2014). Teaching to the tests. Retrieved 21st June, 2014, from <http://www.cis.org.au/publications/ideasthecentre/article/5219-teaching-to-the-tests>
- Buckingham, J., Wheldall, K., & Beaman-Wheldall, R. (2013). Why Jaydon can't read: The triumph of ideology over evidence in teaching reading. *Policy*, 29(3), 21.
- Cain Johnson, A., & Benseman, J. (2005). Adult literacy in New Zealand In J. Comings (Ed.), *The Annual Review of Adult Learning and Literacy* (Vol. 4, pp. 155-186). Mahwah, NJ: Lawrence Erlbaum Associates.
- Cain, K., & Oakhill, J. V. (1999). Inference making ability and its relation to comprehension failure in young children. *Reading and Writing*, 11, 489-503.
- Cain, K., & Oakhill, J. V. (2006a). Assessment matters: Issues in the measurement of reading comprehension. *British Journal of Educational Psychology*, 76, 697-708.
- Cain, K., & Oakhill, J. V. (2006b). Profiles of children with specific reading comprehension difficulties. *British Journal of Educational Psychology*, 76(4), 683-696.
- Cain, K., Oakhill, J. V., Barnes, M., & Bryant, P. (2001). Comprehension skill, inference-making ability, and their relation to knowledge. *Memory and Cognition*, 29, 850-859.
- Cain, K., Oakhill, J. V., & Bryant, P. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills. *Journal of educational psychology*, 96(1), 31.
- Cain, K., Oakhill, J. V., & Elbro, C. (2003). The ability to learn new word meanings from context by school-age children with and without language comprehension difficulties. *Journal of Child Language*, 30, 681-694.
- Cain, K., Oakhill, J. V., & Lemmon, K. (2004). Individual differences in the inference of word meanings from context: the influence of reading comprehension, vocabulary knowledge, and memory capacity. *Journal of educational psychology*, 96(4), 671.
- Calhoon, M. B. (2005). Effects of a peer-mediated phonological skill and reading comprehension program on reading skill acquisition of middle school students with reading disabilities. *Journal of learning disabilities*, 38, 424-433.
- Carretti, B., Borella, E., Cornoldi, C., & De Beni, R. (2009). Role of working memory in explaining the performance of individuals with specific reading comprehension difficulties: A meta-analysis. *Learning and Individual Differences*, 19, 246-251.

- Carroll, J., Gillon, G. T., & McNeill, B. C. (2012). Explicit phonological knowledge of educational professionals. *Asia Pacific Journal of Speech, Language and Hearing*, 15(4), 231-244.
- Cartwright, K. B. (2009). The Role of Cognitive Flexibility in Reading Comprehension: Past, Present, and Future. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 115-139). New York, NY: Routledge.
- Caruana, V., & Ploner, J. (2010). *Internationalisation and equality and diversity in HE: merging identities*.
- . UK.
- Catts, H. W., Adlof, S. M., Hogan, T. P., & Weismer, S. E. (2005). Are specific language impairment and dyslexia distinct disorders? *Journal of Speech, Language & Hearing Research*, 48, 1378-1396.
- Catts, H. W., Adlof, S. M., & Weismer, S. E. (2006). Language deficits in poor comprehenders: A case for the simple view of reading. *Journal of Speech, Language & Hearing Research*, 49(1), 278-293.
- Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (1999). Language basis of reading and reading disabilities: Evidence from a longitudinal investigation. *Scientific studies of reading*, 3(4), 331-361.
- Catts, H. W., Hogan, T. P., & Adlof, S. M. (2005). Developmental changes in reading and reading disabilities. In H. W. Catts & A. G. Kamhi (Eds.), *Connections Between Language and Reading Disabilities* (pp. 25-40). Mahwah, NJ: Lawrence Erlbaum.
- Catts, H. W., Hogan, T. P., & Fey, M. E. (2003). Sub-grouping poor readers on the basis of individual differences in reading-related abilities. *Journal of learning disabilities*, 36(3), 151-164.
- Catts, H. W., Kamhi, A. G., & Adlof, S. (2012). Defining and classifying reading disabilities. In A. G. Kamhi & H. W. Catts (Eds.), *Language and reading disabilities* (3rd ed.). Upper Saddle River, NJ: Pearson Education Inc.
- Caverly, D. C., Nicholson, S. A., & Radcliffe, R. (2004). The Effectiveness of Strategic Reading Instruction for College Developmental Readers. *Journal of College Reading and Learning*, 35(1), 25-49.
- Chall, J. S. (1967). *Learning to Read: The Great Debate*. New York, NY: McGraw Hill.
- Chall, J. S. (1996). *Stages of Reading Development* (2nd ed.). Orlando, FL: Harcourt Brace & Company.

- Cogmena, S., & Saracaloglu, A. S. (2009). Students' usage of reading strategies in the faculty of education. *Procedia Social and Behavioral Sciences*, *1*, 248-251.
- Cohen, J. (2007). A Case Study of a High School English-Language Learner and His Reading. *Journal of Adolescent & Adult Literacy*, *51*(2), 164-175.
- Cohen, J. W. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Coltheart, M., & Prior, M. (2006). Learning to read in Australia. *Australian Journal of Learning Disabilities*, *11*(4), 157-164.
- Conaway, B. J., Saxon, T. F., & Woods, M. B. (2003). A comparison of the reading abilities of teacher candidates. *The Teacher Educator*, *39*(1), 1-17.
- Cromley, J. G. (2005). Metacognition, cognitive strategy instruction, and reading in adult literacy. *Review of adult learning and literacy*, *5*(7), 187-205.
- Cromley, J. G., & Azevedo, R. (2007). Testing and Refining the Direct and Inferential Mediation Model of Reading Comprehension. *Journal of educational psychology*, *99*(2), 311-325.
- Cutting, L. E., & Scarborough, H. S. (2006). Prediction of Reading Comprehension: Relative Contributions of Word Recognition, Language Proficiency, and Other Cognitive Skills Can Depend on How Comprehension Is Measured. *Scientific studies of reading*, *10*(3), 277-299.
- Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, *19*(4), 450-466.
- Daneman, M., & Merikle, P. M. (1996). Working memory and language comprehension: A meta-analysis. *Psychonomic Bulletin & Review*, *3*(4), 422-433.
- Denton, C. A., Fletcher, J. M., Anthony, J. L., & Francis, D. J. (2006). An evaluation of intensive intervention for students with persistent reading difficulties. *Journal of learning disabilities*, *35*, 447-466.
- Devlin, M., & Samarawickrema, G. (2010). The criteria of effective teaching in a changing higher education context. *Higher Education Research & Development*, *29*(2), 111-124.
- Dougherty Stahl, K. A. (2009). Assessing the Comprehension of Young Children. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 428-448). New York, NY: Taylor & Francis.

- Draffan, E. A., Evans, D. G., & Blenkhorn, P. (2007). Use of assistive technology by students with dyslexia in post-secondary education. *Disability & Rehabilitation: Assistive Technology*, 2(2), 105-116.
- Dreyer, L. G., & Katz, L. (1992). An Examination of "The Simple View of Reading". *Haskins Laboratories Status Report on Speech Research*, 111/112, 161-166.
- Duke, N. K., Pearson, P., Strachan, S. L., & Billman, A. K. (2011). Essential Elements of Fostering and Teaching Reading Comprehension. In S. J. Samuels & A. E. Farstrup (Eds.), *What Research Has to Say About Reading Instruction*: International Reading Association.
- Duncum, P. (1999). What generalist teachers need to know to teach art well. *Art Education*, Nov, 33-37.
- Dunn, L. M., & Dunn, D. M. (2007). *PPVT-4: Peabody Picture Vocabulary Test* (Fourth ed.). San Antonio, TX: Pearson.
- Ehri, L. C. (1995). Phases of development in learning to read by sight. *Journal of research in reading*, 18, 116-125.
- Ehri, L. C. (2005). Development of sight word reading: Phases and findings. In M. J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook* (pp. 135-154). Oxford, UK: Blackwell Publishing Ltd.
- Eilers, H. L., & Pinkley, C. (2006). Metacognitive strategies help students to comprehend all text. *Reading Improvement*, 43(1), 13-29.
- Elwér, A., Keenan, J. M., Olson, R. K., Byrne, B., & Samuelsson, S. (2013). Longitudinal stability and predictors of poor oral comprehenders and poor decoders. *Journal of experimental child psychology*, 115(3), 497-516.
- Falk-Ross, F. C. (2001). Toward the new literacy: Changes in college students' reading comprehension following reading / writing projects. *Journal of Adolescent & Adult Literacy*, 45(4), 278-288.
- Farrand, P., Hussain, F., & Hennessy, E. (2002). The efficacy of the 'mind map' study technique. *Medical Education*, 36(426-431).
- Fidler, R. (2009). *The Reading Comprehension Skills of Adult Students with Dyslexia*. University of Surrey, UK. Unpublished doctoral dissertation.
- Fidler, R., & Everatt, J. (Eds.). (2012). *Reading Comprehension in Adult Students with Dyslexia: Areas of Weakness and Strategies for Support* (First ed.): John Wiley & Sons, Ltd.

- Fielding-Barnsley, R. (2010). Australian pre-service teachers' knowledge of phonemic awareness and phonics in the process of learning to read. *Australian Journal of Learning Difficulties*, 15(1), 99-110.
- Fielding-Barnsley, R., & Purdie, N. (2005). Teachers' attitude to and knowledge of metalinguistics in the process of learning to read. *Asia-Pacific Journal of Teacher Education*, 33(1), 65-76.
- Fillmore, L. W., & Snow, C. E. (2000). *What Teachers Need to Know About Language*. Washington DC.
- Flynn, L. J., Zheng, X., & Swanson, H. L. (2012). Instructing Struggling Older Readers: A Selective Meta-Analysis of Intervention Research. *Learning Disabilities Research & Practice*, 27(1), 21-32.
- Franks, B. A. (1998). Logical inference skills in adult reading comprehension: Effects of age and formal education. *Educational Gerontology*, 24(1), 47-68.
- Fraser, D., & McGee, C. (2011). *The professional practice of teaching* (4th ed.). South Melbourne, Australia: Cengage Learning.
- Gillon, G. T. (2004). *Phonological awareness: From research to practice*. New York: The Guilford Press.
- Goswami, U. (2000). Early phonological development and the acquisition of literacy. In S. B. Neuman & D. K. Dickinson (Eds.), *Handbook of early literacy research* (pp. 111-125). New York, NY: Guilford Press.
- Goswami, U., & Bryant, P. (1990). *Phonological skills and learning to read*. Hove, UK: Lawrence Erlbaum Associates.
- Gough, P., Hoover, W. A., & Peterson, C. L. (1996). Some observations of a simple view of reading. In C. Cornoldi & J. V. Oakhill (Eds.), *Reading comprehension difficulties. Processes and intervention* (pp. 1-13). Mahwah, NJ: Erlbaum.
- Gough, P., & Tunmer, W. E. (1986). Decoding, reading and reading disability. *Remedial and Special Education*, 7(1), 6-10.
- Greenberg, D., Pae, H. K., Morris, R. D., Calhoon, M. B., & Nanda, A. O. (2009). Measuring Adult Literacy Students' Reading Skills Using the Gray Oral Reading Test. *Annals of dyslexia*, 59(2), 133-149.
- Greenberg, D., Wise, J. C., Morris, R., Fredrick, L. D., Rodrigo, V., Nanda, A. O., & Pae, H. K. (2011). A randomized control study of instructional approaches for struggling adult readers. *Journal of research on educational effectiveness*, 4(2), 101-117.

- Hannon, B. (2012). Understanding the Relative Contributions of Lower-Level Word Processes, Higher-Level Processes, and Working Memory to Reading Comprehension Performance in Proficient Adult Readers. *Reading Research Quarterly*, 47(2), 125-152.
- Hannon, B., & Daneman, M. (1998). Facilitating Knowledge-Based Inferences in Less-Skilled Readers. *Contemporary Educational Psychology*, 23, 149-172.
- Hannon, B., & Daneman, M. (2001). A new tool for measuring and understanding individual differences in the component processes of reading comprehension. *Journal of educational psychology*, 93(1), 103-128.
- Harper, H., & Rennie, J. (2008). 'I had to go out and get myself a book on grammar': A study of pre-service teachers' knowledge about language. *Australian Journal of Language and Literacy*, 32(1), 22-37.
- Hatcher, J., Snowling, M. J., & Griffiths, Y. M. (2002). Cognitive assessment of dyslexic students in higher education. *British Journal of Educational Psychology*, 72, 119-133.
- Heiman, T., & Precel, K. (2003). Students with Learning Disabilities in Higher Education: Academic Strategies Profile. *Journal of learning disabilities*, 36(3), 248-258.
- Henderson, C. (1999). College freshmen with disabilities: A biennial statistical profile. Washington DC: American Council on Education, Health Resource Center.
- Higgins, E. L., & Raskind, M. H. (1997). The compensatory effectiveness of optical character recognition/speech synthesis on reading comprehension of postsecondary students with learning disabilities. *Learning Disabilities*, 8(2), 75-87.
- Higgins, E. L., & Zvi, J. C. (1995). Assistive technology for postsecondary students with learning disabilities: From research to practice. *Annals of dyslexia*, 45(1), 123-142.
- Hirsch, E. D. (2003). Reading Comprehension Requires Knowledge - of Words and the World: Scientific Insights into the Fourth-Grade Slump and the Nations's Stagnant Comprehension Scores. *American Educator*, 27(1), 10-22 28-29 44.
- Hock, M. F., & Mellard, D. F. (2005). Reading comprehension strategies for adult literacy outcomes. *Journal of Adolescent and Adult Literacy*, 49(3), 192-200.
- Hock, M. F., & Mellard, D. F. (2011). Efficacy of learning strategies instruction in adult education. *Journal of research on educational effectiveness*, 4, 134-153.
- Hogan, T. P., Sittner Bridges, M., Justice, L. M., & Cain, K. (2011). Increasing Higher Level Language Skills to Improve Reading Comprehension. *Focus on Exceptional Children*, 44(3), 1-20.

- Holder, G. M., Jones, J., Robinson, R. A., & Krass, I. (1999). Academic literacy skills and progression rates amongst pharmacy students. *Higher Education Research & Development, 18*(1), 19-30.
- Holmes, V. M. (2009). Bottom-up processing and reading comprehension in experienced adult readers. *Journal of research in reading, 32*(3), 309-326.
- Hong-Nam, K., & Leavell, A. G. (2011). Reading Strategy Instruction, Metacognitive Awareness, and Self-perception of Striving College Developmental Readers. *Journal of College Literacy and Learning, 37*, 3-17.
- Hood, H. (2000). *Left to write too* (2nd ed.). Palmerston North, New Zealand: Dunmore Press.
- Hoover, W., & Gough, P. (1990). The simple view of reading. *Reading and Writing, 127-160*.
- Hurry, J., & Doctor, E. (2007). Assessing Literacy in Children and Adolescents. *Child and Adolescent Mental Health, 12*(1), 38-45.
- Jackson, N. E. (2005). Are university students' component reading skills related to their text comprehension and academic achievement? *Learning and Individual Differences, 15*(2), 113-139.
- Jenkins, J. R., Fuchs, L. S., Van den Broek, P., Espin, C. A., & Deno, S. L. (2003). Sources of Individual Differences in Reading Comprehension and Reading Fluency. *Journal of educational psychology, 95*(4), 719-729.
- Jenkins, J. R., & O'Connor, R. E. (2002). Early identification and intervention for young children with reading/learning disabilities. In R. Bradley, L. Danielson & D. P. Hallahan (Eds.), *Identification of learning disabilities: Research to practice*. (pp. 99-149). Mahwah, NJ: Erlbaum.
- Joshi, R. M., & Aaron, P. G. (2000). The component model of reading: Simple view of reading made a little bit more complex. *Reading Psychology, 21*(2), 85-97.
- Joshi, R. M., Treiman, R., Carreker, S., & Moats, L. C. (2008). How words cast their spell. *American Educator, 32*(4), 6-16, 43.
- Kamhi, A. G., & Hinton, L. N. (2000). Explaining Individual Differences in Spelling Ability. *Topics in language disorders, 20*(1), 37-49.
- Kendeou, P., Savage, R., & van den Broek, P. (2009). Revisiting the simple view of reading. *British Journal of Educational Psychology, 79*(1), 353-370.
- Kennedy, G. (2000). Voiced software packages for literacy: An overview. *Australian Journal of Learning Difficulties, 5*(4), 31-32.

- Kintsch, W. (1988). The role of knowledge in discourse processing: A construction-integration model. *Psychological Review*, 95(2), 163-182.
- Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. New York, NY: Cambridge University Press.
- Kintsch, W. (2005). An Overview of Top-Down and Bottom-Up Effects in Comprehension: The CI Perspective. *Discourse Processes*, 39(2-3), 125-128.
- Kintsch, W., & Rawson, K. A. (2005). Comprehension. In M. J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook*. Oxford, UK: Blackwell Publishing Ltd.
- Klauda, S. L., & Guthrie, J. T. (2008). Relationships of Three Components of Reading Fluency to Reading Comprehension. *Journal of educational psychology*, 100(2), 310-321.
- Kozminsky, E., & Kozminsky, L. (2001). How do general knowledge and reading strategies ability relate to reading comprehension of high school students at different educational levels? *Journal of research in reading*, 24(2), 189-204.
- Kruidenier, J. (2002). *Research-based principles for adult basic education reading instruction*. Washington DC: National Institute of Literacy.
- Kruidenier, J., MacArthur, C. A., & Wrigley, H. S. (2010). *Adult education literacy instruction: A review of the research*. Washington DC: National Institute of Literacy.
- Kutner, M., Greenberg, E., Jin, Y., Boyle, B., Hsu, Y., & Paulsen, C. (2007). *Literacy in Everyday life: Results from the 2003 National Assessment of Adult Literacy*. Washington D.C.: U.S. Department of Education, Institute for Education Sciences, National Center for Education Statistics.
- Kwiatkowska-White, B. (2012). *Understanding Reading Comprehension Performance in High School Students*. Queen's University. Unpublished doctoral dissertation.
- Landi, N. (2010). An examination of the relationship between reading comprehension, higher-level and lower-level reading sub-skills in adults. *Reading and Writing*, 23, 701-717.
- Lehman-Blake, M. T., & Tompkins, C. A. (2001). Predictive Inferencing in Adults With Right Hemisphere Brain Damage. *Journal of Speech, Language, and Hearing Research*, 44, 639-654.
- Lennox, C., & Siegel, L. S. (1998). Phonological and Orthographic Processes in Good and Poor Spellers. In C. Hulme & R. M. Joshi (Eds.), *Reading and Spelling: Development and Disorders* (pp. 395-404). Mahwah, NJ: Lawrence Erlbaum Associates.

- Lindstrom, J. H. (2007). Determining appropriate accommodations for postsecondary students with reading and written expression disorders. *Learning Disabilities Research & Practice, 22*(4), 229-236.
- Long, D. L., Oppy, B. J., & Seely, M. R. (1994). Individual differences in the time course of inferential processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(6), 1456.
- Louden, W., & Rohl, M. (2006). "Too many theories and not enough instruction": perceptions of preservice teacher preparation for literacy teaching in Australian schools. *Literacy, 40*(2), 66-78.
- Lovett, M., Lacerenza, L., & Borden, S. L. (2000). Putting struggling readers on the PHAST track: A program to integrate phonological and strategy-based remedial reading instruction and maximize outcomes. *Journal of learning disabilities, 33*(5), 458-476.
- MacArthur, C. A., Konold, T. R., Glutting, J. J., & Alamprese, J. A. (2010). Reading component skills of learners in adult basic education. *Journal of learning disabilities, 43*(2), 108-121.
- Macaruso, P., & Shankweiler, D. (2010). Expanding the Simple View of Reading in Accounting for Reading Skills in Community College Students. *Reading Psychology, 31*, 454-471.
- Mahar, N. E., & Richdale, A. L. (2008). Primary teachers' linguistic knowledge and perceptions of early literacy instruction. *Australian Journal of Learning Difficulties, 13*(1), 17-37.
- Martin, M. O., Mullis, I. V. S., & Kennedy, A. M. (2007). *Progress in International Reading Literacy Study (PIRLS): PIRLS 2006 Technical Report*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Masterson, J. J., & Apel, K. (2007). Spelling and word-level reading: A multilinguistic approach. In A. G. Kamhi, J. J. Masterson & K. Apel (Eds.), *Clinical decision making in developmental language disorders* (pp. 249-266). Baltimore, MD: Brookes.
- Mather, N., Bos, C., & Babur, N. (2001). Perceptions and Knowledge of Preservice and Inservice Teachers About Early Literacy Instruction. *Journal of learning disabilities, 34*(5), 472-482.
- McCutchen, D., Abbott, R. D., Green, L. B., Beretvas, N., Cox, S., Potter, N. S., . . . Gray, A. L. (2002). Beginning Literacy: Links Among Teacher Knowledge, Teacher Practice, and Student Learning. *Journal of learning disabilities, 35*(1), 69-86.

- McShane, S. (2005). *Applying Research in Reading Instruction for Adults: First Steps for Teachers*. Washington, DC: National Institute for Literacy.
- Mellard, D. F., & Fall, E. (2012). Component model of reading comprehension for adult education participants. *Learning Disability Quarterly*, 35(1), 10-23.
- Mellard, D. F., Fall, E., & Woods, K. L. (2010). A Path Analysis of Reading Comprehension for Adults With Low Literacy. *Journal of learning disabilities*, 43(2), 154-165.
- Mellard, D. F., Woods, K. L., & Md Desa, Z. (2012). An Oral Reading Fluency Assessment for Young Adult Career and Technical Education Students. *Learning Disabilities Research & Practice*, 27(3), 125-135.
- Mellard, D. F., Woods, K. L., Md Desa, Z., & Vuyk, M. A. (2013). Underlying Reading-Related Skills and Abilities Among Adult Learners. *Journal of learning disabilities*(Early Online), 1-13.
- Miller-Shaul, S. (2005). The Characteristics of Young and Adult Dyslexics Readers on Reading and Reading Related Cognitive Tasks as Compared to Normal Readers. *Dyslexia*, 11, 132-151.
- Miller, B., McCardle, P., & Hernandez, R. (2010). Advances and Remaining Challenges in Adult Literacy Research. *Journal of learning disabilities*, 43(2), 101-107.
- Milton, M., Rohl, M., & House, H. (2007). Secondary Beginning Teacher's Preparedness to Teach Literacy and Numeracy: A Survey. *Australian Journal of Teacher Education*, 32(2), 1-20.
- Moats, L. C. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of dyslexia*, 44, 81-101.
- Moats, L. C. (2000). *Speech to Print: Language Essentials for Teachers*. Baltimore, Maryland: Brookes Publishing Company.
- Moats, L. C. (2009). Knowledge foundations for teaching reading and spelling. *Reading and Writing*, 22, 379-399.
- Moats, L. C. (2014). What teachers don't know and why they aren't learning it: addressing the need for content and pedagogy in teacher education. *Australian Journal of Learning Difficulties*, Early online.
- Moats, L. C., & Foorman, B. R. (2003). Measuring Teachers' Content Knowledge of Language and Reading. *Annals of dyslexia*, 53, 23-45.
- Mokhtari, K., & Reichard, C. A. (2002). Assessing students' metacognitive awareness of reading strategies. *Journal of educational psychology*, 94(2), 249-259.

- Moore, D. W., Bean, T. W., Birdyshaw, D., & Rycik, J. A. (1999). Adolescent literacy: A position statement. *Journal of Adolescent and Adult Literacy*, 43(1), 97-112.
- Mullis, I. V. S., Martin, M. O., Foy, P., & Drucker, K. T. (2012). *PIRLS 2011 International Results in Reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Nathanson, S., Pruslow, J., & Levitt, R. (2008). The Reading Habits and Literacy Attitudes of Inservice and Prospective Teachers Results of a Questionnaire Survey. *Journal of Teacher Education*, 59(4), 313-321.
- Nation, K. (2005). Children's Reading Comprehension Difficulties. In M. J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook* (pp. 248-265). Oxford, UK: Blackwell Publishing Ltd.
- Nation, K., Adams, J. W., Bowyer-Crane, C. A., & Snowling, M. J. (1999). Working memory deficits in poor comprehenders reflect underlying language impairments. *Journal of experimental child psychology*, 73(2), 139-158.
- Nation, K., Clarke, P., Marshall, C. M., & Durand, M. (2004). Hidden language impairments in children: Parallels between poor reading comprehension and specific language impairment. *Journal of Speech, Language and Hearing Research*, 47(1), 199-211.
- Nation, K., Cocksey, J., Taylor, J. S. H., & Bishop, D. V. M. (2010). A longitudinal investigation of early reading and language skills in children with poor reading comprehension. *Journal of Child Psychology and Psychiatry*, 51(9), 1031-1039.
- Nation, K., & Norbury, C. F. (2005). Why reading comprehension fails: Insights from developmental disorders. *Topics in language disorders*, 25(1), 21-32.
- Nation, K., & Snowling, M. J. (1997). Assessing reading difficulties: The validity and utility of current measures of reading skill. *British Journal of Educational Psychology*, 67, 359-370.
- Nation, K., & Snowling, M. J. (2004). Beyond phonological skills: Broader language skills contribute to the development of reading. *Journal of research in reading*, 27(4), 342-356.
- National Inquiry into the Teaching of Literacy. (2005). *Teaching Reading Report*. Retrieved from <http://www.ag.gov.au/cca>.
- National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: National Institutes of Child Health and Development.
- Neale, M. D. (1999). *Neale Analysis of Reading: Third Edition*. Melbourne: ACER Press.

- Nicholson, T. (1998). Reading Comprehension Processes. In G. B. Thompson & T. Nicholson (Eds.), *Learning to Read: Beyond Phonics and Whole Language* (pp. 127-149). New York, NY: Teachers College Press.
- Oakhill, J. V. (1982). Constructive processes in skilled and less skilled comprehenders' memory for sentences. *British journal of psychology*, 73(1), 13-20.
- Oakhill, J. V. (1984). Inferential and memory skills in children's comprehension of stories. *British Journal of Educational Psychology*, 54(1), 31-39.
- Oakhill, J. V., & Cain, K. (2012). The Precursors of Reading Ability in Young Readers: Evidence From a Four-Year Longitudinal Study. *Scientific studies of reading*, 16(2), 91-121.
- OECD. (2014). *PISA 2012 Results: What Students Know and Can Do – Student Performance in Mathematics, Reading and Science* (Vol. I, Revised edition, February 2014). PISA: OECD Publishing.
- Paris, S. G., & Hamilton, E. E. (2009). The Development of Children's Reading Comprehension. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 32-53). New York, NY: Routledge.
- Paris, S. G., Wasik, B. A., & Turner, J. C. (1991). *The development of strategic readers* (Vol. 2). New York, NY: Longman.
- Parr, C., & Woloshyn, V. (2013). Reading Comprehension Strategy Instruction in a First-Year Course: An Instructor's Self-Study. *The Canadian Journal for the Scholarship of Teaching and Learning*, 4(2), 1-19.
- Parry, G. (2009). Policy Contexts: Differentiation, competition, and policies for widening participation. In M. David, A. Bathmaker, G. Crozier, P. Davis, H. Ertl, A. Fuller, G. Hayward, S. Heath, C. Hockings & G. Parry (Eds.), *Improving learning by widening participation in higher education* (pp. 31-46). Oxfordshire, UK: Routledge.
- Pearson, P. D. (2009). The Roots of Reading Comprehension Instruction. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 3-31). New York, NY: Routledge.
- Perfetti, C. A., & Bell, L. C. (1994). Reading skill: Some adult comparisons. *Journal of educational psychology*, 86(2), 244-259.
- Perfetti, C. A., Landi, N., & Oakhill, J. V. (2005). The Acquisition of Reading Comprehension Skill. In M. J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook* (pp. 227-247). Oxford, UK: Blackwell Publishing Ltd.

- Phillips, L. M. (1988). Young Readers' Inference Strategies in Reading Comprehension. *Cognition and Instruction, 5*(3), 193-222.
- Piaget, J. (1964). Part I: Cognitive development in children: Piaget development and learning. *Journal of research in science teaching, 2*(3), 176-186.
- Portney, L. G., & Watkins, M. P. (2009). *Foundations of clinical research: Applications to practice* (3rd ed.). Upper Saddle River, NJ: Pearson Education.
- Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. Kamil, P. Mosenthal, P. Pearson & R. Barr (Eds.), *Handbook of reading research* (Vol. 3, pp. 545-561). Mahwah, NJ: Erlbaum.
- Pressley, M., & Gaskins, I. W. (2006). Metacognitively competent reading comprehension is constructively responsive reading: how can such reading be developed in students? *Metacognition and Learning, 1*(1), 99-113.
- Ramus, F., Rosen, S., Dakin, S. C., Day, B. L., Castellote, J. M., White, S., & Frith, U. (2003). Theories of developmental dyslexia: Insights from a multiple case study of dyslexic adults. *Brain, 126*, 841-865.
- Ransby, M. J., & Swanson, H. L. (2003). Reading Comprehension Skills of Young Adults with Childhood Diagnoses of Dyslexia. *Journal of learning disabilities, 36*(3), 538-555.
- Rapp, D. N., Van den Broek, P., McMaster, K. L., Kendeou, P., & Espin, C. A. (2007). Higher-Order Comprehension Processes in Struggling Readers: A Perspective for Research and Intervention. *Scientific studies of reading, 11*(4), 289-312.
- Rashotte, C. A., MacPhee, K., & Torgesen, J. K. (2001). The Effectiveness of a Group Reading Instruction Program with Poor Readers in Multiple Grades. *Learning Disability Quarterly, 24*(2), 119-134.
- Raven, J., Raven, J. C., & Court, J. H. (2003). *Raven's Progressive Matrices and Vocabulary Scales*. San Antonio, TX: Harcourt Assessment.
- Reder, S. (2000). Adult Literacy and Postsecondary Education Students: Overlapping Populations and Learning Trajectories. In J. Comings, B. Garner & C. Smith (Eds.), *Annual review of adult learning and literacy* (Vol. 1, pp. 111-157). San Francisco: Jossey-Bass.
- Rich, R., & Shepherd, M. J. (1993). Teaching text comprehension strategies to adult poor readers. *Reading and Writing, 5*, 387-402.
- Ricketts, J., Nation, K., & Bishop, D. V. M. (2007). Vocabulary is important for some, but not all reading skills. *Scientific studies of reading, 11*(3), 235-257.

- Rohl, M., & Greaves, D. (2005). How are pre-service teachers in Australia being prepared for teaching literacy and numeracy to a diverse range of students? *Australian Journal of Learning Difficulties*, *10*(1), 3-8.
- Roman, A. A., Kirby, J., Parrila, R., Wade-Woolley, L., & Deacon, S. H. (2009). Towards a comprehensive view of the skills involved in word reading in Grades 4, 6, and 8. *Journal of experimental child psychology*, *102*, 96-113.
- Rose, J. (2006). *Independent review of the teaching of early reading: Final report*. Nottingham, UK.
- Rumelhart, D. (1977). Toward an interactive model of reading. In S. Dornic (Ed.), *Attention and performance VI* (pp. 573-603). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Sabatini, J. P., Shore, J. R., Holtzman, S., & Scarborough, H. S. (2011). Relative effectiveness of reading intervention programs for adults with low literacy. *Journal of research on educational effectiveness*, *4*(2), 118-133.
- Sabatini, J. P., Shore, J. R., Sawaki, Y., & Scarborough, H. S. (2010). Relationships Among Reading Skills of Adults with Low Literacy. *Journal of learning disabilities*, *43*(2), 122-138.
- Satherley, P., Lawes, E., & Sok, S. (2008). *The Adult Literacy and Life Skills Survey : Overview and International Comparisons*. Wellington: Comparative Education Research Unit Retrieved from www.educationcounts.govt.nz/goto/all.
- Savage, R. S. (2006). Reading comprehension is not always the product of nonsense word decoding and linguistic comprehension: Evidence from teenagers who are extremely poor readers. *Scientific studies of reading*, *10*(2), 143-164.
- Savage, R. S., & Wolforth, J. (2007). An additive simple view of reading describes the performance of good and poor readers in higher education. *Exceptionality Education Canada*, *17*(1), 243-268.
- Scarborough, H. S., Sabatini, J. P., Shore, J. R., Cutting, L. E., Pugh, K., & Katz, L. (2013). Meaningful reading gains by adult literacy learners. *Reading and Writing*, *26*, 593-613.
- Seigneuric, A., & Ehrlich, M. (2005). Contribution of working memory capacity to children's reading comprehension: A longitudinal investigation. *Reading and Writing*, *18*(7-9), 617-656.
- Seigneuric, A., Ehrlich, M., Oakhill, J. V., & Yuill, N. (2000). Working memory resources and children's reading comprehension. *Reading and Writing*, *13*(1-2), 81-103.

- Semel, E., Wiig, E. H., & Secord, W. (2003). *Clinical Evaluation of Language Fundamentals - Fourth Edition (CELF-4)*. San Antonio, TX, USA: The Psychological Corporation.
- Shankweiler, D., Lundquist, E., Dreyer, L. G., & Dickinson, C. C. (1996). Reading and spelling difficulties in high school students: Causes and consequences. *Reading & Writing, 8*, 267-294.
- Sheorey, R., & Mokhtari, K. (2001). Differences in the metacognitive awareness of reading strategies among native and non-native readers. *System, 29*, 431-449.
- Simpson, M. L., & Nist, S. L. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent and Adult Literacy, 43*(6), 528-541.
- Snow, C. E., Griffin, P., & Burns, S. M. (2005). *Knowledge to support the teaching of reading: Preparing teachers for a changing world*. San Francisco: Jossey-Bass.
- Snowling, M. J., Hulme, C., & Nation, K. (1997). A connectionist perspective on the development of reading skills in children. *Trends in Cognitive Sciences, 1*(3), 88-91.
- Spear-Swerling, L., & Brucker, P. O. (2003). Teachers' acquisition of knowledge about English word structure. *Annals of dyslexia, 53*, 72-103.
- Spear-Swerling, L., & Brucker, P. O. (2006). Teacher-Education Students' Reading Abilities and their Knowledge about Word Structure. *Teacher Education and Special Education, 29*(2), 116-126.
- Stainthorp, R. (2004). W(h)ither phonological awareness? Literate trainee teachers' lack of stable knowledge about the sound structure of words. *Educational Psychology, 24*(6), 753-765.
- Stanovich, K. E. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16*, 32-71.
- Stanovich, K. E. (1984). The interactive-compensatory model of reading: A confluence of developmental, experimental, and educational psychology. *Remedial and Special Education, 5*(3), 11-19.
- Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360-407.
- Stothard, S. E., & Hulme, C. (1992). Reading comprehension difficulties in children: The role of language comprehension and working memory skills. *Reading and Writing, 4*, 245-256.
- Swanson, H. L., & Berninger, V. (1995). The Role of Working Memory in Skilled and Less Skilled Readers' Comprehension. *Intelligence, 21*, 83-108.

- Thiede, K. W., Anderson, M. C. M., & Theriault, D. (2003). Accuracy of meta-cognitive monitoring affects learning of texts. *Journal of educational psychology, 95*(1), 66-73.
- Torgesen, J. K. (1999). Assessment and instruction for phonemic awareness and word recognition skills. In H. W. Catts & A. Kamhi (Eds.), *Language and reading disabilities* (pp. 128-153). Boston: Allyn and Bacon.
- Torgesen, J. K. (2000). Individual Differences in Response to Early Interventions in Reading: The Lingering Problem of Treatment Resisters. *Learning Disabilities Research and Practice, 15*(1), 55-64.
- Treiman, R., & Kessler, B. (2005). Writing systems and spelling development. In M. J. Snowling & C. Hulme (Eds.), *The Science of Reading: A Handbook* (pp. 120-134). Oxford, UK: Blackwell Publishing Ltd.
- Tunmer, W. E., & Chapman, J. W. (2012). The simple view of reading redux: Vocabulary knowledge and the independent components hypothesis. *Journal of learning disabilities, 45*(5), 453-466.
- UNESCO. (2013). Adult and Youth Literacy: National, regional and global trends, 1985-2015. Montreal, Canada: UNESCO Institute for Statistics.
- UNICEF. (2010). The children left behind: A league table of inequality in child well-being in the world's rich countries (Vol. Innocenti Report Card 9). Florence, Italy: Innocenti Research Centre.
- Van Dyke, J. A., Johns, C. L., & Kukona, A. (2014). Low working memory capacity is only spuriously related to poor reading comprehension. *Cognition, 131*, 373-403.
- van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard, 16*(40), 33-36.
- Vaughn, S., Crinio, P. T., Wanzek, J., Wexler, J., Fletcher, J. M., & Denton, C. D. (2010). Response to intervention for middle school struggling readers: Effects of a primary and secondary intervention. *School Psychology Review, 32*, 2-21.
- Vaughn, S., Roberts, G., Wexler, J., Vaughn, M. G., Fall, A., & Schnakenberg, J. B. (2014). High School Students With Reading Comprehension Difficulties: Results of a Randomized Control Trial of a Two-Year Reading Intervention. *Journal of learning disabilities, Early Online*, 1-13.
- Vellutino, F. R., Tunmer, W. E., Jaccard, J. J., & Chen, R. (2007). Components of reading ability: Multivariate evidence for a convergent skills model. *Scientific studies of reading, 11*(1), 3-32.

- Vogel, S. A., Leonard, F., Scales, W., Hayeslip, P., Hermansen, J., & Donnels, L. (1998). The national learning disabilities postsecondary data bank: An overview. *Journal of learning disabilities, 31*, 234-247.
- Wanzek, J., Wexler, J., Vaughn, S., & Ciullo, S. (2010). Reading interventions for struggling readers in the upper elementary grades: a synthesis of 20 years of research. *Reading and Writing, 23*, 889-912.
- Washburn, E. K., Joshi, R. M., & Binks-Cantrell, E. S. (2011). Are preservice teachers prepared to teach struggling readers? *Annals of dyslexia, 61*(1), 21-43.
- Washburn, E. K., Joshi, R. M., & Binks-Cantrell, E. S. (2011). Teacher knowledge of basic language concepts and dyslexia. *Dyslexia, 17*(2), 165-183.
- Wiig, E. H., & Secord, W. (1993). *Test of Language Competence - Expanded Edition (TLC-E)*. San Antonio, TX: Psychological Corporation.
- Williams, R. S., Ari, O., & Santamaria, C. N. (2011). Measuring college students' reading comprehension ability using cloze tests. *Journal of research in reading, 34*(2), 215-231.
- Wolf, M., & Kennedy, R. (2003). How the origins of written language instruct us to teach: A response to Steven Strauss. *Educational Researcher, 32*(2), 26-30.
- Wolter, J., & Apel, K. (2010). Initial acquisition of mental graphemic representations in children with language impairment. *Journal of Speech, Language & Hearing Research, 53*(1), 179-194.
- Woodcock, R. W. (1987). *Woodcock Reading Mastery Tests - Revised*. Circle Pines, Minnesota: American Guidance Service.
- Yeh, Y., McTigue, E. M., & Joshi, R. M. (2012). Moving from explicit to implicit: A case study of improving inferential comprehension. *Literacy Research and Instruction, 51*(2), 125-142.
- Yuill, N., & Oakhill, J. V. (1991). *Children's problems in text comprehension: An experimental investigation* Cambridge, England: Cambridge University Press.
- Yuill, N., Oakhill, J. V., & Parkin, A. (1989). Working memory, comprehension ability and the resolution of text anomaly. *British journal of psychology, 80*(3), 351-361.

APPENDIX A

Assessment Battery

SPELLING DICTATION TASK

1. Assessor
The assessor came to evaluate the damage to the property.
2. Repeat
The class wasn't listening so he was forced to repeat himself.
3. Liaison
She acted as a liaison between the two parties.
4. Inseparable
The two children were inseparable at school.
5. Immersion
She stayed with a local family in the village to allow for complete cultural immersion.
6. Acquire
Children gradually acquire new skills as they develop.
7. Courageous
The heroic act showed how courageous he was.
8. Repetition
The lecturer used a lot of repetition to get important points across.
9. Commit
She couldn't commit to the long distance relationship.
10. Space
There wasn't enough space in the house for a fourth flatmate.
11. Continuity
There was good continuity between the different courses in the degree.
12. Definitely
I definitely prefer to relax rather than to work.
13. Assess
Teachers use many methods to assess their students' numeracy skills.

14. Committee
The literacy committee meet once a fortnight.
15. Separate
The twins ended up in separate classes.
16. Begin
I can't begin any work until I've had my coffee.
17. Acquisition
The acquisition of knowledge is the goal of research.
18. Courage
It takes a lot of courage to complete the task.
19. Spacious
The house was spacious enough to fit three bathrooms.
20. Liaise
Part of her new role was to liaise between teachers and students.
21. Immerse
It was so hot that he decided to immerse his head under the cool water.
22. Continue
He wanted to continue dancing after the music had stopped.
23. Define
The students had to define four words from the list.
24. Beginning
It's hard to make new friends at the beginning of the year.

READING COMPREHENSION TASK (P. Brooks et al., 2004)¹**Text 1: Film**

Maria Tipsot is perhaps the best-known female film director of the last century. Born in the Ukraine, she was brought up and educated in Moscow, and moved to Austria as a young and enthusiastic student. Her films include 'The Unbearable Darkness of Living', 'The Shrinking Violet' and 'A Portrait of a Jealous Man'. She studied at the Vienna School of Film and Drama for five years under the ingenious master of avant-garde film, Sam Green. Many believe that she developed her own unique style of film-making by absorbing the theoretical teachings of Green and then re-interpreting them by using her own cultural influences. This has led one film critic to describe her as 'an individual who has broken the conventional barriers of modern film-making'.

She first came to the attention of the public and media, when she filmed a real bank robbery as it took place in a retail centre in West Berlin. Unfortunately, the authorities viewed her knowledge of the planned robbery with derision and disdain, and the court unanimously rejected her defence of freedom through art. She was sentenced to two years in jail, but only served eleven months and was released for good behaviour.

She was heavily influenced by the ideas of Victor Krantz, who collaborated with her on the ground-breaking series of short films entitled 'Visions of an Electric Era'. In 1984, she won the renowned Arvais International Film Award for best director for 'The Shrinking Violet'. Nine years later, she produced her last and most controversial film, 'A Portrait of a Jealous Man'. Although rumours abound regarding her re-emergence from retirement, there are no known plans for a forthcoming motion picture.

Q1. Who is Maria Tipsot?

Q2. Name two of her films

Q3. Where did she study?

Q4. What did she think of Sam Green?

Q5. What sort of a film director is Maria Tipsot?

Q6. What did she re-interpret using her own cultural influences?

Q7. How much time did she get off for good behaviour?

Q8. Where did she serve her prison sentence?

Q9. What award did she receive?

Q10. What do current rumours suggest?

¹ Used with permission.

Text 2: Science

Scientists at the Levin Institute of Molecular Research contend that they have uncovered a major breakthrough in their ability to understand the structure of the nervous system. Professor Marianne Courvierre and her colleagues commenced their exploration into the crucial role the nervous system plays in animal development more than twenty years ago. Initial studies using a revolutionary scanning system that can identify subtle changes in the structure of nerve endings were developed with laboratory rats. Groups of rats were located from birth in different environments: one group was placed in a bleak environment that consisted of a dark coloured box, another in a standard laboratory cage and a third in a rich and visually stimulating environment. Otherwise, all the rats were treated similarly: they were fed the same food; they inhabited equal amounts of physical space; the amount of light they received was equal; and they experienced similar auditory stimuli. Specified points in their life span were determined and each rat was observed and scrutinized with the new scanning system: the Nwabula-Garcia Machine, named after its inventors. Professor Courvierre and her colleagues observed distinct differences in the nervous systems of the groups. There were positive fluctuations in the development of the nerve endings and networks of nerves in the rich environment group compared to that of both the control group and the bleak environment group.

The measurements taken by the scanner are unrivalled in their use of magnetic resonance technology. The machine is able to detect miniscule changes in the nervous system at the molecular level and can also measure the reaction speed of the nervous system when the rats are subjected to specific stimuli or tasks. Each group of rodents, which consisted of twenty in each environment, after they had been scanned repeatedly over a six month period, was then placed in a specifically designed maze and timed how long it took them to find their way to the centre.

The rich environment group out-performed the other two and, significantly, when the rats were scanned after completing a number of tasks, the molecular structure of nerve endings had altered in all three groups, but more significantly in the rich environment group.

The internationally renowned research team commenced a longitudinal study on human participants ten years ago. Using the same magnetic scanning techniques the project is attempting to investigate the development of nerve endings in a diverse cross-section of families from different socio-economic groups with miscellaneous environmental influences. Initial analysis indicates significant differences in familial background and the research team are trying to ascertain the multitude of possible determinants of these variations. For example, high income participants have a propensity for a more developed nervous system than their lower socio-economic counterparts, but interestingly, city dwellers have significant deficiencies in facets of their nerve endings compared to rural occupants. Professor Courvierre commented that “this is only the commencement of the study and we have a convoluted, yet stimulating, journey ahead of us if we are to advance our understanding of the inter-relationship between environment, mind and body”

- Q1. Who led the research team?
- Q2. What body system were the scientists examining?
- Q3. What is the name of the institute where the research is taking place?
- Q4. How was the scanning system first developed?
- Q5. What is the name of the scanning machine?
- Q6. What does the machine do?
- Q7. Which group of rats was the control group?
- Q8. Why do you think that the scientists believe that the environment affects the development of the nervous system?
- Q9. How many rats were used in the initial experiments?
- Q10. When do you think the study will be completed?

INFERCING TASK – Listening Comprehension: Making Inferences (Wiig & Secord, 1993)

1.

The sun was shining when the Robertsons started out for their picnic. Unfortunately they had their picnic in the living room.

They had their picnic in the living room because:

- e. They didn't like to eat at a picnic table
- f. Their car broke down and had to be fixed
- g. It was a beautiful sunny day
- h. It rained heavily all afternoon

2.

Michelle waited for more than half an hour for Sam at the restaurant. When she got home, she refused to take any phone calls.

Michelle didn't want to talk on the phone because:

- a. She was angry and didn't want to listen to any excuses
- b. Sam hurt her feelings by not meeting her
- c. She didn't want anyone from the restaurant calling
- d. She had to help Sam with his homework

3.

Hannah and James met at the movie theatre. They were unhappy when they didn't get to see the movie.

They didn't get to see the movie because:

- a. The projector broke down
- b. They were out of popcorn
- c. Movie theatres are closed in the afternoon
- d. The movie was sold out

4.

Luke worked harder than anyone else on his school project. He met with his teacher after school to talk about his bad grade.

Luke met with his teacher because:

- a. The teacher never graded Luke's project
- b. Luke did not feel that he had done a bad job
- c. He realised he might have misunderstood the assignment
- d. His work was better than anyone else's

5.

Chloe carefully made a list of everything she would need while backpacking in the woods.

On the trail, Chloe panicked when she opened her backpack.

Chloe panicked because:

- a. She had seen a snake on the trail
- b. She had left the map of the trail behind
- c. She had forgotten to include a first aid kit
- d. She had misplaced the list of things to take

6.

Matthew had wanted a moped for the longest time.

He felt very grateful towards his Uncle William.

Matthew felt grateful towards his Uncle William because:

- a. Uncle William bought himself a moped
- b. He gave Matthew a moped for his birthday
- c. He warned Matthew's mother about the dangers of riding a moped
- d. He loaned Matthew the money to buy a moped

INFERENCE TASK – Ambiguous Sentences (adapted from Wiig & Secord, 1993)**1.**

The man was sure that the duck was ready to eat

2.

The roar of the fans disturbed the team

3.

The lady was looking up the street

4.

Bob did not blame the girl as much as her mother

5.

I knew that glare really bothered Jane

6.

I have always known that flying planes can be dangerous

7.

Did you see the girl with the telescope?

8.

Those prosecutors have been trying to lock him up for ten years

9.

The parents of the bride and groom were waiting outside

WORKING MEMORY TASK**Trial Item**

ROW 1	54
ROW 2	83
ROW 3	56

1.

ROW 1	90
ROW 2	93
ROW 3	71

2.

ROW 1	79
ROW 2	81
ROW 3	89

3.

ROW 1	84
ROW 2	88
ROW 3	90
ROW 4	68

4.

ROW 1	53
ROW 2	70
ROW 3	82
ROW 4	97

5.

ROW 1	83
ROW 2	90
ROW 3	63
ROW 4	48
ROW 5	36

6.

ROW 1	92
ROW 2	74
ROW 3	90
ROW 4	56
ROW 5	61

APPENDIX B

Knowledge of Language Structure Assessment (adapted from Binks-Cantrell, Joshi, et al., 2012; Mather et al., 2001; Moats, 2000).

1. How many speech sounds are there in the following words? For example, the word 'cat' has 3 speech sounds – 'k' 'a' 't'. It is important to remember that speech sounds do not necessarily equal the number of letters.

Tick the box with the corresponding number of sounds

	1	2	3	4	5	6
box						
grass						
ship						
moon						
brush						
knee						
through						

2. For each of the words given below, determine the number of syllables in each word. Write the number of syllables in the box next to the word.

	Number of Syllables
disassemble	
heaven	
observer	
spinster	
pedestal	
frogs	
teacher	

3. For each of the words given below, determine the number of morphemes in each word. Write the number of morphemes in the box next to the word.

	Number of Morphemes
disassemble	
heaven	
observer	
spinster	
pedestal	
frogs	
teacher	

4. A combination of two or three consonants pronounced so that each letter keeps its own identity is called:

- Silent consonant
- Consonant digraph
- Diphthong
- Consonant blend

5. What is the rule that governs the use of 'c' in the initial position to represent the 'k' sound?

- 'c' is used for /k/ in the initial position before e, i, or y
- The use of 'c' for /k/ in the initial position is random and must be memorised
- 'c' is used for /k/ in the initial position before a, o, u, or any consonant
- None of the above

6. Which of the following words has a prefix?

- Finely
- Virtue
- Commit
- Inner
- Furnish

7. If a Year 4 student spells the word 'expression' as 'ekspreshun', which of the following is most likely true?

- a. The student does not know the alphabetic principle
- b. The student does not know how to spell the common morphemes in the word
- c. The student has a poor ear for the sounds in our language
- d. The student has poor visual-spatial memory
- e. All of the above

8. The 'k' sounds in lake and lack are spelled differently. Why is the 'k' in lack spelled with a 'ck'?

- a. The 'k' sound ends the word
- b. The word is a verb
- c. 'ck' is used immediately after a short vowel
- d. c and k produce the same sound
- e. All of the above

9. Why is there a double n in stunning?

- a. Because the base word ends in a single consonant preceded by a single vowel, and the ending begins with a vowel
- b. Because the final consonant of a word is always doubled with -ing
- c. Because the letter 'u' has many different pronunciations
- d. Because the consonant 'n' is not well articulated and needs to be strengthened
- e. There is no principle or rule to explain this

APPENDIX C

Texts for reading comprehension assessment within Study Two and Three (Fidler, 2009)

Text 1

The revolutionary writings of Leonardo Panchas have only just come to light. For years he led a guerrilla war against the military government who controlled the once idyllic island of Limonique. In 1985, after a wave of industrial revolt in the fishing fleet and cannery industry, the government imposed draconian laws that outlawed all forms of protest. Many of the opposition forces took to the hills and mountain jungles of the interior of the island and began an armed insurgency movement against the police, the army, and government officials. Supported by the peasants, the guerrillas launched a long term strategic war against the forces of oppression, which in 2005 led to the overthrow of the Mourinio regime.

Now in power, the coalition movement of guerrillas and peasants led by Panchas have begun to reveal the ideological rationale behind their struggle. Many have assumed that the guerrillas followed a Marxist view of politics and history, especially as their movement blossomed during the trade union struggles of the 1980's. Now in power the new regime are following a more liberal, quasi capitalist route to social reform. There has not been whole scale nationalisation of key industries, apart from the fisheries and transport. Banks are still in control of the multi national corporations, as indeed are the power companies and telecommunications. There have been promises of massive investment in education and health, but as of yet, little has been delivered.

Panchas's recently published series of short essays reveals his commitment to a programme of social reform and limited powers given to big business and a free market economy. This mix of ideological opinions stems from a merging of the industrial trade union movement that spawned the guerrilla movement and the peasant movement who strive for control of the land. Many of the peasant leaders have taken control of the large farming estates on the island, and as a means of appeasing the old colonial powers, Panchas has promised to leave certain sectors of the economy in the hands of the traditional elite. This has caused a degree of friction within the movement, with the old trade unionists calling for greater nationalisation of industry. Neither are the remnants of the old regime happy, for although they still control the banks and other sectors of the economy, they have lost a great deal within the agricultural sector.

- Q1. In which industries did the industrial revolt occur?
- Q2. What was the name of the island?
- Q3. How long did the guerrilla war last?
- Q4. Whose regime was overthrown in 2005?
- Q5. Of what does the coalition government comprise?
- Q6. Do you think the guerrillas are for or against capitalism?
- Q7. Who or what controls the multinationals?
- Q8. Who or what has promised investment in health and education?
- Q9. What did the revolutionary writings reveal?
- Q10. When did the peasant leaders take control of the farming estates?

Text 2

Cancer is a common disease in the western world. Approximately one in three people in the West develop cancer and one in four of the population dies from this disease. This compares significantly with mortality statistics in the developing world. For example in Sierra Leone, one in five of the population die before they are five years old and life expectancy is approximately 30 years lower than the average figure for Western Europe. Likewise in Tanzania, Cancer is not listed as one of the top ten reasons for either adult or child mortality; mortality rates are more often associated with socially constructed or economic circumstances.

The incidence of cancer in the West has increased in recent years as a result of smoking and an increasingly ageing population. However, a significant number of patients recover; current estimates put this figure at one in three and many people survive for five to ten years after diagnosis. Research into breast cancer has revealed that an improved prognosis is achieved if the patient has a positive outlook, as opposed to a feeling of helplessness. It appears that the psychological well-being of the patient has a significant impact upon the outcome that is achieved.

Professionals often treat patients with an incurable or fatal disease using a process of palliative care. This refers to the total care of a patient and their family using a team of staff when the patient is not responding to curative treatments. A triad of care is used including symptom relief, psychosocial support and teamwork. Palliative care is patient-centred rather than using the disease as the focus for intervention. Patients are encouraged to lead as active and full life as is possible within a compassionate and caring environment. The partnership approach links the patient and their family with doctors, various therapists, social support and voluntary organisations. The key to a successful approach is the careful coordination of services that avoids a duplication of provision and deals with any potential conflict between professionals and the patient and their family. This approach hopefully ensures the best possible quality of life for patients under emotionally difficult circumstances.

- Q1. How many people in the west develop cancer?
- Q2. Out of 100 people in the West, how many would be expected to die of cancer?
- Q3. If life expectancy in Western Europe was 68 years, what would it be in Sierra Leone?
- Q4. Apart from Sierra Leone, what other 'developing' country is mentioned in the text?
- Q5. According to the text, which two groups of society are more likely to develop cancer?
- Q6. What did research into breast cancer reveal?
- Q7. Why does the psychological well-being of the patient impact upon patient outcome?
- Q8. According to the passage, what is palliative care?
- Q9. What sort of medical intervention would be used with palliative care?
- Q10. Why is careful coordination of services important?

Text 3

Much work has been done on the development of the theory of organisations. Scholars have examined and interpreted the ancient civilisations of Greece, Rome and Egypt, compared and contrasted their societies and related the key components of these to the organisation of society. Of particular interest was the contrast between the notion of democracy within Greek society compared with that of Egypt and Rome. These Greek democratic principles had implications for the organisation of society, particularly political, legal and other aspects of civil life. For example the complicated and bureaucratic system employed in choosing a jury for court trials typified the notion of democracy at this time. Of course, such democratic freedoms only applied to citizens of the state; many people who inhabited Athens, and other areas of Greek influence, were slaves, who had no rights to speak of at all. Ancient Greek society reflected the norms of a slave economy and the organisation of such a system was reflected both in the attitudes of people and the organisational structures that evolved as a result.

In modern societies the structure of large state run organisations or private companies also reflects the wider norms within the society. Today, in a capitalist economy, most organisations tend to be hierarchical and focused on generating profit or reducing expenditure. If we take the example of Airbus Aerospace, one of the largest aeroplane manufacturers in Europe, we can see how the internal structure of the company reflects the external demands of the world economy. The company is run by the chief executive, who sits on the board of directors who control the day to day running of the company. These individuals, all white middle aged men, are responsible to the shareholders of the company who meet bi-annually to hear reports on company progress. In fact, what the shareholders are really interested in is how much profit they have made from their investment. It is this driving force, the profit motive, that is the central rationale behind the way the whole company is organised. For example the headquarters of the company are still located in their prestigious offices in Geneva, whilst manufacturing has been relocated to South East China and Mumbai, India. Distribution of parts is located at large depots, located at the seven busiest airports across the globe. Just in time methods of distribution are employed to ensure costs are kept to a minimum.

- Q1. What three ancient civilisations have scholars examined?
- Q2. What notion was of particular interest to them?
- Q3. How does the passage describe the jury system in Ancient Greek society?
- Q4. Why did Greek citizens think slavery was normal?
- Q5. How are the economies of Ancient Greece and Modern Societies different?
- Q6. How often do the shareholders meet?
- Q7. What do you think is contained in the company progress reports?
- Q8. Who runs Airbus Aerospace?
- Q9. Why do you think the directors are all white middle aged men?
- Q10. Why do you think that manufacturing has been relocated to India and China?

Text 4

In the United States it is estimated that each year over a million elderly persons are abused, neglected or exploited by their family or care-givers. Unfortunately, abuse of the elderly is difficult to identify because victims are unlikely to report their abuse, especially if they are isolated from others, as many elderly are, and often signs of abuse are quite subtle and can easily go undetected.

Previous research on abuse in the home has tended to focus on child abuse and spouse abuse. Very little data have been collected on elder abuse by family members. In 1980 the U.S. Senate Special Committee on Elder Abuse reported that between 500,000 and 2.5 million cases of geriatric abuse, neglect or mistreatment occur in the U.S. each year; producing a statistic of one in every 25 people over the age of 65 experiencing some form of abuse. However, one of the problems of compiling statistical information is obtaining a consensus as to the exact definition of elder abuse, whether it consists of physical violence, neglect, deliberate social isolation or all three.

There are a number of causative theories for elder abuse. Three main models exist: the Psychopathological Model, the Learning Model and the Situational Stress Model. The first of these three identifies the pathological abuser, prone to alcohol and/or drug abuse and associated bouts of violent behaviour. The Learning Model purports that violent parents who abuse their children create the potential abusers of the elderly later in life. The final model is focussed on a build up of stress due to the situation that the carer finds themselves in. This stress can take many forms including physical, psychological and financial, leading to exhaustion and anger and potential violence.

In order to deal with and intervene successfully in a situation of elder abuse, a multiagency approach is required, using both hospital staff and social services. Staff who are involved with the care of the elderly should be trained to spot potential signs of abuse and know the appropriate protocols to follow. Local authorities need to have policies in place to deal with this growing problem and need to liaise with carers to ensure that they are able to cope with a caring role.

- Q1. Why is elder abuse difficult to identify?
- Q2. Where does most elder abuse take place?
- Q3. List all three signs of elder abuse that are contained in the passage?
- Q4. How old do you have to be to be classed as an elder?
- Q5. According to the text, what percentage of elders is likely to suffer some form of abuse?
- Q6. When was the US senate committee report published?
- Q7. What problem did the US senate committee have in compiling statistics of elder abuse?
- Q8. Which of the three models could include anyone in a caring situation?
- Q9. Who should be involved in a successful intervention?
- Q10. Who needs to have policies in place to deal with this problem?

APPENDIX D

Texts used for summarising assessment within Study Two and Three

Course text 1: Extract from Hood (2000, pp. 48-49)

The Five Specifics of Writing

The Importance of Spelling in Teaching Emergent Writing

It is important that children develop a systematic method of attempting unknown words. Although they might not go into the senior school as correct spellers, they should have a large bank of known high frequency words. They should be able to make close visual approximations of other words using sound sequencing techniques.

Donald Graves, in his new book “A Fresh Look at Writing”, mentions the fact that he used to believe that children could get under way with writing if they knew a few sounds. Now he believes that there is a core of known words that beginning writers must learn to write automatically.

Sound sequencing means being able to hear the sounds within words and being able to map these. Dr Richard Gentry, a world authority in spelling research, says that although people do not learn to spell using applied phonetics, they manage to get close enough visually to use dictionaries and other spelling resources to check their approximations. If this self correction does not occur then the children do not quickly move to becoming correct spellers.

Children must be taught how to say the word slowly and to listen to their own voices. They should do this several times, putting the sounds down in order as they write. It is not enough to put down just the first and last letter. This can lead to lazy spelling as the child leaves the rest to the teacher. They must record all they can hear.

Hood’s 1994 research showed that 29 percent of eight to ten year old children interviewed used a *sound it out* strategy, while 28 percent used a *sound it, underline, check in dictionary later* strategy. Hood believes that this identification and checking approach is the one that must be taught. When children are close to visually correct they must be eased into the self correction. The N E M P results stress how important it is that schools develop a common method of error identification. The time to identify probable error is at the time of writing, not going back to hunt for errors after the writing is complete.

Course text 2: Extract from Duncum (1999, pp. 33-34)

Many elementary generalists feel that if they can't draw, they can't teach art. Instead, they explore numerous materials, or one material in numerous ways. Limited time devoted to art during pre-service, inadequate in-service education, and competing curriculum demands, conspire to ensure that elementary generalists possess very little specialist knowledge in art. Consequently, pre-service teaching of elementary generalists is sometimes called the "black hole" of art education. No matter what pains are taken in teacher training, there appear to be few long term gains.

However, this perspective resists rather than attempts to work with the conditions under which elementary generalists operate, their main professional preoccupations, or their considerable generic teaching skills. I believe there is little point in expecting them to learn anything but the most basic content in art. And, moreover, there is no need for them to do so.

If a discipline based approach is eschewed and art is considered to be essentially about making meaning in visual forms, it is possible to capitalise on the chief professional concerns of elementary generalists. If art is viewed as a form of literacy, of making and communicating meaning, it can be seen to serve elementary generalist's overriding concerns. What elementary generalists need to teach art well is a solid grounding in just a few teaching-cum-learning strategies for both making and responding to art and to know how to apply them in different grade levels.

Making Strategies – Verbal Reflection Strategy

The Verbal Reflection Strategy relies on teachers providing verbal feedback to children on their picture-making with the intention that children reflect upon their own efforts. The principle is to recognise and validate children's efforts. It is based on two assumptions: development will occur if children can critically appraise their own work, and critical appraisal is best undertaken when understanding is encoded in language. Vague comments like "That's beautiful" or "I like that" provide encouragement but do not assist thinking. It's better to describe to children that they have accomplished in order for children to critically appraise their own work, and this is best done by commenting upon children's images in a gentle, non-judgemental way.

Course text 3: Extract from Fraser and McGee (2011, p. 28)

Five Theories of Learning: Origins, Fortunes, Falls from Grace

First, some general comments about five public theories of learning which we might be expected to espouse: behaviourist, development, humanistic, social constructivist, and sociocultural. Many of their key features have been helpfully outlined by two of my colleagues, Fred Biddulph and Ken Carr, but we three readily concede that the five theories are not as separate as the table provided might suggest. As will be made clear below, they often coalesce, they diverge and they replace each other.

Where do these learning theories come from? Do they spring ready-made from classrooms? In fact, it is important to acknowledge that learning theories have often ultimately arisen in complex ways from fields quite remote from classrooms and education systems. How this comes about is often related to the method that we choose to look for evidence of learning in classrooms. We may decide to observe children's behaviours; to analyse their classroom conversations; to interview them before, during or after learning; or even to record physiological and neural changes. Each of these methodologies may draw on expertise very remote from teachers' own experience: from behavioural psychology, linguistic theory, cognitive psychology, or medical practice, respectively.

This susceptibility to the influence of outside methods should not cause us to conclude that the whole area of learning theory is in some unique way weak or unable to sustain itself. (The writing of history, it should be remembered, has also been similarly enriched by methodologies from sociology, statistics and literary theory.) Instead, we need to accept that it is totally proper that learning theories resonate with disciplines as seemingly remote from the classroom as economics, philosophy, psychotherapy, and medical science. Failure of this feedback process would result in two dire consequences: our education systems would be fatally isolated and irrelevant for living in the world at large; and educators would have cut themselves off from sources of inspiration and new ideas. However, the connections between established methods in education and those in other fields are often complex, and occasionally controversial. Educators often apply labels like 'positivist' or 'interpretivist' or 'critical' (Robottom & Hart, 1993) to justify their own favoured methodology, which they have adapted from other fields, or to distance themselves from methodologies favoured by others.

Course text 4: Extract from Fillmore and Snow (2000, p. 19)

Oral Language

What are the basic units of language?

Teachers need to know that spoken language is composed of units of different sizes – sounds (called phonemes if they function to signal different meanings in the language), morphemes (sequences of sounds that form the smallest units of meaning in a language), words (consisting of one or more morphemes), phrases (one or more words), sentences, and discourses. Crucial to an understanding of how language works is the idea of “arbitrariness.” Sequences of sounds have no meaning by themselves – it is only by convention that meanings are attached to sound. In another language a sequence of sounds that is meaningful in English may mean nothing at all, or something quite different.

Furthermore, each language has an inventory of phonemes that may differ from that of other languages. Phonemes can be identified by virtue of whether a change in sound makes a difference in meaning. Thus, in English *ban* and *van* constitute two different words, showing that [b] and [v] are different phonemes. Similarly, *hit* and *heat* are two different words, showing that the short vowel sound [ɪ] of *hit* is different from the long vowel sound [i] of *heat*. It is clear that such contrasting phonemic patterns across languages and dialects can have an impact on what words children understand, how they pronounce words, and also how they might be inclined to spell them.

The next language unit is the morpheme. The morpheme, the smallest unit that expresses a distinct meaning, can be an independent or free unit, like *jump*, *dog*, or *happy*, or it can be a prefix or suffix attached to another morpheme to modify its meaning, such as *-ed* or *-ing* for verbs (*jumped*, *jumping*), plural *-s* or possessive *'s* for nouns (*dogs*, *dog's*) or *-ly* or *-ness* added to adjectives to turn them into adverbs or nouns (*happily*, *happiness*). These units are called bound morphemes because they do not occur alone. The relevance of bound morphemes to teachers' understanding emerges most strongly in the domain of spelling, discussed below. But it is worth noting here that English, reflecting its origin as a Germanic language, features many irregular forms (see Pinker, 1999) that can cause problems.

APPENDIX E

Texts for the post-intervention reading comprehension assessment (P. Brooks et al., 2004)

Text 1: Psychology

A study has revealed that the main indicator for bad behaviour amongst teenagers is early literacy skills. The research team at the University of Pavlinka carried out a study examining the educational and social progress of 973 children from their first year at school, when they were six years old, to when they finished their education, aged eighteen. Children were chosen randomly, but a balance was given to gender, and second language speakers with less than three years' experience of the local language were not included. Measures of reading and spelling were given when the children entered the education system, and every year until they were ten. After this, data were obtained from national exams at age fifteen and eighteen. This was then compared with school disciplinary records, such as suspensions and expulsions, as well as police and court records. These two factors were compared to see if there was a relationship.

The researchers say that they have found a significant link between literacy and teenage behaviour. They are suggesting that the government invest heavily in early years' literacy programmes. However, others have criticised the approach taken by the research team, especially the location of the schools used in the study. Martha Krieg at the Centre for Psycho-Social Studies has analysed the data and cross-referenced them against where the children lived as an indicator of socio-economic status. She concludes that it is not literacy skills that are the key issue, but economic status.

The professor states that changes in the educational system alone will not reduce problems of youth crime, but rather that the underlying issue of poverty needs to be addressed.

- Q1. What was the name of the University?
- Q2. How long did the study last?
- Q3. How many children were tested?
- Q4. In which area do you think the research took place?
- Q5. What tests did the children do?
- Q6. When did the children start school?
- Q7. Why do you think second language speakers with less than three years' experience of speaking the native language were excluded from the study?
- Q8. What is the relationship that the authors think that they have found?
- Q9. Why are the geographical locations of the schools important?
- Q10. What variables does Martha Krieg consider to be of chief significance in causing deviant behaviour?

Text 2: Politics

Not since the political theory of post-emancipationism, has the academic world been so avidly discussing a new social discourse that claims to encompass a holistic approach to social construction. Global Domination Theory takes as its starting point the view that the world is controlled by a small elite of top financiers, oil magnates and military leaders. Politicians and nation states are seen as irrelevant and without significant influence on world events. With the advance of the world capitalist economy, four major blocks of capital are now perceived as the main players in world affairs; other nations will need to align themselves with one of these blocks or face economic marginalisation.

Post-emancipationism heralded an era of continuing wealth development in the advanced capitalist societies, leading to a decline in the need for social reform as wealth generation in these countries negated the need or demand for state intervention. The unrestrained development of the free market led to the withering away of the state and welfare provision, with social services being provided by the major multi-national corporations. Freedoms and services could be bought, and all those citizens that were part of the system were able to purchase their social and leisure needs. The theory, however, had a major flaw: it failed to understand or incorporate those who were outside of the economic system. It also failed to understand the inter-relationship between the prosperous and the socially outcast. Whole regions of the world were unexplained by the theory; those who critiqued post emancipationism felt that this was deliberate and accused the advocates of the theory of not caring for the poor and impoverished. Criticisms were made by a plethora of liberal organisations and particularly environmentalists.

Now, a number of leading political analysts and academics have produced a collection of essays entitled 'Who Controls the World'. They will present their arguments and theoretical paradigm at a conference next month in Seattle. The theory sets a context of post oil production wars, the coming together of world economic interests and the continued battle against global terrorism and industrial working class power. Global Domination Theory sprang from an analysis of the Beijing Agreement between the oil-producing corporations, the World Bank, the Arms Industry and international communications companies. This agreement, the authors argue, set the world on a course for the merging of regional economic elites, uniting against their common foe, an anti-'western', anti-capitalist movement that is fractured into a multitude of different groups across the globe. The theory argues that the days of inter-capitalist competition are over, replaced by a more focussed determination to destroy and subjugate the enemies of the elite. The 'war on terror', that was central to the propaganda machine of years gone by, has been replaced by a 'war on the dispossessed'. The authors conclude that this shift in world politics may have united the capitalist world, but it may have also united the enemies of capital to such an extent that it may well have sown the seeds of its eventual downfall.

- Q1. What sort of people are said to be in control of society?
- Q2. What is the name of the first theory mentioned in the passage?
- Q3. Why was post-emancipationism criticised?
- Q4. How many main blocks of capital are there thought to be?
- Q5. What does GDT stand for?
- Q6. What is the name of the authors' book?
- Q7. What societies benefited during the post-emancipationism era?
- Q8. What do you think might have been discussed at the Beijing agreement?
- Q9. Global Domination Theory states that the world is controlled by whom?
- Q10. Who are the enemies of the elite?