Reading for Meaning: Interventions to ameliorate children's reading comprehension difficulties

A randomised controlled trial to investigate whether interventions in oral language and text-based strategies improve the reading comprehension skills of students aged between 11 and 13.

Thesis submitted for the Degree of Educational Doctorate

by

Grace Elliott

University of Reading, Institute of Education

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Authors Declaration

I confirm that this is my own work and the use of materials from other sources has been properly and fully acknowledged.

Grace Elliott

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Acknowledgements

Without grit, there will be no pearl. This phrase is a reminder of the challenges that people with literacy difficulties face. As someone with dyslexia, I particularly struggled with learning how to read and write, and I am forever grateful to my parents, Hugh and Carolyn Devlin, Christine Lewis (who helped me with reading at school) and Jane Clark (who helped me with writing in my undergraduate university degree).

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Abstract

It is vital that secondary school students have a good level of reading comprehension, and that teachers have evidence-based interventions to improve the reading comprehension of their students. Research indicates that oral language training is effective at improving the reading comprehension of primary age children; however, it is not clear whether this also applies to secondary age children. This randomised controlled trial examined the efficacy of text based (TB) and oral language (OL) training on the reading comprehension of students between the ages of 11 and 13 with poor reading comprehension, when compared to a waiting list control group (WLC). The main study was preceded by a pilot study. In the main study, the parallel intervention programmes were delivered for an hour each week over a period of eight weeks. Oral language training included vocabulary, reciprocal teaching with spoken language, spoken narrative and figurative language. Text-based training included metacognitive strategies, written narrative and inference skills. A specific re-attribution strategy was introduced at the start of each session in both the oral language and text-based training programmes to help students understand and develop effective beliefs about their reading comprehension success and failure, and to help internalise externally delivered strategies, so that they become a habit and basic attitude towards reading.

There were statistically significant gains in reading comprehension and vocabulary in both the text-based and oral language intervention when compared to the waiting list control group, indicating that both the oral language and text-based interventions were effective at improving reading comprehension and vocabulary standard score. Therefore, the design and delivery of the intervention programmes enabled the participants to close the gap in reading comprehension between themselves and their peers when reading comprehension was measured immediately after the intervention.

The change in word reading standard score from pre-intervention to post-intervention was significantly different for the text-based group when compared with the waiting list control group. There were improvements in the students' perceived value of reading and reading self-concept in both the text-based and oral language training compared to the waiting list control group. Neither the gain in vocabulary and word reading standard scores, or these standard scores at initial testing (T1) mediated the mean reading comprehension for either the OL or TB groups at re-testing (T2).

Overall, this research shows that evidence-based interventions can be feasibly implemented within a school environment to ameliorate students' reading comprehension difficulties, and interventions directly targeting both students' oral language comprehension and text-based skills produce significant gains in the reading comprehension of secondary-age students relative to a waiting list control group.

Introduction

1.1 Identifying the Issues

Gough and Tunmer's (1986) Simple View of Reading (SVR) indicates that both decoding print and oral language comprehension are required for skilled reading comprehension. The term 'poor comprehender' is used to refer to students with deficits in oral language comprehension but unimpaired word recognition skills (Cain & Oakhill, 2007; Nation, 2005). These students can read words relatively fluently and accurately, but have difficulty understanding the meaning conveyed by a text (Cain & Oakhill, 2006; Catts et al., 2012; Oakhill, Cain & Elbro, 2014). The study of children with poor reading comprehension difficulties has highlighted oral language problems associated with vocabulary (Clarke, Snowling, Trulove & Hulme, 2010; Quinn, Wagner, Petscher & Lopez (2015), semantic understanding (Nation, 2005; Nation & Snowling, 1997), narrative production (Clarke, Snowling, Trulove & Hulme, 2010), verbal working memory difficulties (Florit, Roch, and Levorato (2011), syntax (Kim, 2016) inference (Lepola, Lynch, Laakkonen, Silven & Niemi, 2012) and figurative language (Hulme & Snowling, 2009). There is no definitive definition of a poor comprehender, and reading comprehension ability operates along a continuum so any criteria are essentially arbitrary. However, it has been argued that the best available criteria for defining students with clinically significant reading difficulties is "students whose reading comprehension standard score is equal to or below 90, reading accuracy score is 90 or above, and who show a greater than one standard deviation deficit in reading comprehension compared to word reading" (Snowling et al., 2009; 109).

The term dyslexia can be applied to students who demonstrate specific deficits in decoding, due to difficulties associated with poor phonological processing (Marshall, Snowling and Bailey, 2001), but who have good or average oral language comprehension (Shaywitz &

Shaywitz, 2005). These difficulties have implications for their word recognition, single word reading, spelling and ultimately their reading comprehension (van Der Kleij, Groen, Segers & Verhoeven, 2019), as there can be no comprehension without decoding. Furthermore, a lack of fluency in word reading can also impair reading comprehension.

Reading problems for some students may be due to a combination of oral language and word recognition difficulties, and this is referred to as a mixed reading disorder subgroup (Catts et al., 2012). This group is likely to have phonological and nonphonological difficulties, which impact language and reading comprehension. It is likely that there are some observed similarities in the behaviour between poor decoders, poor comprehenders and the mixed reading disorder subgroup in reading. However, overlap at the behavioural level does not imply that reading disorders are qualitatively the same, and similarities at the behavioural level could mask different underlying cognitive impairments (Bishop & Snowling, 2004).

Research indicates that early on in learning to read, most variance is explained by decoding skill (Snowling et al., 2000; Keenan et al., 2008). Once word reading becomes automatic and fluent, the barrier to effective reading comprehension is reduced, hence the association between reading comprehension and oral language is stronger (Gough, Hoover & Peterson, 1996; Verhoeven & van Leeuwe, 2012). Although we know that there is a strong relationship between oral language and reading comprehension skill in students of primary school age, there has been insufficient focus on interventions and the underlying components that can improve the reading comprehension of secondary age students. Whilst some evidence suggests that improvements in vocabulary knowledge can lead to gains in reading comprehension (Clarke, Snowling, Trulove & Hulme, 2010), few studies have examined the relative importance of other potential component skills for the development of reading comprehension such as grammar, figurative language, narrative and inference skills.

There continues to be limited research in this area, despite the fact that reading is of

fundamental importance for society, and a key requirement for learning at all stages of a child's education. In particular, secondary age students with reading comprehension difficulties face significant challenges at school (Polychroni, Koukoura & Anagnostou, 2006) as there is an assumption that students of secondary school age can read with understanding, and are able to read information at speed under the timed conditions of an examination. There is also a requirement for an understanding of domain specific academic vocabulary (Bauman & Graves, 2010) and if students are unable to decode words and access the meaning of these texts, their learning will be impeded (Paul & Clarke, 2016).

Data indicates that the literacy levels of many students approaching secondary school age in the United Kingdom (UK) are a cause for concern (National Literacy Trust, 2016). According to the Department of Education, in 2018, only 64% of pupils in Key Stage 2 achieved above Level 4 in English, and 5% of pupils aged between 9 and 10 had a reading age of 7 or below. Furthermore, the data indicates that boys continue to do less well than girls, with 8% fewer boys making the expected level of progress in reading at Key Stage 2. The gap widens further for students with Free School Meals (FSM), as 13% fewer of these students make the expected progress in reading when compared with other pupils. This means that a large number of students entering secondary school at age 11 will have reading levels that are below those required to access the secondary school curriculum, with significant implications for the academic attainment of these pupils (Department of Education, 2017).

Furthermore, the figures for reading comprehension of UK students compare unfavourably to other developed economies. In 2015, using data from the attainment of 28 million 15-year old students, the Programme for International Student Assessment (PISA) concluded that the UK was placed 21st out of the 72 participating countries for levels of reading comprehension. The report indicated that 17% of students in the UK did not attain a secure foundation in reading comprehension. This meant that these students were unable

to access the basic requirements of reading comprehension, such as identifying the author's purpose, main themes and links between ideas within a text (PISA, 2016).

The percentage of students entering secondary school with low levels of reading comprehension remains high, and there have been many reviews and guidance documents for schools related to reading instruction, for example the Department of Education commissioned an Independent Review into the Teaching of Early Reading (Rose, 2006). This influential report recommended a high-quality, systematic phonics approach to reading instruction, delivered within the context of a language-rich curriculum (Stuebing, Barth, Cirino, Francis & Fletcher, 2008). Whilst there is good evidence to support the teaching of phonics as a means of teaching early-stage readers (McArthur et al., 2012; Torgerson, Brooks and Hall, 2006; Barker & Torgesen, 1995), the Rose Review (2006) highlighted that "best practice for beginner readers should provide them with a rich curriculum that fosters all four independent strands of language: speaking, listening, reading and writing" (p. 16). Following the Rose Review there was a much greater emphasis on quality phonics instruction, however, we do not yet have sufficient evidence about interventions that address the underlying components required for successful reading comprehension (Hulme & Snowling, 2012), and "the relative importance of different language skills for the development of listening and reading comprehension remains unclear" (Lervag, Hulme & Melby-Lervag, 2018; 156). Indeed, whilst recent changes to the curriculum appear to have led to improvements in word level reading, there is much less certainty about how to intervene for comprehension, particularly at secondary level.

Secondary school teachers are still often unaware of the particular needs of poor comprehenders, and when interventions are being delivered, it is often in the absence of any assessment of the needs of pupils or appropriate evidence on the effectiveness of the intervention (Strong, Torgerson, Torgerson, and Hulme, 2011). A lack of accessible

information has meant that secondary school classroom teachers and special educational needs co-ordinators (SENCOs) may not have the appropriate information and training to meet the needs of children with reading difficulties in their classroom (MacMahon, 2014), and "there is a significant number of students entering secondary school with very poor reading skills but a paucity of rigorous research into effective interventions for these students" (Paul & Clarke, 2016; 125).

Furthermore, those secondary age students with reading comprehension difficulties are often taught by Teacher Assistants (TAs) who have typically received limited training, have an inadequate amount of preparation or reflective time with classroom teachers, and whose skills are not fully utilised in the classroom (Webster et al. 2010). Indeed, a longitudinal UK study by Blatchford, Russell and Webster (2012), involving 8,200 pupils of primary and secondary school age assessing the deployment and impact of TAs, found that the progress made by pupils declined as the amount of support that they received from TAs increased, even when ability and prior attainment was accounted for.

Despite recent efforts, the proportion of students at the transition from primary to secondary school with reading comprehension levels below those needed to access the curriculum has remained static for the last decade (Education Endowment Foundation, 2016). There is a clear need for innovative research to improve outcomes for secondary school students with poor reading comprehension. To do this, educators need access to evidence-based research to improve their pedological understanding of reading comprehension, and to apply this understanding in appropriate and reflective ways to individual contexts. For this to happen, there is a need "to clarify the factors that influence response to intervention and aim to replicate and extend previous findings in educationally realistic contexts in order to ascertain their feasibility and costs" (Duff & Clarke, 2011; 7).

There has been good progress in the research to understand the cognitive profiles of

students with poor reading comprehension (Atkinson, Slade, Powell & Levy, 2017; Lervag, Hulme & Melby-Lervag, 2017; Erbeli, Hart & Taylor, 2018). However, the diagnosis of reading comprehension difficulties can be delayed, as the impairment often goes unnoticed in the classroom. For example, a student with poor reading comprehension may read aloud with ease, and it is only if they are asked questions that their difficulties become more evident. It is therefore probable that a large number of students, and their teachers, are unaware of their reading comprehension difficulty (Hulme & Snowling, 2011), and for these reasons, reading comprehension impairment has been referred to as a "hidden disability" (ibid, 139).

In order to improve provision, attention must be paid to effective identification of poor comprehenders, understanding the cognitive profile of individual adolescent students with poor reading comprehension and delivering effective, evidence-based interventions.

1.2 Personal and professional background

My interest in reading comprehension interventions stems from personal experience from my teaching roles. For the duration of the data collection phase of this research project, I was a secondary school teacher working with students who were making below expected progress in their studies, and many of these students had a range of specific learning difficulties, including reading comprehension impairment. After working in the Academic Support Department within the school for a year, it was clear that proactively identifying students that may need additional support should be a priority. For this reason, I secured funding to facilitate the assessment of all students when they entered the school in Year 9, and all new students entering the 6th Form. The assessments measured reading comprehension, word reading, spelling, handwriting speed and typing speed, and provided a standardised score for each student in each of these measures. For any student with a standardised score of 85 or below, additional testing was carried out with me. Although this additional testing highlighted many

students who would benefit from interventions to ameliorate reading difficulties, when planning these teaching programmes, I found a dearth of evidence-based intervention programmes for poor comprehenders of secondary school age. Furthermore, many of those that were available were based on small scale research with conflicting results. As I began to read more about reading comprehension interventions at the transition between primary and secondary school, it became clear that my experiences were not unique.

Paul and Clarke (2016) carried out a review of reading comprehension interventions between 1999 and 2014 for secondary school students, and only eight studies published from 1999 to 2014 met their inclusion criteria. The relatively broad inclusion criteria were that the intervention was carried out in a school, the results were reported in English in a peer-reviewed journal, a randomised controlled trial was used and they included pre- and post-test measures. From the research available, promising approaches included training teachers to adapt the language that they use (Starling, Munro, Togher & Arciuli, 2012), re-attribution training (Berkeley, Mastropieri & Scruggs, 2011), a class-based learning strategies curriculum (Cantrell, Almase, Carter, Rintamaa, & Madden, 2010), training for teachers in a cooperative group reading strategy (Vaughn et al., 2011), and content acquisition focused instruction (Vaughn et al., 2013). Although some interventions suggested promising results, the effect sizes reported were small, and most of the interventions used single strategy-based techniques for large groups of children.

Visiting secondary schools and meeting with Special Educational Needs Co-ordinators (SENCOs) and specialist teachers, highlighted the lack of time and resources that are available to help students with reading comprehension impairment. Alongside this barrier, was the surprising assumption held by some SENCOs that reading comprehension strategies were covered in English lessons and poor comprehenders did not need one-to-one support. These informative conversations with SENCOs and specialist teachers highlighted a number of

concerns, including a need for a simple message of what skills make up reading comprehension, further information on which of these skills can be trained or improved, accessible information for teachers on the heterogeneity of cognitive profiles within a sample of children with low reading comprehension and appropriate evidence-based interventions. The apparent lack of understanding by some SENCOs and specialist teachers was concerning for me, particularly as research indicates a link between reading comprehension difficulties and poor educational outcomes at ages 11 (when students in the UK are making key transitions into secondary school education) and 16 years (when students in the UK are moving out of compulsory schooling) (Ricketts, Sperring & Nation 2014; Cain & Oakhill, 2006).

Engagement with the literature on reading comprehension interventions, highlighted the beneficial effects of reciprocal teaching, which focuses on a structured discussion-based approach to develop the learners' understanding of written text. Prior to becoming a SENCO, I was a Geography teacher in a secondary school, and as part of on-going professional development, I was trained in dialogic teaching pedagogy. In my school at the time, this training included regular videoed lesson observations with advisory and non-judgemental feedback from a mentor, followed by target setting and support with planning future lessons. Teachers were also encouraged to complete self-evaluations and attend weekly discussion groups with colleagues to discuss dialogic teaching. As this approach was supported by the school's leadership team, the dialogic approach was embedded in its everyday professional discourse, including at staff meetings, with an aim to mediate teacher development through dialogue, reflective inquiry and collaboration over an extended period of time.

My professional teaching experiences, and increasing awareness of the research in this area, compelled me to undertake a randomised controlled trial to understand the impact of

oral language and text-based interventions on the reading comprehension of poor comprehenders between the ages of 11 and 13 years old.

This research project was set up to study the effect on reading comprehension standard score of using a text-based intervention versus an oral language intervention for students aged between 11 and 13. The text-based intervention consisted of explicit and cumulative training in metacognitive strategies, reciprocal teaching with text, written narrative and inferencing from text. In contrast, the oral language intervention consisted of training in vocabulary, reciprocal teaching with spoken language, spoken narrative and figurative language. Improvements were measured in terms of the amount of progress made in their reading comprehension standard score. The student's verbal ability, vocabulary knowledge, perceived value of reading and reading self-concept were also recorded before and after the intervention. In addition to the RCT, a survey was carried out with teachers to ascertain more information regarding the frequency of the assessment of reading comprehension, the frequency that poor comprehenders received interventions and areas of focus for the interventions that were being delivered to poor comprehenders in secondary schools.

The structure of the thesis is that Chapter 2 provides a literature review of the theory and empirical research about reading comprehension, including the causes of poor reading comprehension. Chapter 3 outlines the research methodology, including the research philosophy, research design, data collection methods and ethical considerations. The structure of the two different interventions (oral language and text based) are outlined in Chapter 4, along with a justification of the intervention design. Chapter 5 describes the findings of the study by addressing each research question. Chapter 6 discusses the theoretical and practical implications and impacts of the research findings, including an evaluation of the research and next steps.

Chapter 2 Literature Review

2.1 Poor Comprehenders

The goal of reading is to gain meaning from text. As outlined in the Simple View of Reading (Gough & Tunmer, 1986), adequate reading comprehension is dependent on the decoding of words and oral language, and both are necessary but not sufficient for successful reading comprehension to occur.

A child has a reading comprehension impairment, and is referred to as a 'poor comprehender' when they have a deficit in their comprehension that is discrepant with their word reading accuracy. As previously stated, these students read accurately but do not always understand what they have read (Clarke et al., 2010). Whilst poor comprehenders perform adequately or well in phonological tasks (Catts et al., 2006), they demonstrate impairments in a number of non-phonological language tasks such as those that involve working memory, inference and vocabulary knowledge (Nation, Clarke, Marshall & Durand, 2004).

The processes needed for understanding the meaning of text are complex, as it involves interconnected cognitive processeses at the word, sentence and discourse level (Hulme & Snowling, 2011), and therefore it is perhaps not surprising that a significant minority of children struggle to understand much of what they read. To understand the meaning of written texts, first words need to be identified and their meanings retrieved. Then, guided by syntactic knowledge, the reader must combine the meaning of words within larger units such as clauses and sentences. Finally, using relevant background information, inferences must be generated in order to integrate meaning across the text. Whilst the student is reading, metacognitive strategies are also required to monitor ongoing comprehension (Cain, Oakhill, and Bryant, 2004), facilitating awareness for the reader of when comprehension has broken down, and allowing the initiation of repair strategies such as re-reading the text (Wang et al., 2004). Available evidence suggests that the percentage of children in unselected samples

who meet the criteria for the 'diagnosis' of poor comprehender is between 3 and 10% (Nation, Cocksey, Taylor & Bishop, 2010), and the difficulties associated with poor reading comprehension become apparent when word reading is more fluent from around the age of 8 years old (Clarke et al., 2014).

Poor reading comprehension is defined as a Specific Learning Difficulty in DSM-5 (American Psychiatric Association, 2013) as it is a type of Neurodevelopmental Disorder that impacts the ability of students to use the specific academic skills of reading that are a foundation for other academic learning. However, reading comprehension is difficult to measure as it is not a unitary construct, and there are multiple components that are required that cannot be directly observed. Furthermore, research by Keenan and Meenan (2014) looked at how different standardised tests categorised children as poor comprehenders. The authors found that there was only a 43% consistency in the diagnosis of reading comprehension across different standardised assessments, as different tests rely on different components of reading comprehension to a greater or lesser degree. Indeed, the inconsistency in diagnosis suggests that there is separability in reading comprehension skills, and that very few children are poor in all the component skills.

More broadly, as there is a continuous distribution in the comprehension of text within the general population (Hulme & Snowling, 2009), definitions of deficits in reading comprehension are essentially arbitrary, and it probable that there are a number of children with deficits that lie midway between the tightly defined discrete categories for language and literacy skills. The research literature distinguishes between children with dyslexia and poor comprehenders, when in fact this is a false dichotomy, and neither reading impairment is a "diagnostic entity with clear cut boundaries" (Snowling and Hulme, 2012; 33). Furthermore, it is probable that the understanding of reading comprehension, and appropriate interventions for those with comprehension deficits, will improve as the understanding of the underlying

components of reading comprehension develop.

As previously discussed, the best available criteria for defining students with clinically significant reading comprehension difficulties are "students who show a greater than one standard deviation deficit in reading comprehension compared to reading accuracy, and whose reading-comprehension standard scores are equal to or below 90, with a reading-accuracy score of 90 or above" (Snowling et al., 2009; 134). This definition is 'educationally relevant' as it provides an indication of a level of poor comprehension that is likely to have educational implications. However, there is no definitive definition used in research, meaning that there is a large degree of variability in how reading comprehension is defined, and how students with poor reading comprehension are selected for intervention studies.

The inconsistencies in identifying students with reading comprehension impairments has meant that intervention studies targeting students with poor reading comprehension skills have been conducted irrespective of the specific cognitive profile of the students. For example, Berkeley et al. (2011) carried out a randomised controlled trial involving 59 students between the ages of 12 and 15 years who were randomly allocated to one of three conditions. The students were selected for the study based on the school identifying students who had "identified weakness in the area of reading" (Berkeley et al., 2011; 22), referring to neither specific decoding or comprehension difficulties. Furthermore, in a randomised controlled trial by Clarke et al. (2010), due to difficulties with selecting sufficient sample sizes, 11.25% of the students involved in the study had a reading accuracy score of between 80 and 85 (as measured by NARA 11), which would mean they had more general reading difficulties (low reading accuracy and low reading comprehension) than the children that they were specifically targeting. In the same study, the average reading comprehension standardised score across the three groups prior to the intervention was 95.30 (measured using the Wechsler Individual Achievement Test- Second Edition), which is

higher than the standardised score of 90 for reading comprehension impairment as defined by Snowling et al. (2009). Other studies do not specify whether or not students involved had a reading difficulty. For example, Brooks et al. (2006) conducted a randomised controlled trial for reading comprehension interventions with all students in a one-year group (Year 7) in one comprehensive school. There is also variability across the studies regarding the extent to which non-verbal IQ or decoding is controlled for, and whether vocabulary and other oral language skills are measured. The variability in the selection and randomisation of sample populations in this field of research adds to the complexity in the analysis and comparison across studies. Caution is also required when interpreting research in this field, due to the differences in the type and nature of the assessments that are used to identify reading comprehension impairments and the age of the students involved in the study (Keenan & Meenan, 2014).

2.2 Reading Comprehension of Adolescents

Poor comprehenders between the ages of 11 and 13 will be the focus of this study, as the move from primary to secondary school in the United Kingdom at the age of eleven is an important transitionary year for students (Clarke et al., 2017; Ricketts et al., 2014). The research relating to poor comprehenders as they start secondary school will be discussed with reference to five important aspects. Firstly, on transition to secondary school, research suggests that there can be a re-emergence of literacy difficulties for students who have previously been diagnosed with developmental language disorder (Snowling, Bishop & Stothard, 2000). Secondly there can be a divergence in reading ability among poor and good readers (Cain & Oakhill, 2011). Thirdly, students can experience difficulties associated with 'reading to learn' when presented with challenging texts (Saenz & Fuchs, 2002; Weaver and Kintsch, 1991). Finally, the difficulties that poor comprehenders face can lead to implications

for the academic attainment (Ricketts et al., 2014) and psycho-social development (Arnold et al., 2005) of poor comprehenders.

2.2.1 Re-emergence of literacy difficulties for students who have previously been diagnosed with developmental language disorder

A critical factor in the study of reading comprehension impairment of adolescents is the re-emergence of literacy difficulties for students who have previously been diagnosed with developmental language disorder. The 'critical age hypothesis' (Bishop and Adams, 1990) states that oral language difficulties only constitute a risk factor for later reading difficulties if they continue to 5.5 years (the age when formal reading instruction is introduced into most UK schools). However, longitudinal research by Snowling, Bishop and Stothard (2000) involving 56 children (47 males and 9 females) provides evidence that the reading difficulties of students diagnosed with developmental language disorder at 4 years old increased between the ages of 8.5 and 15 years, despite an average decrease between the age of 4 and 8.5 years (Bishop & Edmundson, 1987). This is likely to reflect the fact that the focus of literacy instruction up to the age of 8 years old is on word reading rather than reading comprehension, which is where their difficulties lie (Dale, McMillian, Hayiou-Thomas & Plomin, 2014).

These findings support the illusory recovery theory (Scarborough & Dobrich,1990), emphasising how oral language skills that contribute to the development of the literacy skills of students change over time, placing children at increased risk of failure at different stages of their education (Whitehurst & Fischel, 2000). This highlights the importance of identifying current cognitive deficits that explain a behavioural deficit (proximal cause), and cognitive deficits that were evident in the past that have led to a current behavioural deficit (distal cause). To achieve this, it is important that the primary school setting communicate with secondary schools about a particular child's difficulties in order to provide a developmental overview of the student's learning background. On entry to secondary school, this will help

to ensure the proactive identification of students who have previously been diagnosed with a developmental language disorder, and may go onto experience reading comprehension difficulties.

2.2.2 A divergence in reading ability among poor and good readers on transition to secondary school

Research also suggests that there is a divergence in vocabulary growth among poor and good readers on transition to secondary school (Cain & Oakhill, 2011), as better comprehenders are able to improve their vocabulary knowledge through reading to a greater degree that poorer comprehenders. Matthew effects refer to the gap between good and poor readers that increases over time (Stanovich, 1986). Although some research has shown Matthew effects to be elusive (Bast and Reitsma, 1998; Shaywitz et al., 1995; Scarborough & Parker, 2003; Catts et al., 2003), they have been reported in a number of studies. For example, in a longitudinal study involving 102 children, Cain and Oakhill (2011) found that poor comprehenders at the age of 11 showed slower rates of vocabulary growth at the age of 14 and 16 when compared with peers of the same age with good reading comprehension (after controlling for cognitive ability and vocabulary skills measured at the age of 8). The findings highlight that learning the meaning of new words from context is a crucial part of reading development, and most new words are learned through independent reading from the age of 9 onwards (Nagy & Scott, 2000). Students with good reading comprehension are able to use pragmatic, syntactic, and semantic information from the text to increase their vocabulary (Cain, Oakhill & Elbro, 2003; Beck, Perfetti & McKeown, 1982). Whereas poor comprehenders find it more difficult to use context to understand the meaning of new words (Cain, Oakhill & Lemmon, 2004; Oakhill, 1983), and are less able to remember the meaning of new words over time (Perfetti, Wlotko & Hart, 2005). Whilst the relationship between reading comprehension and vocabulary is strong and reciprocal, it is also unclear whether

vocabulary instruction can improve generalised reading comprehension. For example, Wright and Cervetti (2016) carried out a systematic review of 36 studies, and found that although vocabulary instruction can improve comprehension of a text containing taught words, it is not clear that vocabulary instruction can lead to broader improvements in reading comprehension. This finding reflects the argument made 29 years earlier by Nagy and Herman that "it is highly unlikely that teaching individual word meanings could ever produce more than a very slight increase in general reading comprehension" (1987; 31).

2.2.3 Difficulties associated with 'reading to learn' using challenging texts

One substantial change from primary to secondary school is the frequent use of textbooks in lessons. Expository texts are materials that are written to help the reader learn something new (Saenz and Fuchs, 2002; Weaver & Kintsch, 1991), and a textbook is an expository text that is frequently used for instruction in secondary schools. Text books can include numerous unfamiliar concepts, and the technical nature of the vocabulary can make it challenging for students to use contextual information for clues in understanding key vocabulary (Saenz & Fuchs, 2002). For example, textbooks can be difficult for adolescents to follow as they are "inconsistently organized from chapter to chapter, lack good structure, provide insufficient definitions of essential vocabulary, and require inappropriate skill demands of learners" (Mastropieri, Scruggs & Graetz, 2003, p. 103). For these reasons, expository reading can be more challenging than narrative reading (Wong & Wilson, 1984), and poor comprehenders find this type of text more challenging than their peers and more challenging than narrative texts (Bryant et al., 1999). The difficulties that poor comprehenders of secondary school age face are worsened as secondary school subject teachers do not feel they have had the appropriate training about reading instruction to meet the needs of struggling readers in their classrooms (Ricketts, Sperring & Nation, 2014; Bryant et al., 2001;

Schumm & Vaughn, 1995).

2.2.4 Implications of poor reading comprehension on academic attainment

Reading comprehension difficulties have implications for the academic attainment of pupils at secondary school. The Education Endowment Foundation (2014) indicates that one in seven children will begin secondary school with below required levels of reading comprehension, and only one in ten of these children will go on to achieve five or more GCSEs, including in English and Maths. Possible explanations for a fall in academic performance on transition to secondary school are changes in pedagogy, increased anxiety levels amongst students who are adjusting to a new environment, increased demands in the skills that are required, and poor communication between primary and secondary schools about the difficulties that poor comprehenders experience (See & Gorard, 2014).

A combination of these factors has led to emerging evidence that poor levels of reading comprehension at primary school can lead to significant implications for educational attainment at secondary school (Ricketts et al., 2014 and Cain & Oakhill, 2006). Using data from School Assessment Tests (SAT-UK) for 16 poor comprehenders and 17 good comprehenders, Cain and Oakhill (2006) found that the mean score for the good comprehender group in Maths, English and Science tests was higher than the poor comprehender group, although both groups were in line with government targets. This small data sample show that although the poor comprehenders attained an age-appropriate level, they performed less well when compared to students of the same age without a history of comprehension difficulties. Initial research findings suggest that the situation is similar for poor comprehenders of secondary school age. For example, a longitudinal study by Ricketts et al. (2014) involving a small sample size of 30 students (15 poor comprehenders and 15 controls), which tracked the students development from identification at age 9 to 16 years, found that

when the performance of the poor comprehenders was compared to the controls, their educational attainment was significantly lower at ages 11 and 16 years, and they were at a higher risk of not obtaining five or more GCSEs.

These findings support the argument that a key element of teaching instruction in secondary schools must be for students to understand text, in order to learn concepts and to develop their understanding (Gajria et al., 2007). Having the capacity to read information and learn from it, is a key attribute for academic success (Cervetti, Jaynes & Hiebert, 2009). However, it is important to emphasise that these studies involve small samples of students, and they do not identify the specific causal factors that could explain the poor performance of poor comprehenders. As the literature comprises just two longitudinal studies involving small groups of students, further research is required, involving larger groups, control group comparisons, details of group level performance and data on variability in response to intervention in order to ascertain a more accurate idea of the academic implications for students with poor reading comprehension.

2.2.5 Implications of poor reading comprehension on psycho-social development

In addition to evidence on the academic implications for poor comprehenders, there is emerging evidence that a lack of appropriate reading competency amongst adolescent students also has implications for their psycho-social development, with elevated risks of behavioural difficulties and poor mental health when compared with adolescents who have age-appropriate reading ability (Arnold et al., 2005). Behavioural and emotional difficulties also predict low attainment, which further increases the risk of literacy failure for poor comprehenders. For example, in a study involving 188 15-year old students, Daniel et al. (2006) found that students with poor reading ability were at higher risk of experiencing suicidal ideas or attempts (even after controlling for sociodemographic and psychiatric

variables). This research shows that adolescents with poor reading ability (of which reading comprehension is a significant component) are individuals that could be labelled at risk, and therefore vulnerable. Further longitudinal large-scale research is required to ascertain the impact of reading comprehension impairment on the psycho-social development of adolescent students.

Overall, the literature indicates that the gap in reading comprehension is substantial and that there are no quick fixes; tackling it requires a co-ordinated and concentrated effort. Investing in resources to identify and support poor comprehenders at the transition from primary to secondary school is likely to bring wider benefits to their education and well-being.

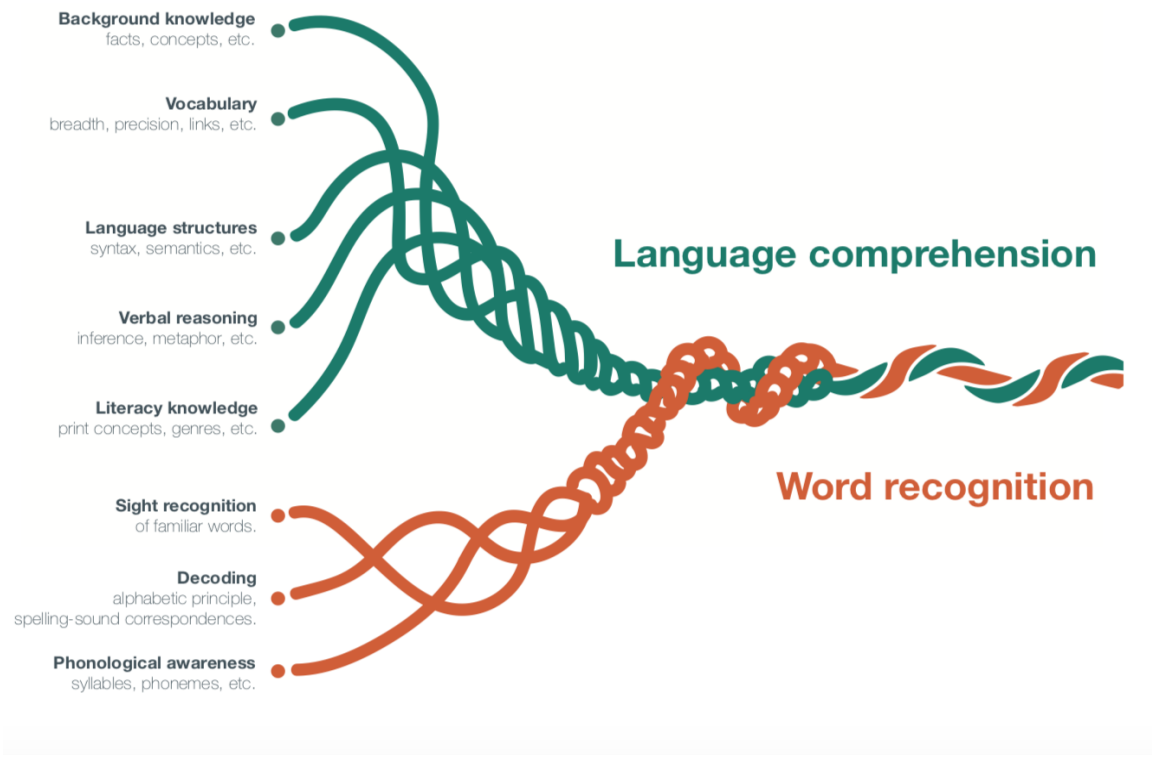
2.3 Models of Reading and Reading Comprehension

There are numerous models and frameworks that have been used to understand the mechanisms behind the successful comprehension of text. Scarborough's (2001) Reading Rope, Gough and Tunmer's (1986) Simple View of Reading (SVR), the Construction-Integration Model of Kintsch, and Rawson (2005) and Perfetti, Landi and Oakhill's (2005) Reading Systems Framework will be discussed here, as these models are useful to consider when designing an intervention programme to improve reading comprehension.

2.3.1 Scarborough's Reading Rope

Scarborough (2001) used the image of a reading rope to identify the strands such as word recognition and language comprehension, which are woven into skilled reading, see Figure 1. Within the two main strands there are sub-strands. For word recognition, these sub-strands are sight recognition, decoding and phonological awareness. For language comprehension, the sub-strands are background knowledge, vocabulary (including breadth, depth, accuracy, ability to make links between words), language structure (including syntax

and semantics), verbal reasoning (including inference skills, understanding of metaphors) and literacy knowledge (including print concepts, genres). This framework is a useful tool to understand the building blocks for reading as it highlights that both word recognition and language comprehension are significant, and that these processes operate and develop interactively. Whilst it is not a complete model and the underlying processes involved for each component are not clearly defined, it is a useful tool for practitioners to achieve effective communication with parents, carers and teachers about the cognitive profiles of different



studies in an accessible way (e.g. Improving Literacy at Key Stage 2 Guidance Report,

Figure 1: Reading Rope Scarborough (2001)

Education Endowment Foundation, 2017). However, it does not address the underlying mechanisms of poor reading comprehension.

2.3.2 Gough and Tunmer Simple View of Reading

Gough and Tunmer's (1986) Simple View of Reading (SVR) takes a broader perspective of the skills required in reading. The SVR is an accessible way to broadly

distinguish between reading impairments as it also captures individual variability, and creates subgroups of students that have practical, academic and clinical utility (Ricketts et al., 2010). Within this multidimensional approach, is the understanding that decoding print and oral language comprehension processes are required for skilled reading. Figure 2 depicts the SVR as a quadrant model, with the two component processes as two continuous variables. Language comprehension processing is on the y-axis and word recognition processes (alphabetic decoding and recognising familiar words) on the x-axis (Ricketts, 2011; Nation & Norbury, 2005). The quadrant shows four types of reading profile and in particular separates poor comprehenders from those with dyslexia.

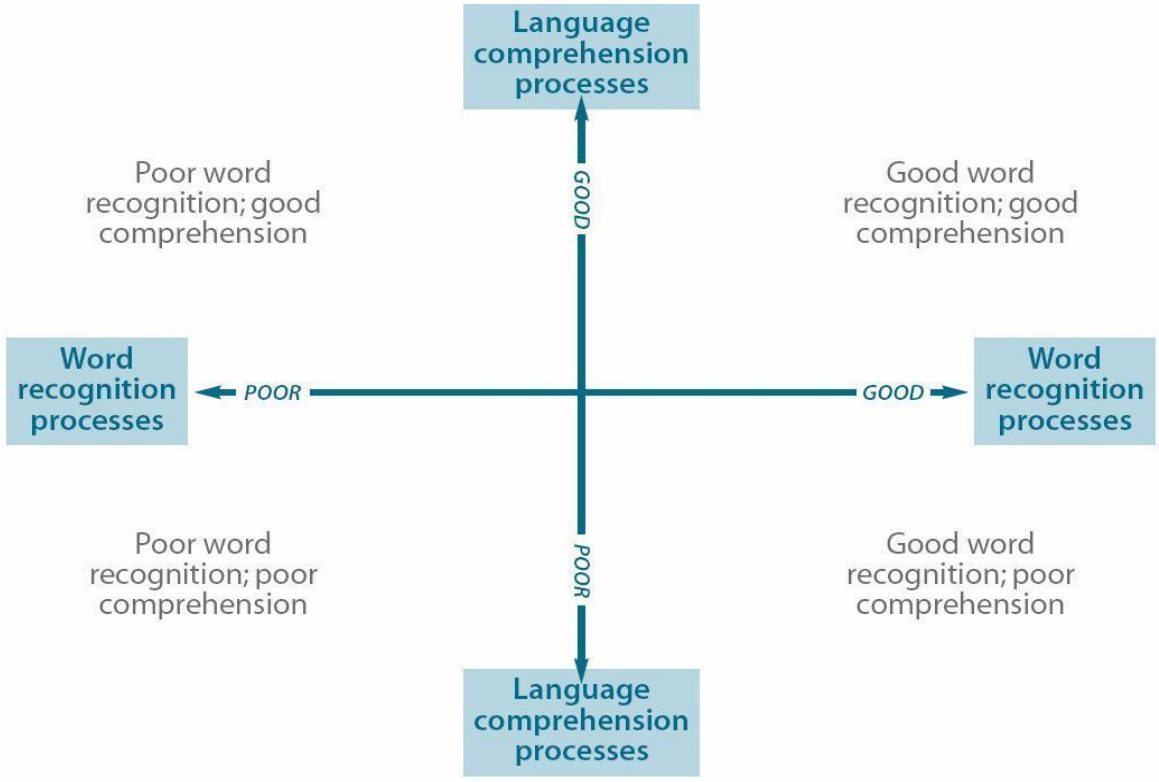


Figure 2: The Simple View of Reading (The Rose Report, 2006)

The assumption that oral language comprehension and decoding are independent is supported by empirical research (Kendeou et al., 2009), including longitudinal studies (Tunmer & Greaney, 2010), behavioural genetic studies (Harlaar et al., 2010), studies with

typically developing readers, and those with specific reading difficulties (e.g. Savage et al., 2009; Leach et al., 2003; Sabatini et al., 2010). The SVR provides a conceptual framework for designing effective teaching interventions within educational settings (e.g. Oakhill et al., 2001; Kendeou et al., 2007), and it has also been used to underpin several aspects of educational policy (DfES, 2006; Rose 2009).

Developmental studies provide evidence of a strong association between word reading and reading comprehension (Rayner et al., 2001), that decreases with age due to the increased automaticity in decoding/word reading (Olson, Keenan, Byrne & Samuelsson, 2014), and the increasing role of other skills such as listening comprehension (Stanovich, Cunningham & Feeman, 1984). However, as reading comprehension is dependent upon successful and efficient word recognition, identifying two independent parts of reading helps teachers to separate between students who have difficulties in decoding, and those with difficulties in comprehending. The SVR efficiently explains the bases of heterogeneity in reading difficulties and is widely accepted as a suitable framework for describing, explaining and investigating reading difficulties.

However, some researchers have argued that the SVR is too simplistic (Pressley et al., 2009), and other components are needed to account for the variance that is unexplained by decoding and oral language (Kirby & Savage, 2008). For example, according to the multicomponent view of reading (Cain, 2009; Cain et al., 2004) additional components could include speed of processing (Joshi & Aaron, 2000), naming speed (Johnston & Kirby, 2006), executive function (Johnson, Jenkins, & Jewell, 2005), vocabulary (Ouellette & Beers, 2010), as well as higher-order comprehension skills such as inference making (Cain, Oakhill & Bryant, 2004) and comprehension monitoring (Kim, 2015; Oakhill & Cain, 2012).

There are also a number of limitations in the way in which the SVR has been referred to within the literature. This relates to inconsistent definitions of oral language and the

application of the SVR beyond its original intention. The SVR does not specify the role of oral language skills within the oral language construct, nor does it specify the relative importance of receptive and expressive oral language (Santoro, 2012; Adolf, Catts & Lee, 2010; Uppstad & Solheim, 2011). Whilst the Simple View of Reading treats decoding and language comprehension as independent variables, studies have shown that they are correlated or are sub-served by the same sub-components (Vellutino et al., 2007; Johnston & Kirby, 2006). The SVR implies that skilled decoding and language comprehension leads to skilled reading comprehension. However, there is evidence that the relationship between reading comprehension and language comprehension is not unidirectional but somewhat bidirectional (Oakhill & Cain, 2007; Tunmer & Chapman, 2012), due to shared variance of components such as vocabulary, grammar, verbal working memory and inference skills (Lervag, Hulme, Melby-Lervag, 2018). The Simple View may also not apply in the same way to typically developing and poor readers (Conners & Olson, 1990; Savage, 2006).

Therefore, although the SVR is an imperfect framework, it simplifies the complexities of reading, allowing for empirical prediction, a way to organise language assessments into broad constructs, and provides a starting point for an analysis of the relationship between oral and written language comprehension (Scott, 2011). Therefore, it is very useful for practitioners despite criticisms within the research community.

2.3.3 Kintsch and Rawson's Construction-Integration Model

The Construction-Integration Model of Kintsch and Rawson (2005) focuses on reading comprehension, rather than providing a general framework of reading like the Simple View of Reading (Gough & Tunmer, 1986) and Reading Rope (Scarborough, 2001). The Construction-Integration Model describes three inter-related stages that are required for successful reading comprehension (see Table 1).

At the linguistic level, graphic symbols are decoded. This requires phonological awareness, letter recognition, knowledge of grapheme-phoneme correspondences, parsing and access to word meanings. In the second stage, semantic understanding is combined to form propositions, which is referred to as the microstructure of the text. In the third level, ideas and the interrelationships between these ideas are established, and this is referred to as the macrostructure of the text. Together the microstructure and macrostructure are referred to as the text base. The text base is initially constructed from the surface information within the text such as the semantic and situational representation. This is then integrated with the readers' background knowledge to form a representation of the text.

Table 1: An interpretation of the Construction–Integration Model (Kintsch and Rawson, 2005).

1	Linguistic Level	The reader recognises individual words and the meaning of these words.
2	Microstructure	The reader works at the sentence or phrase level to go beyond the meaning of words in isolation, and to process the meaning of larger amounts of text.
3	Macrostructure	The reader recognises themes, topics and genre information about the text.
4	Text base + General Knowledge	The reader draws on the text base (including the explicit meaning of the text and general knowledge that is drawn from their experiences) to create a situation model. The reader may also draw on 'theory of mind' skills to understand what a character might be thinking or feeling, and how they might feel in a similar situation.
5	Situation Model	For a deeper understanding of the text, the reader goes beyond the text base to reach a personal and emotional representation of what has been read.

The Construction-Integration Model provides a global theoretical framework which can be used to make theoretical predictions. More specifically, it demonstrates that text comprehension can be explained by an interactive combination of top-down (knowledge-drive) and bottom-up (word-based) processes. There are a number of supporting studies that highlight the importance of knowledge, including general world knowledge and passage specific knowledge, in making inferences and building a coherent representation of the text (e.g. Bransford, Stein, Shelton & Owings, 1981; Oakhill, 1983). However, the model does not refer

explicitly to the role of some comprehension processes, for example the role of inference skills in constructing a deeper understanding of text. Furthermore, it is rather vague, has a lack of focus on processes and therefore does not give rise to testable propositions and implications.

2.3.4 Perfetti, Landi and Oakhill's Reading Systems Framework

Perfetti, Landi and Oakhill (2005) provide a more general framework of reading systems, referred to as the Reading Systems Framework, which places word-level processes alongside higher-level language processing mechanisms at the centre of a framework for reading comprehension (see Figure 3). These processes refer to the identification of phonological and orthographic units for word identification. Following this, the identification of the contextually appropriate meaning for words is made, using morphology and syntax to parse word strings, and make appropriate inferences using general knowledge to link information and create more complete representations of text. In this model, the semantic aspect of lexical knowledge is the point at which the meaning of a word is integrated into a mental representation of the text or situation model. These word-to-text integration processes enable the reader to continuously monitor and tune their current understanding. The framework also introduces the ideas that children have different standards of coherence (or standard for determining whether something has been understood), and that a high standard of coherence is required for good reading comprehension skills. Indeed, even subtle differences in the semantic aspect of lexical knowledge might affect word-to-text integration, and comprehension more broadly.

The Reading Systems Framework details a set of processes and the interactions between them that form sub-systems and systems. The framework can be used to highlight the pressure points in reading comprehension, as well as generate hypotheses about the sources of reading comprehension difficulties. For example, the Lexical Quality Hypothesis (Perfetti, 2007; Perfetti & Hart, 2002) assumes that the lexicon is a pressure point in the system. The

lexicon is required for two reading systems: one, the word identification system, requires good linguistic and orthographic information to enable rapid word identification; the second, the comprehension system, uses information from the word identification system to build meaning. Therefore, lexical knowledge, in mediating the interaction between the word identification system and the comprehension system, is a pressure point for reading comprehension, and a prime cause of difficulties with reading comprehension.

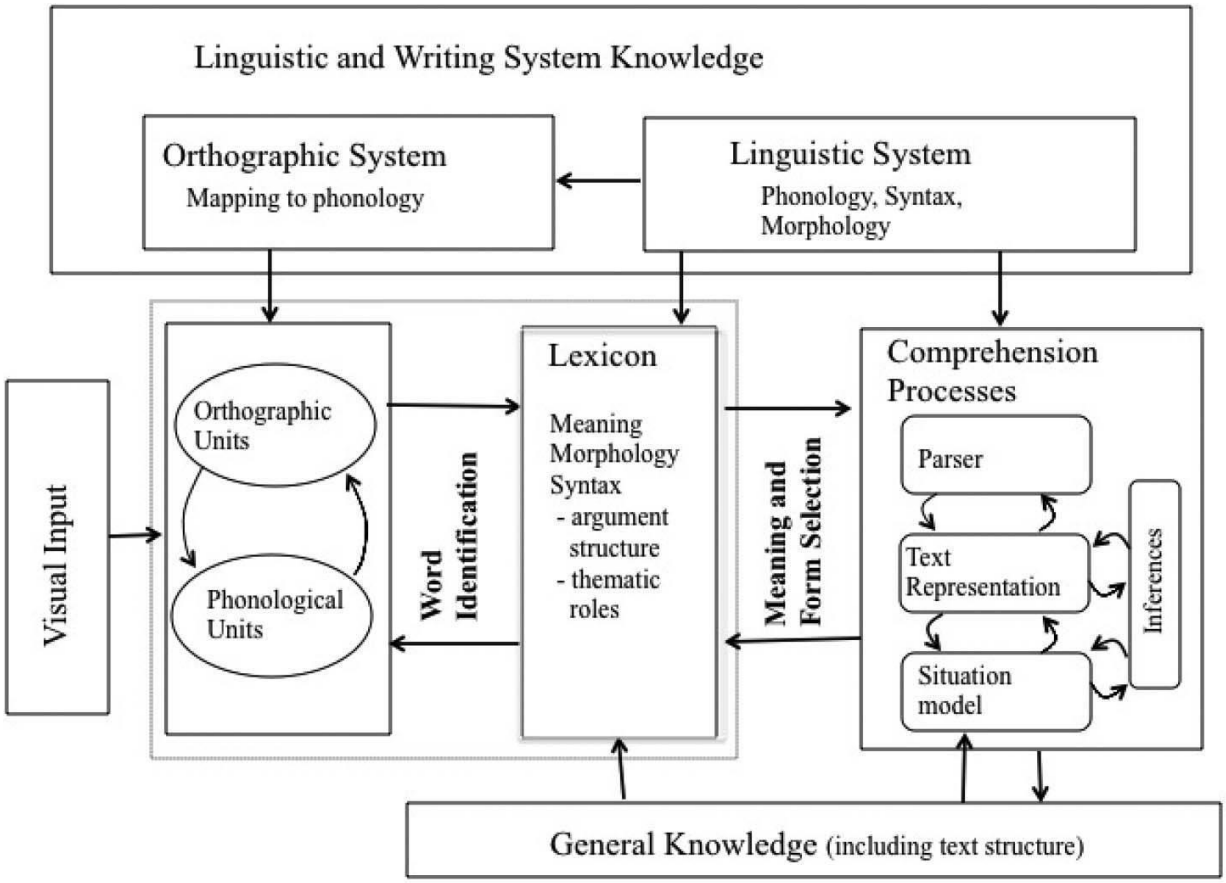


Figure 3: Reading Systems Framework (Perfetti, Landi, and Oakhill, 2005)

In contrast to the frameworks of word-reading that make precise predictions (e.g., Coltheart, Rastle, Perry, Langdon, and Ziegler, 2001), frameworks for reading comprehension provide a global theoretical framework and interconnected claims that can lead to theoretical models with testable propositions and implications. Frameworks of reading comprehension include broad- scope ideas outlined in the Reading Rope (Scarborough, 2001) and Simple View of Reading (Gough & Tunmer, 1986). The Construction-Integration Model (Kintsch, 1988)

and Reading Systems Framework (Perfetti, Landi & Oakhill, 2005) present a more detailed representation of the interactions between knowledge-driven (top-down) and word-based (bottom-up) processes, which has allowed progress in the study of the components for successful reading comprehension.

Within this research study, the Simple View of Reading (Gough & Tunmer, 1986) will be used to define and discuss reading comprehension in relation to word reading and language comprehension.

2.4 Causes of Poor Reading Comprehension

We have just seen that reading comprehension is complex and multifaceted, so it makes sense that the cause of reading comprehension difficulties is also not simple. There are multiple causal factors behind poor reading comprehension, meaning that 'poor comprehenders' have a heterogenous cognitive profile (Nation, Clarke & Snowling, 2002), and will differ in their developmental trajectories (Ebert & Scott, 2016). Researchers investigating the causes of poor reading comprehension have observed weakness in oral language ability (e.g. Clarke, Marshall & Durand, 2004; Nation et al., 2004; Cain et al., 2004), vocabulary and semantic understanding (e.g. Stothard & Hulme, 1992), narrative production (e.g. Cain and Oakhill, 1996), figurative language (e.g. Cain, Oakhill & Lemmon, 2004), motivation (e.g. Schiefele, 1999; 2009; Berkley, 2011), verbal working memory (Cain, 2006), making inferences (Yuill & Oakhill, 1998) and comprehension monitoring (Skarakis-Doyle, 2002; Ruffman, 1996; Berkeley & Riccomini, 2013). These factors will be discussed below with reference to current theoretical understanding and findings from intervention studies. This theoretical background will be used to create the intervention programmes that will be delivered in this study.

2.4.1 Reading Comprehension and Oral Language

Mattingly famously wrote that 'reading is parasitic on speech' (1972; 9) and more recently Snowling et al. have stated that more broadly 'reading is parasitic on language' (2007; 19). Indeed, as previously discussed, the Simple View of Reading (Gough & Tunmer, 1986) captures the different roles of decoding and oral language in reading development. Whereas decoding is dependent on letter knowledge and phoneme awareness (Bowey, 2005), oral language is dependent on a range of factors including phonology (the sounds of letter combinations), semantics (word meanings), grammar (syntax and morphology) and pragmatic language skills (the expression and social aspects of language) (Nation et al., 2010). Given the importance of spoken language for the development of reading, research has indicated that oral language provides the skills later required for reading development (Clarke et al., 2014).

A number of longitudinal studies, which have followed the progress of children learning to read and retrospectively analysed literacy data, have been able to show that adolescents who have reading comprehension difficulties have had underlying oral language problems (Bishop & Snowling, 2004; Nation et al., 2010). This suggests that there is homotypic co-morbidity between oral language difficulties and poor reading comprehension (Caron & Rutter, 1991), and therefore diagnosed reading impairments could be a later manifestation of what may or may not have been observed earlier as an oral language problem (Bishop & Snowling, 2004). Whilst it is not possible or advisable to always map between communication and reading disorders, there should be an awareness amongst educators that oral language difficulties are a causal risk factor in reading comprehension impairments. This is important, as the combination of these specific difficulties over time could impact a child's ability to first listen and communicate effectively in the classroom, as spoken language is the medium of instruction, and later to develop an understanding through written materials. Indeed, there remains "a pressing need…for more research aimed at understanding the cognitive, neural

and genetic mechanisms that contribute to the genesis of language learning difficulties" (Hulme & Snowling, 2014; 7).

There is some evidence that components of oral language can be successfully taught. Bianco et al. (2010) assigned 1,273 4-year olds to a language comprehension programme (involving comprehension monitoring, understanding causality and connectives and inference making), phonological awareness training or a reading programme (involving repeated reading and analysis of the same storybook over a period of 4-8 weeks). The comprehension programme produced significant improvements in spoken language comprehension, suggesting a possible link with comprehension monitoring, understanding causality, connectives and inference with broader language comprehension. However, groups were not randomly allocated, standardised assessments were not used, and there were no measures of transfer to wider reading development or identification of casual factors or mechanisms in the improvement of spoken language comprehension.

Similar conclusions were made by Bowyer-Crane et al. (2008) who carried out a randomised controlled trial investigating the impact of delivering a twenty-week oral language skills programme (involving training in vocabulary, inferencing, expressive language and listening skills), comparing the impact to a phonology with reading programme (with direct instruction on letter-sound knowledge, phonological awareness and reading books at the instructional level). The RCT involved 152 children aged between 4 and 5 years old with poorly developed language skills, who were identified from a screening test using an expressive language test (Picture Naming subtest of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III UK)), and test of nonword repetition involving 30 items from the Children's Test of Nonword Repetition (Gathercole & Baddeley, 1996).

The study showed that the phonology with reading programme produced improvements in letter knowledge, spelling, prose reading accuracy and segmenting/blending/deletion. The effects for letter knowledge, spelling, and nonword reading were maintained six months after the intervention. However, the Oral Language (OL) group made better progress than the control group in vocabulary (measuring words directly taught in the oral language programme) and expressive grammar (measured using The Action Picture Test by Renfrew, 2003). These effects were also maintained six months after the intervention. According to the Simple View of Reading, word-level decoding difficulties in reading relate to phonological deficits, and reading comprehension difficulties are associated with deficits in oral language skills. This understanding highlights the theoretical rationale for a focus on evidence-based intervention programmes to foster good speaking and listening skills, particularly for language-delayed children who are likely to be at risk of later reading comprehension difficulties (Rose, 2006).

Building on the findings of Bowyer-Crane et al. (2008), Fricke et al. (2013) investigated the extent to which these early interventions for children with oral language difficulties can successfully support the skills that underpin more generalised measures of both oral language and reading comprehension. They reported their findings from an oral language programme that was delivered over thirty weeks to children between the age of 3 and 5 years old. The programme was created and structured with the aim to improve vocabulary, grammar, narrative and active listening skills. In the first ten weeks, groups of two to four students received the intervention within their nursery classroom, and this was directly followed with daily intervention in Reception for 20 weeks, alternating between individual and group teaching. The study was able to show that the oral language programme led to significant gains in standardised assessments of reading comprehension when measured following the intervention, and at a 6-month follow-up point when compared with the waiting list control

group. These studies provide evidence of the link between language comprehension and reading comprehension, as outlined in the Simple View of Reading (Gough and Tunmer, 1986). However, Fricke et al. (2013) were not able to establish the advantage of starting the intervention within the nursery classroom, as compared with at school entry, or the optimal duration of the intervention.

More recently, Burgoyne, Gardner, Whiteley, Snowling and Hulme (2018) conducted an RCT involving 208 pre-school children to assess the effects of an oral language programme delivered by parents. The intervention included interactive book reading (using prompts, sentence starters, and links between the book and the child's life), direct teaching of vocabulary (one new word was chosen for teaching in each session) and narrative skills (targeted sequencing, summarising and retelling the story). Students receiving this intervention made significantly larger gains in language (*d*=.21), when compared with children involved in an active control programme targeting motor skills, measured immediately after the intervention. These effects on language were maintained 6 months later (*d*=.34), indicating the potential effectiveness of parent-delivered early language enrichment. However, this study did not involve a waiting list control group, the programme was relatively time consuming for parents (5 days per week in 20-minute sessions over 30 weeks) and required parents to have a reasonable level of literacy.

To fully evaluate the degree to which oral language skills may predict reading comprehension, Clarke et al. (2010) explored the casual factors or mechanisms underlying improvements in reading comprehension. Their randomised controlled trial involved 184 children (with 160 included in the final sample) aged between 8 and 9 years old in twenty-three different schools, and assessed the effectiveness of three interventions delivered by a teaching assistant who worked in the school the child attended. The first programme focused

on developing oral language skills (OL), and included activities aimed at improving vocabulary, figurative language, spoken narrative and listening comprehension skills. The second intervention programme involved text level training (TL) within the written language domain, involving inference training, direct instruction to develop metacognitive strategies and a written narrative. The third intervention was an integrated programme (COM) that incorporated activities to improve oral language and text level processing. All participants in the study were assessed prior to the start of the intervention, 10 weeks later at the mid-point of the programme, and then following a further ten weeks at the end of the intervention. The students were also assessed 11 months later to investigate the maintenance of gains.

All groups made significant progress over twenty weeks and made an average gain of 3 points in their reading comprehension standard score, indicating that there were similar benefits associated with the TL, OL and COM intervention programmes when compared to the control group. However, it is striking that the OL group maintained these improvements and continued to progress to make significant gains (an average gain of 7 standard points) when tested 11 months after the intervention programme finished. Although all interventions improved comprehension skill, the effect was most durable when oral language was specifically targeted.

The lasting effect of the oral language intervention allowed the authors to conclude that oral language difficulties were a causal risk factor for reading comprehension impairments. Furthermore, construction of a mediation model (with reading comprehension as the long-term outcome and vocabulary as a mediator), indicated that vocabulary mediated improvements in reading comprehension. As the indirect effects of the COM and OL programs on reading comprehension, via vocabulary, were reliable, the authors concluded that improvements in reading comprehension in these programs were mediated by vocabulary

growth. The results indicated that training in oral language is particularly likely to help adolescent readers improve their reading comprehension in the long-term. This association has also been demonstrated within longitudinal and training designs (Duff and Hulme, 2012; Duff, Reen, Plunkett, and Nation, 2015; Lee, 2011).

Whilst these findings have been significant in informing evidence-based practice, it is important to note that moving from an understanding of everyday oral language to reading a word and then to an understanding of written text can be difficult, as written language involves a greater depth and breadth in the vocabulary that is used when compared with spoken language (Cunningham & Stanovich, 1998). Indeed, 2000 words make up 80% of spoken language, which means that if teachers simply focus on developing oral language in the classroom, without a structured approach that is focused on the development of specific vocabulary, it is unlikely to develop vocabulary and language skills for most students (Quigley, 2018). Carson (1985; 1995) underscores this point by using the concept of a 'lexical bar' to define the barrier that must be crossed from understanding spoken text to written or academic text.

The study by Clarke et al., (2010) was highly influential, yet subject to a small number of methodological limitations. Firstly, only 53% of the participants satisfied the criterion for comprehension impairment (one standard deviation discrepancy between word reading and reading comprehension, a reading-comprehension standard scores equal to or below 90 and a reading-accuracy score of 90 or above). For example, the criteria for reading accuracy was reduced to a standard score of between 80 and 85 for 18 children. The average reading comprehension baseline standard score also varied from an average of 95.43 (in the oral language group at T1) to 97.77 (in the waiting list control group at T1). It is therefore possible that the study included generally poor readers and students with poor reading accuracy or

decoding skills. Furthermore, there was a relatively small sample size of 40 students in each of the four strata.

Further studies are required to provide robust evidence on the efficacy of oral language and text-based programmes for adolescent students, in particular focusing on the development of sub-components of reading comprehension (Snowling & Hulme, 2012).

2.4.2 Reading Comprehension and Vocabulary

One important component of reading comprehension is vocabulary knowledge. The correlation between vocabulary knowledge and reading comprehension is significant, ranging between 0.3 and 0.8 (Tannenbaum, Torgesen & Wagner, 2006; Cain and Oakhill, 2011; McKeown, Torgesen, Wagner, Rashotte, Burgess & Hecht, 1997). There is a tendency toward larger correlations with age and reading experience, suggesting that the role and importance of vocabulary knowledge increases with age and reading experience (Torgesen, Wagner, Rashotte, Burgess & Hecht, 1997). For example, in one study, correlations between receptive vocabulary and reading comprehension increased from r=.46 at the age of 7 to r = .66 at the age of 10 (Potopapas et al., 2007).

However, it is not true that all poor comprehenders have poor vocabulary knowledge. Cain, Lemmon & Oakhill (2004) distinguished between poor comprehenders with high versus low lower vocabulary skills, highlighting the complex relationship between reading comprehension and vocabulary, and that the causes of poor comprehension are multifaceted (Nation, Snowling & Clarke, 2007).

There are a number of possible explanations for the relationship between reading comprehension and vocabulary knowledge. The first is that if children have limited vocabulary knowledge or are unable to access word meanings rapidly and efficiently it will have a negative impact on their reading comprehension (Beck, Perfetti & McKeown, 1982; Daneman & Green,

1986). Indeed, exposure to words in different contexts, episodes and experiences brings about a rich and nuanced knowledge of words, which over time, develop into a database detailing the lexical history of an individual's experience, which is referred to as a lexical legacy (Nation, 2017). Research in this area builds on Perfetti's (2008) lexical quality hypothesis, which specifies the extent to which a word's representation reflects its orthographic, phonological and semantic constituents that together comprise the word's identity. A higher lexical quality enables readers' more efficient lexical retrieval, thereby allowing them to focus more cognitive resources on reading comprehension, as well as providing opportunities to gain further knowledge and tune lexical quality to the benefit of future processing.

An alternative interpretation is that reading comprehension may have an instrumental effect on vocabulary development (Nagy & Anderson, 1984; Stanovich, 1986). This hypothesis is supported by research indicating that good comprehension skills allow new information to be learnt from context, and this assists learning (Sternberg & Powell, 1983; Kintsch, 1998; Nagy & Scott, 2000). Indeed, using context within the text is a means of vocabulary development (Sternbery & Powell, 1983), and once a child develops their word reading, the majority of a child's vocabulary development occurs through reading, rather than being taught new words (Cunningham, 2005). Children with poor reading comprehension are poorer and less efficient at inferring the meaning of novel words from contextual information (Cain, Oakhill & Lemmon, 2004; Joseph & Nation, 2018). Thus, because poor comprehenders are less efficient at using the context within a text to infer the meaning of new words (Jarlaar et al., 2011) and have reduced longer term retention of semantic knowledge (Nation, Snowling & Clarke (2007) they will fail to develop and retain vocabulary knowledge at the same rate as better comprehending peers. Research involving a large sample of twin children (n=11,559) also found evidence to suggest that the hours a child spends reading outside of the classroom is determined by their reading ability, rather than the number of hours spent reading

influencing their reading ability (van Bergen, Snowling, de Zeeuw, van Beijstervedldt, Dolan & Boomsma, 2018). These findings are consistent with findings from behavioural studies (Mol and Bus, 2011; Schiefele et al., 2012), and they suggest that poor comprehenders are less efficient at inferring the meaning of novel words from the words that they read, and that they read less frequently than good comprehenders of the same age.

Some have also argued that vocabulary and reading comprehension are correlated due to common underlying processes. For example, the development of vocabulary depends on the mappings between the semantic meaning of a word and its phonological form. Similarly, reading comprehension requires effective mappings between semantic, phonological and orthographic units (Plaut, Seidenberg, McClelland & Patterson, 1996). Thus, any underlying processes that are impaired, will lead to weaknesses in both reading comprehension and vocabulary.

Finally, some studies have found Matthew effects for vocabulary growth between poor comprehenders and good comprehenders. For example, in a longitudinal research project by Cain and Oakhill (2011), tracking the word reading, reading comprehension and vocabulary of 102 students from the age of 8 to 16 years old, the authors concluded that the divergence in vocabulary scores was due to the reciprocal relationship between vocabulary and reading comprehension.

The four different perspectives of the relationship between reading comprehension and vocabulary that have been discussed are summarised in Figure 4.

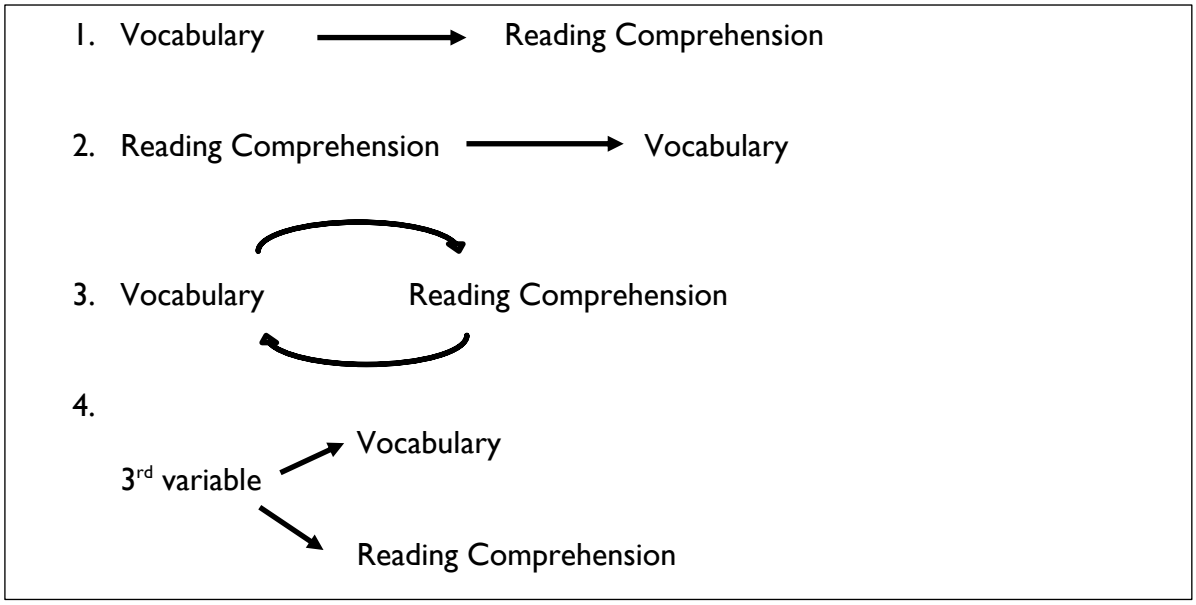


Figure 4: Four different perspectives regarding the relationship between vocabulary and reading comprehension (the arrow denotes the direction of the relationship)

2.4.2.1 Effective vocabulary instruction

It is estimated that children must have a detailed knowledge of 90% of the words within a text in order to fully understand it (Nagy & Scott, 2000), and the ability to quickly retrieve the meaning of words and use the knowledge that they have activated is critical for reading comprehension (Christopher et al., 2012). However, a subjective survey of 1,000 teachers in the UK by Oxford Language Report (2018) found that 69% of primary school teachers, and over 60% of secondary school teachers, believe that children they are teaching have a vocabulary far below age-related expectation. For a number of reasons such as time constraints, teacher training, and conflicting priorities within the curriculum, vocabulary teaching is often incidental, limited and rushed, when it should be cumulative, planned, structured and explicit (Quigley, 2018).

Growth in vocabulary knowledge involves developing a reader's lexicon, consolidating

and deepening knowledge of the meanings of known words, and strengthening associations between words related in meaning. With regards to the kinds of words to teach, the research can be roughly categorised into two different approaches. The first are those researchers who describe criteria for choosing words (e.g. Nation, 2001; Stahl & Nagy, 2006), and the second is those who have developed specific procedures for the identification of specific words, often based on the frequency of appearance in written language (e.g. Biemiller & Slonim 2001, 2005). Although using frequency lists is attractive as they are objective and easily available, they do not indicate how difficult a word is or how useful it is for developing reading comprehension. Therefore, describing the criteria for choosing words for vocabulary instruction is preferable as it considers the utility of words for both reading comprehension and written composition as the priority.

An effective approach to vocabulary instruction that incorporates this understanding is the Three-Tiers Framework (Beck, McKeown & Omanson, 1987). Within this framework, the first tier consists of high frequency words of everyday speech that children are exposed to from a very early age. Children rarely need explicit instructional attention to the meaning of these words. The second tier contains words that are found across a variety of domains. As they are rarely found in everyday language, a deeper understanding of words in the second tier can have a powerful impact on verbal functioning and reading comprehension (Hiebert, 2005). The instruction of words within Tier 2 will support readers in experiencing different contexts of a word (i.e. its semantic diversity) (Hoffman, Lambon Ralph & Rogers, 2013). Tier 3 words appear much less frequently as they are often limited to specific topics and domains. The Three-Tiers Framework (Beck, McKeown & Omanson, 1987) is summarised in Figure 5.

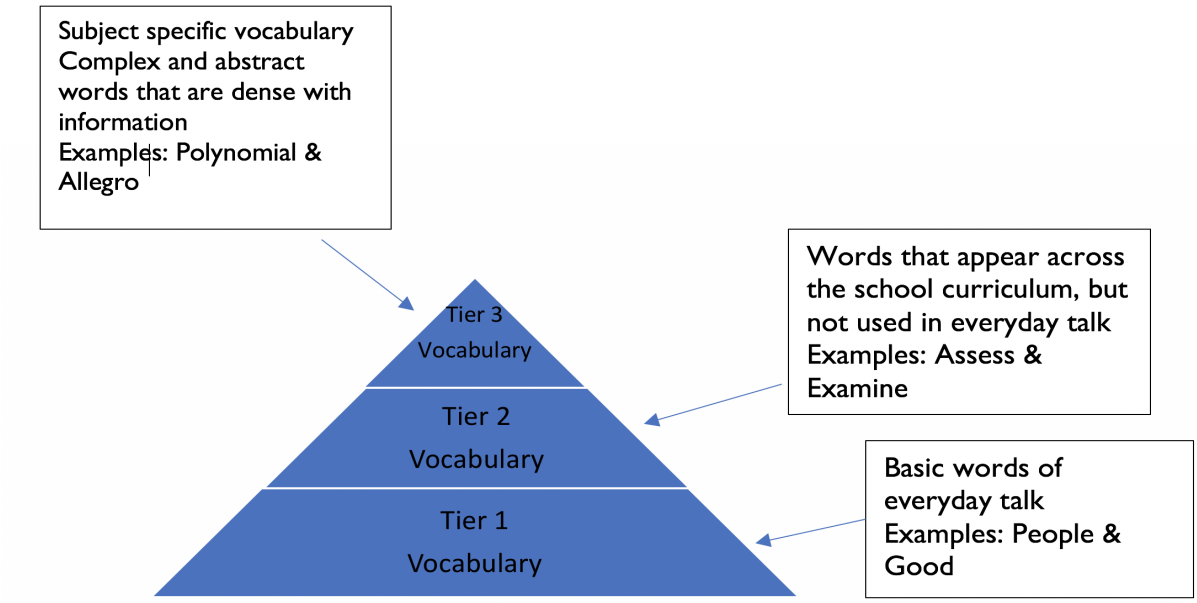


Figure 5: Three-Tiers Framework (Beck, McKeown and Omanson, 1987)

There are significant challenges associated with selecting appropriate words for instruction. For example, Biemiller (2005) advocates teaching students ten new words a week through a structured vocabulary programme. This would limit students to learning a maximum of 400 words a year, and it would be unlikely that the programme would address rare and infrequently used words. Therefore, in addition to explicit instruction of the meanings of words (Jenkins et al., 1989), one must teach associations between words, morphology (Kieffer & Lesaux, 2007) and inference-making strategies to help students to acquire new word knowledge during independent reading. This may have a greater impact on reading comprehension (Oakhill, Cain & Elbro, 2015). For example, Lubliner and Smetana (2005) examined the effects of a 12-week programme that taught students metacognitive word-learning procedures, such as strategies to actively monitor their understanding of word meanings when reading, and clarifying strategies to develop their semantic knowledge. The aim of the intervention was to provide children with self-regulating skills and word-learning strategies that they could use independently whilst reading. Post-test scores indicated a large effect size on generalised reading comprehension of 1.03.

Indeed, teaching children strategies to learn new words can be most effective when instruction involves an active processing of word meanings, rather than passive approaches such as providing a definition or using dictionary methods (Wright & Cervetti, 2016). For example, Stahl and Fairbanks (1986) argued that effective vocabulary teaching involves the student in deeper processing of words by providing both definitional and contextual information, providing at least two exposures to the word, and using specific strategies such as using mnemonics to recall definitions. Bransford, Brown and Cocking (1999) focused on the importance of the "active mental manipulation of word meanings" (154) in order to improve recall of these word meanings from memory, and the role of deliberate practice in helping students to actively evaluate their current level of understanding and, when and where required, use strategies to establish the meaning of unfamiliar words.

Vocabulary knowledge is important in comprehension, and vocabulary instruction is strongly recommended by the National Reading Panel (National Institute of Child Health and Human Development, 2000). However, it is important to note that Wright and Cervetti (2016) conclude that although vocabulary instruction can improve the comprehension of a text containing taught words, there is limited evidence to suggest that it can improve general reading comprehension. One explanation of this is due to vocabulary knowledge being an unconstrained skill with a long developmental trajectory (Paris, 2005). Therefore, although vocabulary is a factor in explaining variations in reading and linguistic comprehension, the evidence is unclear whether or not vocabulary training can lead to gains in generalised reading comprehension.

2.4.3 Reading Comprehension and Metacognition

Metacognition (i.e. thinking about thinking) is a term that was first defined by Flavell (1976) as "knowledge concerning one's own cognitive processes and products, or anything related to them" (p. 232). Metacognition relates to higher-order thinking processes and reflection on these processes (Kuhn, 2000), such as thinking about decisions, making links, evaluating a response to the information presented and forming mental images (Bayne, Cleeremans & Wilken, 2010). Metacognitive knowledge develops over the lifespan, and as children get older, they gain an increasing understanding of their own mental states, from general beliefs about how the mind operates to beliefs about the emergence of forgetting and strategies to manage this.

Within reading comprehension, metacognition occurs following activation of the reader's declarative knowledge, and in particular when they become aware of the gaps in their understanding of the text through evaluation of their reading. This awareness prompts the reader to fill these gaps by selecting the most appropriate strategy for the given situation (conditional knowledge). This will enable the reader to cope with any reading comprehension difficulties encountered, make the necessary adjustments and then evaluate the success of their efforts.

There are a number of strategies that can be used to help students implement metacognitive skills that will form part of the text-based intervention programme delivered to students in this study. Metacognitive strategies that were implemented as part of this intervention study include re-reading (Garner, Macready & Wagoner, 1984), looking-back (Garner, 1982), thinking in pictures (Joffe, Cain and Maric, 2007; Oakhill & Patel, 1991) and reflection and explanation (McNamara, 2004). The theoretical basis of these strategies will be discussed below.

Research on the efficacy of re-read and look-back strategies suggest that re-reading

text that has been misunderstood, missed or forgotten is effective at improving students' comprehension of text (Baker and Brown, 1984; Palinscar & Brown, 1984). Look back and re-read strategies can help students to activate relevant background knowledge, allocate attention to the most relevant parts of a text, test inferences and critically evaluate the content for internal consistency (Brown, Palinscar & Armbruster, 1988). A number of studies have found specific metacognitive strategies to be useful in supporting reading comprehension. For example, Alvermann (1988) found that graphic organisers helped self-perceived poor comprehenders to re-assess the text in order to improve their comprehension of the text. Kendeou, van der Broek, White and Lynch (2007) found that focusing on causes (i.e. 'why did this happen?'), the characters actions (i.e. 'what did he/she do?) or the main themes (i.e. 'what did the characters learn?') helped students to construct their comprehension through an understanding of the important events. Garner, Hare, Alexander, Haynes and Winograd (1984) delivered three sessions on how and why to use lookbacks, and found a significant difference between the training and control groups, with a higher percentage of correct answers in the training group who also more frequently used look backs. However, these studies do not present a pre- or post- standardised score of reading comprehension and they have small sample sizes.

'Thinking in pictures' (also referred to as 'mental imagery') is a strategy that has been successfully implemented in a number of different reading comprehension interventions (Oakhill & Patel, 1991). Research has indicated that this strategy can lead to improvements in a number of different aspects of reading comprehension, including answering questions about the narrative (*ibid*), structuring story events (Center et al., 1999) and comprehension monitoring (Gambrell & Bales, 1986). Peters, Levin, McGivern and Pressley (1985) suggested that students who are taught the 'thinking in pictures' strategy should receive two types of training. The first is representational training, which is creating images that provide detailed

and accurate representations of information in the text. The second is transformational training, which is creating images that focus on specific parts within the text to be remembered.

A number of theories have been proposed to explain the link between 'thinking in pictures' and reading comprehension. The dual-coding theory argues that there is a verbal system dealing with language, and a non-verbal system specialising in non-linguistic events (Paivio 1991; Sadoski & Paivio 2001; 2004), and that these two systems can work independently (i.e. reading without mental images), in parallel (i.e. reading with unrelated images) or in an integrated way (reading with related images) (*ibid*). When working in an integrated way, language can evoke imagery, and imagery can evoke language (Sadoski et al., 1991). In this way, 'thinking in pictures' facilitates reading comprehension by supporting the effective integration of information. An alternative theory is that 'thinking in pictures' serves an important role in enhancing the organisation of information and supporting retrieval from memory (Sadoski et al., 1991; Sadoski & Paivio 2001).

The 'explain and reflect' strategy focuses on the importance of affecting processes while reading unfolds (McNamara, 2007). Activities focused on reflecting and explaining the meaning of the text help students to make connections (Fuchs and Fuchs, 2007; Yuill, 2007), and as a result, construct better mental representations of the texts (as outlined in the Reading Systems Framework of Perfetti, Landi and Oakhill, 2005 and Construction-Integration Model of Kintsch and Rawson, 2005). For example, explaining their own understanding of text or reflecting on other students' comments, adds meaning to ideas within the text. Block and Israel (2004) note that "discussion significantly increases students' scores on comprehension tests, adds to students' self-assessment of their comprehension, and enhances students' abilities to select thinking processes to overcome comprehension challenges while they read" (154).

In summary, there are robust relations between metacognition and reading comprehension (Kendeou et al., 2009; Sesma et al., 2009; Atkinson, Slade, Powell and Levy, 2017), and as a result it is important that specific strategies to develop metacognitive skills are integrated into intervention programmes for poor comprehenders.

2.4.4 Reading Comprehension and Inference

Reading comprehension is an integrative process, and not all the information that a reader requires to build a coherent and complete understanding of a text is explicitly stated. Inferences establish links between events in the text and facilitate connections with relevant background knowledge (Graesser, Singer & Trabasso, 1994). Indeed, inferences are readily made by skilled readers as and when they are required to link ideas and ascertain specific details that are not explicitly referred to in the text (Garnham & Oakhill, 1996; Van den Broek, 1994; Cain & Oakhill, 1999), and they must be made to form an integrated and coherent representation of text. There is little consensus within the literature regarding the categorisation of inference types (Kispal, 2008), which ranges from thirteen types of inferences, defined by Graesser et al. (1994), to nine types defined by Pressley and Afflerbach (1995), and the more useful two types, defined by many more researchers (e.g. Baker and Stein, 1981: Bowyer-Crane & Snowling, 2005). Indeed, the distinction between global (or gap-filling) and local (or text-connecting) inference has been made in numerous studies with children (McGee & Johnson, 2003; Currie & Cain, 2015), as well as with adults (Long & Chong, 2001). Global inferences create a coherent representation of the whole text, whereas local inferences create a coherent representation at the level of sentences and paragraphs (Kispal, 2008).

Research indicates that poor comprehenders find it challenging to make inferences in a number of different ways. With reference to local inference, early studies by Oakhill (1982;

1984) found that poor comprehenders find it challenging to integrate information to establish coherence between different sentences. For example, inferring that "the mouse ate some bread" from the text: "The mouse ate some food. The food was bread. The mouse looked for some cheese" (Oakhill, 1982). Poor comprehenders also find it more challenging to make global inferences that require the reader to draw on their general knowledge to provide information that can be incorporated to complete missing details (Oakhill, 1984). For example, understanding that a boy was riding a bicycle from the phrase "he was pedalling as fast as he could". Finally, poor comprehenders have difficulties with adjusting the number and type of inferences that are drawn with the demand of the comprehension task (Kendeao, 2014; Cain & Oakhill, 1999).

A large number of correlation studies provide evidence that a student's inferential ability is highly predictive of their reading comprehension (e.g. Oakhill, 1982; 1984). For example, in a small study of 25 students between the age of 9 and 10 years old, inference-making skills predicted reading comprehension after controlling for word reading, vocabulary, and cognitive ability (Cain et al., 2004).

Longitudinal and training studies have investigated the direction of the relationship between inference and reading comprehension to try to determine a causal hypothesis. Cain and Oakhill (1999) determined that poor comprehenders were less effective at making inferences compared to a younger, comprehension age-matched group (CAM). The comprehension-age-matched design (Cain & Oakhill 1996; Stothard & Hulme 1992), meant the CAM group's superior performance indicates that poor comprehension is (at least in part) the result of difficulties with inference making, although it does not rule out the possibility that the relationship between inference making and reading comprehension is reciprocal. The research also indicates that both skilled comprehenders and poor comprehenders found making global inferences more difficult than making local inferences, and that this difficulty was

greater for the poor comprehenders (Cain and Oakhill, 1999). Bowyer-Crane and Snowling's (2005) study supports these findings, and they hypothesise that competency with making global inferences may emerge later in development than local inference, as older children become aware of the need to draw on background knowledge for understanding (Cain & Oakhill, 1999). In short, poor comprehenders have poor inference skills, and particularly global inference making ability, and this can be a contributing variable for poor reading comprehension.

2.4.5.1 Explaining the link between reading comprehension and inference making skills

Moving beyond the language system to more general cognitive processing systems, evidence suggests that deficits in working memory explain the link between inference making and poor reading comprehension, as well as being a contributing factor of poor reading comprehension itself (Oakhill & Yuill, 1986; Yuill et al., 1989; Singer et al., 1992 and Virtue et al., 2008). Kintsch and Van Dijk (1978) hypothesised that readers use their working memory to establish coherence between sentences, and that if working memory is taxed, for example by a long and complex sentence, global and local inference making may become more difficult. This may mean that the poor comprehender with a poor working memory is unable to retain a sufficient amount of information in working memory, including the concurrent maintenance of prior and current textual ideas (Budd et al., 1995; Just & Carpenter, 1992; Schmalhofer et al., 2002). As a result, fewer propositions from the text will be recalled and the reader will be less able to construct a coherent representation of the text in memory.

This hypothesis is supported by research findings. For example, Yuill et al. (1989) created a memory task which required the child to recall the final number from a string of three numbers. Poor comprehenders obtained significantly lower scores than typical readers, with a significant correlation between the recall of numbers in the task and reading comprehension score. Furthermore, in a small-scale study involving twenty-four 7-8-year olds

from two primary schools in the UK, Oakhill (1986) found that children with poor reading comprehension and poor working memory were less efficient in their ability to identify and resolve coherence gaps between non-adjacent textual ideas than skilled comprehenders with high working memory capacity. However, as the digit span task only tapped verbal working memory resources, these results do not provide direct evidence of more general working memory difficulties, or whether another variable were the cause of weakness in identifying and resolving coherence gaps. Indeed, researchers have argued that there are alternative variables that mediate the relationship between working memory and reading comprehension, including slow processing speed (Cain et al., 2001), an inadequate understanding of word or clause meaning (Perfetti, Landi & Oakhill, 2005; Cain & Oakhill, 1999) and difficulties with executive function skills such as attentional control (Conners, 2009).

Other researchers have found that working memory deficits associated with poor comprehension are specific to the verbal domain and associated with broader language impairment rather than a specific cause of comprehension failure (Nation, Adams, Bowyer-Crane & Snowling, 1999). For example, a longitudinal study by Cain (2018) found that although vocabulary, grammar and inference making are predictors of reading comprehension, working memory is more important for listening comprehension and not a unique predictor of reading comprehension. This finding of an indirect relation between working memory and reading comprehension being mediated by listening comprehension is in line with other research (Cain et al. 2004; Miller et al, 2014).

Poor working memory is an important factor in explaining the link between inference making skills and reading comprehension, although some research suggests that the influence of poor working memory on poor comprehension is indirect, and mediated by wider language difficulties. The theoretical implication of these associations is that models of reading comprehension, such as the Simple View of Reading, should also consider the role of working

memory on reading comprehension. The educational implications are that students with poor working memory will need additional support, particular those of secondary school age when texts become longer, with more complex syntactic structures (Adlof, Perfetti, & Catts, 2011).

2.4.4.1 Reading Comprehension and Figurative Language

One aspect of inference making is interpreting figurative language, which is an inferential task of higher-order comprehension. The importance of figurative language comprehension will be discussed in relation to the three aspects of familiarity, transparency, and context (Cain, Towse & Knight, 2008).

The familiarity of figurative language refers to how frequently the figurative language occurs within language. Research indicates that readers find that familiar figurative language is easier to understand than less familiar figurative language (Nippold, Moran & Schwarz, 2001), as the meaning of figurative language is learnt when they are encountered in written and spoken contexts (Nippold & Taylor, 2002). Exposure to figurative language alone is insufficient to explain developmental effects, meaning that factors such as transparency and context are important.

Transparency refers to the amount of overlap between the literal and figurative meaning of a phrase. When figurative language is transparent there is a clear overlap between the literal and figurative meaning, such as the idiom '*to speak your mind*' (meaning to say what you are thinking). Semantic analysis is useful when comprehending transparent idioms as its literal meaning may help to understand its figurative meaning (Caillies & Le Sourn-Bissaoui, 2006). Nippold and colleagues explain the role of semantic analysis in their metasemantic hypothesis of figurative language comprehension (Nippold, 1998; Nippold & Taylor, 1995). According to this hypothesis, the ability to analyse the internal semantics of a phrase and their pragmatic context aids the comprehension of figurative language (Roth, Speece, Cooper & de

la Paz, 1996). When figurative language is opaque, the figurative meaning of the phrase cannot be understood through semantic analysis, for example the idiom '*to be wet behind the ears*' (meaning 'to be young and inexperienced'), and therefore the reader relies more on context to interpret the meaning.

Context refers to the use of information to support an interpretation of figurative language. Research suggests that figurative language is easier to understand when presented in supportive narrative contexts rather than in isolation (Levorato and Cacciari, 1995). In Levorato and Cacciari's (1995, 1999) global elaboration model, the ability to relate the meanings of figurative language to the appropriate context is a crucial factor in acquiring and understanding the intended meaning.

The comprehension of figurative language is important for language comprehension (Kerbel and Grunwell, 1998), which requires semantic analysis and the use of supportive narrative context. Comprehending figurative language can be particularly challenging for those with wider language difficulties, as well as some adolescent students, as knowledge of figurative language is not fully developed by 12 or 13 years of age (Cain, Towse & Knight, 2008).

2.4.5 Reading Comprehension and Cognitive Inhibition

Successful reading comprehension requires the detection and resolution of comprehension failure (Conners, 2009). For example, when decoding is inaccurate, skilled readers may look back or re-read the text in order to establish accurate word reading and facilitate successful reading comprehension. Being able to detect and resolve reading comprehension failures requires the continuous monitoring of reading processes, establishing when there is a problem, and initiating repair strategies when necessary. This skill requires executive function skills such as attentional control.

Executive function is a wide-ranging multidimensional concept that involves inter-

related cognitive and self-regulatory processes, such as working memory, self-regulation and behavioural inhibition (Diamond, 2013). Each process is an important contributory factor in the control required for goal-oriented actions (Welsh, Pennington & Groisser, 1991). Reading comprehension depends on the implementation of executive function skills in order to suppress irrelevant information and to guide attention to the most relevant parts of the text (Gernsbacher & Faust, 1991). Research supports a moderate positive association between executive function and reading comprehension, which does not vary systematically by age range or type of executive function being measured after controlling for decoding and language comprehension (Lipsey & Wilson, 2001; Conners, 2009).

Bishop, Nation, and Patterson (2014) proposed three different models when outlining a framework for the relationship between language impairment and deficits in executive functional skills. The first was that poor executive functions inhibit the development of language, for example through poor attentional skills. One possible explanation for this is that executive function skills allow readers to develop and review plans for reading text, establish links between incoming information and prior knowledge or previously read text, inhibit ideas or information not textually relevant during reading, process different aspects from the text concurrently and employ strategies flexibly to facilitate the development of an accurate mental representation of the text.

The second framework is that language skills influence the development of executive function. Petersen, Bates, and Staples (2014) assessed the relationship between language and self-regulation during the preschool years. The study found that language ability predicted later self-regulation, and that the effect of self-regulation on later language was not significant. A prospective longitudinal study by Kuhn, Willoughby, Wilbourn, Vernon-Feagans and Blair (2014) exploring the relationship between children's early communicative gestures at 15 months, language skills at 2 to 3 years and executive function skills at 4 years in a sample of

1,117 children also found that individual differences in communicative gestures at age 15 months predictive language development at ages 2 and 3, which in turn predicted executive function skill at age 4. A limitation of the study, however, was that it did not include earlier measures of executive function, which meant that autoregressive effects were not accounted for. It is worthy of note that the causal relationships described in these studies are not mutually exclusive, and it is possible that language skills and executive function skills may develop reciprocally (Gooch et al., 2015).

It is also possible that there is no direct causal relationship between language and executive function skills at the cognitive level, but that there are shared genetic risk factors affecting neuronal migration during development (Gooch, Thompson, Nash, Snolwing and Hulme, 2016), and that certain risk factors influence the correlation between executive function and language development.

Some training studies for executive function skills have shown effectiveness in improving reading comprehension (Antoniou and Souvignier, 2007; Berkeley, Mastropieri, & Scruggs, 2011; Mason, 2013; Zentall & Lee, 2012). However, the effect of executive function training on reading comprehension is unclear. For example, Cirino et al. (2017) reports findings from a training study involving 75 students between 9 and 10 years of age who had a reading comprehension standard score of 90 or less (measured using the Gates-MacGinitie Reading Test (MacGinitie, MacGinitie, Maria, Dreyer & Hughes, 2000)). The students were randomly allocated to one of three conditions: text-based reading (TB), text-based reading plus executive function (TB +EF) or to a control group. Both the TB and TB+EF groups outperformed the control group on measures on reading comprehension. However, the two researcher-led groups performed similarly and there were no significant differences between the groups. These findings are similar to those found in the extant literature (Johnson, Graham & Harris, 1997; Spörer & Schünemann, 2014), which suggests that further intervention studies

are required in order to fully understand if executive function training has an impact on reading comprehension, and casual mechanisms behind any improvements. In particular, future research should ensure that the target constructs are accurately measured, and that there is no overlap of the components that are being measured in two intervention studies (i.e. behavioural scaffolds and motivational components are only taught in the intervention involving executive function training).

2.4.6 Reading Motivation and Reading Comprehension

Discussion of the causal factors behind poor reading comprehension has so far been studied through a predominately cognitive lens, yet to fully understand the full array of processes that affect reading comprehension, one must also look at the integration of cognitive and socio-emotional factors affecting its development, and in particular the influence of reading motivation on reading comprehension.

Within the literature, there exists a wide range of definitions and measures of reading motivation (Schiefele et al., 2012; Watkins & Coffey, 2004). This is a reflection of the range of motivational constructs that contribute to different theories of motivation (Pintrich & Schunk, 1996; Eccles et al., 1998). Reading motivation essentially defines a child's inclination toward reading, and the extent to which he or she uses those inclinations to repeatedly initiate reading activities (Tucker-Rob & Harden, 2012). In distinguishing between current and habitual reading motivation (Pekrun, 1993), the latter is present when the child repeatedly shows a form of current reading motivation (Schiefele, 1999; 2009).

There are a number of important constructs of motivational cognition including; competence beliefs (Bandura, 1997); outcome expectations (Chapman et al., 2000); self-efficacy (McKenna et al., 1995; Unrau & Schlackman, 2006); perceived autonomy (Schunk & Zimmerman, 1997); goal orientations (Wang et al., 2004); valuing of reading (Schaffner and

Schiefele, 2007), and reading attitude (Law, 2009; Lau & Chan, 2003) as well as intrinsic and extrinsic motivation (Guthrie et al., 1999).

A student's competence beliefs result from the causal attributions, the opinions of others and concrete feedback (Shavelson et al., 1976; Helmke, 1996). When considering an individual's' causal attributions, it is possible to differentiate between outcome and self-efficacy expectations (Bandura, 1997 and Schunk & Zimmerman, 1997). Outcome expectations refer to the belief that a given behaviour will result in a certain outcome, and self-efficacy refers to the expectations of being able to execute that behaviour (often influenced by past experiences with similar tasks). Research indicates that there is a correlation between self-efficacy score and reading comprehension score, even when previous performance was controlled (Schunk and Pajares, 2009; Mucherah & Yoder, 2008). Furthermore, the extent to which students are orientated to mastery goals (reading to learn) or performance goals (reading so that they avoid negative judgement of one's competence) will influence the strategies used in reading. For example, students engaged in mastery goals will engage more in metacognitive strategies (such as re-reading a sentence that is an important part of a story), and make more inferences than students who are orientated towards performance goals (Wang et al., 2004). In-line with the expectancy-value model of achievement behaviour (Eccles, 1994; Eccles et al., 1983), the overall value that students place on reading predicts both the amount of time spent reading outside of school and the level of reading comprehension at primary and secondary school (Greene et al., 2004).

There are several explanations regarding the relationship between reading comprehension and motivation. Firstly, children who are successful at learning to read have greater self-efficacy and therefore are more intrinsically motivated than children who face difficulties with reading (Chapman et al., 2000; McKenna et al., 1995; Unrau & Schlackman, 2006). Indeed, recent research suggests that reading comprehension ability is the most

important factor in determining how much a child chooses to read rather than vice versa (van Bergen et al., 2018). Another theory is that the additional time intrinsically motivated readers may spend reading on their own accord will influence the time spent practising comprehension strategies and therefore reading comprehension skill (Guthrie et al., 1999). Finally, it is possible that the relationship is bi-directional (Schiefele et al., 2012).

Reading motivation is a particularly important factor to consider when designing reading interventions for adolescents, particular as evidence suggests that many students become less interested in reading as they get older (Wigfield, 2000; McKenna et al., 1995). There are a number of different explanations within the literature for this, including intrapersonal changes, such as a greater capacity to understand their own performance (Wigfield et al, 2015), reading being less relevant to the values and goals of adolescent students (Assor et al., 2002), and the perception of a greater level of restriction in students' choice of reading topics and materials (Ryan & Deci, 2009). Furthermore, strengthening a student's belief about their academic achievement can encourage students to implement and persist in the use of a range of different reading strategies, with associated large effect sizes for reading comprehension (Robertson, 2000; Miranda, Villaescusa & Vidal-Abarca, 1997; Chan, 1996; Berkeley et al., 2011).

Berkeley et al. (2011) conducted a study involving 59 students aged between 12 and 15 years, who were stratified by class and randomly allocated to a reading comprehension intervention programme with (RCS + AR) or without (RCS) attribution retraining, or a group that completed the reading program currently used by the schools involved in the study (RN). In addition to reading strategy information, the attribution re-training group received reminders about attribution concepts, such as "(a) I know lots of good strategies, (b) I will try hard to use the best ones, and (c) I will only have positive thoughts" (109). The RCS+AR and RCS outperformed the control (RN) group with large effect sizes RCS + AR *vs* RN

(ES = 1.21), and RCS *vs* RN (ES = 0.71), and the difference between the RCS+RN vs RN and RCS vs RN was larger, indicating the positive impact of attribution retraining in improving reading comprehension of adolescents when used alongside a reading comprehension intervention programme.

However, the generalisability of the findings of this study are limited by the involvement of only two schools, the sample size was just twenty children per condition and the maintenance of the effect was measured after only a six-week delay. It is also unclear what impact this intervention had on other components of reading comprehension (such as inference), and whether the improvements identified in the test are replicated in academic reading comprehension tasks within the classroom.

2.4.7 Summary of Causes of Poor Reading Comprehension

To conclude, there are multiple causes of reading comprehension difficulties including genetic, cognitive and environmental factors. Consideration of these factors, their relative importance for secondary age pupils, and how they relate to theoretical models of reading comprehension is essential when designing evidence-based interventions. In other words, it is important to have a clear theory about the causes of poor reading comprehension and origins of a given child's difficulties in order to plan suitable educational interventions.

2.5 Reading Comprehension Instruction and Intervention Studies

The majority of reading interventions have been carried out using pre- and post-test design, with improvements in reading comprehension ascribed to the effects of the intervention in a causal relationship. However, using the pre- and post-test design neglects the consideration that there are unmeasured variables that might affect outcomes (Torgerson

& Torgerson, 2008). In the pre- and post-test design, any conclusions that are drawn may also be subject to a number of confounding variables. For example, a review by Lipsey and Wilson (1993) showed an increased likelihood of Type I error in the pre- post-test design, and that this methodology consistently overestimates the effectiveness of an intervention by an average of 61%.

Another potentially significant risk of the pre- post-test design is that the groups being compared may not be equivalent, and it is possible that improvements in a child's knowledge, understanding and skills occur irrespective of any intervention, and simply due to increased maturity. Separating the effects of the intervention from maturation effects is virtually impossible if there is no untreated control group, and when there is more time between pre- and post-test the potential impact is greater (Shadish et al., 2002). Furthermore, data collected could be subject to regression to the mean effects, which is a widespread 'group' phenomenon (Morton & Torgerson, 2003) that occurs when there is a measurement error so that the student's score is not determined purely by the student's academic ability. In practice, this means that high scores go down and low scores go closer to the mean score.

2.5.1 Randomised controlled trials (RCT)

Randomised controlled trials are widely regarded as the 'gold standard' research methodology for assessing the effect of an intervention on an identified outcome (Cook and Campbell, 1979; Shadish, Cook and Campbell, 2002; Torgerson and Torgerson, 2008). There is an awareness among policy makers and practitioners of the need for researchers to establish, in an objective and unbiased way, whist controlling for selection bias, regression to the mean and temporal changes, whether or not educational interventions are effective at improving children's educational outcomes and the magnitude of impact. Using a control group design, RCTs allow the researcher to compare the impact to what would happen if

children had not been exposed to an intervention (Cook and Campbell, 1979; Torgerson and Torgerson 2001; Torgerson and Torgerson). A review of randomised controlled trials provides policy makers and practitioners with clear and actionable evidence, placing them in the best position to judge what is likely to work in the classroom and how they can make best use of their available resources and time. RCTs can also tell us about the causal mechanisms behind poor reading comprehension, and once this is established one is able to consider the appropriate application of the intervention to different context and learners. For example, if pre-intervention data indicates that a student has a particular weakness in their ability to make inferences, as research suggests that this can be a cause of poor reading comprehension, the resources can be adapted so that this is an area that is prioritised in the lessons delivered by the teacher to this student.

2.5.2 Critiques of the Randomised Controlled Trial Design

There have been numerous critiques of the application of the RCT design to educational research. It has been argued the unproblematic adoption of a methodology, that was first designed for medical discourse, is inappropriate for educational research. This is due to the differences between educational and medical research, and in particular the different meaning of evidence in these fields (Pirrie, 2001; Nutley, Davies and Walterm 2003). For example, Gale (2018) argues that students should not be pathologized through a 'diagnosis' of their condition, and then 'treated' with an intervention delivered by a person external to their normal educational setting.

Secondly, some critics of RCTs argue that they assume that the realities of the physical world can be applied universally across the social world, as the social world has no particular features that demarcate it from the physical world. For example, by assuming that all variables

remain constant throughout the intervention period. Morrison (2001) suggests that RCTs promote a linear and simplistic representation of social reality:

"Chaos and complexity theories here are important, for they argue against the linear, deterministic, patterned, universalisable, stable, atomised, objective, controlled, closed systems of law-like behaviour which may be operating in the world of medicine and the laboratory but which do not operate in the social world of education" (p. 72).

Furthermore, critics of RCTs argue they remove personal characteristics from research participants when they become part of the study, and students become a statistic within a group (Taylor, 1985). Instead, they argue that research should be about "interpretations of the learners, and the diverse ways in which learners make sense of the situations they encounter" (Biesta, 2007; 9), as this is a primary part of our existence that directly influences our actions and behaviour (Abbey, 2000). Proponents of this argument cite Dewey's transactional theory of knowing, and focus on the role of interrelationships, the importance of understanding our actions and their consequences on learning.

Fourthly, some have argued that RCTs privilege epistemology over ontology. This means that RCTs follow a technocratic model that reduces research questions to the pragmatics of technical efficiency and effectiveness, as they assume "that the only relevant research questions are questions about the effectiveness of educational means and techniques, forgetting, among other things, that what counts as 'effective' crucially depends on judgements about what is educationally desirable" (Biesta, 2007; 5). Proponents of this position argue that education is a moral practice more than a technological enterprise, and that focusing on 'formal' scientific and technical knowledge neglects the role of practical wisdom and 'informal' tacit knowledge, and the ethical-moral dimensions of research. Critics refer to the danger of context becoming just another variable that needs to be factored in and controlled for, rather

than an important factor influencing social and cultural aspects that determine ways of being, doing and understanding.

For Morrison (2001), "the importance of context is undeniable, yet where is this taken into account in the RCT?" (p. 671). The argument here is that RCTs try to remove the impact of context as it could introduce bias into the programme. In fact, context could be a vital factor to acknowledge within the research, as research can only inform us about what happened in a particular situation, and not what will work in future or different situations as other influences of student learning has not been taken into account (Berliner, 2014). Finally, critics from the critical paradigm perspective, argue that RCTs fail to understand the structural, historical and political nature of discourse (Foucault, 1980; Usher and Edwards, 1994). This discourse sets conditions of "what kind of talk occurs and which talkers speak" (Anyon, 1994; 120). One could draw on Foucauldian methodologies to argue that discourse around traditional intervention studies wrongly suggests that these students are deficient, or that the research itself is a force for the disablement of vulnerable students' (Slee, 2010). Indeed, Gale (2018) argues that the "RCT offers governments and schools the prospect of more precise instruments to engineer their populations into forms of human capital, which will enable them to claim a controlling stake in a knowledge economy and thus retain disproportionate positions of global power" (220). What these arguments fail to consider are the opportunities for teachers to make informed judgements, in a way that is sensitive to and relevant for their own contextualised settings (Biesta, 2007), once a causal link between the content of an intervention and the outcome has been established.

Whilst some trials can be criticised as being too small or too badly implemented to evaluate an intervention, many are rigorous and robust. Indeed, in a systematic review of 1017 unique RCTs that have been reported between 1980 and 2016, Connolly, Keenan and Urbanska (2018) concluded that 81% of RCTs included in their study were able to generate

evidence of the effects of the educational intervention under study, 38% recognised the importance of context and experience through the inclusion of a process evaluation, 50% included a sub-group analysis, 78% discussed the theory underpinning the intervention under investigation and 61% provided some reflections on the implications of their findings for theory. This data indicates that some randomised controlled trials are subject to limitations and constraints that introduce bias into the study, however, it is not the method itself that is at fault, but the implementation of the approach.

2.5.3 A Review of Randomised Controlled Trials of Reading Comprehension Interventions

A systematic review of RCTs targeting reading comprehension skills in a school-based setting involving children of secondary school age (11–18 years old) found only four studies that met their inclusion criteria (Paul and Clarke, 2016). These studies are summarised in Table 2, alongside a summary of the REACH RCT by Clarke et al. (2017) designed to improve reading accuracy and comprehension in pupils with reading difficulties in Years 7 and 8.

	Participants	Administration	Results
Berkley et al. (2011)	Involved 59 students 12-15 years • 19 in Reading Comprehension Strategy (RCS) • 20 in Reading Comprehension Strategy and Attribution Retraining ((RCS + RN) • 20 in Read Naturally (RN; control)	• Delivered by teachers to groups • 12 X 30 mins over 4 weeks (6 hours total)	• RCS and RCS + AR > RN on Summarisation Score and Meta-comprehension Strategy Index • RCS + AR > RCS and RN on Summarisation Score and Meta-comprehension Strategy Index • Summarization RCS + AR Vs RN (ES = 1.44); RCS vs RN (ES = 0.94)
Cantrell et al. (2010)	Involved 655 students 11-12 and 14-15 years old ○ 365 in Learning Strategies Curriculum (LSC) Strategies included word identification, visual imagery, self-questioning, paraphrasing, vocabulary and sentence writing ○ 290 in control group Not specified what this group did other than 'business as usual' approach	• Delivered by teachers to whole classes • 50-60 minutes per day over 1 year	• LSC (11-12-year olds) > Control on standardised measure of reading comprehension (Group Reading Assessment and Diagnostic, Evaluation, GRADE) (ES = 0.22) • LSC (14-15 years olds) = Control on standardised measure of reading comprehension (Group Reading Assessment and Diagnostic, Evaluation, GRADE)
Vaughn et al. (2011)	Involved 782 students 12-14 years • 400 in Collaborative Strategic Reading and Metacognitive Strategic Learning (CSR + MSL) • 382 in control group Not specified what this group did other than 'business as usual' approach	• Delivered by teachers to whole classes in 24-48 x 50 minutes sessions	• Treatment group > Control on a standardised measure of reading comprehension (Grey Oral Reading Test, GORT) (ES=0.12)
Vaughn et al. (2013)	Involved 419 students • 261 in treatment group (teachers used practices that focused on teaching essential words, using text as a source for reading and discussion and team-based learning approaches) • 158 in control group	• Delivered by teachers in whole classes	• Treatment group > control on a standardised measure of reading comprehension (Gates-MacGinitie Reading Test, GMRT) (ES = 0.20)
Clarke et al. (2017)	Involved 287 students • 97 REACH Reading Intervention • 97 REACH Reading Intervention + Comprehension • 93 Control Group	• Delivered by trained Teaching Assistants over 20 weeks	• Reading Intervention > standard provision (ES =.076 [95% CI -0.220, 0.372) • Reading intervention with comprehension vs. standard provision ES=0.29 ([95%, CI 0.037, 0.545)

Table 2: A summary of the findings from RCT targeting the improvement of reading comprehension skills for students of secondary school age (i.e. above the age of 11) (Paul and Clarke, 2016). A summary of the REACH RCT has also been added.

2.5.1 The Reported Effect Sizes of Intervention Studies

The intervention studies listed in Table 2 indicate effect sizes for reading comprehension of 0.22 (Cantrell et al., 2010), 0.12 (Vaughn et al., 2011), 0.20 (Vaughn et al., 2013) and 0.34 (Clarke et al., 2017), thus indicating that in the intervention studies listed there is only a small effect of the intervention on the reading comprehension of the participants. Considering the small effect size, Vaughn et al. (2011), questioned whether interventions should include multiple-component based approaches, or focus on developing a specific skill such as vocabulary or background knowledge. This is an important consideration, as a balance is required between targeting a specific aspect of reading comprehension, with an intervention design that is appropriate for a heterogenous sample of poor comprehenders with different cognitive profiles (Duff and Clarke, 2011).

It is also important to consider possible reasons for the small effect sizes in the intervention studies to date. One possible reason is that the small effect sizes that have been reported for reading comprehension interventions relate to improvements in trial design and execution, as this is something that has already been identified in medical trial outcomes. For example, a meta-analysis of 33 studies related to pregnancy and childbirth by Schulz, Chalmers, Hayes, and Altman (1995) found that effect sizes were smaller in trials which were double blind, when patients were not excluded from the trial after randomisation had taken place and when allocation to treatment condition was concealed.

Another consideration is that typical classroom reading instruction has improved as a result of the availability of research on reading instruction, thus making it more difficult to accelerate progress in reading comprehension beyond 'business as usual' (Duff, Hulme, Grainger, Hardwick, and Snowling, 2014). Furthermore, if outcomes are measured in terms of age-standardised scores, it might not be realistic to measure progress in terms of

development above the normal rate – an increase that is needed to demonstrate that an intervention is effective.

Alternatively, the low effect sizes could be related to insufficient intensity of the intervention, which includes not only the duration of the intervention but also its frequency, the heterogeneity in the cognitive profile of poor comprehenders, and the size of the group receiving the intervention. Indeed, delivering an intervention to a whole class may not be as effective as delivering a targeted intervention for small groups of poor comprehenders. For example, in their synthesis of available evidence on reading comprehension interventions at the transition between primary and secondary school, Higgins, Katsipataki, and Coleman (2014) concluded that there is a weighted mean effect size of 0.31 on reading comprehension for whole class intervention and 0.49 for small group interventions.

Within-child factors that are missing from causal models of reading comprehension are also important considerations when assessing the efficacy of an intervention. For example, language variation, including differences in the dialect of children from minority groups and the teacher, may account for differences in the response to intervention.

2.5.3 The Centre for Reading and Language REACH study

The Centre for Reading and Language REACH study was conducted by members from University of Leeds, University of Oxford and University College London (Clarke, Paul, Smith, Snowling and Hulme, 2017), and was the only RCT to assess the impact of interventions focusing on oral language skills for the reading comprehension of secondary school students. REACH is a targeted reading support programme that is designed to improve the reading accuracy and comprehension of 287 pupils between the ages of 11 and 12, who were identified as having relatively poor reading ability. In this research, 'poor reading ability' was defined as those students with a standard score of 91 or below in a Single Word Reading Test (SWRT,

Foster and National Foundation for Educational Research, 2008), which is an untimed test measuring reading accuracy. These students were then randomly allocated to three groups: reading intervention (RI) that targeted word recognition and decoding skills, reading intervention plus comprehension (RI+C) or a waiting list control group (C). Each intervention programme shared the same basic structure and consisted of three 35-minute sessions per week for 20 weeks (35 hours of intervention per child). Pupils in the RI programme received three RI sessions per week, and those in the RI+C programme received two RI sessions per week and one C session per week. The RI session contained six components: "(a) reading an easy-level book; (b) reading an instructional-level book, during which a record of reading was taken; (c) letter knowledge, word level, and phonological work; (d) writing; (e) introduction to a new instructional-level book; and (f) reading aloud from a new instructional-level book. The C sessions contained six components: (a) introduction, (b) vocabulary, (c) listening comprehension, (d) figurative language, (e) narrative, and (f) plenary that reviewed what had been taught and learnt in the lesson" (112).

The authors found that the RI + C group showed a small but statistically significant improvement in average reading comprehensiom standard score compared to the control immediately after the intervention, while the RI group did not. However, the authors of the study recognise that the improvements in reading comprehension were only evident when reading comprehension was measured using the New Group Reading Test (NGRT), since the effects on the WIAT II were negligible. As the NGRT involve multiple choice questions, guessing may have played a role, and the test is more likely to be subject to practice effects as the same test was given at two time points (T1 and T2).

Further evaluation of the study revealed a number of limitations at different stages of the programme. Firstly, with regards to participants, difficulties in recruitment meant that the sample size was smaller than anticipated (230 compared to a target of 487). Six schools left

the trial with no outcome data collected (introducing attrition bias into the study), and there were additional missing pre- and post-test data, for example 28% of participants did not complete all the tests at the end of the intervention. However, this attrition does appear to be random with no evidence to suggest that it introduced significant bias into the study (Clarke et al., 2017).

In terms of the procedure, due to delays in recruiting schools, the trial was carried out in two phases, which subverted the randomisation process. After participants had been allocated to groups, it was clear that there were small differences across the groups. For example, a difference of 7% in pupils eligible for Free School Meals and 8% difference in students who were not White-British between the RI and the control group. Therefore, it is possible that certain groups were able to make more progress than others irrespective of the intervention.

Evaluation of the REACH teaching materials by the TAs, who were trained to deliver the interventions, identified four main areas of concern. Firstly, the language component training was the most challenging aspect of the programme to deliver, and students became bored by it. In particular, the TAs felt that the comprehension section was the weakest and most difficult to deliver in an engaging way, meaning that the TAs were less confident in delivering this in general. Secondly, the length of the sessions was commonly mentioned as a barrier to successful delivery as TAs felt that the 35-minute long sessions were not well matched with the standard one-hour school lessons. Another concern regarding the length of the sessions was that the materials provided could not be delivered in the time allocated. The feedback from the TAs, reported by the Education Endowment Foundation, stated that "TAs either had to cut the sessions slightly short or, more commonly as they often overran, take the pupil out of the class for the full hour and do a slightly longer session, or find something else for the pupil to do in the remaining time until the start of the next lesson. This

sometimes increased the workload of the TAs" (REACH, 2006; 24). Thirdly, the resources provided were not differentiated to accommodate variations in pupil ability, and TAs felt that this limited the progress that the more able students were able to make. The feedback suggests that the TAs were reluctant to adapt the resources to fit the particular needs of the individual pupils that they were teaching. Finally, although the process evaluation reported improved confidence levels among the pupils, this concept is not explored in detail; for example, by analysing the impact on their locus of control, self-concept or perceived value of reading.

Furthermore, the outcome tests that were carried out after nine months were problematic as the control group had already received the language comprehension intervention at this time, and any differences could be a result of fade out and maturation effects. As with intervention studies involving a control group, it was also not possible to rule out the likelihood that the waiting list control group received individualised or group-based remedial teaching either inside or outside of school. Finally, there was also no follow-up data on those students who failed to respond adequately to the intervention, which is an important consideration when maximising the impact of the intervention for all students. The limitations of REACH reduced the robustness of the findings and indicate that other interventions with students of secondary school age would be useful.

2.5.4 Teaching Principles

Analysis of the intervention designs and principles followed in the studies outlined in Table 2 highlighted the importance of following specific teaching principles when delivering a reading comprehension intervention. These teaching principles are summarised below.

2.5.4.1 Small Group Teaching

Overall, the available evidence indicates that small group instruction is effective, and that in general, the smaller the group the better the outcomes. The research indicates that in general, interventions with two students have a slightly higher impact than when the intervention is delivered in groups of three, but a slightly lower impact than one to one delivery. Furthermore, once group size is increased to above six or seven students, there is a noticeable reduction in the effects of an intervention (Education Endowment Foundation, 2018). Studies suggest that this can be explained by the greater level of individual feedback from teachers, and a higher level of sustained engagement from students who may be working at a level that is more closely matched to their learning needs when they are part of a smaller group (Slavin, Lake, Davis & madden, 2011; Foorman & Torgesen, 2001; Vaughn et al., 2010). This is an important consideration as each additional student that can be added to an intervention group represents a reduction in the individual student cost of an intervention or an increase in the number of students who can receive an intervention (Shanahan & Barr, 1995).

However, one-to-one interventions in reading have not been shown to be more effective than small-group interventions (National Reading Panel, 2000). A possible explanation for this is that students provide each other with the opportunities to learn aspects of reading comprehension such as vocabulary and concepts presented in text from their peers (Gersten & Jimenez, 1998). For example, Vaughn et al. (2010) conducted a reading intervention emphasizing word study, vocabulary development, fluency, and comprehension with 546 students aged between 12 and 13. They compared the effects of the intervention for a group size of between 10 and 20 students with a group size of between 3 and 5 students. The study concluded that group size was not a significant factor in improving reading

comprehension outcomes for poor comprehenders, and the effect sizes were 0.19 for the large group and 0.09 for the small group of students. However, limitations of this study are that from randomisation at the start of the intervention to post-test, 48% of students had left the study, introducing attrition bias into the study. Furthermore, 73% more students were allocated to the large group treatment than the small group treatment, and the allocation ratio changed part way through the intervention, and this unequal allocation to intervention group reduced the statistical power. An additional limitation was that 37% of the students reported receiving one or more additional forms of instruction, which may have exaggerated any beneficial effects. Finally, the intervention occurred 50 minutes every day over one year, which has implications for the feasibility of implementing a programme of this intensity in other schools. In a meta-analysis of reading intervention for students at risk of reading failure, Elbaum et al. (2000) also concluded that one-to-one instruction is no more effective than small group instruction (involving up to 6 students). However, it is important to note that this conclusion was based on the findings from only two studies, one of which involved just 8 students within a single class (Evans, 1996).

In short, when designing an intervention one must consider the balance between the number of students served and the effectiveness of the intervention. Whilst studies have demonstrated the success of interventions requiring one to one delivery (Clarke et al. 2010; 2017), the cost of delivering interventions of this intensity can be prohibitive for many schools. Furthermore, research suggests that there are additional benefits associated with delivering reading interventions to small groups of students, compared to just one student, which are brought about through collaborative work and sharing knowledge and expertise.

2.5.4.2 Reciprocal Teaching

All of the intervention studies listed in Table 2 taught elements of Reciprocal Teaching (Palincsar & Brown, 1984). This is a strategy in which a group of students collaboratively apply four cognitive strategies of predicting, clarifying, questioning, and summarising to their reading in order to co-construct the meaning of a written text.

In reciprocal teaching, children are taught metacognitive skills and how to read proactively. In in the initial stages of reciprocal teaching, the teacher will focus on modelling the processes and strategies. Extensive modelling by the teacher provides a clear model of covert processes required in reading comprehension, and what expert readers do when they try to understand and remember texts. After modelling, the teacher will move onto supporting students in practicing the strategies by providing specific feedback, additional modelling, coaching, and explanation. Reciprocal teaching is also a cooperative learning intervention in which participants learn from the contributions of more expert peers (Brown & Palincsar, 1989). Therefore, group goals, individual accountability and engagement at the highest level are factors that contribute most to its efficacy (Tarchi & Pinto, 2016).

Hattie's synthesis of 800 meta-analyses relating to student attainment ranks reciprocal teaching as extremely effective in improving achievement (Hattie, 2009). In relation to reading comprehension, Rosenshine and Meister (1994) reviewed 16 intervention studies that assessed the effect of reciprocal teaching, and found that the median effect size favouring reciprocal teaching when using standardised assessments of reading comprehension was 0.32, and 0.88 with experimenter-developed reading comprehension assessments.

Reciprocal teaching situates classroom dialogue at its core and is considered to follow a dialogic pedagogy (Alexander, 2008; Littleton & Mercer, 2013; Nystrand et al. 1997; Tharp et al. 2000; Wells, 1999). There is no single and agreed definition of dialogic teaching, although the various ways in which the term is used intersect with coherence. This research focuses

on the definition of the term dialogue as defined by Burbules & Bruce (2001) as 'a relation characterized by an ongoing discursive involvement of participants, constituted in a relation of reciprocity and reflexivity' (1112). This definition reflects how at the heart of pedagogical dialogue is the student's mutual involvement, requiring them to make active efforts to develop shared understandings, as well as an ability to reflect on the discursive dynamic itself.

In reciprocal teaching students are required to listen to each other, share ideas, consider alterative viewpoints and build on their own and each other's contributions to make coherent lines of thinking and understanding through discussion and argumentation. Collaborating means that students are involved in making a coordinated, continuing attempt to solve a problem or in some other way construct common knowledge. It involves co-ordinated joint commitment to a shared goal, reciprocity, mutuality and the continual (re)negotiation of meaning (Barron, 2000). This approach requires a collective responsibility in learning and enquiry, which takes place in a supportive environment in which students help each other to reach common understandings and feel able to express their ideas freely without fear of judgement. Research has demonstrated the value of students working together (Slavin, 2009), and the positive effects when students are encouraged to talk and work together on curriculum related tasks (Littleton & Howe, 2010).

Although student talk is the ultimate preoccupation because of its role in shaping thinking and learning, it is largely through teachers' talk that students' talk is facilitated, mediated and extended using linguistic and conceptual tools to bridge the gap between current and intended understanding. Whilst offering a specific framework, this pedological approach rejects the view that there is one right way to maximise talk's quality and power, acknowledging the uniqueness of each classroom's personalities and circumstances, it gives the teacher the responsibility for deciding how a repertoire of pedological skills should be applied. This requires a change in the mindset of some teachers, as the approach contrasts

with 'the discourses of dichotomy' that dominates the educational policy sphere (Alexander, 2001) and the prevailing political climate in which test scores are given the greatest weight by politicians, as it focuses on the depth of knowledge gained from thorough investigation and inquiry (Haneda & Wells, 2008). Therefore, ongoing teacher development is an important element for the successful implementation of reciprocal teaching. Coaching has shown to be an effective strategy for eliciting teacher change (Cornett & Knight, 2009; Speck & Knipe, 2001; Teemant, Wink & Tyra, 2010), and therefore offers a suitable approach for teacher professional development.

2.5.4.3 Attribution Training

The study by Berkeley et al., 2011 (listed in Table 2) suggests that re-attribution training can increase the effect size of reading comprehension strategies, and for this reason it will be included in both the text based and oral language intervention study. Re-attribution training refers to attempts to change students' self-beliefs regarding achievement, and relates to factors including self-concept, self-efficacy and causal attributions. Its focus is on helping students to make connections between insufficient effort and failure, to promote effort attributions and persistence (Schunk and Cox, 1986). For example, feedback that helps students to understand when academic failure is a result of lack of effort can promote future task persistence and effort attributions (Schunk and Cox, 1986), and feedback that helps students to make links between effort and success will enhance motivation and self-efficacy (Shell et al., 1995).

2.5.4.4 Vygotskian Principles

The study by Vaugh et al. (2011) is grounded in sociocultural theory, which is built from the foundations of Vygotsky's work (Vygotsky, 1978). The intervention programmes

delivered in this study will employ a Vygotskian approach because evidence from these studies suggests that this is an effective form of delivery.

It is argued that there are three aspects that Vygotsky considered to be important in learning: that learning is a historical process; that it is social in nature; and that it is enabled by employing the 'tools' of language, numbers and symbols (Wertsch, 1991). Vygotsky contested that cognitive development results first from the processes that occur between people, followed by the processes that occur within the individual, and referred to the process of "functions moving from the interpersonal to the intrapersonal as internalisation" (Keenan, 2002; 133).This means that at first the activity of individuals is regulated and mediated by others, but eventually the individual will come to organise and regulate their own activity. Vygotsky believed that internalisation occurred in the Zone of Proximal Development (ZPD), which is a point of optimal learning between a child being able to solve a problem, and only being able to solve a problem with assistance. Vygotsky wrote that instruction within the ZPD fostered self-regulation for greater independence in learning (Chaiklin, 2003), and dialogic pedagogy draws on the importance of student-led dialogue to achieve this.

The main premise of Vygotsky's most famous work 'Thought and Language' are the interrelationships between thought and language, and in particular that thought is internalised language (Palmer and Dolya, 2004). Some have argued that this means a child constructs and understands "the world through his or her collaboration in social activities, and this includes the talk that occurs between skilled and less skilled participants" (Urquhart, 2000; 61). Whilst others have taken a broader understanding of the scope of the ZPD to include more than just expert/novice interaction (Kuutti, 1996). This means that through collaborative, expertise emerges as a feature of the group, as is the case in dialogic teaching (Lantolf, 2010). It follows that oral language comprehension is a matter of individual development that is enhanced

through interactions with others, and that collective understanding is created from interactions among individuals.

2.7 Summary of the Literature

The demands placed on poor comprehenders on entering secondary school are significant due to the increasing difficulty of texts, the increasing role of written text in learning and the role of expository text. This can have significant implications for the academic attainment, motivation, self-concept and psycho-social development of poor comprehenders.

The literature indicates that there are two alternative hypotheses regarding the origins of poor reading comprehension. Some researchers (Cain, 2010; Atkinson et al., 2017; Garnham & Oakhill, 1996; Cain & Oakhill, 1999) have concluded that problems with reading comprehension can be traced back to difficulties with text-based meta-cognitive strategies and inferencing skills. In contrast, others indicate that poor comprehension can be traced to oral language weakness (Nation, 2003; Nation et al., 2010), and longitudinal studies (Bishop & Snowling, 2004) indicate that these difficulties are evident before learning to read, and not a consequence of poorly developed word reading skills. Furthermore, RCT by Clarke et al. (2010) for 8-10- year olds indicated that oral language interventions incorporating listening comprehension, vocabulary development and figurative language can be as effective (and possibly more effective in the long-term) as an intervention for reading comprehension using text-based approaches. However, it was not clear from this study whether text-based approaches that rely more heavily on metacognitive skills, and in particular developing inference making skills, will be more effective for students in secondary schools.

Indeed, there remains a significant gap in the evidence from RCTs concerning the efficacy of language comprehension for poor comprehenders of secondary school age. This is important due to the differences in the role of reading comprehension within the curriculum

as children move from 'learning to read' to 'reading to learn' (Savage, 2006; Johnston & Kirby, 2006; Lee & Wheldall, 2009), as well as the increasing importance of oral language as decoding becomes more fluent.

Adolescent readers will also be at a different stage of reading development from primary readers, and they will also have varied affective and environmental factors affecting their levels of engagement and academic progress. It is hypothesised that this will impact their response to reading comprehension intervention programmes training different component skills. Students with reading comprehension difficulties at secondary school often attribute success and failure to factors that they cannot control such as ability, difficulty of the task or luck rather than effort or strategy use. It is possible that this problem may worsen with age as students experience repeated difficulties and become more aware of their own challenges. Therefore, current research suggests that changing students' attitudes towards learning, and addressing aspects related to their perceived value of reading and reading self-concept, could be effective in increasing the motivation of students to persist in the use of reading comprehension strategies (Berkley et al., 2011).

The literature review indicates that there has been significant progress in understanding the causes behind reading comprehension impairment, and there are a small number of intervention studies, primarily with primary-age children, indicating that once children have been identified as having reading comprehension difficulties, it is possible to provide additional teaching that has significant and durable effects on their reading comprehension. However, to date there are only a few small-scale studies, many of which have not randomly allocated students to treatments, or assessed progress using standardised assessment measures. It also seems that there are also barriers for teachers in delivering interventions that limit the access of some poor comprehenders of secondary school age to effective intervention.

Therefore, the present study aims to investigate whether an oral language or text-based intervention delivered to secondary school pupils by a trained teacher in small groups would improve the average standardised reading comprehension scores when compared to the waiting list control, and the extent to which the intervention can be practically delivered within schools. Furthermore, this study will assess when students have a good level of decoding, whether, in line with the simple view of reading (Gough and Tunmer, 1986), linguistic comprehension is the most significant factor in improving reading comprehension, and the extent to which vocabulary knowledge and word reading specifically influence the development of reading comprehension. Reviewing the literature and evaluating the intervention studies carried out to date, led to the development of two multiple component reading comprehension programmes (a text-based and oral language programme), that was delivered to 150 students aged between 11 and 13 over a period of eight weeks. The relative effectiveness of each reading programme was then assessed immediately after the intervention. In contrast to REACH, the intervention programmes in this study were delivered by one specialist teacher working across the schools, rather than trained TAs working in each school. It was hoped that this would improve treatment fidelity and resolve the issue of some TAs not feeling confident when delivering the interventions, which was experienced in the REACH study. Indeed, in the REACH study some TAs applied strategies from a different intervention programme as they found that they were enjoyed by the students or presumed them to be more effective than those prescribed (Education Endowment Foundation, 2016). The methodology employed in this study will provide data on the impact of two intervention programmes whilst assessing the practicality, strengths and limitations of this intervention delivered by a classroom teacher.

Chapter 3: Methodology

3.1 Research Questions

In order to address the gaps in the research, the following research question was formed:

What is the best way to improve the reading comprehension of secondary school students with poor reading comprehension?

A survey of secondary school teachers and a randomised controlled trial with adolescents clustered within schools was conducted in order to further understand how best to ameliorate the reading comprehension difficulties faced by poor comprehenders of secondary school age. The randomised controlled trial used the following sub-questions:

1. Does targeting oral language skills and text-based skills improve the reading comprehension of secondary-age poor comprehenders, when compared with a waiting list control group?

2. Do the oral language and text-based programmes have a positive effect on vocabulary knowledge?

3. Do the oral language and text-based programmes have a positive effect on word reading?

4. Do improvements in vocabulary knowledge mediate improvements in reading comprehension?
5. Do interventions in text based and oral language comprehension strategies improve the students' self-concept as a reader and their perceived value of reading?

In order to answer these research questions, hypotheses were generated based on the findings of the literature review and professional practice expertise. Based on the findings from Clarke et al. (2010) with students of primary school age, it was hypothesised that both the oral language and text-based intervention would lead to significantly different reading comprehension standard scores for students when compared with the control group, that the oral language intervention would lead to significantly higher average vocabulary standard scores for students, when compared with the text-based and waiting list control intervention groups, and that improvements in vocabulary knowledge in the oral language intervention would mediate improvements in reading comprehension standard score. As neither intervention included instruction related to word reading, it was hypothesised that neither the oral language or the text-based intervention programme would result in a significantly different word reading standard scores for students when compared with the control group.

The hypotheses are summarised below:

- The oral language and text-based interventions resulted in a significantly different reading comprehension standard scores for students than the control group.
- The oral language intervention led to significantly higher average vocabulary standard scores for students when compared with the text-based and waiting list control intervention groups.
- Neither the oral language or the text-based intervention programme resulted in a significantly different word reading standard scores for students than the control group.
- Improvements in vocabulary knowledge in the oral language intervention will mediate improvements in reading comprehension standard score.

- The oral language and text-based interventions were significantly better at improving the average score for students' self-concept as a reader and value of reading, when compared with the waiting list control group.

An additional research question was considered, as it was also important to establish the extent to which findings from the literature is corroborated by what is occurring in practice within secondary schools. This will provide further information on the impact of research into evidence-based reading comprehension interventions for teachers in secondary schools, as well as the challenges and barriers to teachers delivering these interventions to poor comprehenders in secondary schools. This is vital in addressing the practical implementation of intervention programmes, and assessing the practical impact of research in the field.

This was addressed with a survey of secondary school teachers and the following sub-question:

6. To what extent do teachers use evidence-based strategies to support children with reading comprehension difficulties?

3.2 Epistemology and Ontological Perspective

In carrying out educational research, it is important to establish the ontological considerations, (the nature of reality) as well as the epistemological considerations (how we can know this reality). Research that takes a positivist approach explains phenomena by "collecting numerical data that are analysed using mathematically based methods" (Aliaga and Gunderson, 2000; 15), and presents findings as objective fact and established truth (Crotty, 1998). The positivist paradigm investigates patterns and causality with the understanding that

aspects of social reality are objective, observable and measurable. Critics of scientific positivism and post-positivism have pointed to the fallibility of this perspective. For example, highlighting the close relationship between quantification and political decision making, arguing that "the exercise of politics depends upon numbers; acts of social quantification are politicized; our images of political life are shaped by the realities that statistics appear to disclose" (Rose, 1991; 673).

These criticisms highlight the complexities of research involving individual students, and within this research it is particularly important to acknowledge that there are no definitive answers when supporting an individual with poor reading comprehension. Instead, evidence-based practice is a tool that is used to provide information to a practitioner, who should then interpret the evidence and develop strategies and tools that are suitable for the individual and context in which they are working. Indeed, whilst the randomised controlled trial carried out for this thesis operates within a positivist framework, the perspectives and opinions of teachers and students were also collected, thereby addressing some of the criticisms of positivism, and acknowledging that in line with constructivist and interpretivist epistemology, in practice multiple-constructs abound and established theories and knowledge are often formed and adapted in light of individual experiences (Bridges, 1999).

Consideration of the epistemological and ontological perspective of research also highlights the importance of reflexivity to inform all stages of research. This reflexivity must include the effects of one's existing biases as a researcher, the social context in which results are interpreted, and a consideration that there will be "unthought categories of thought which delimit the thinkable and predetermine the thought" (Bordieu and Wacquant, 1992, p.40).

3.3 Ethical Considerations

An important premise of all educational research is having appropriate regard for ethical

considerations. In the survey of teachers, care was taken to ensure that completing the survey was voluntary, and as it was online, a teacher could complete only part of it if desired, or change their mind about completing it. The questions were carefully designed to ensure that they were not leading or judgemental, to ensure that teachers felt comfortable being as honest as possible when answering the questions. The responses were anonymous to protect the identity of the teachers, and reference to the findings was general to make it impossible to identify a teacher or school from their responses. Submitting the questionnaire was taken as an indicator of informed consent.

In the RCT at all stages of planning, delivering and evaluating the intervention programmes, key steps were taken to ensure that the best interests of the child were always the primary consideration. For example, consent from participants and their parents/carers was both voluntary and informed, the right of the students to withdraw from the study at any time was made clear, all possible strategies were put into place to help students maintain any progress they made and time was allocated to establish a relationship with students prior to starting the intervention programme. The implications of being in the waiting list control group were discussed in detail with the participants and their parents/carers, and it was ensured that this group received the most effective intervention following the collection of post-intervention data from the oral language and text-based intervention groups.

To address ethical engagement, before conducting any research, specific ethical procedures were approved by the University of Reading Research Ethics Committee (Appendix 1; p. 256-259). Following approval by the University of Reading, a meeting with the Head Teacher and SENCO from each of the schools that were involved in this study was arranged in order to discuss the study and to answer any questions. This was followed up with a written agreement, including written permission from the Head Teacher and SENCO. Following receipt of this written approval, a meeting was arranged with the SENCO to discuss

the word reading and reading comprehension standard score data that was available for students and to confirm the number and names of students who would be involved in the study. After this was confirmed with the school, parental permission was sought through a letter in which the researcher outlined why and how the student has been selected to take part, how the confidentiality of data and anonymity of the participants would be preserved, potential limitations and benefits for participants involved in the study and the feedback that the participants would receive following the study. At the end of the letter, parents were notified that informed consent was required for their child to take part in the study (Appendix 1; p.260-267).

After parental permission was received, students were invited to attend an introductory group session prior to the start of the intervention that was held at each of the six schools the students attended. At the initial meetings, the purpose, proposed benefits and requirements for involvement in the study were clearly outlined to the parents and children, and time was allocated for any questions to be answered. After the introductory sessions, all students received an accessible information booklet about the project (Appendix 1; p.266-267). Within the information booklet, care was taken to ensure that the words used within the booklet were easy to understand and carefully selected pictures were used where possible to illustrate and support the words. Students were also directed to the best way in which to get further information if it was required.

Both parents and students were reminded that they could withdraw from the research project at any point, and that all data would be kept securely following completion of the thesis. The study involved a waiting list control group to minimise the effects of the research design being advantageous or perceived to be advantageous to one group of participants over another, and to ensure that a desirable intervention was received by all participants, including the control group.

For practical reasons, and in particular due to a lack of available funding for this research, the assessments had to be carried out by the researcher, who also carried out the interventions, and thus the study did not follow double blind procedures. The researcher had the appropriate training and qualification to carry out the assessments, including an Assessment Practising certificate (awarded by Patoss). However, a significant limitation of this study was the possible occurrence of ascertainment bias, which could be introduced by the researcher who was both delivering the interventions and carrying out the assessments. Blinding of assessors is an important consideration, as bias in test marking is a significant issue (Howlin, Gordon, Pasco, Wade and Charman, 2007; Torgerson, 2009). It is also possible that the researcher reported events more conscientiously in one intervention group compared than another. For example, the researcher may have been convinced of the efficacy of a particular intervention group. This may have influenced their interpretation of a students' answer when scoring subjective responses in the outcome assessment, the conclusions that are drawn, or the manner in which problems with the alternative treatment group are reported. To combat these risks, an independent specially trained assessor randomly selected 50 assessments to observe and review. This resulted in only five discrepant reading comprehension scores (with a maximum discrepancy of 4 standard points), and these scores were amended at the end of each assessment.

Throughout the research process, all data were treated with confidentiality and anonymity in recognition of the students' entitlement to privacy. Storage and use of personal data complied with the legal requirements of the General Data Protection Regulation (GDPR) (2018), which builds on the Data Protection Act (1998). This included ensuring that there was transparency with regards to the personal data that were collected and how long it was going to be kept for, that only the minimum number of data that were required was collected, appropriate security measures were taken to prevent unauthorised use or accidental loss of

information, and that the data that were collected would not be used for any other purpose. Finally, there was an opportunity for all students to meet with the researcher at the conclusion of the research, and students were given the opportunity to receive information on the findings of the research arising from their participation.

During the initial research process, it became clear that ethical judgements could not be generalised, and instead had to be made in relation to the context and the particular needs and requirements of individual students to ensure that the students were the primary consideration (Simons and Usher, 2000). The most important ethical procedures are not covered in the formal ethical review process, which is arguably overly bureaucratic and "represents the practice of research as an ordered, linear process with objective principles/rules that inform/direct ethical decision making and moral action" (Halse and Honey 2007; 336), rather than acknowledging the more nonlinear processes which typify much of the educational research (Lichtman 2010). As researchers, we must be aware of the changing ethical landscape of the research involving people, that "once seemed settled and fixed is once again a shifting ground" (Clandinin and Connelly 2000, 175).

Beyond the "superficial, easily identifiable ethical issues, such as informed consent and anonymity" (Floyd and Arthur, 2012; 172), internal ethical engagement "relates to the deeper level ethical and moral dilemmas that insider researchers have to deal with in the field" (*ibid*). This might include issues relating to anonymity, information about specific learning difficulties of students involved in the study, or information that students shared about their lives during the intervention (Floyd and Arthur, 2012). Internal ethical engagement was an important concept in this research, as the researcher was also delivering interventions to students, and this could create tensions between the professional and researcher roles. For example, the students seemed to enjoy and benefit from the fact that the interventions were being delivered by someone with no prior knowledge about their academic and behavioural

reputation, and over time the students receiving the interventions began to see the researcher as more of an insider. This meant that the researcher was both insider and outsider (Adler 2004; Bridges 2002), which challenged the inside/outside binary concept (Thomson and Gunter 2011, 18), and made the researcher much more aware of ethical positioning and careful ethical decision making at every stage of the research, and particularly in the data collection phase.

3.4 Pilot Project

Six months before the start of the definitive RCT, a pilot project was carried out. Whilst there is no agreed definition of a pilot trial (Lancaster et al., 2004), Torgerson and Torgerson (2008) state it can be loosely defined as a study "that is either too small to have a reasonable chance of detecting a minimally important effect size, and/or a study that is evaluating an incompletely developed intervention" (Torgerson and Torgerson, 2008; 119). There are two types of pilot study: external and internal pilots. An external pilot is one that is independent of the main study, whereas the internal pilot is part of the definitive study and makes up part of the 'run-in' phase. It can be challenging to apply the lessons that have been learnt from an internal pilot to the main trial due to time constraints involved, so this study used an external pilot. The study design was as similar as possible to the proposed design of the RCT to allow for the characteristics of the main study to be tested before the main trial was begun. It was useful to undertake the pilot study under the best possible circumstances, with the knowledge that if it was not feasible it would be unlikely that the larger definitive trial could be executed successfully.

3.4.1 Methodology

The pilot study first involved carrying out a screening assessment with four hundred pupils in Years 8 and 9 in one secondary school in south-east England with a mixed socio-

economic demographic who had agreed to their data being collected and analysed for the pilot study. Lucid Exact by GL Assessment was used to collect screening data on the word reading standard score and reading comprehension standard score for each pupil. From this screening data, sixty-five pupils were selected who had a reading-comprehension standard score equal to or below 90, and a reading-accuracy score of 90 or above, and a difference between the standard scores for the two measures of one standard deviation or more (Snowling et al., 2009). Of the sixty-five pupils selected, sixty agreed to take part in the pilot intervention study, which was 16% of the initial sample. The mean age of these participants was 13 years 6 months, and there were thirty-six boys and twenty-four girls involved in the study. At Time 1(T1), the students had an average reading comprehension standard score of 83.17 and an average word reading standard score of 97.56, which is as would be expected for poor comprehenders.

Students were randomly assigned to either the text based, oral language or waiting list control group, so that each group has a total of twenty students. These groups were then split randomly into four teaching groups with five students in each. The software available at www.randomisation.com was used for the random allocation of students to groups, as it enabled the user to specify the number of participants per intervention group as well as the number of intervention groups. The groups were first compared to each other to assess for age, gender, verbal ability, word reading and baseline reading comprehension. The randomisation process was repeated 1,000 times, resulting in 1,000 different allocations. The optimal randomisation was chosen based on the random assignments that led to a non-significant difference between groups in terms of age, gender, verbal ability and baseline reading comprehension score. The one that resulted in the smallest total average difference in these characteristics was selected.

Before starting the intervention at T1, students were tested using the York Assessment of Reading Comprehension (YARC), Wechsler Abbreviated Scale of Intelligence: Vocabulary (WASI), Test of Word Reading Efficiency (TOWRE) and Wechsler Individual Achievement (WIAT 11) Numerical Operations. These tests were repeated immediately after completion of the intervention programme at T2.

Table 3: A summary of the tests used in the pilot study.

Test	Overview	Measures of reliability
Lucid Exact Test	○ Lucid Exact is a computerised programme designed to assess word recognition, reading comprehension, reading speed, spelling and writing to dictation (typing speed and handwriting speed) for individuals aged between 11 and 24 years.	Reliability was calculated from studies carried out in 2010-11 in 4 different schools involving 103 students. Correlation values were calculated with a number of different tests. Reading comprehension: from 0.51 (comparison with Test of Single Word Reading Efficiency) to 0.56 (comparison with Wide Range Achievement Test, 4th Edition) Word Recognition: from 0.70 (comparison with Wide Range Achievement Test, 4th Edition) to 0.84 (comparison with Test of Single Word Reading Efficiency)
York Assessment of Reading Comprehension (YARC)	○ YARC requires students to read two passages, and answer 13 questions about each passage that test different aspects of reading comprehension. Students are then asked to give a short summary of the passage, making clear what the main events were. Passages from Level 1 and 2 are designed to be read silently, and the Supplementary passage is designed to be read aloud as this also provides a standard score for reading accuracy. The appropriate reading comprehension passage is chosen based on the word reading level of the student, which is measured at the start of the assessment. ○ Standard scores for reading comprehension as well as reading rate and summarisation ability can be calculated. The supplementary passages also provide data on reading accuracy. ○ Forms A and B: these are equivalent tests: Form A was used at pre-test and Form B was used at post-test to reduce the effects of improvements due to repeated testing	Reading Comprehension: reliability co-efficient ranges from 0.76 (supplementary passage) to 0.90 (Form A level 1) Summarisation: reliability co-efficient ranges from 0.65 (Form A Level 1) to 0.74 (Form B Level 1) Reading Rate: reliability co-efficient ranges from 0.67 to 0.91

Wechsler Abbreviated Scale of Intelligence: Vocabulary (WASI)	○ The Vocabulary subtest includes 28 items, in which the student gives a definition of a word presented orally. Words such as clock, car, puppy, and refrigerator are used at the start of this sub-test for children ages between 11 and 13, and towards the end of the sub-test words include apostasy, ephemeral and enervate. ○ The vocabulary subtest is designed to measure students' word knowledge and verbal concept formation.	Reliability co-efficient = 0.91
Test of Word Reading Efficiency (TOWRE)	○ Test of Word Reading Efficiency – 2nd edition ○ The test is divided into two subtests: ○ The first subtest displays real words (Sight Word Reading Efficiency: SWRE) and is designed to assess the efficiency with which children can read words. Words have been selected based on the frequency of occurrence in printed texts, the length and complexity of syllables and the number of syllables. ○ The second subtest displays non-words (Phonemic Decoding Efficiency: PDE), and is designed to assess an individual's ability to apply graphonemic knowledge to decoding words in print. ○ These two sub-test scores are used to calculate the Total Word Reading Efficiency Index: TOWRE. ○ Forms A and B: these are equivalent tests: Form A was used at pre-test and Form B was used at post-test to reduce the effects of improvements due to repeated testing	Reliability co-efficient: ○ SWRE: 0.90 ○ PDE: 0.88 ○ TWRE: 0.94 Interscorer Differences = 0.99
Wechsler Individual Achievement (WIAT 11) Numerical Operations	○ This subtest evaluates the ability of students to identify and write numbers (e.g. counting and solving paper and pencil computations). This test was carried out to assess whether the effect of the intervention was specific to reading comprehension.	Internal consistency 0.92 Test-retest reliability 0.93

Each group of students received a thirty-minute intervention every day for a period of four weeks. The interventions took place in a classroom during school time, and the timing of the sessions were changed each week to ensure that the students did not miss the same lesson every week. The sessions in both interventions were tailored around two books: *The Tales of Beedle the Bard* by JK Rowling and *Brock* by A McGowan. The structure for each session was taken from Clarke et al. (2010) and is outlined in the table below.

Table 4: The structure of each session within the pilot project

Time (minutes)	**Text based strategies**	**Oral language strategies**
2 minutes	Introduction or re-cap from previous session and attribution re-training strategies	Introduction or re-cap from previous session and attribution re-training strategies
5 minutes	Metacognitive strategies	Vocabulary
5 minutes	Reciprocal teaching with text	Reciprocal teaching with spoken language
5 minutes	Written narrative	Spoken narrative
5 minutes	Inferencing from text	Figurative language
5 minutes	Plenary	Plenary

The two intervention programmes were designed, as much as possible, to be parallel, with the same type of activity, resources used and time spent on each activity. For example, the text-based intervention included a section on written narrative for 5 minutes, and the oral language intervention included a section on spoken narrative for 5 minutes.

Within two parts of the programme the text-based and oral language interventions focused on different components of comprehension. The text-based intervention taught metacognitive strategies and inference skills from text, whereas the oral language intervention taught vocabulary and figurative language. These differences were designed for two main reasons. Firstly, it would enable a comparison between the explicit teaching of word solving strategies in the oral language intervention, with the use of metacognitive strategies to work

out the meaning of unfamiliar vocabulary, by integrating ideas from the text with the reader's background knowledge (Joseph and Nation, 2018), in the text-based intervention. Secondly, it was hoped that including the teaching of word solving strategies in the vocabulary element of the oral language programme would facilitate an analysis of whether vocabulary instruction could lead to improvements on standardised scores for non-taught vocabulary tests.

There were three core principles from the work of Vygotsky (1962, 1978) underpinning the oral language and text-based intervention that provided a rationale for some of the features of the interventions:

1. All sessions should involve rich social interactions

As previously discussed, Vygotsky's ideas are situated in social constructivism, with the understanding that learning is historically-situated and mediated by inter-subjective social experiences and culturally specific tools, including language. To optimise learning, the interventions incorporated cooperative and collaborative group work (Hacker and Tenent, 2002). Cooperative learning, in which peers listen to one another's ideas about text and support one another to use appropriate reading comprehension strategies, was highlighted as one of the most effective methods for improving reading comprehension by the National Reading Panel (2000). The benefits of collaborative learning are that by sharing ideas and perspectives, children are able to gain new ideas about the meaning of a passage along with the understanding that interpreting the meaning of text is subjective and that the meaning of words, sentences and passages can be interpreted in a range of different ways. A further benefit of collaborative learning is the experience of explaining one's own thoughts and views to others. The sessions were structured so that they provided a safe, supportive and encouraging space for children to express themselves and vocalise their thoughts.

2. Where appropriate, all teaching, including resources, should be individualised to the child's cognitive profile and motivations.

Vygotsky (1978) concept of the zone of proximal development explains how learning takes place in the gap between what can be achieved by the student on their own, and what cannot be achieved without the help of another person. Therefore, as much as possible, the sessions were adapted to meet the particular needs of each child, and a log of brief descriptive comments was kept for each child in order to keep track of each child's progress in the each of the components taught in the intervention to inform instruction in subsequent sessions.

3. Students are encouraged to become independent learners through the use of scaffolding

Scaffolding (Bruner, 1978) was particularly important when introducing new strategies or tasks, breaking an activity down into manageable parts and providing regular feedback to help learners reflect on their progress and help them to plan their next steps. As the interventions might include many new ideas and strategies for individual students, careful scaffolding was implemented at all stages of the intervention programme. For example, the teaching manual included a script of how to model strategies and support the gradual introduction of new tasks. Images, keywords and symbols were also used to support the learning and implementation of strategies. These strategies were employed in both intervention programmes to the same degree.

Attribution re-training strategies

- Identify positive and negative thoughts, and develop an awareness of the potential implications of these thoughts

Metacognitive strategies

- Setting a purpose
- Self-questioning
- Linking text to prior knowledge
    - Ask questions: Who? What? Where? When? Why?
    - Turn the heading and subheadings into headings
    - Activate prior knowledge
    - Preview the text e.g. What clues does the title provide about the text? What is the story about and where does it take place? What clues could this give us about the narrative?

Vocabulary

- Definitions
- Develop context, explanations and multiple associations (e.g. use of morphology)
- Practice with words
- Review
- Extended talk around examples e.g. ask 'why?'
- Present the words in multiple contexts

Reciprocal teaching with text (text-based) and Reciprocal teaching with spoken language (oral language)

The same strategies were used in different format. In the text-based programme, the strategies were conducted in a written and text-based format, and in the oral language programme, the following strategies were discussed.

- Predicting
    - Activate prior knowledge
    - Examine headings, sub-heading and pictures
- Clarifying
    - Reread or listen again to parts of the text
    - Think about what makes sense
    - Look ahead for cues
    - Analyse word parts
    - Consult with other sources of information
- Summarisation
    - Who or what is the sentence/paragraph/section about?
    - What is happening/what are we supposed to learn from this section?
    - Discuss/write the main idea from the text
- Questioning
    - Question generation
    - Use of signal words and question stems
    - Students encouraged to self-question
- Use questions for a range of purposes such as to understand why authors might have made the choices they did when writing the text, to connect the ideas and/or characters in the text and to use different senses (visualising, tasting, smelling, feeling) to imagine the text

Written narrative (text-based) ● Using the respective narrative and expository structures inherent in text ● Support children in understanding and identifying the themes in narrative text, e.g. using organising questions to identify themes ● Transfer and application of themes to other stories examples and real-life experiences	**Spoken narrative** ● Understanding and identifying themes in spoken text ● Support children in understanding and identifying the themes in narrative text, e.g. using organising questions to identify themes ● Transfer and application of themes to other stories examples and real-life experiences
Inferencing from text ● The teacher models inference skills to show how they arrive at an inference. For example, asking themselves relevant questions and exploring possible answers to them aloud, or pausing whilst reading to think thoughts aloud ● Pair or group work to facilitate pupils modelling inference making, alongside training in how to spot meaning breakdown and use repair strategies such re-reading and looking at key words in the text. ● Training to help students derive implicit meanings through the integration of background knowledge with ideas from the text (connecting the text to themselves and the world) ● Developing predictive skills, for example by asking pupils to use inference and deductive skills to guess missing segments or words in a passage ● Encouraging questioning to address knowledge gaps, anomalies or contradictions ●	**Figurative language** ● The teacher models understanding figurative language. For example, asking themselves relevant questions and how you can use the surrounding context to support your understanding of figurative language ● Pair or group work to facilitate pupils modelling inference making. ● Training to help students derive implicit meanings through the integration of prior-knowledge with text concepts and context ● Developing predictive skills, for example by asking pupils to use inference and deductive skills to discuss the meaning of idioms, metaphors, hyperbole, personification, alliteration and dialogue ● Encouraging questioning to address potential knowledge gaps, anomalies or contradictions
Plenary ● Strategy monitoring and self-evaluation was an important part of each component of the programme, and particularly in the plenary, as students were required to engage in reflection to consider questions such as: o Did I set a purpose before I began reading or listening? o Did I preview the text before reading or listening? o Did I use my background knowledge about the topic while reading or listening? o Did I think of questions to ask myself whilst reading or listening? o Did I summarise what I had read when I finished reading or listening?	

Table 5: An outline of the teaching strategies that were used in each aspect of the programme.

Table 6: A summary of the weekly sessions within the oral language intervention programme

Oral Language Pilot Project Intervention		
Week		**Content and strategies covered each week**
Week 1	**Vocabulary**	Discussion on strategies that can be used to effectively explore and learn word meanings, focusing on the importance of active processing to learn the meaning of new words.
	Reciprocal Teaching	Teacher to model the use of the clarification strategy to work out the meaning of a word, followed by games and activities using clarification strategies with oral language.
	Figurative Language	Identification of similes with a text, followed by a guided discussion on the implied meaning and effect of the use of similes within spoken narrative.
	Spoken Narrative	Discussion of the structure of spoken narrative.
Week 2	**Vocabulary**	Using mnemonic strategies to remember the meaning of words.
	Reciprocal Teaching	Teacher to model the use of summarisation using a short piece of spoken narrative, followed by a discussion about techniques to remember the sequence of events and key points within the narrative. Summarisation games and activities using oral language.
	Figurative Language	Identification of similes and a discussion on the implied meaning and effect of the use of similes within spoken narrative.
	Spoken Narrative	Discussion of the opening and build-up in spoken narrative: listen to examples and discuss the strategies that have been used to make the narrative effective. Consider how the examples could be improved.
Week 3	**Vocabulary**	Use of multiple context learning to explore the meaning of identified words with a spoken narrative.
	Reciprocal Teaching	Teacher to model the use of the prediction strategy whilst the class is listening to a short piece of spoken narrative. This is followed by a discussion on the techniques one can use to predict what might happen in spoken narrative, and prediction games and activities using oral language.
	Figurative Language	Identification of metaphors within spoken narrative, and a discussion on the implied meaning and effect of the use of metaphors within spoken narrative.
	Spoken Narrative	Discussion of the climax of an event within a spoken narrative.
Week 4	**Vocabulary**	Using graphic organisers (with words and images) to identify and explore the meaning of words (including the morphology of the word and multiple contexts in which the word can be used).
	Reciprocal Teaching	Teacher to model the use of the questioning after listening to a short piece of spoken narrative. This is followed by a discussion about questioning techniques that can be used when listening to a spoken narrative, and question games and activities using oral language, making use of the key question words (Why? What? When? Where? Why? How?).
	Figurative Language	Identification of metaphors within spoken narrative, and a discussion on the implied meaning and effect of the use of metaphors within spoken narrative.
	Spoken Narrative	Discussion of the ending or resolution phases in the examples of spoken narrative provided.

Table 7: A summary of the weekly sessions within the text-based intervention programme

Text Based Pilot Project Intervention		
Week	**Content and strategies covered each week**	
Week 1	**Metacognitive Strategies**	Teacher to model the use of the 're-read' strategy, followed by a discussion about how and when to implement this strategy, as well as the advantages and disadvantages of using it for text comprehension.
	Reciprocal Teaching	Teacher to model the use of clarification to work out the meaning of a word, followed by games and activities using the clarification strategy with written text.
	Inference Making	Activities requiring the use of coherence inferences.
	Written Narrative:	Discussion about the structure of written narrative.
Week 2	**Metacognitive Strategies:**	Teacher to model the use of the look back strategy, followed by a discussion about how to implement this strategy, and the advantages and disadvantages of using this strategy for text comprehension.
	Reciprocal Teaching:	Teacher to model the use of summarisation after reading a short piece of written narrative, followed by a discussion of techniques to help the learner remember the sequence of events and key points within the narrative. Summarisation games and activities e.g. pick out the accurate sentences from those provided, put them in order of importance when trying to establish meaning and then put them in an appropriate chronological sequence.
	Inference Making	Activities requiring the use of elaborative inferences.
	Written Narrative:	Discussion about the opening and build-up phases of written narrative.
Week 3	**Metacognitive Strategies**	Teacher to model the use of the 'think in pictures' strategy, followed by a discussion of how to implement this strategy, the advantages and disadvantages of using this strategy for text comprehension.
	Reciprocal Teaching	Teacher to model the use of the prediction strategy after reading a piece of written narrative. This is followed by a discussion of techniques to predict what might happen in a written narrative, and prediction games and activities using written text.
	Inference Making	Activities requiring the use of bridging inferences.
	Written Narrative	Discussion of the climax of an event within written narrative.
Week 4	**Metacognitive Strategies**	Teacher to model the use of explain and reflect strategy, followed by a discussion of how to implement this strategy, the advantages and disadvantages of using this strategy for text comprehension.
	Reciprocal Teaching:	Teacher to model the use of the questioning after the class has read a piece of written text. This is followed by a discussion of techniques to question what might happen in a written text, and question games and activities using written text making use of the key question words (Why? What? When? Where? Why? How?)
	Inference Making	Activities requiring the use of elaborative inferences.
	Written Narrative	Discussion of the ending or resolution in written narrative.

3.4.2 Pilot Study Results

For each outcome measure, the extent to which gains in performance after the intervention were significantly different for the oral language and text-based intervention programmes compared to the waiting-list control group are reported. These analyses were conducted in SPSS (IBM SPSS Statistics, version23).

It was expected that the reading comprehension and vocabulary standard scores would be greater for the intervention groups compared to the waiting-list control group, that there would be greater gains in word reading for the text-based intervention group compared to the waiting list control and oral language group, and that there would be greater gains in reading comprehension and vocabulary for the oral language group. Number skills were also assessed to examine the specificity of the effects of the interventions. It was expected that there would be no difference in the number skills for each intervention group compared to the waiting-list control group.

Table 8: A summary of the data obtained at all time points for the primary (reading comprehension) and secondary (vocabulary, word reading and number skills) outcome measures.

	Waiting List Control Group at T1	Waiting List Control Group at T2	Text Based Group at T1	Text Based Group at T2	Oral Language Group at T1	Oral Language Group at T2
No. males (M) and females (F)	12 F and 8 M		15M and 5F		13 M and 7 F	
YARC	83.80 *(3.23)*	84.80 *(3.25)*	81.60 *(4.26)*	84.85 *(3.28)*	84.10 *(5.43)*	91.25 (5.*76)*
WASI Vocabulary baseline	83.80 *(1.35)*	85.15 *(2.35)*	83.5 *(1.32)*	85.85*(0.93)*	82.35 *(0.72)*	*92.65(0.67)*
TOWRE Baseline	100.98 *(0.87)*	99.80 *(1.78)*	90.80 *(1.25)*	103.55 *(3.45)*	100.65 *(2.23)*	101.10 *(0.98)*
WIAT 11 Numerical Operations	93.75 *(1.98)*	93.55 *(1.87)*	92.05 *(1.35)*	92.55 *(3.28)*	93.45 *(3.21)*	93.40 *(2.98)*

3.4.2.1 Effect of intervention: Reading Comprehension

The oral language intervention produced the greatest increase in standardised comprehension score (7.15 points from pre- to post-test), with a large effect (*d* = 0.75). There was very little difference between the mean waiting list control and text-based group scores, and the increase in the reading comprehension standard score for the control and text-based groups was 1.0 and 2.9 respectively. Cohen's *d* effect size for the text-based intervention compared to the waiting list control group was just 0.015, indicating that the intervention explains about 1% of the total variance.

Figure 6 shows the relative changes in reading-comprehension standard scores on the York Assessment for Reading Comprehension (YARC). The confidence intervals around the mean in Figure 6 indicate that these increased particularly for the oral language intervention group between T1 (prior to the intervention) and T2 (after the intervention). In contrast, the confidence interval of text-based intervention group showed little change between T1 and T2.

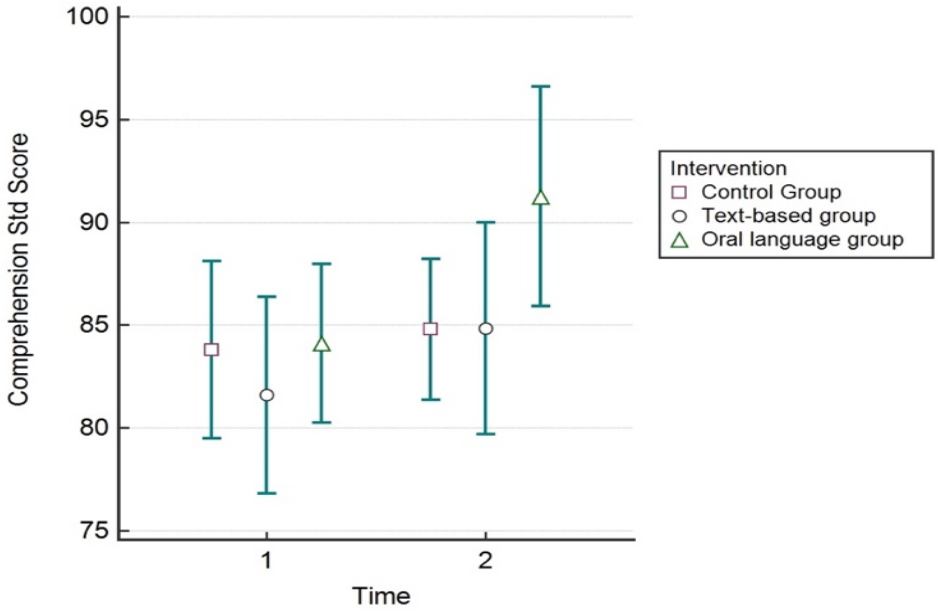


Figure 6: A graph to show the relative changes in reading-comprehension standard scores on the York Assessment for Reading Comprehension (YARC). The points show the mean scores before and after the intervention for the three groups. Error bars show the 95% confidence intervals. Time 1 = pre-intervention and Time 2 = post-intervention

ANOVA was used to analyse the effect of the intervention type (between participants factor: oral language, text-based and waiting list control groups) and time (within participants factor: before and after the intervention). There was a significant main effect of time ($F(1,57) = 47.02$, $p < .001$). Thus, across all groups, reading comprehension standard scores were higher at T2 than T1. There was also a significant effect of the intervention ($F(2,57) = 6.791$, $p = .002$). There was a significant interaction between time and intervention, ($F(2,57) = 10.509$, $p < .001$).

To explore this significant interaction further, a one-way ANOVA was carried out to explore the simple effect of Intervention Group at each level of Time. At T1 there were no significant differences between the intervention groups ($F(2, 114) = 2.059$, $p = 0.137$, and at T2 there was a significant difference $F(2, 114) = 12.40$, $p < .001$. At T2, there was a significant difference in reading comprehension score between the oral language group and the text-based group ($t(38) = 3.864$, $p < .001$) and between the oral language and the control group scores ($t(38) = 4.552$, $p < .001$). These differences were significant even after applying a Bonferroni correction with a criterion p-value cut-off of p=.016. There was no significant difference between the text-based group and the control group score ($t(38) = 0.036$ $p < 0.97$). This indicates that the oral language group had a significantly improved reading comprehension score at T2.

For the simple effect of Time at each level of Intervention, a t-test was used as there were only two groups (T1 and T2). The effect of time was significantly different for the oral language group ($t = 4.857$, $df = 38$, $p<0.0001$), and for the text-based group ($t=2.069$, $df=38$, $p=0.045$), however, it was not significant for the waiting list control group ($t = 0.813$, $df = 38$, $p = 0.421$). However, after applying a Bonferroni correction, where the criterion p value for

significance was reduced to $p < 0.016$, only the oral language group showed a significant improvement from pre to post test results.

3.4.2.2 Effect of intervention: Vocabulary

Table 9: Mean standard scores and standard deviations (in parentheses) for the vocabulary outcome scores for all groups at T1 (assessment before the intervention) and T2 (assessment after the intervention).

	Waiting List Control Group	Text Based Group	Oral Language Group
Vocabulary Score T1	83.80 (1.35)	83.5 *(4.63)*	82.35 *(3.93)*
Vocabulary Score T2	85.15 *(4.08)*	85.85 *(4.15)*	92.65 *(5.59)*

A two-way mixed ANOVA was used to analyse the effect of the intervention type (between participants' factor: oral language, text-based and waiting list control groups) and time (within subjects factor: before T1 and after T2 the intervention) on vocabulary score. The time variable (T1 and T2) was highly significant ($F(1,57) = 108.19$, $p < 0.001$ and the effect of the intervention was not significant ($F(2,57) = 2.665$, $p = .078$). The interaction time x intervention was highly significant ($F(2,57) = 55.64$, $p < 0.001$). There were no significant pairwise comparisons in the intervention variable across both time points (oral language v text based, $p = .114$, oral language v control $p = .212$, and text-based v control $p = 1.0$) but there was a significant difference across all groups between time T1 and T2 ($p < .001$). Therefore, there was an overall improvement from T1 to T2 in all intervention groups (mean change = 4.28, *se* = 0.412), but no significant differences were observed between the intervention groups in the vocabulary score.

A one-way ANOVA was carried out to explore the effect of intervention group on vocabulary score at each level of time. At T1, there were no significant differences between the groups $F(2,57) = 1.814$, $p = .172$. At T2, there was a significant difference between the groups $F(2,57) = 15.809$, $p < .0001$. Pairwise comparisons at T2 between the groups were as follows: OL-TB = 6.8 (se = 1.47), p <.0001; OL- CON = 7.5 (se = 1.47) p < .0001; TB – CON

= 0.7 (se = 1.47), p = 1.0. Therefore, at T2, the OL group vocabulary score was significantly higher than that of the other two groups.

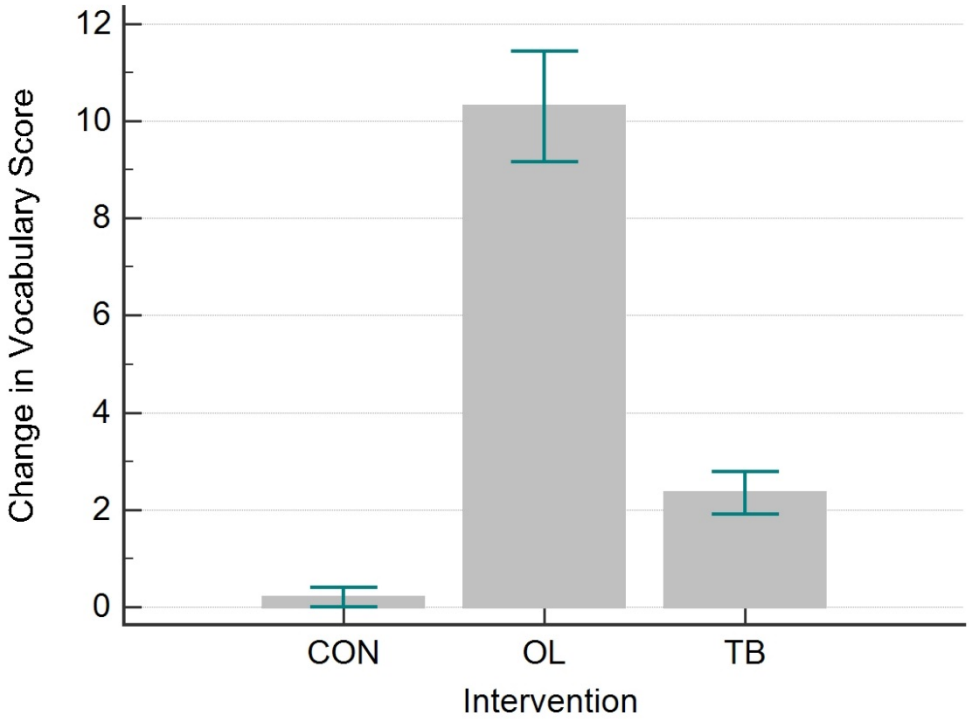


Figure 7: Change in vocabulary standard score between T1 and T2 for the oral-language (oral language), text-based (TC) intervention groups and the waiting-list control group (CON). Error bars show SE.

Using ANCOVA the change in reading comprehension score (T2-T1) was the dependent variable, with the change in change in vocabulary score (T2-T1) as the covariate and the intervention group as a fixed factor. This showed that the change in vocabulary score from T1 to T2 was highly significant in predicting the change in reading comprehension ($F(1, 56) = 30.89$, $p < .00001$ over the same time period. The intervention group was not a significant variable in the model $F(2,56) = 1.247$, $p = 0.295$. Pairwise comparisons between the intervention groups were not significant.

3.5.2.3 Effect of intervention: Word Reading

It was evident from the initial data that the text-based intervention group had a lower word reading standard score at T1, and that there was a large increase in the word reading standard score from T1 to T2 (12.75 standard points). Therefore, it was possible that increased exposure to text in this group resulted in an improvement in word reading efficiency, more so than in the oral language group.

Table 10: Word reading standard score at Time 1 (T1) and Time 2 (T2)

	Control	Text Based	Oral language
T1	101.25 (*2.86*)	90.8 (*2.04*)	100.65 (*3.2*)
T2	99.8 (*4.25*)	103.55 (*2.31*)	101.1 (*2.81*)

Note: Word reading standard score at Time 1 (T1) and Time 2 (T2) showing means and *(standard deviations)*

A repeated measures ANOVA was used to analyse the effect of the intervention (between subjects' factor: oral language, text-based and waiting list control groups) and time (within subjects' factor: before and after the intervention) on word reading score. The effect of the intervention type, time and the interaction between them were examined. There was a significant main effect of time ($F(1,57) = 119.9$, $p < .0001$), a significant effect of the intervention ($F(2,57) = 11.77$, $p < .0001$) and a significant interaction between these two factors ($F(2,57) = 154.8$, $p < .0001$).

A one-way ANOVA was used to analyse the effect of the intervention group separately at pre-intervention (T1) and post-intervention (T2). At T1, there was a significant difference for intervention group $F(2,57) = 90.5$, $p < 0.0001$. Using the Bonferroni post hoc test, the text-based group was lower with a significant difference between text-based v control groups ($p = 0.0001$), and for oral language v text-based groups ($p < 0.0001$). There was no significant

difference for the oral language v control group comparison (p = 1). At time T2, there was a significant difference across intervention groups (F(2,57) = 6.96, p = .002. Using the Bonferroni post hoc test, there was a significant difference between text-based v control groups (p = 0.002) with the text-based group higher, but there was no significant differences between the text-based and oral language groups (p = 0.06) or between the oral language group and the control groups (p = .624).

When analysing the simple effect of time across group between time 1 and time 2, there was a small but significant difference for the oral language group (t = 2.651, df = 19, p = .016) and a large difference for the text-based group (t (19) = 18.97, p < .0001), but not for the control group. Therefore, it can be concluded that the text-based group significantly improved their word reading score as a result of the intervention.

3.4.2.3 Effect of intervention: Numerical Operations

A repeated measures ANOVA was used to analyse the effect of the intervention (between subjects' factor: oral language, text-based and waiting list control groups) and time (within subjects' factor: before and after the intervention) on numerical operations. Time did not have a significant effect, F(1,57) = 1.026, p = 0.315 and neither was the effect of intervention significant F(2,57) = 0.61, p = 0.547. However, the interaction variable (time x intervention) was significant, F(2,57) = 6.689, p = 0.002.

A one-way ANOVA was used to analyse the effect of the intervention group separately at pre-intervention (T1) and post-intervention (T2). At T1 there was no significant differences between the intervention groups, F(2,57) = 0.91, p = 0.408. Similarly, at T2 there were no significant differences between the groups (F(2,57) = 0.355, p = 0.703. To analyse the effect of time in each group, a paired t-test was used, with the p-value for significance corrected to p = 0.016 (i.e. Bonferroni correction). Comparing T1 and T2, the control group

difference was not significant (t = 2.179, df = 19, p = 0.042), nor was the text-based group (t = 2.517, df = 19, p = 0.021) or the Oral language group (t = 0.438, df = 19, p = 0.66).

The interventions did not influence numerical scores at T2. This suggests that the intervention effects found for reading comprehension were not a result of more general effects in skills that were not directly taught as part of the intervention.

3.4.3 Discussion of the pilot study data

This pilot study evaluated the effectiveness of an oral language and text-based reading comprehension interventions, in order to assess which programme was most effective at improving reading comprehension standard score. A subsidiary aim was to evaluate the impact of vocabulary and word reading standard scores.

In line with the Simple View of Reading (Gough and Tunmer, 1986), the findings from the pilot study provide an initial indication of support for the claims that oral language training can be effective at improving the ability of poor comprehenders of secondary school age to extract meaning from a text (Clarke et al., 2010; 2017; Fricke et al, 2013), and that text-based training can be effective at improving word recognition and decoding skills (Bowyer-Crane et al. (2008).

The overall pattern of results is clear; the oral language intervention delivered statistically significant improvements in the average reading comprehension of students when compared with the waiting list control group. The oral language programme also led to greater improvements in reading comprehension skill than the text-based intervention programme and waiting list control, with a large effect size of d=.75, which is a larger effect size than the d=.25 suggested as being educationally important by at least two organisations (Promising Practices Network, 2007; What Works Clearing House, 2007). Similar studies have showed

smaller effect sizes (0.30 (Fricket et al., 2017), 0.22 (Cantrell et al., 2010), 0.12 (Vaughn et al., 2011), 0.20 (Vaughn et al., 2013) and 0.34 (Clarke et al., 2017), and this likely reflects differences in the delivery of the programme (i.e. other interventions have been delivered by a TA), or differences in treatment fidelity e.g. Fricke et al., 2017 state that "many children in the current study received less than the full "dose" of the programme" (*21*).

It is important to note that the waiting list control group also showed small gains in reading comprehension, which was unexpected as there is often a pattern of decreasing attainment in those children with poor reading comprehension who are not receiving an intervention (Clarke et al, 2010). The small gains could be due to effective classroom teaching, and despite the parents, school and children agreeing to no-intervention between T1 and T2, the additional possibility of some students receiving some form of reading comprehension intervention can also not be ruled out.

The oral language intervention group made significant improvements relative to the text-based intervention group and waiting list control group on measures of vocabulary knowledge standard score. This provides some evidence that the pupils were able to apply strategies to learn the meaning of new words. Whilst this finding supports previous research by Clarke et al (2010;2017), it contrasts with much of the available research that has failed to find improvements in generalised measures of vocabulary knowledge beyond taught words (Wright and Cervetti, 2016). In both this current intervention and the intervention reported by Clarke et al (2010; 2017), the vocabulary section of the programme was taught using a Multiple Context Learning approach (Beck et al., 2002) that was integrated with Reciprocal Teaching (Palincsar and Brown, 1984), suggesting that this is a potentially important consideration when delivering vocabulary instruction.

The text-based intervention group made significant gains in word reading with an increase of 12.75 standard points between T1 and T2, in comparison with an improvement of 0.45 and 1.18 for the oral language intervention group and waiting list control group, respectively. This finding is in contrast to Clarke et al. (2017) who found that neither the students who received reading intervention (targeting word recognition and decoding skills) with comprehension instruction, nor the group who just received reading intervention produced statistically significant gains in word reading. As the text-based intervention programme did not include explicit instruction relating to letter-sound knowledge or phonological awareness, it seems possible that the reading and writing elements of the programme facilitated the development of word reading. However, it is important to note that at T1 there was a significant difference in the word reading standard score between the intervention groups. Therefore, on average the pupils in this text-based intervention group had weaker word recognition and decoding skills at the start of the intervention, when compared with the oral language and waiting list control groups. It may therefore be possible that students in this group were able to make more progress in word reading than the oral language intervention group or the waiting list control. This may have been particularly pronounced as the activities for the text-based intervention group were based around reading passages of text aloud, rather than listening to and discussing text, and therefore placed more emphasis on word reading.

In short, the data for this small-scale pilot study indicates that the reading comprehension and vocabulary standard scores were higher at T2 than at T1 for all groups. The oral language intervention group had statistically significant improvements in reading comprehension standard score. The overall change in vocabulary score from T1 to T2 in all groups was highly significant in predicting the change in reading comprehension. The finding that oral language interventions can improve reading comprehension standard score is in line with other research findings (Fricke et al., 2017; Cantrell et al., 2010; Vaughn et al., 2011;

Vaughn et al., 2013; Clarke et al., 2017). The text-based intervention programme led to significant gains in word reading standard score, and this gain has not been found in other intervention studies (Clarke et al., 2017).

3.4.4 Evaluation of pilot study

The pilot study facilitated an evaluation of the validity and reliability of the methods to be used in the research trial. In particular, it facilitated a realistic evaluation of the resources and materials that had been planned as well as the structure and organisation of the project. The pilot study helped to identify likely recruitment rates that could be expected in the main trial (Farrin et al., 2005; Salter et al., 2006), likely retention and adherence rates for the study, and the challenges of recruiting poor comprehenders. In particular, it highlighted the challenge of meeting the strict inclusion/exclusion criteria of a "reading-comprehension standard score equal to or below 90, and a reading-accuracy score of 90 or above with a standard deviation between the two measures of 1 or more" (Snowling et al., 2009; 187). Indeed, just sixty-five students were identified from a sample population of 400 students who met the inclusion/exclusion criteria (16.3%). Although this figure is higher than the current evidence that indicates between 3 and 10% of unselected samples of children satisfy the criteria for the 'diagnosis' of poor comprehenders (Hulme and Snowling, 2011), it serves to highlight the challenges of recruiting a sufficient number of poor comprehenders for the main trial. To overcome these recruitment challenges in the main trial, it was decided that students would be screened by the school, and those who did not meet the strict criteria would be allocated to a separate waiting list control group and their data would not be analysed.

Delivering the intervention programme to a small number of students enabled the researcher to reflect on the programme and to seek informal feedback. Relevant classroom teachers were then asked about the practical implications of the intervention programme on

classroom teaching. Students were asked about the style of delivery of the programme, the teaching materials, the structure of the programme, and their motivation and level of enjoyment of the sessions.

Following analysis of this feedback, a key concern expressed by classroom teachers was that students spent a considerable amount of lesson time going from the intervention back to their classroom. For this reason, and following a review of the findings from the REACH programme, the duration of each session in the main trial was increased from twenty minutes to an hour, as this could be more appropriately tailored to the structure of the school day. Another benefit of this was that students had additional time to learn, explore and practise the teaching points and concepts.

Whilst it is acknowledged that to make a significant impact on reading comprehension an intensive intervention is necessary (Vaughn et al., 2012), and due to practical requirements it was decided to reduce the frequency of the sessions to one per week. However, an increase in both the duration of each session and period over which interventions were delivered (from four to eight weeks) helped to reduce the effect of a reduction in the frequency of the intervention. As the total time of the intervention was eight hours, it was decided to reduce the number of books that were being studied during the intervention from two to one to ensure that there was sufficient time to read the book, as well as teach and practise the planned comprehension strategies.

It was important to carefully consider the required intensity of the intervention, as a balance is required between improvements in reading comprehension, and feasibility factors such as the availability of specialist training and cost effectiveness of intensive support. For example, Berkeley et al. (2011) delivered twelve thirty-minute sessions over a period of four weeks (a total intervention time of 6 hours) and found an effect size for reading comprehension of 1.10. Cantreal et al. (2010) had a longer total intervention time (delivering

a 50-60-minute intervention everyday over one year) and found a small effect size for reading comprehension of 0.22. Whilst this provides an indication of the range in total intervention times between studies, it is important to acknowledge that the interventions were different so no claims can be made about the intervention intensity by comparing these two programmes.

The feedback from lesson observations highlighted the importance of providing scaffolding to students in order to meet their current stage of capability by making the learning explicit. An introduction in each session was also added to train and support students in talking effectively together and in asking useful questions of each other. Peer observational feedback also highlighted the importance of facilitating more social interactions and peer-to-peer learning during the lesson, which is in line with the underpinning principles of Vygotsky cultural-historical social activity theory. A resource booklet was also produced for each student to support their learning through interactive, multi-sensory resources. Finally, it was decided to increase the number of students in each group (from 4 to between 5 and 10 students in each group) in order to facilitate effective learning through social interactions.

The pilot enabled careful consideration of the viability and feasibility of the study. In particular, the structure and timing of the intervention programme and the proposed schedule for the assessment and delivery of the intervention. It is acknowledged that carrying out a pilot as a precursor to a RCT can increase the risk of a Type 1 error, as analysing the results of the pilot project provides preliminary data. However, this was outweighed by the benefits gained from being able to evaluate the design and delivery of the pilot intervention programme to inform the main study.

3.5 Methodology: Intervention Study

Following the pilot study, and in order to address the research questions, a randomised controlled trial with children clustered within six schools was conducted. Two intervention programmes were delivered (oral language and text-based programme) and compared with a waiting list control group. The aim was to determine the intervention that delivered the highest overall mean gain in reading comprehension standardised score from T1 (baseline) to T2 (immediately after the intervention). To show that any gains made by the intervention groups were greater than the gains made as a consequence of standard classroom practice, the students in the waiting list control did not receive any additional interventions between T1 and T2. Instead the delayed waiting list control received the oral language intervention following data collection at T2. All three interventions were delivered by the same teacher.

3.5.1 Randomised controlled trial

A randomised controlled trial (RCT) was chosen as it is widely considered to be the best research methodology for assessing the effect of an intervention on an identified outcome (Torgerson and Torgerson, 2008). An RCT requires groups to be formed by random allocation, as this controls for the unmeasured variables that may affect reading comprehension outcomes (Brooks, Miles, Torgerson and Torgerson, 2006). This means that any potential confounding variables such as socio-economic status, gender, classroom teachers, educational background and general ability are distributed across the groups if the sample size is sufficiently large.

In this study, students were randomly allocated to groups whilst accounting for gender, age and baseline reading comprehension standard score so that the between group differences were minimised. Randomisation was carried out after receiving parental consent to ensure

that the internal validity of the study was not compromised. In line with other related studies, such as 'REACH' developed by the Centre for Reading and Language at York, within-school rather than across-school randomisation was adopted as this was the only viable option, especially when considering the need to minimise the amount of lesson time missed by students. Across-school randomisation was a significant limitation of the study as it involved randomly allocating a small number of pupils (the smallest number of students that were randomly allocated to one of three groups was thirteen).

The use of a waiting control group was important to account for the possibility that pupils were able to make progress in their reading comprehension over time simply due to increased maturity and irrespective of any intervention that was delivered. These maturation effects can be further exaggerated by the widespread effect of 'regression to the mean' (Morton and Torgerson, 2003). The effect is of particular significance in interventions involving pupils with reading comprehension impairment, as students with extreme values will have a greater error value attached to their 'true' score when compared with students close to the average value. A waiting control group was considered appropriate for ethical reasons, as it was important to deliver the intervention to all pupils who had been identified as poor comprehenders. All the pupils were blinded to the intervention apart from those pupils who were randomly allocated to the waiting control group. The students in the waiting list control received the oral language intervention over a period of eight weeks after data collection at T2 ?and subsequent data was not collected.

To ensure that the students in this study met the specific inclusion criteria (of a reading comprehension standard score below 90 and word reading standard score above 90) in this study, screening data for two different year groups in each of the six large secondary schools was collected and analysed prior to group allocation. It is possible that adherence to this strict inclusion criteria meant that the intervention programmes were more appropriately tailored

to target improvements in reading comprehension for students involved in the study. This could contribute to the success of the intervention programmes in improving reading comprehension.

Students receiving the interventions were blind to which intervention that they were receiving, thus reducing dilution bias. Dilution bias occurs when, after randomisation, participants receive one of the comparator interventions, thus increasing the chance of Type 11 error (i.e. erroneously concluding that there was no difference, when in fact there was). Nevertheless, the possibility that students compared the content of the interventions and worked out the difference between the interventions cannot be discounted. The possibility of dilution bias was minimised by clearly explaining the research methodology, aims and expectations to the SENCOs and parents before they agreed to take part in the research. Students allocated to the waiting list control group were also invited to a group and individual meeting to address any concerns regarding their allocation to the waiting control group. Brewin and Bradley (1989) refer to the effects of resentful demoralisation amongst those allocated to a control group, which can alter psychological outcomes so students under-perform on outcome measures. This risk was reduced by using a waiting control group who received the most effective intervention after T2. A disadvantage of the waiting list control was that it limited the length of the follow-up and prevented an assessment of the long-term effects of the interventions. An alternative to dealing with resentful demoralisation is to ask for the students' preference, and then randomise 'indifferent' students and exclude from the randomisation process students with a strong preference who could bias the trial (Brewin and Bradley, 1989). However, this approach will bias the external validity of the study.

Despite measures taken to eliminate bias within the study, it is possible that the outcomes of this study were also subject to Hawthorne Effects, and the improvements were due to being part of a research study rather than because of the intervention (Silverman,

1998) leading to a Type 1 error. For example, informal observations during the delivery of the programme suggested that pupils enjoyed aspects of the programme that were not directly related to the intervention. In particular, in the follow-up feedback 83% of pupils stated that they enjoyed the programme, and many students recognised or directly referred to being part of a small group within a mutually supportive and accepting atmosphere.

3.5.2 Participants

Careful consideration was given to the sample size used in this study, to ensure that the trial was large enough to detect a maximum standardised difference of 0.5 standardised points between the intervention and control groups (Torgerson and Torgerson, 2008). The calculations were based on the findings of the pilot study, and what was considered an educationally meaningful effect size. Similar intervention studies have found effect sizes of 0.27 for an intervention targeting reading comprehension strategy acquisition for 11-15-year olds and an effect size of 0.29 for a reading comprehension intervention for 13-14-year olds delivered by teachers to the whole class (Berkeley et al., 2011). Thus, a minimum effect size of 0.5 for generalised measures of reading comprehension was considered a suitably large effect size.

As the study was aiming for an effect size of 0.5, a reasonable approach was to use Lehr's formula. Indeed, Lehr (1992) describes an approach that "generates samples that are very similar in size to the more usual complex methods" (Torgerson and Torgerson, 2008; 132), and over-estimates the sample slightly for small samples. Using this formula, the minimum sample size was calculated as 128 students.

Day and Graham (1989) describe an alternative method to estimate the required sample size when comparing three or more intervention groups using a linear nomogram.

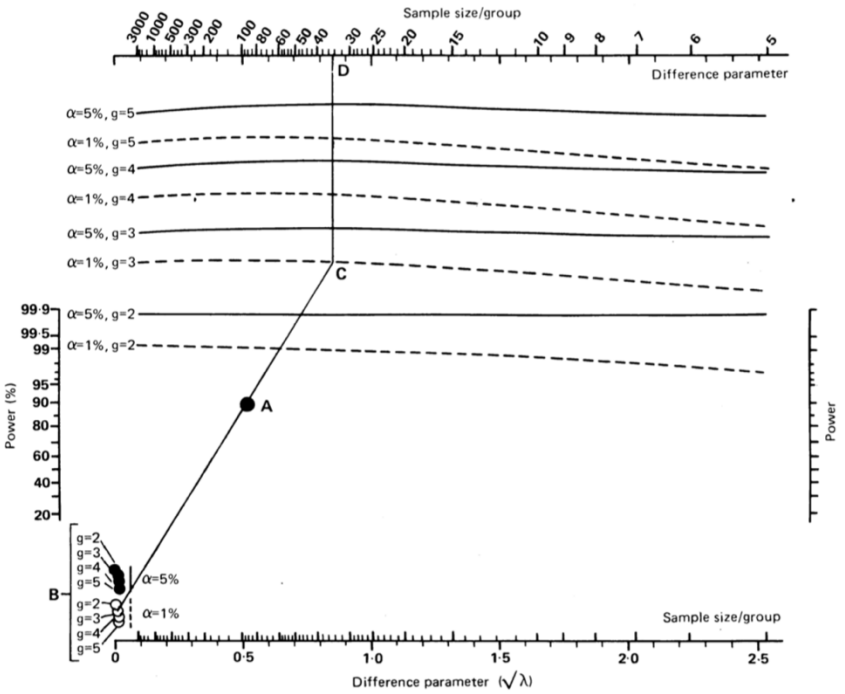


Figure 8: Nomogram for calculating sample size when using up to five independent samples (Day and Graham, 1989)

Using this method, from the pilot study it was expected that the reading comprehension standard score would increase to 100 (oral language), 95 (text-based) and remain at 85 for the waiting list control, and that the standard deviation would be about 15. A 90% power to detect a difference between the intervention groups at 1% level of significance would be used. To determine the sample size for each group the point corresponding to difference parameter = 0.509 (derived from the mean and standard deviation) and power = 90% was plotted on the monogram (point A). For 1% significance and 3 groups, a line was drawn to point C from the bottom left hand corner (point B). A vertical line was then drawn to point D, indicating that a sample size group of 35 (105 students in total across the 3 groups).

To achieve a minimum sample size, participating students were identified from a number of schools in a 'Teaching School Partnership' in the south-east of England. Of the sixteen schools within the partnership, five of the schools satisfied the inclusion criteria of: 1) being a mainstream state school, 2) being within a ninety-minute drive of each other and 3) having the capacity to withdraw students from lessons to receive a weekly intervention of

one hour over an eight-week period. Two of the schools within the Teaching School Partnership scheme were not included in the study because three were not mainstream state schools, two schools did not meet the criteria of being within a ninety-minute drive, four schools were unable to withdraw students from lessons on a weekly basis, one school wanted to offer the intervention to all pupils rather than just those with poor reading comprehension and one school stated that they were already participating in a number of different literacy interventions.

Another twenty schools outside of the 'Teaching School Partnership' were contacted in an attempt to increase the number of eligible students in the study. However, only one school outside of the Teaching School Group committed to joining the intervention study. The schools were first contacted by telephone to request the name and e-mail address of the school's SENCO. An initial contact e-mail was then sent to provide a brief overview of the research project and to ask the school to respond to the invitation.

The reasons that the schools gave for becoming part of the RCT were that they wanted to help pupils who were struggling with reading comprehension, that they did not have the resources, staff or facilities to deliver interventions to students with poor reading comprehension and that they wanted to have access to the resources after the project, should the intervention prove to have a significant effect on reading comprehension.

A meeting was arranged with all SENCOs who expressed an interest in being involved in the project in order to go through the information pack. SENCOs were then asked to read through the information and return a signed copy, along with a letter signed by the Head Teacher.

Table 11: Demographic information about the students participating in the study was collected from the schools.

	This Study	National Average (Department for Education, 2018)	Percentage Difference
Mean Age	11.4 years	NA	NA
% of students in Year 7	73	NA	NA
% of students in Year 8	27	NA	NA
% Male	63	NA	NA
% Female	37	NA	NA
% of students eligible for Free School Meals (FSM)	11.9	13.6	1.7
% of students with English as an Additional Language (EAL)	12.2	16.6	4.4
% of students with a statement of special educational needs or Education and Health Care Plan (EHCP)	3.1	2.9 (EHCP)	0.2

Table 11: Demographic information about the students participating in the study and how these compare to national averages (where applicable). NA – not applicable

The demographic characteristics of the pupils involved in this study are influenced by the geographical constraints of the study and the cognitive profile of the students who had a reading comprehension impairment. Despite the potential for significant differences, the sample of pupils included in the study had characteristics that were broadly representative of other groups of Year 7 and 8 students in secondary schools in the UK. All students were taught in mainstream classrooms in mainstream schools following the English National Curriculum (Department of Education, 2014).

The participants received the interventions while in Year 7 or 8 (aged between 11 - 13 years old), meaning that there was a difference in the age of the participants and the amount of education that they had received at the point at which the intervention began. The intervention took place between February 2017 and December 2017 with all students in the oral language and text-based intervention groups receiving the intervention at the same time. The timing of the programme ensured that there was no break in the programme over the longer summer holidays.

The schools that the participants attended were mixed co-educational secondary schools that taught students from the age of 11 to 18, the average number of pupils attending the schools were 1,087, and four of the six schools were a member of an academy of schools. The Indices of Deprivation related to small areas in England indicate that on average the areas in which the schools are located are ranked 27,470 out of 32,844 small-areas in England, where 1 is the most deprived. This means that on average the areas in which the schools were located rank in the top 20 per cent of the least deprived small areas in the country. According to the Income Deprivation Affecting Children Index (IDACI), on average the areas in which the schools are located are ranked 23,788 out of 32,844 small-areas in England, where 1 is the most deprived. These findings are consistent across the different measures of deprivation, including income (8 decile), employment (8 decile), education and skills (8 decile), health and disability (9 decile), crime (7 decile), barriers to housing and services (6 decile) and living environment (8 decile). Therefore, according to the IDACI, on average the areas in which the schools were located rank in the top 30 per cent of the least deprived small areas in the country (Noble et al, 2019).

3.5.3 Materials

3.5.3.1 Screening materials

A range of different standardised assessments were used for screening and at pre-intervention (T1) and post-intervention (T2), and these have been summarised in the table 12 below.

Table 12: A table to show the tests that were carried out at pre-intervention (T1) and post-intervention (T2* NB: Only the standard score for word recognition and reading comprehension were collected and used for analysis

Screening	Pre-intervention (T1)	Post-intervention (T2)

• Lucid Exact, GL Assessment*
  ○ Word recognition
  ○ Reading comprehension
  ○ Reading speed
  ○ Spelling
  ○ Typing to dictation
  ○ Handwriting to dictation
 	
• School C (Lucid Exact data unavailable)
  ○ The Wechsler Individual Achievement Test for Teachers (WIAT 111 – UK Wechsler, 2004)
  ▪ Reading Comprehension
  ○ Test of Word Reading Efficiency 2 (TOWRE-2; Wagner, Torgesen and Rashotte, 2011)
  ▪ Sight Word Reading Efficiency (SWRE) (word reading)
  ▪ Phonemic Decoding Efficiency (PDE) (non-word reading)
  ▪ Total Word Reading Efficiency SWRE + PDE)
	• York Assessment of Reading for Comprehension (YARC)
	<u>Form A</u>
	  ○ Single word reading
	  ○ Reading comprehension
	  ○ Summarisation
	  ○ Reading fluency
	• Wide Range Intelligence Test (WRIT)
	  ○ Vocabulary
	  ○ Verbal Analogies
	  ○ Verbal IQ
	• Motivation to Read, Revised Profile (MPR-P)
	  ○ Perceived value of reading
	  ○ Self-concept as a reader
	• Wechsler Individual Achievement Test - Second UK Edition (WIAT 11) Numerical Operations sub-test
		• York Assessment of Reading for Comprehension (YARC)
		<u>Form B</u>
		  ○ Single word reading
		  ○ Reading comprehension
		  ○ Summarisation
		  ○ Reading fluency
		• Wide Range Intelligence Test (WRIT)
		  ○ Vocabulary
		  ○ Verbal Analogies
		  ○ Verbal IQ
		• Motivation to Read, Revised Profile (MPR-P)
		  ○ Perceived value of reading
		  ○ Self-concept as a reader
		• Wechsler Individual Achievement Test - Second UK Edition (WIAT 11) Numerical Operations sub-test

The students were first identified by the school's SENCO, and it was requested that SENCOs use the strict criteria of a "reading comprehension standard score below 90 and a word reading standard score of above 90 a difference in standard scores for reading comprehension and word reading equivalent to at least one standard deviation" (Snowling et al., 2009; 187). Five of the six schools had already used the computer programme 'Lucid Exact' by GL Assessment to screen all the pupils in their school in years 7 and 8, and this data was used to identify the individual students who met the specified criteria. Lucid Exact is a computerised programme designed to assess word recognition, reading comprehension, reading speed, spelling and writing to dictation (typing speed and handwriting speed) for individuals aged between 11 and 24 years.

The word recognition sub-test is a timed test requiring students to match spoken and written forms of words, thus testing participants' ability to map phonology to orthography. Each of the words is first spoken, and the student is then presented with six words on the computer screen that have been selected due to their lexical and phonological similarities. For example, the word 'century' is spoken, and the words presented to the students on the screen are 'century', 'centre', 'sanctuary', 'centrally', 'scented', 'central'. The student selects the word that they think is correct by clicking on it using the computer mouse as quickly as possible, and students are given a maximum of five seconds per word to respond.

The reading comprehension sub-test involves reading a passage of text and answering seven multiple choice questions about the passage requiring literal and inferential reading comprehension skills to answer the questions correctly. The total time of the reading comprehension sub-test is ten minutes, there are five passages of text and each has between 104 and 210 words. There are no restrictions on the time spent on each passage, and students can refer back to the text when answering the questions.

Validation studies for Lucid Exact are limited, for example tests for validity and

reliability have been carried out with just 103 students in four different schools between 2010 and 2011. The company states that "all tests in Lucid Exact correlate significantly with equivalent conventional tests that are in regular use for exam access assessments, evidencing the validity of the tests in Exact" (www.Luicd-Reserach.com,). However, in the report the correlation values that they provide for reading comprehension are compared with the Test of Word Reading Efficiency (TOWRE) (r = 0.51), which is a test for single word reading and phonemic decoding efficiency, rather than reading comprehension. It is also important to demonstrate that the comprehension questions are a measure of reading comprehension level, rather than background knowledge, and this is an aspect of content validity that is not considered in the validity studies. For these reasons, it is difficult to ascertain the reliability and validity of Lucid Exact as a form of literacy assessment. Despite these limitations, the data was used for screening purposes in this study, as Lucid Exact was being used across the six schools that had agreed to participate in this study. It is probable that this form of assessment is used by SENCOs as it can be delivered in large groups without a specialist assessor being required, and is therefore convenient when testing a large number of students on entry to the school. Due to the identified limitations of Lucid Exact, standardised assessments with high validity and reliability were later used by the researcher to collect the data before and after the intervention for analysis in this research.

The limitations of the test may provide a partial or complete explanation of why sixty students who were initially selected by SENCOs did not meet the inclusion criteria when tested by the researcher at T1, as all these students had a word reading standard score below 90. The data for these students were not used in the study, however, as the school SENCO had identified these individuals as students who would benefit from the study, the students received the intervention alongside the students in the waiting list control group.

One school (school C) that volunteered to be part of the study did not have any data on the literacy skills of pupils in their school, and this school did not offer any regular literacy interventions to their students. As interventions were not normally delivered to students in School C, it was considered that delivering a reading comprehension intervention in this school could be particularly beneficial for these students. Thus, School C selected fifty students who they thought had poor reading comprehension based on teacher judgement. The researcher then carried out screening assessments within the school to ascertain the standardised scores for word recognition and reading comprehension for these students, as Lucid Exact is a computer software package requiring a subscription that School C could not afford to purchase. Students in School C were screened using a different standardised assessment to the one used at T1, to avoid any improvements in the score at T1 from the effects of repeated testing, for example due to students remembering the passages or answers to the questions.

In School C, the Wechsler Individual Achievement Test for Teachers (WIAT 111 – UK Wechsler, 2004) was used as a screening tool to assess reading comprehension. This standardised assessment includes a range of reading passages and sentences that can be read either silently or aloud. They are able to refer back to the passage in front of them, and students respond orally to a number of questions. The questions require the student to identify the main idea in the text, identify specific details, make inferences and define vocabulary using context clues. A reading comprehension standard score is calculated based on the total number of questions answered correctly in five passages of text. The Test of Word Reading Efficiency 2 (TOWRE-2; Wagner, Torgesen and Rashotte, 2011) was used as a screening tool to assess single word reading in School C.

Thirty-two students from School C did not meet the criteria for inclusion into the

study as they had a word reading standard score that was lower than 90. This meant that the percentage of students who met the criteria for inclusion in School C was 36%, which was lower than the 88% of students who met the criteria for inclusion from the other schools combined. This provides an indication that using Lucid Exact data for screening, rather than teacher judgement, allowed more students to meet the criteria for inclusion in the study when tested at T1.

3.5.3.2 Assessment Battery at T1 and T2

A total of 279 students were initially selected from screening tests, however, informed consent for inclusion in the intervention study was obtained from only 150 students. Therefore, 150 were tested at T1 to provide baseline data.

The York Assessment of Reading for Comprehension (YARC) (Stothard, Hulme, Clarke, Barmby, and Snowling, 2012) was used to measure reading rate, reading accuracy, reading comprehension, reading fluency, summarisation skills and single word reading. The Wide Range Intelligence Test (Glutting, Adams and Sheslow, 2000) was used to measure vocabulary and verbal analogies. Motivation to Read, revised profile (MPR-P) (Malloy et al., 2013) was completed by students as a measure of their perceived value of reading and self-concept as a reader. The same tests were completed prior to the intervention and immediately after the intervention. To avoid practice effects on the YARC, different but comparable passages of text were used before and after intervention.

The full battery of assessments took one hour per pupil to carry out, and the tests were conducted individually in a quiet room in the participant's school. The first test that was delivered was the Motivation to Read, revised profile (MPR-P) (Malloy et al., 2013), as this test facilitated a discussion with the student about their reading. It was hoped that this would

make the student feel more relaxed and at ease, hopefully enabling them to perform to the best of their ability, and to be confident in asking any questions they may have. The second sub-test that was administered was the single word reading sub-test from the YARC, and the outcome of this provided guidance to the assessor on the most appropriate passage level for the reading comprehension sub-test. Administration of the reading comprehension sub-test was followed by the summarisation sub-test and the reading fluency sub-test. The process of administering these sub-tests is described below.

3.5.3.2.1 York Assessment of Reading for Comprehension

The single word reading sub-test is untimed and requires students to read as many words as they can from a list of 70 words graded in terms of difficulty. The word reading sub-test was carried out to ensure that participants had a standard score for word reading of 90 or over, thus aiming to exclude students with dyslexia or generally poor readers from the study. Twenty-eight students who were tested did not meet the strict inclusion/exclusion criteria due to their single word reading standard score being below 90. As these students had been identified by the school SENCO as requiring support with reading comprehension and they met the criteria using Lucid Exact screening data, it was considered appropriate to exclude the testing data of these students from analysis, and to include the students in a separate waiting list control group.

The passage that the student read for the reading comprehension sub-test was based on their raw score in the single word reading sub-test, and the guidance given on the appropriate passage to select is summarised in Table 13 below. It is important to note that the assessor uses this guidance at their discretion. For example, a student with a single word reading test raw score of above 42 who is struggling to read the words in the level 1 passage could be asked to read the supplementary passage, if this is deemed more appropriate for the

individual. Prior to the intervention (T1), the supplementary passage was used with 27 students (18%), level 1 was used with 89 students (59%), and level 2 with 34 students (23%). After the intervention, the supplementary passage was used with 22 students (15%), level 1 was used with 95 students (64%) and level 2 with 31 students (21%).

Table 13: The single word reading test scores advised for each reading comprehension passage

Single Word Reading Test (SWRT) Raw Score	**Passage Level**
0-42	Supplementary
43-51	Level 1
52-70	Level 2

In the YARC reading comprehension sub-test every question had been independently categorised into one of ten categories, and each category represents an important aspect of reading comprehension. These categories are summarised in the table 14 and discussed below.

Table 14: A table summarising the aspect of reading comprehension that the questions addressed

Cohesive Devices
Knowledge-based Inference
Evaluative Inference
Elaborative Inference
Predictive Inference
Literal Information
Vocabulary
Figurative Language
Sequencing
Summarisation

One of the aspects of reading comprehension that were assessed include the ability to make inferences that rely on linguistic cues such as pronoun resolution (cohesive device)

and inferences that are necessary for making a coherent representation of the passage (knowledge-based inferences). Other inferences that are assessed relate to the emotional outcome of events and the consequences of actions (evaluative inference), add to the mental representation of the passage (elaborative inference) and involve making predictions about future events (predictive inference). There are some questions that do not require an inference to be made because the answer is written in the text (literal information). In some questions the most important aspect for correctly deriving the answer is to understand a keyword (vocabulary). Other questions require the use of non-literal words to convey a sense beyond that associated in their usual meaning (figurative language), or focus on assessing the understanding of the sequence of events, the order of ideas or the passing of time (sequencing). The final question for each reading comprehension passage assesses the ability of students to give a short summary of the passage, making clear what the main priorities/events were (summarisation). In the summarisation question, students are not able to look back at the passage, and are asked to '*give a short summary of the passage, making clear what the main events are'*. The summaries are scored based on the total number of statements that the student is able to correctly recall about the passage.

This detailed level of analysis makes it possible to accurately pinpoint the specific aspect/s of reading comprehension that the student may have difficulty with. However, as the assessment involves using only two passages, the categorical differences must be analysed with caution, with an understanding that this is only one source of information out of many that should be used when drawing conclusions about the difficulties faced by an individual child.

The assessment also includes a supplementary passage, which has been designed for students with reading difficulties as it is includes simpler vocabulary and fewer words. The supplementary passage follows the same format, although the questions are designed to address specific objectives from the comprehension strand of the *Primary National Strategy in*

England (DfES, 2006). Students would read this passage when their Single Word Reading Test raw score is below 42 (i.e. below the age equivalent of ten years).

Standardisation of YARC occurred in 2009, and involved 1230 students (including those with SEND) who were randomly selected from 39 schools covering a range of socio-economic and geographical backgrounds. The reliability measures (Cronbach's alpha) for the YARC measures of reading comprehension range from 0.76 (for the supplementary passages) to 0.90 (Form A Level 1) and for summarisation skills range from 0.65 (Form A Level 1) to 0.74 (Form B Level 1). The YARC includes a Form A and B so that different texts are used to ascertain the baseline (T1) and outcome level (T2). This reduces the likelihood that improvements occur as a result of test effects, such as students remembering the answers to certain questions or as a result of learning that has occurred simply from having done the test.

All pupils in this research project were able to access one of the three passage levels provided, meaning that a standard score was collected for all pupils. This was in contrast to the REACH study that found 'the reading skills of some pupils were too low to record any scores and other pupils were only able to complete one of the two passages' (Education Endowment Foundation, 2016; 20). For this reason, REACH decided to remove the YARC reading comprehension baseline score from their analysis. One possible reason why there were no students in this study who were unable to access one of the YARC passages was that the students included in this study were first screened to ensure that their word reading standard score was above 90. In contrast, the REACH study selected those students with attainment levels in English below Level 4 (the level expected at the end of primary school; see Department of Education, 2014) and focused on generally poor readers (with a single word reading standard score of 91 or below, measured using the Single Word Reading Test (SWRT; Foster and National Foundation for Educational Research, 2008).

3.5.3.2.2 Wide Range Intelligence Test (WRIT)

The Wide Range Intelligence Test (WRIT; Glutting, Adams and Sheslow, 2000) is used as an assessment of underlying verbal ability. It is an individually administered test, with sub-tests that include vocabulary and verbal analogies. These sub-tests enable expressive and receptive vocabulary to be assessed. Tests for receptive vocabulary involve assessing the understanding of word meanings, where the student has to choose the picture or sentence that best describes the meaning of a particular word. In contrast, expressive vocabulary tests require the child to name pictures of objects or to give verbal definitions of particular words.

The vocabulary sub-test requires students to verbally define an orally presented word, and there is no time limit given for students to make their responses. This sub-test provides a measure based around expressive vocabulary skills, which is important because being able to provide a definition of a word requires a more detailed understanding of that word's meaning than is assessed in a test of receptive vocabulary. In tests of receptive vocabulary, it is possible that the correct representation of a word can be selected based on a less well-specified knowledge, or even through a process of eliminating alternative pictures or sentences. Therefore, a test of expressive vocabulary skills can give an indication of the depth of vocabulary knowledge (the richness of knowledge about individual words), as well as vocabulary breadth (the number of words in a reader's lexicon), both of which have been shown to contribute to students' reading comprehension (Binder, Cote, Lee, Bessette and Vu; 2017).

The verbal analogies subtest requires students to orally provide a word that best completes a verbally presented analogy, such as 'Moon is to earth, as earth is to…', and this is a measure of both receptive and expressive language, as well as verbal reasoning and general knowledge. The scores for these two sub-tests are then combined to make a composite score for Verbal IQ, defined as "a measure of verbal information, acquired skills and knowledge –

each highly dependent on an individual's exposure to formal academic training, western culture and the English language" (Glutting, Adams and Sheslow, 2000; 1). A Verbal IQ standard score of below 84 was used to exclude the data of participants in the study who had broader verbal impairments. This led to one student being excluded from the study before the randomisation of students to groups was carried out. As the student had been identified by the school SENCO as someone who would benefit from receiving an intervention, the student was included in a separate waiting list control group and their data was not included in the analysis.

3.5.3.2.3 Motivation to Read, Revised Profile (MPR-P)

Students' perceived value of reading and their self-concept as a reader was assessed using the Motivation to Read, revised profile (MPR-P) (Malloy et al., 2013). The questionnaire is based on research that explores the relationship between motivation and reading comprehension (Taboada, Tonks, Wigfield, and Guthrie, 2009). Cronbach's Alpha (1951) was used to assess the internal consistency of the scale indicating $\alpha = .87$ for the full scale, $\alpha = .85$ for the value subscale, and an $\alpha = .81$ for the self- concept scale, suggesting that the items have relatively high internal consistency. The authors of the profile define the value of reading as the extent to which reading is valued, in terms of "how personally interesting it is, how important the task is deemed to be, and how the successful completion of the task serves future needs" (*ibid;* 280). Self-concept as a reader is defined as the extent to which students engage in reading tasks and strategic reading practices with enthusiasm and interest (Malloy et al., 2013). MPR has been used in a number of literacy research projects on student motivation for reading (Shaaban, 2006; Applegate and Applegate, 2010; Quirk, Schwanenflugel, and Webb, 2009; Marinak and Gambrell, 2010), and consists of twenty self-report questions with a four-point scale for student responses. For example, one question states: "*I think*

libraries are _____: 1) a really great place to spend time; 2) a great place to spend time 3) a boring place to spend time 4) a really boring place to spend time". To increase the reliability of student responses, the items were variably scaled so that responses to some questions were listed in order from least motivated to most motivated (scored 1-4), and other questions listed responses from most motivated to least motivated (scored 4-1). A score of 4 indicated a high reading self-concept/value of reading. The questions are completed in a conversational interview, with the assessor alongside the student. This semi-structure questionnaire format is to enable the researcher to more fully understand the students' perception of reading.

The odd-numbered items indicated the students' perceptions of themselves as a reader, including their perceived ability to successfully negotiate different aspects of reading for meaning, including the extent the child can implement strategies effectively, and the extent to which they can accurately recall and explain what they have understood from the text. For example, item 7 asks students how much they understand when they read by themselves, and items 17 states, "When I am in a group talking about books I have read, I [*hate*; *don't like*; *like*; or *love*] to talk about my ideas." The even-numbered items on the reading survey target students' perceptions of value of reading. For example, item 2 states, "Reading a book is something I like to do, *never; almost never; sometimes; often"*, and item 12 states, "I think becoming a good reader is, *not very important, sort of important, important, very important*".
No students were excluded from the study following administration of the Motivation to Read, Revised Profile (MPR-P).

There are some limitations of the Motivation to Read, Revised Profile (MPR-P), including that the reliability testing was carried out with only 281 students from three schools in the mid- Atlantic and Southern regions of the United States, and that there is no specific reference to considerations of socio-economic, geographic and ethnic diversity or age within this small sample size.

3.5.3.2.4 Wechsler Individual Achievement Test - Second UK Edition (WIAT 11) Numerical Operations

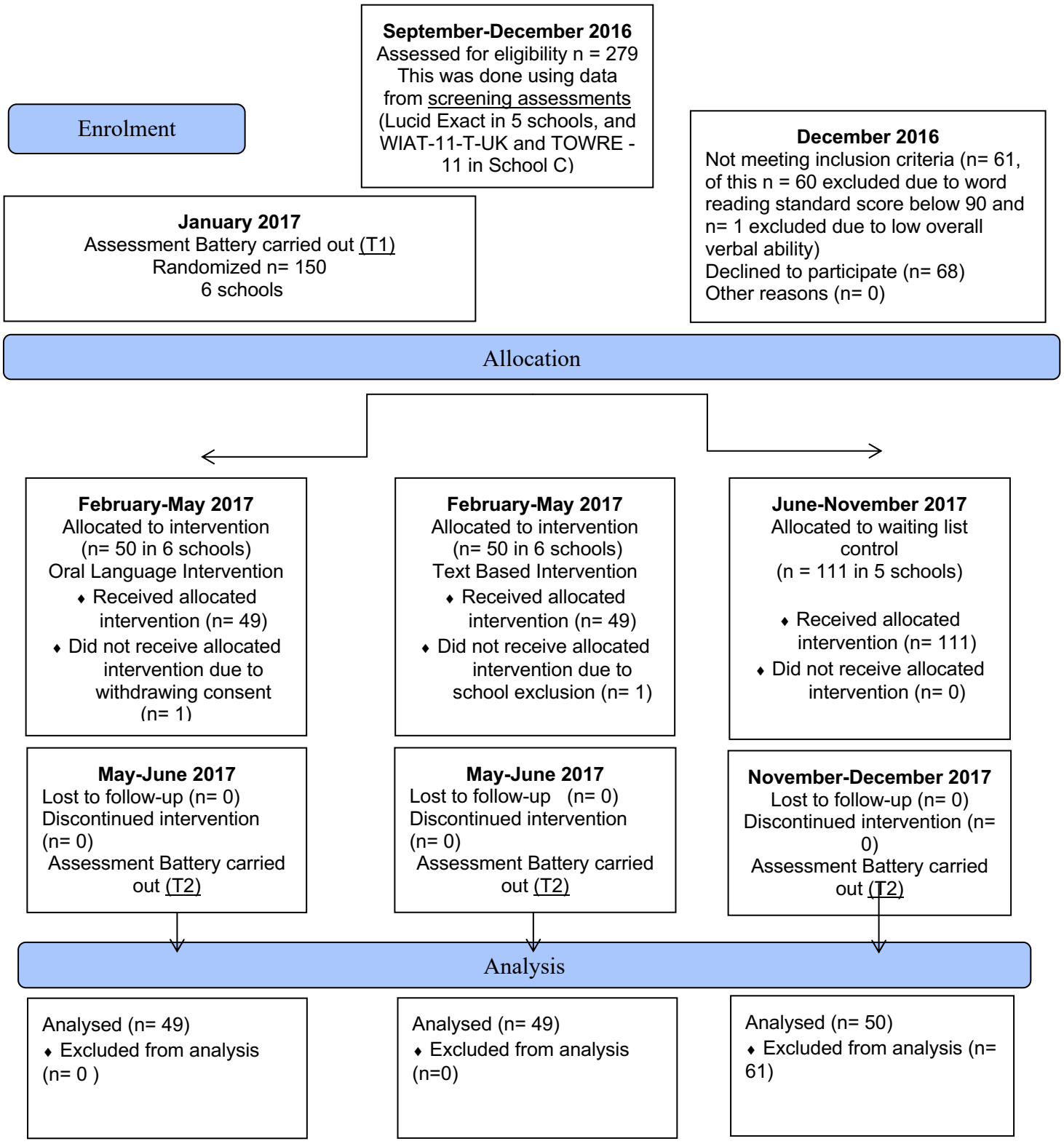
The Numerical Operations sub-test of the Wechsler Individual Achievement Test-Second UK Edition was carried out in order to allow an analysis of whether any improvements shown by the students after receiving the interventions were generalised, or specific to the skills that were taught as part of the intervention programme. The Numerical Operations sub-test assess the ability of students to identify and write single- and double-digit numbers, count using 1:1 correspondence and solve written calculation problems involving addition, subtraction, multiplication and division.

3.5.3.3 Procedure for measures

Completion of the YARC and Motivation to Read revised profile (MPR-P) (Malloy et al., 2013) took approximately thirty-minutes per pupil. This provided a good opportunity for the student to have a short break to reduce the possibility of order effects due to fatigue. The Wide Range Intelligence Test vocabulary and verbal analogies sub-tests were then administered, followed by the numerical operations sub-test of the Wechsler Individual Achievement Test - Second UK Edition. Prior to commencing the assessment stage, it was decided that if any student was unwilling to complete part or all of the assessments, they could continue to receive the intervention, but their data would not be included in the study. In practice, all students completed all elements of the sub-tests in the assessments. The details of participant recruitment, allocation to intervention groups and flow of participants through the study is summarised in the CONSORT diagram (Figure 9) (Moher *et al.,* 2001).

Figure 9: Participant recruitment, allocation to the intervention groups and flow of participants through the study

Adapted from CONSORT 2010 Flow Diagram from http://www.consort-statement.org/consort-statement/flow-diagram.



Recruitment and consent bias were reduced by obtaining parent and pupil consent before randomisation, so that non-consenting people were not included in the trial. Any refusal of participant consent did not introduce bias into the study as this occurred before randomisation and non-consenting students were not included in the trial. However, this may have reduced the extent to which the sample was representative of the population of interest. The students who met the inclusion criteria and gave consent to be included in the intervention (*N* = 150, mean age = 11.8 years old) had an average reading comprehension standard score of 81.18 (lowest = 71; highest = 90) and average word reading standard score of 96.25 (lowest = 90; highest =123).

During the research, one student in the oral language intervention decided to drop out as they did not want to miss their timetabled lesson to receive the intervention, and one student in the text-based intervention was asked to leave the group due to his poor behaviour impacting the amount of work that could be covered in each session. Although the loss of two students (1.82% of participants) is small in comparison with other studies, it is potentially significant due to the possibility of selection bias, which can occur even if the rate of attrition is the same in both groups. It is significant as participants that leave one group may be systematically different from those who remain and are quite likely to be different to each other (one was keen not to miss his lessons and the other was excluded for poor behaviour). These drop-outs may have some other known or an unknown co-variate that may influence the improvement made in their reading comprehension standard score. As this co-variate is unknown, we cannot use statistical approaches such as regression analysis to adjust for its effect.

The effects of attrition bias were minimised because the attrition rates were similar in both groups. Furthermore, the two students who left (one in week two and one in week five of the intervention) gave consent for their outcome data to be measured, and whilst these

students will give a slightly more conservative estimate of the effects of the intervention, it is preferable to attrition bias, as this can change the direction of effect. This could lead the analyst to conclude that the intervention had a positive effect when it may have had a detrimental effect. The intention to treat hypothesis (Hollis and Campbell, 1999) also states that once a participant has been randomised, for analysis their data should be included in the group they were allocated to, even if they drop out of the intervention. An alternative method that can be used to deal with attrition bias is paired randomisation of students (Farrington and Walsh, 2005). This methodology ensures that if one of the pairs is lost to follow-up, the remaining student in the pair is dropped to limit the effects of attrition bias. This methodology was not adopted due to the small anticipated attrition rate and because removing the remaining student of the pair was inappropriate and would not correct for imbalances that have occurred in the unmeasured confounders.

RCTs are at risk of bias from a range of different factors and variables (Ainsworth et al., 2015). Table 15 summarises the steps that have been taken in this RCT to reduce the potential bias.

Table 15: A summary of steps taken to reduce bias in this RCT

Factor	Description of measures taken in this study
Inclusion Criteria	● The participants were first screened by the school using Lucid Exact, this provided a standard score for word reading and reading comprehension ● As Lucid Exact screening data was not available for participants in School C, WRIT-11-T-UK and TOWRE-11 were used to provide word reading and reading comprehension standard scores for screening purposes ● 68 students declined to participate in the study by not providing parent and student written consent. This refusal of participant consent did not introduce bias into the study as this occurred before randomisation and non-consenting students were not included in the trial, although it may have reduced the extent to which the sample was representative of the population of interest ● Demographic information about the sample population was collected to inform conclusions about the generalisability of the findings ● Students who did not meet the inclusion criteria when tested at T1 were included in the waiting list control, and their data was not included in the data analysis
Randomisation	● Students were randomly allocated to one of three groups taking into account

	age, gender, general verbal ability and baseline reading comprehension standardised score as important predictors of outcome ● A stratified form of randomisation was undertaken to ensure that these variables were balanced between the groups
Control Group	● The inclusion of waiting list control group helped to inform conclusions about the extent to which improvements would have occurred anyway, as part of natural development or regular schooling
Sample size	● A minimum sample size of 150 students was calculated to ensure that any differences found between the interventions and the control group had not occurred by chance. This reduces the chance of Type 11 error, which occurs when the trial is too small and the conclusion that there is no difference between the groups is made when in reality there is a difference
Study participants comparable to those for whom the intervention is intended	● The criteria for involvement in the study was clearly specified as a word reading standard score above 90 and a reading comprehension standard score below 90 with a standard deviation between the two measures of 1 or more (measured using the York Assessment of Reading Comprehension) ● Students were drawn from a range of different state schools in South East England
Drop-outs from the study	● Two students did not receive the full intervention, and the data for these 'non-active' participant was collected and included in the data analysis to avoid attrition bias. This is because dilution bias tends to underestimate the effectiveness of a treatment, which is preferable to selection bias, as this can change the direction of effect
Assessment measures	● The primary measure (Reading comprehension (YARC)) and secondary measures (Word Reading (YARC); Vocabulary (WRIT); Reading self-concept and Motivation to Read (MPR-P)) were clearly defined ● Standardised assessments were used to give an indication of the generalisability of the findings, as this will also avoid the possibility of bespoke tests being too similar in their content to the teaching sessions (i.e. avoid teaching to the test)

3.4 Delivery of the intervention programme

The interventions were delivered by the same trained specialist teacher who was also the researcher. The teacher was observed delivering at least one of the eight lessons in each school by an expert who was either an independent specialist teacher or independent SENCO. Following each observation, feedback was discussed and noted by the teacher. A manual that included a script was used to ensure that the programme delivery was consistent for all groups, although it is acknowledged that it was sometimes necessary to deviate from the script in order to maximise the learning of students involved in the study. A consistent approach in who delivered the lessons contributed to ensuring treatment fidelity. It also

minimised spill-over effects. For example, the REACH programme evaluation suggested that some Teaching Assistants involved in the delivery of their reading intervention used the resources and techniques with pupils in the control group. The report notes that "these pupils were not supposed to receive the REACH interventions, and the fact that they did makes it harder to estimate the size of the impact accurately" (REACH, 2016; 4).

The structure of each intervention was adapted from the randomized control trial conducted by Clarke, Snowling, Truelove and Hulme (2010). Dr Paula Clarke, an Associate Professor in Childhood and Inclusive Education, shared the resources from the REACH study, and these resources were adapted for use in the pilot study. Student and teacher feedback following the pilot study led to changes in the resources to ensure that they were engaging, interactive and accessible. Furthermore, re-attribution training was added at the start of each session with the aim to address students' perceptions of themselves as a reader and the value of reading. The parallel programmes were designed so that they were identical in their duration, including the time spent listening or reading text.

In the text-based intervention program, all teaching involved working with written text, comprising metacognitive strategies, developing inference from written text and reciprocal teaching with text. All teaching in the oral language comprehension program involved working with spoken language, and comprised of targeted activities to develop vocabulary, reciprocal teaching with spoken language and developing figurative language. The overall structure of each lesson was carefully planned to ensure a balance of the most appropriate strategies for improving reading comprehension. Care was taken to make the programmes as equivalent as possible whilst assessing the mediating role of vocabulary instruction, which was only explicitly delivered within the oral language programme.

Table 16: A table summarising the differences between the pilot and main intervention study

Participants	• The number of pupils involved in the study increased from 60 to 150. • Pupils were selected from one school in the pilot study and six schools in the main intervention study. • In the pilot study, 60% of the participants were boys and in the main study 63% were boys.
Measures	• Screening data was used to select 279 pupils who would be invited to take part in the study. In the pilot study, 64 pupils were selected following screening. • In the main study, the Motivation to Read, Revised Profile (MPR-P) was used at T1 and T2 to provide a measure of the student's perceived self-concept and perceived value of reading. This was not measured in the pilot study.
Materials used	• Whilst two books (The Tales of Beedle the Bard by JK Rowling and Brock by A McGowan) were used in the pilot study, one book was chosen for the main intervention study. This book was called *The Last Soldier* by Keith Gray. The book was chosen as it has just 85 pages, which meant that it could be completed in the time allocated. The book also avoids complex language structures and has a linear plot, which makes it easier for students to follow in each session. One book was used in order to simplify the programme and facilitate a deeper exploration of reading comprehension strategies. • In the main study, students were given a booklet of resources for each session in the programme, with a separate resource booklet for students in the oral language and text-based intervention programme. This enabled students to see what they had covered in previous sessions and what they would go on to cover. • The resources provided appropriate visual images and multisensory learning techniques to make the sessions interesting. For example, students were introduced to a character for each reciprocal teaching strategy, and a variety of objects and costumes were used for each character to help students remember the reciprocal teaching strategies (e.g. a cow boy hat for 'Sammy the Super Summariser').
Delivery of the intervention	• In both the pilot study and the main study, the interventions were delivered in small groups. • The duration of the intervention was increased from twenty minutes to one hour, and from four weeks to eight weeks. • For the main study, training was added in the first session of the programme to help students facilitate better discussions, especially during the reciprocal teaching strategies sections of the session. Resources were included in the booklet to remind students of ways in which to develop independent learning. • Attribution re-training was added into the programme, focusing on developing student self-efficacy. • A 'partnership agreement' was completed with each group at the start of the first session to address commitment to the programme, to agree on how the group wanted to interact and support each other and to address any potential areas for miscommunication with the group. • Greater scaffolding of learning through use of a script and resource booklet for each lesson was introduced in the main study. • The number of students in each group was increased to facilitate more effective collaborative learning in the main study.

3.4.1 Structure of the intervention programmes

An example of the session outline for the Oral Language intervention and Text Based intervention are outlined in the tables 17 and 18 below.

Table 17: An example of the session outline for the Oral Language intervention. This was the second session in the programme
An example of the equivalent session outline for the Text Based intervention

Time	*Component*	*Objectives*
2.5 mins	Introduction and Attribution concept/strategy	➢ Introduce the content and structure of the session ➢ Use the examples and findings from the questionnaire completed prior to the intervention to discuss and analyse student attitudes towards reading and aspects of reading that they find difficult
10mins	Vocabulary	➢ Revise words from the previous session ➢ Introduce and discuss new words ➢ Complete the mind map for each word using the structure provided
30mins	Reciprocal Teaching with spoken language	➢ Introduce and practise summarisation strategy ➢ Complete the 'Title Quest' task ➢ Revise and practise clarification strategy ➢ Use the questioning strategy ➢ Revisit predictions made at the end of last session
5mins	Spoken Narrative	➢ Revise story structure using mountain analogy ➢ Continue visual summary of the story so far ➢ Make predictions about the next part of the story
3 mins	Figurative Language	➢ Play with words and their meanings using the cards provided
2.5mins	Plenary	➢ Recap ➢ Reflection

Table 18: An example of the equivalent session outline for the Text Based intervention. This was the second session in the programme

Time	***Component***	***Objectives***
2.5 mins	Introduction or re-cap from previous session and introduce attribution concept/strategy	➢ Introduce the content and structure of the session ➢ Use the examples and findings from the questionnaire completed prior to the intervention to discuss and analyse student attitude towards reading and aspects of reading that they find difficult
10mins	Metacognitive strategies	➢ Introduce and practice the re-read and think aloud strategies (write summary of this strategy on prompt card)
30mins	Reciprocal teaching with text	➢ Introduce and practise summarisation strategy ➢ Complete 'Title Quest' task ➢ Revise and practise clarification strategy (using card from the pack) ➢ Complete the questioning strategy task ➢ Revisit predictions made at the end of last session
5mins	Written narrative	➢ Revise story structure using mountain analogy ➢ Continue written summary of the story so far ➢ Make predictions about the next part of the story
3 mins	Inferencing from text	➢ Introduce and practice bridging as a concept to connect information between sentences (use modelling, examples and visual clues to reinforce the importance of building bridges and making links to form a chain of ideas)
2.5mins	Plenary	➢ Recap ➢ Complete written reflection using the structure provided

The structure of the interventions ensured a range of component reading skills were covered for both the text-based and oral language intervention. The programmes followed the principles of distributed practice, which requires distributing multiple practice or study opportunities rather than learning new information in a single study session. Evidence in a wide range of tasks, from studies involving a basic memory of words (Cepeda, Pashler, Vul, Wixted, and Rohrer, 2006) to tasks that require engagement with more complex reading material (Krug, Davis, and Glover, 1990), indicate that the positive effects of distributing practice are robust. To ensure that the components of the programs followed the principles

of distributed practice, and built over time through a repetitive structure, a table was drawn up for each intervention programme. (Table 19 and 20).

Table 19: An example from the oral language programme of the planning used to ensure that distributed practice was built into the intervention programmes (adapted from Hulme, Truelove, Snowling and Clarke, 2013)

	Week Number							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Vocabulary								
Graphic Organisers	■	■	■	■		■		■
Multiple Context Learning					■		■	
Illustrations	■	■						
Verbal Reasoning			■	■			■	■
Mnemonic Strategies					■	■		
Reciprocal Teaching with Spoken Language								
Clarification	■	■	■	■	■	■	■	■
Summarisation	■	■	■	■	■	■	■	■
Prediction			■	■		■	■	
Question Generation				■	■			■
Schematic Representation		■			■			■
Graphic Organisers/Images	■		■	■		■	■	
Figurative Language								
Idioms	■	■	■	■	■	■	■	■
Jokes/Riddles	■	■	■	■	■	■	■	■
Simile					■	■	■	
Metaphor							■	■
Spoken Narrative								
Sequencing	■							
Planning	■							
Opening		■						
Build Up		■						
Climax			■					
Problem			■					
Event				■				
Resolution				■				
Ending					■			
Presenting						■		
Reflection							■	■

Table 20: An example from the text-based programme of the planning used to ensure that distributed practice was built into the intervention programmes (adapted from Hulme, Truelove, Snowling and Clarke, 2013)

	Week Number							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Metacognitive strategies								
Re-read	■	■	■	■		■		■
Look Back					■		■	
Think Aloud	■	■						
Think in Pictures			■	■			■	■
Explain and Reflect					■	■		
Reciprocal Teaching with Text								
Clarification	■	■	■	■	■	■	■	■
Summarisation	■	■	■	■	■	■	■	■
Prediction			■	■		■	■	
Question Generation				■	■			■
Schematic Representation		■			■			■
Graphic Organisers/Images	■		■	■		■	■	
Inferencing from Text								
Coherence Inferences	■	■	■	■	■	■	■	■
Elaborative Inferences	■	■	■	■	■	■	■	■
Bridging Inferences					■	■	■	■
Evaluative Inferences					■	■	■	■
Written Narrative								
Sequencing	■							
Planning	■							
Opening		■						
Build Up		■						
Climax			■					
Problem			■					
Event				■				
Resolution				■				
Ending					■			

3.4.2 Duration and frequency of the intervention programmes

Each intervention session has the same basic structure and consisted of an hour each week for 8 weeks (8 hours of intervention per child). The duration of each session was determined following consultation with the schools involved and evaluation of the pilot project.

The total duration of the intervention was determined based on practical constraints and findings from previous studies in which there were statistically significant gains in reading comprehension skills over a relatively short period of time (e.g. Oakhill and Patel, 1991: three 20-minute sessions; Yuill and Oakhill, 1988: six 45-minute sessions; Dockrell et al., 2010: 7.5 hours of intervention). However, other studies have highlighted that their findings "strike a note of caution regarding the impact of language interventions of short or medium duration" (Haley et al., 2017; 78) (see also Dockrell et al. 2010). Although the duration of the intervention was increased from 4 weeks in the pilot study to 8 weeks in the main study, it is important to note that the total duration of the intervention was shorter than similar interventions studies. For example, the intervention programme delivered in the study by Clarke et al. (2010) involved 30 hours of intervention per child by a TA, and in the REACH study by Clarke et al. (2017) 35 hours intervention per child by a TA.

3.4.3 Selection of an appropriate book

The selection of an appropriate book that would be used for both interventions involved three main stages. Careful selection procedures were followed to ensure that the book used in the study was age appropriate, included a wide range of vocabulary, was accessible to struggling readers, had an engaging storyline and could be finished over the eight-week period. The first stage involved consulting Dr Paula Clarke who has conducted two randomised controlled trials on reading comprehension (Clarke et al., 2010; 2017). Following this, several experts on young fiction were consulted using informal semi-structured

interviews. Those consulted included school librarians, as well as students aged between 11 and 13, and other researchers in the field. Finally, a selection of books was graded, taking into account word length, sentence length, and grammar used within the text (from Hatcher, 2000). This was to ensure books were at an 'easy level' (books read with less than 95% accuracy by 11-13-year olds). 'The Last Soldier' by Keith Gray was selected, and the text in the book was divided into sections, with the tasks/activities designed around each section of the text that had been selected for each lesson. This ensured the activities were appropriate and facilitated an in-depth exploration of the text, including its narrative, structure and vocabulary. Both the text-based and oral language group read or listened to the same section of the book in each session. In both the oral language and text-based intervention the book was finished, meaning that the students had access to the same narrative and language.

Prior to any reading comprehension instruction, students in the text based and oral language programme were introduced to a specific re-attribution strategy or concept to help students understand and develop effective beliefs about their reading success and failure. The same strategy or concept was taught in the same way to both the oral language and text-based group. This was done in an engaging way with the use of an interactive activity, and the strategy was then referred to and used throughout the session as outlined in the script for that session. For example, at the start of session four, students were asked about the kinds of thoughts that they have when something is hard. After being introduced to the idea that we can have both positive and negative thoughts, they were asked to categorise a range of statements into either positive or negative under two headings. Later in the session, the teacher would link the students' success in the reading comprehension strategies to their self-talk, effort and effective use of strategies reinforcing what was covered in the re-attribution strategy taught earlier in that session. For incorrect responses, teachers would attribute failure to ineffective strategy use and, if required, direct the student to the reading

comprehension strategy card or re-teach the appropriate strategy to the student. A summary of the strategies used in lessons one to eight are included in Appendix 2.

3.5 Intervention Programmes

3.5.1 Oral Language Intervention Programme

3.5.1.1 Vocabulary Instruction

Each session in the oral language programme began with 'words of the day', which were selected from the text being studied. The new words were introduced via listening to a section of the book. The selection of the words was determined using the three-tier framework, ensuring that the focus of the vocabulary instruction was on second tier words (Beck et al., 2013). As previously discussed, second tier words are those that are likely to appear in a wide variety of texts and only infrequently in oral language (such as *circumstance, precede and retrospect)*, which means that students are less likely to encounter these words in spoken language. Typically, vocabulary instruction involves students looking up the meaning of words in a dictionary or requiring them to create a glossary of words (Scott et al., 2003; Watts, 1995). However, for students to build their vocabulary repertoires they must develop an interest and awareness of words (Beck et al., 2013). Therefore, the words for each session were taken from the text read in that session to ensure students used the context within the text to derive word meanings. This is important as providing directive contexts with surrounding descriptions helps to ensure that the precise meanings of words are clear (Quigley, 2017). Care was also taken to ensure that the words were unlikely to be part of a child's prior knowledge, that they appeared repeatedly in a text or a topic and as many as possible were interrelated and could be used to help children infer the meaning of other words.

The instruction process that took students through the process of deriving word

meanings was adapted from research by Goerss, Beck and McKeown (1999). The instructional sequence included five components, first starting with the text being read and paraphrased, then the student explaining what the text was about (i.e. establishing meaning of the text to prevent students from just focusing on the word). This was followed by the student providing an initial notion of the word's meaning, or some sense of what the word might mean along with a rationale for how the context could support their choice. The fourth step required the student to consider further possibilities, and whether the context would allow other potential meanings. This included exploring the etymology of the word, common word parts, common word families, more examples of the word in use and strategies to remember the word or concept. Reciprocal teaching strategies with spoken language (e.g. clarification) were often used to support vocabulary instruction at this stage, to ensure that students developed their word knowledge from a general sense of the word. The aim was to develop a wide and deep knowledge of word meanings, including their relationship to other words and metaphorical uses. This is consistent with the lexical quality hypothesis (Perfetti, 2007; Perfetti and Hart, 2001, 2002), which conceptualises how a greater depth in the knowledge of individual words (through training orthography, phonology, grammar and meaning) contributes to a student's ability to better understand what they read (Ouellette, 2006). Finally, the information that had been established through the dialogue was summarised, and information about the unfamiliar word was pulled together. This carefully structured process ensured that students received repeated exposure to the words to facilitate a deep understanding of them, and to optimise the use of strategies for students to become more aware of useful ways to transfer their knowledge of words and improve their understanding of new and unfamiliar vocabulary.

In week 1-4, 6 and 8, vocabulary instruction was supported with graphic organisers, such as mind maps, to explore the different meanings of a particular word, how that word can be used in a range of contexts and how the word can be used in a sentence. In the

remaining weeks (week 5 and 6), mnemonic strategies were used, as evidence indicates that this strategy is helpful for recall of information (Bulgren, Schumaker, and Deshler, 1994; Mastropieri, Scruggs, Bakken, and Brigham, 1992). One example of a strategy that was used is the keyword method (Atkinson, 1975), which is a two-stage procedure in which the student must first choose a word that they know that sounds like a salient part of the item to-be-learned (this is the keyword). In the second stage, the student must then encode a meaningful connection between the keyword and the vocabulary's word definition. This strategy helped students to develop better ways to encode information by relating new information to information that is already in their long-term memory.

3.5.1.2 Reciprocal Teaching with Spoken and Written Language

The second component of the programme involved students completing an activity based on the principles of reciprocal teaching (Palincsar and Brown, 1984) using the part of the text that they have just read or listed to. The taught sections in the reciprocal teaching with spoken language were parallel to the written component in the text-based programme, and as such the explanation below applies to both intervention programmes.

A number of researchers have provided broad reciprocal teaching frameworks for delivering reading comprehension interventions, which has included strategies such as self-questioning, visualising, evaluating, making connections and previewing (McLaughlin and Allen, 2002; Harvey and Goudvis, 2007; Keene and Zimmermann, 2007; Oczkus, 2004). The four reciprocal teaching strategies that were chosen for these intervention programmes were predicting, questioning, clarifying and summarising, with at least one of these strategies informing the activities in each session.

The introduction of each reciprocal teaching strategy to the group was teacher-led. First, the teacher explained the strategy, including why they were learning the strategy, the

rules that would help them learn the strategy and the context in which the strategy could be applied. The teacher then provided sentence starters to help the students when they started to use the strategy, and this was followed by an explanation of how they would be learning the strategy. One strategy was used in each activity, although there are clear overlaps in the strategies, for example effective questioning required the student to clarify words or ideas within the text. Furthermore, it is hoped that eventually students will use these various approaches in combination as this is the goal of a multiple-strategy approach. Over time, the teacher monitored the success with which students were employing the strategies, provided scaffolding, feedback and further modelling of the strategies to help facilitate a student-led dialogue about the text. This required the students to take an active role in recognising and resolving discrepancies in their understanding of text through collaborating to form and test conjectures, offering and critiquing explanations in order to arrive at a better understanding of the text. Furthermore, the students were required to talk not only about what they are reading, but also about what they do when reading. It was intended that this approach would promote learner autonomy, deeper levels of engagement and help students to generalise their skills to other contexts. The reciprocal teaching approach involves a gradual transfer of responsibility (Rosenshine and Meister, 1994) with the eventual aim of helping students to develop their reading comprehension skills independently (Palinscar and Brown, 1984).

Throughout the intervention programme, the four reciprocal teaching strategies were represented by four characters, to enhance the extent to which the activities were engaging, fun and memorable. These characters can be seen in Figure 10.

MEET THE FAB FOUR

Figure 10: The four reciprocal teaching strategies were represented by four characters

Images:www.alamy.com/weightlifter-lifting-barbell-isolated-cartoon-image277369858.htm,https://muqaabla.com/quiz-master/, https://www.vectorstock.com/royalty-free-vector/elegant-businesswoman-eating-in-table-vector-24455883, https://www.vectorstock.com/royalty-free-vector/cowboy-kid-cartoon-twirling-a-lasso-vector-1334492

Activities were completed based around the four key aspects of reciprocal teaching, each developing specific skills needed for successful reading comprehension, and these are described below.

In predicting what might happen within a narrative, students must activate any relevant background knowledge and interact with the text that is available, for example by assessing the text structure (including headings and subheadings) or any clues in the text that have been made by the author as a means of anticipating what might occur next. Clarifying draws on the principles of comprehension monitoring to draw the student's attention to factors that might impede their understanding, and then requires them to take the necessary steps to restore meaning. Summarising is an important tool for integrating information presented in the text, which requires students to prioritise core information over that which is more peripheral, and make connections between this information. To make meaningful connections between parts within a text, readers must identify the causal and logical relations between and within these sections of the text (Trabasso et al., 1984). Questioning provides the opportunity for students to identify appropriate details in the text to form the substance of a question, to frame the question in an appropriate format, and then to engage in self-testing. When students are encouraged to ask questions about the text, rather than simply responding to questions from a teacher, they are more likely to develop a critical engagement with the text, and as a result their comprehension will deepen (Armbruster et al., 2001: Keene and Zimmermann, 1997). Questioning can also be used to direct the reader's attention to establish useful causal relations in constructing a coherent representation of the text.

3.5.2 Text Based Intervention Programme

The text-based intervention programme specifically targeted the extraction of meaning from text using metacognitive strategies, inference skills, written narrative and reciprocal teaching strategies using text.

3.5.2.1 Metacognitive Strategies

Within the text-based programme, five metacognitive strategies were taught:

- Look back (Garner, 1982) and Re-read (Garner, Macready and Wagoner, 1984)
- Think aloud (Farr and Conner. 2004)
- Think in pictures (Joffe, Cain and Maric, 2007)
- Explain and reflect (McNamara, 2004)

The strategies that were easiest to grasp were taught first and the more complex strategies were taught later in the programme. After each strategy was taught, the students critically analysed the benefits and disadvantages of applying the strategy to support the comprehension of a text. Students were then asked to record a short summary of the strategy in a table at the back of the resource booklet.

3.5.2.1.1 Look Back and Re-Read

The re-read and look back strategies were introduced at the start of the programme, and students were asked to answer simple targeted questions to encourage re-reading of particular passages of text. These strategies were introduced immediately after reading the text passage, and helped to support comprehension monitoring and the use of clarification when reading or listening to a text.

3.5.2.1.2 Think-aloud

Unlike the re-read and look-back strategies, the think-aloud strategy was introduced before the reading of the passage in order to model what a good reader might be thinking while reading. This strategy involves the teacher modelling in a conversational manner their thinking as they are reading a piece of text in a way that would help students to scaffold how they build new knowledge and language about an unfamiliar topic, and gain further information about the features and structure of the text in which the information is contained. The teacher explains how students could go about working out unknown vocabulary through context, morphology or through use of a glossary or dictionary, and how they use other sources of information to support their knowledge base. This strategy was introduced in week two of the programme, using the five scaffolding steps detailed below (Oczkus, 2009).

Table 21: The scaffolding steps that were used to introduce the think-aloud strategy in the text-based programme

1	Introduce the strategy	Ask students what they about the strategy Define the strategy
2	Model the strategy	Using an example text to model the strategy
3	Provide support and guided practice	Pairs or teams of students turn and talk, and find examples in another piece of text
4	Provide independent practice	Students look from examples to share later within their pairs or groups
5	Wrap up	Ask students what they learned about the reading strategy

The 'think aloud' strategy was implemented in a number of exercises after it was introduced to students in week two. Regularly returning to the strategies throughout the programme was expected to help the students to feel confident in deciding which strategies were most useful in which circumstances.

3.5.2.1.3 Think in pictures

To introduce the 'think in pictures' strategy, students looked at a number of images and discussed the ways in which information in the text had been used to inform the content of the illustration. Students were then asked to draw a representational image of a key character in the book using the information provided in the text. Finally, students created a comic strip focusing on a specific part of the text in order to explore how to sequence and link causal ideas within the text when developing a situational model of the text.

3.5.2.2 Inference

In this component of the teaching programme, children learnt and performed interactive tasks related to the different inference types. The inference tasks ranged from resolving coherence inferences when creating a representation of sentences and paragraphs (e.g. resolving pronouns and elaborating on words in the context of a passage), to more sophisticated inferences such as resolving elaborative and bridging inferences in weeks 5-8, requiring the student to develop the ability to draw upon life experiences to help activate their background knowledge, general knowledge and an understanding of the theme, main point or moral of the text. From week 5, the inference section of the intervention was structured so that students were first encouraged to share their background knowledge about the subject of the text, with the understanding that background knowledge could connect the text to their own experiences or their world knowledge. Students were then asked to apply their own experiences to the topic to generate hypotheses about the text. The teacher then guided students in how to identify words or phrases that they didn't understand and how to use repair strategies to resolve this. This was followed by looking for word clues and elaborating on certain words to develop their understanding of the text. The student's

hypotheses were then evaluated and revised, and any prior knowledge that was inconsistent with ideas in the text was reviewed. Further detail of the tasks used in the inference section of the intervention are summarised in appendix 2.

3.5.2.3 Narrative

A story mountain diagram (see appendix 2) was used to provide a simple overview of the stages within a spoken and written narrative, and was used alongside a range of graphic organisers to help scaffold a student's understanding of the structure within a written or spoken narrative.

3.5.2.4 Summary of interventions

To conclude, the parallel text-based and oral language interventions were designed to target the causes of poor reading comprehension identified in the research. This was namely depth and breadth of vocabulary knowledge, understanding narrative, metacognitive skills, inference making skills including understanding figurative language as well as developing self-regulation, behavioural inhibition and self-efficacy through attribution re-training). The interventions were designed to incorporate the principles of distributed practice to ensure that learning was cumulative, and all teaching was delivered in line with Vygotsky's cultural-historical social activity theory. Indeed, the teacher was working towards the student becoming independent in their learning through a strategy approach to instruction, extensive modelling of what expert readers do and scaffolding of the student's learning.

3.6 Teacher Survey

As previously discussed, the causal mechanisms of poor reading comprehension are complex and heterogeneous, ranging from underlying language difficulties to a lack of reading experience, and students with poor reading comprehension may also have wider reading

difficulties. Furthermore, teaching one skill does not necessarily lead to broader reading comprehension gains and some causal factors cannot be trained. Perhaps due to this complexity, research suggests that the teaching of some reading comprehension strategies has been overlooked by some secondary school teachers (Ricketts and Dixon, 2018). Therefore, a small-scale survey of teachers in a selection of secondary schools was carried out in order to determine the prevalence of reading comprehension interventions involving poor comprehenders in a small selection of secondary schools. The aim of the survey was to determine the extent to which representations made in the literature review are corroborated by the findings of a survey of secondary school teachers in the South East of England.

3.6.1 Teacher survey: Participants

The survey was sent to seventy teachers in twenty secondary schools within England in order to further understand the role and importance of reading comprehension interventions for students in these secondary schools. The secondary schools included ten co-educational independent selective schools and ten co-educational state schools (one of which was an academy). These schools were chosen as one or more teachers from the school had attended a conference on reading comprehension and had expressed interest in completing the questionnaire. The respondents were not randomly selected, and therefore it is important to note that the results are not representative of all schools within England or the United Kingdom, and no claims for generalisability can be made. Indeed, the sample was a convenience or opportunity sample, for the purposes of triangulation with the intervention study and findings from the literature review.

Fifty-five teachers responded to the questionnaire and this gave a 79% response rate. This response rate is greater than the typical response rate of questionnaires such as those of 40% (Lewin, 2005), and the size of the sample is larger than the 30 cases recommended by

Cohen et al., (2007). Although it is understood that a larger sample population would enable conclusions to be drawn with a greater level of statistical power within a quantitative research project, it was felt that the sample size was appropriate to provide contextual background on the delivery of reading comprehension interventions within a small sample of secondary schools. The survey was to gain a 'snapshot' of the local situation and was not intended to be representative of the total population of teachers. Indeed, it is noteworthy that the sample of teachers in the survey is not representative of the teachers working with the sample of students used in this randomised controlled trial.

Table 22: A summary of questionnaire respondents by sex, age and school

Sex	• Male: 5 • Female: 50 • Prefer not to say: 0
Age	• 20-29: 1 • 30-39: 19 • 40-49: 25 • 50-59: 5 • 60-69: 0 • Prefer not to say: 5
Type of School	• State Maintained Secondary: 31 • Academy: 5 • Independent: 19
Role	• Specialist Teachers (working within SEN Departments): 30 • SENCO: 15 • Teaching Assistants: 10

3.6.2 Materials and Measures for the Teacher Survey

A survey offers the advantage that large amounts of data can be collected in a short period of time in a cost-effective way without the researcher needing to be present. It is particularly useful for the investigation of issues that require a subjective perspective. The use of digital technology, along with the possibility of completing the questionnaire anonymously,

allowed the possibility of richer responses to the open-ended questions, and also reduced the likelihood of responses being skewed by unequal access. This avoided the possibility of respondents feeling that they could be judged by the responses they made, as teachers and SENCOs are regularly put under pressure over what they 'should' be doing by Ofsted, school or government policies. For this reason, the questionnaire could be completed anonymously.

Whilst this had the disadvantage of reducing the possibility of following up responses, an e-mail address was added to the bottom of the questionnaire, and respondents were encouraged to e-mail if they had any further comments or questions. It is important to note that questionnaires can lack validity and can be limited in scope, as the researcher is not present to give guidance or interpret the responses. Furthermore, when designing the questionnaire, the researcher is likely to make decisions or assumptions based on what they think is important or unimportant (Cohen et al., 2007; Popper, K., 2004).

A pilot questionnaire was completed and piloted with one researcher, three teachers and three SENCOs. Some minor adjustments were made in the wording of questions where the pilot respondents felt the wording could be unclear. All questions and response statements were carefully worded to avoid the use of technical language and the potential of leading respondents.

The area of focus for the questionnaire was derived from the review of the literature, and the questionnaire collected data on the following:

- information regarding the school and the role of the respondent
- approaches and policies regarding the assessment of reading comprehension (e.g. frequency of testing, what tests are used and how the data from the assessments are used)
- frequency in the use of reading comprehension interventions with all pupils, and pupils aged between 11 and 13 with poor reading comprehension

- causes of poor reading comprehension that the interventions address and the resources that are used for these interventions
- barriers to delivering reading comprehension interventions

The survey consisted of nine questions, seven of which were closed questions and two were open questions (see Appendix).

The two open questions were:

- What resources or programme/s do you use to deliver or support your delivery, of interventions in reading comprehension for secondary school pupils?
- What are the barriers to delivering interventions in reading comprehension for secondary school students?

The closed questions about reading comprehension interventions generally had four choices of responses: 'never or rarely', 'now and again', 'frequently' and 'very frequently'. These subjective terms were used rather than more precise descriptors such as 'once a week', because the nature of the interventions and the timescales over which different interventions are delivered can mean that identifying whether an intervention delivered 'once a week' is frequent or infrequent within the academic year is challenging and inaccurate. Respondents were also asked to tick which aspects of reading comprehension they focus on with students in their interventions from the following options: oral language; vocabulary; semantic understanding; narrative production; understanding words or expressions; verbal working memory; making inferences; metacognitive skills; students' self-concept as a reader; students' perceived value of reading; reciprocal teaching and other. The options were selected as they were strategies that had been frequently used in reading comprehension intervention programmes.

Chapter 4: Results

This chapter presents the results of the RCT and teacher survey. The results section will be structured by addressing each research question in order. The research questions are found in Chapter 3, Section 3.1.

A summary of the data obtained before and after the intervention is given in Table 23. For each outcome measure, the pre-intervention (T1) and post-intervention (T2) data is reported, and then analysed alongside data from the waiting list control group. These analyses were completed in SPSS (IBM SPSS Statistics version 23).

Table 23: The mean standard scores (SD) for the data collected for all groups at T1 and T2. YARC: York Assessment of Reading Comprehension; WRIT: Wide Range Intelligence Test; MPR-P: Motivation to Read, Revised Profile

Test	Measure	Time of assessment	Waiting List Control	Text-Based Intervention	Oral Language Intervention
YARC	Reading Comprehension	T1	85.3 (4.25)	86.91 (5.76)	85.80 (5.60)
		T2	87.1 (4.66)	96.66 (10.40)	103.31(11.19)
	Single Word Reading	T1	95.48 (3.90)	93.11 (3.19)	99.16 (3.19)
		T2	95.48 (4.50)	101.00 (4.29)	98.75 (4.29)
	Reading Fluency	T1	89.80 (3.59)	90.10 (4.59)	90.87 (3.96)
		T2	89.89 (4.52)	93.76 (2.36)	100.45 (3.29)
WRIT	Vocabulary	T1	92.6 (6.52)	84.78 (14.0)	90.68 (14.27)
		T2	93.3 (6.21)	88.5 (10.23)	96.6 (6.21)
	Verbal Analogies	T1	94.25 (5.45)	94.39 (2.45)	94.26 (5.67)
		T2	93.27 (4.27)	98.34 (2.98)	102.98 (4.37)
	Verbal IQ	T1	102.98 (2.89)	103.19 (2.67)	103.87 (3.20)
		T2	103.10 (3.10)	103.20 (3.10)	110.98 (4.25)
MPR-P	Perceived value of reading	T1	2.37 (0.51)	2.42 (0.96)	2.15 (0.66)
		T2	3.04 (0.78)	3.01 (0.70)	2.40 (1.03)
	Self-concept as a reader	T1	2.43 (1.56)	2.30 (1.08)	2.36 (0.57)
		T2	2.45 (1.46)	2.76 (1.63)	2.84 (0.61)
WIAT	Numerical Operations	T1	98.7 (2.97)	95.98 (3.90)	94.90 (3.89)
		T2	98.2 (3.87)	95.98 (3.60)	95.23 (4.98)

4.1 Effect of intervention: Reading Comprehension

The following section is an analysis of the reading comprehension data, which was carried out to address the following sub-questions:

1. Does targeting oral language skills and text-based skills improve the reading comprehension of secondary-age poor comprehenders, when compared with a waiting list control group?

In order to address these sub-questions, the following null hypothesis was generated:

- The oral language and text-based interventions were no different from the control group at changing the average reading comprehension standard scores for students.

The alternative hypothesis was that:

- The oral language and text-based interventions resulted in a significantly different reading comprehension standard scores for students than the control group.

From T1 to T2, there was an overall increase in the mean reading comprehension standard score of students in both the oral language and the text-based intervention programme, with a smaller increase in the waiting list control. The average increase in mean reading comprehension standard score for the oral language intervention was 20.4% (with an effect size of 0.67) and for the text-based intervention was 11.9% (with an effect size of 0.53), whereas for the control group the score increased by only 2.1%. Figure 11 shows that at Time 2 (post-intervention), the text-based and oral language intervention groups made large mean gains relative to the waiting list control group mean on the York Assessment of Reading Comprehension (YARC) measure of reading comprehension. It is also clear that there was an increase in the standard deviation of reading comprehension standard scores in both the oral language and text-based group, with a particularly large increase in the oral language group.

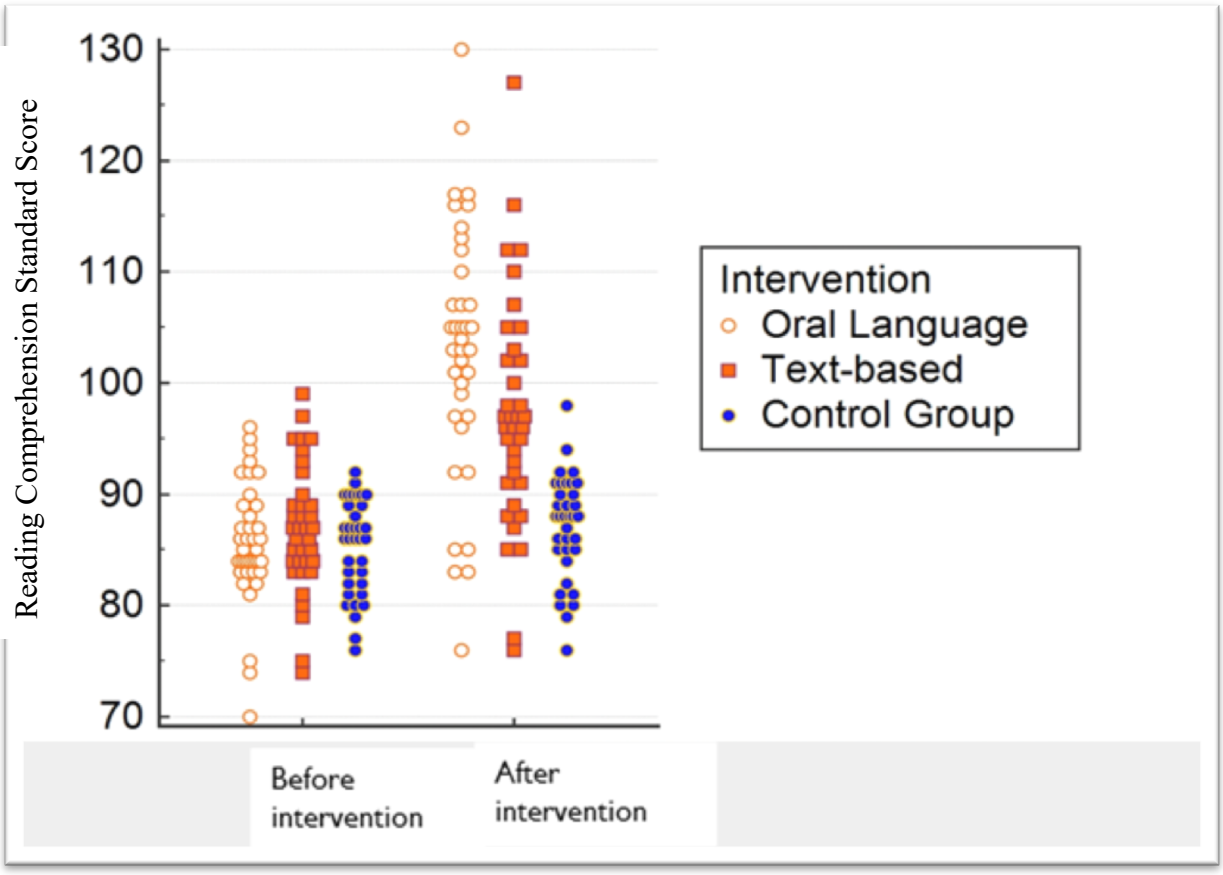


Figure 11: Reading comprehension standard scores before and after the text-based and oral language intervention and waiting list control group. Each marker represents one student

A repeated measures mixed ANOVA was used to analyse the effect of the intervention group (between subjects factor: control, oral language and text-based) and time (within subjects factor: T1 and T2). The dependent variable was reading comprehension standard score (YARC). The effect of the intervention on reading comprehension score was highly significant $F(1,105) = 16.35$, $p < .0001$. This was further analysed using a post-hoc Bonferonni test to analyse the effect of the intervention variable across T1 and T2. This showed that the comparison of text-based intervention group and waiting list control group) was significant (mean difference = 5.855, $SE = 1.478$, $p < .001$), and between oral language intervention group and waiting list control groups was significant (mean difference = 8.178, $SE = 1.468$, $p < 0.0001$). The difference between the oral language and text-based intervention groups was not significant (mean difference = 2.32, se = 1.458, $p = 0.343$),

showing that both intervention groups produced significant differences when compared with the waiting list control group. There was a significant main effect of time $F(1,105) = 135.14$, $p < 0.0001$, showing a significant increase in reading comprehension standard scores from T1 to T2. There was also a significant interaction between time and intervention group, $F(2,105) = 28.60$, $p < 0.0001$ (Figure 16).

Given the significant interaction, simple effects tests were carried out. To explore the interaction further, at pre-intervention (T1), a one-way ANOVA showed that there was no significant difference in the reading comprehension standard scores of oral language, text-based and waiting list control groups $F(2,105) = 0.986$, $p = 0.377$, but at post-intervention (T2) there was a significant difference between the groups $F(2,105) = 26.287$, $p < .0001$. After Bonferroni correction, pairwise comparisons of the groups at T2 showed that the text-based group score was significantly higher than the waiting list control group (mean difference = 10.08, SE = 2.24, $p < .0001$) and oral language group score was significantly higher than the waiting list control groups (mean difference = 16.02 SE =2.23, $p < .0001$). However, the text based and oral language differences (mean difference = 5.9, SE = 2.21, $p = .025$) were not significant after Bonferroni correction.

To determine the effect of time in each of the three groups, a paired t-test was performed (with Bonferroni correction). For the comprehension score differences between T2 and T1 (i.e. T2-T1), there were significant differences for the text –based group (mean difference = 10.25, t = 6.589, df = 35, $p < .0001$), the oral language group (mean difference = 17.49, t = 9.168, df = 36, $p < .0001$) and the control group (mean difference = 1.8, t = 4.045, df = 34, $p = 0.0003$). One can conclude that there was a significant increase in comprehension scores for the oral language and text-based groups at T2.

4.1.2 Further analysis of performance on the York Assessment of Reading Comprehension Test

In order to further understand the aspects of reading comprehension in which there were most change from T1 to T2, analysis of the individual responses to the YARC assessment was carried out. Individual responses were categorised according to the manual guidelines on the aspect of reading comprehension each question was assessing (see Table 24).

Table 24: Number of questions for each category of reading comprehension

Category	**Questions per category for Level 1**	**Questions per category for Level 2**	**Questions per category for supplementary passage**	**Total (%of total number of question)**
Cohesive Devices	2	2	3	7 (5%)
Knowledge Based Inferences	8	9	7	24 (17%)
Evaluative Inferences	7	5	1	13 (9%)
Predictive Inferences	4	4	2	10 (7%)
Literal Information	22	18	6	46 (33%)
Vocabulary	8	11	6	25 (18%)
Figurative Language	1	2	0	3 (2%)
Sequencing	0	1	1	2 (1%)
Summarisation	4	4	2	10 (7%)
Total number of questions				140

It is evident from Table 24 that for some categories of reading comprehension, the data was made up of responses to just two questions, and therefore it is important to note that this reduces the power of the data.

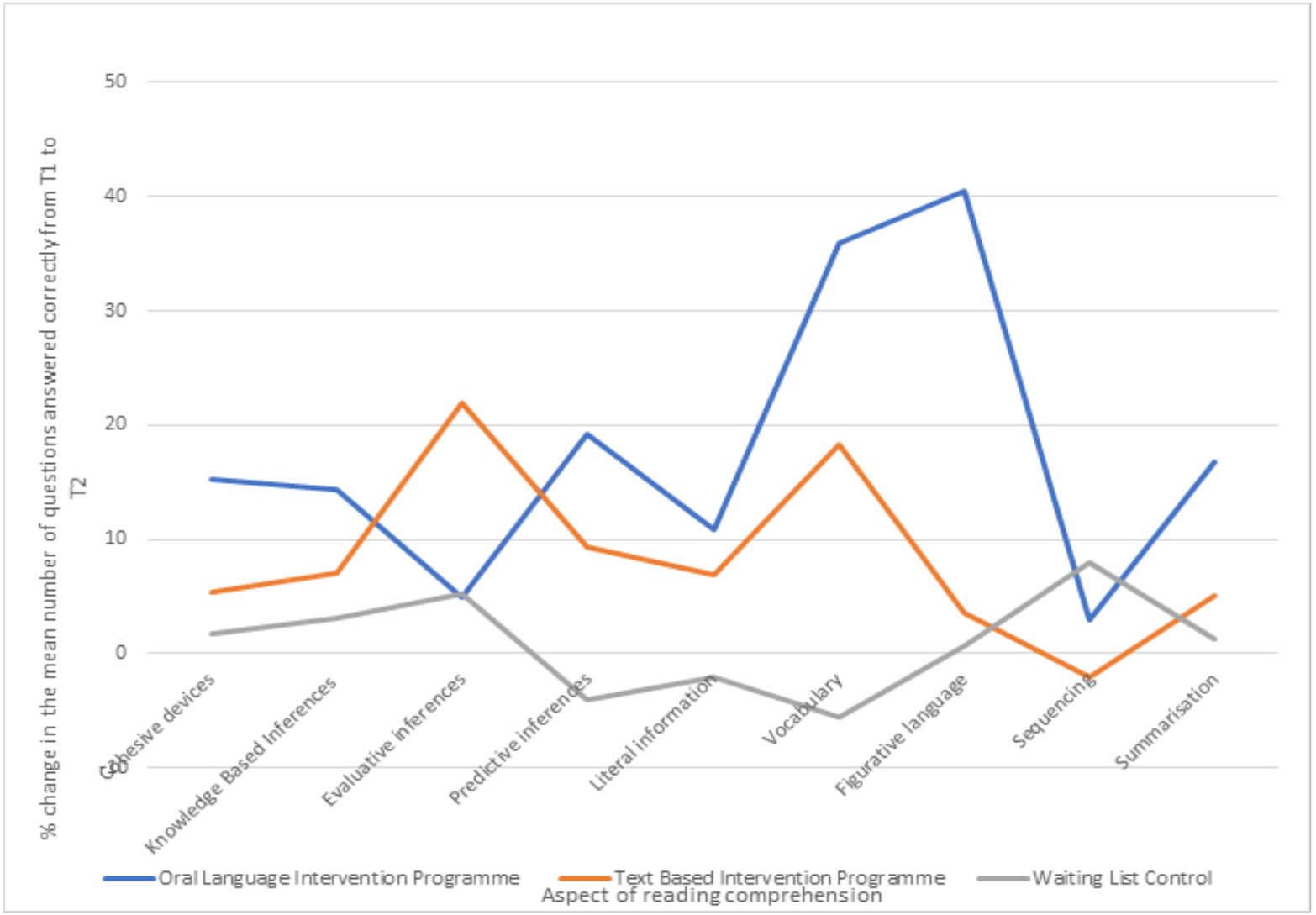


Figure 13: A graph to show the percentage change in the mean number of questions answered correctly from T1 to T2 in the Oral Language (oral language), Text-Based (text-based) and Waiting List Control (WLC) groups

Fine-grained analysis of the questions that were correctly answered in the YARC reading comprehension assessment indicated that students who received oral language training made the largest average improvements from T1 to T2 when answering questions that required knowledge of figurative language (40.5% increase in correct responses) and vocabulary (35.9% increase in correct responses), both of these aspects were taught within the oral language intervention programme. The effect size for vocabulary was much bigger for the oral language programme (ES = 0.39) compared to that for the text-based group (ES = 0.12), however, both represent medium effect sizes. On average, the largest improvements from T1 to T2 for students who received the text-based training were when answering questions that required knowledge of evaluative inferences (21.9% increase in correct responses) and vocabulary (18.3% increase in correct responses). Although inference skills were taught within the text-based intervention programme, explicit vocabulary instruction was not part of this programme. Therefore, it is hypothesised that students may have used the inferences skills that were taught to infer the meaning of novel words from supportive contexts (Cain, Oakhill, and Lemmon, 2004; Joseph and Nation, 2018). The waiting list control group showed slight improvements in the sequencing information (8% increase in correct responses) and the correct use of evaluative inferences (5.2% increase in correct responses). The effect sizes for each of these categories are recorded below.

Table 25: Effect sizes for aspects of reading comprehension with the highest percentage change in correct responses from T1 to T2

	Aspect of Reading Comprehension	Effect Size
Oral Language Intervention Group	Figurative Language	0.45
	Vocabulary	0.39
Text Based Intervention Group	Evaluative Inferences	0.27
	Vocabulary	0.12

4.2 Effect of intervention: Vocabulary Knowledge

This section examines the effect of vocabulary knowledge on reading comprehension for the main study data. The analyses below look at: (1) the effect of the intervention on vocabulary knowledge; and (2) the role of vocabulary in accounting for the effects on reading comprehension, by addressing the following sub-questions:

1. Does targeting oral language skills and text-based skills improve the vocabulary knowledge of secondary-age poor comprehenders, when compared with a waiting list control group?
2. Are oral language interventions more effective in improving the vocabulary knowledge of secondary school students when compared to text-based interventions?
3. Do improvements in vocabulary knowledge mediate improvements in reading comprehension?

In order to address these sub-questions, the following null hypotheses were generated:

- The oral language and text-based interventions were no more effective than the waiting list control group at improving the average vocabulary standard scores for students.
- The oral language intervention was no more effective than the text-based intervention at improving the average vocabulary standard scores for students.

The alternative hypothesis was that:

- The oral language intervention led to significantly higher average vocabulary standard scores for students when compared with the text-based and waiting list control intervention groups.

Table 26: Mean and Standard Deviations (sd) for vocabulary scores for the three groups at time 1 (T1) and time 2 (T2)

	Control Group	Oral language Group	Text Based Group
Time 1 (sd)	92.60 (6.52)	90.68 (14.27)	84.78 (13.98)
Time 2 (sd)	93.34 (6.21)	93.64 (12.78)	88.50 (10.23)

Table 26 above shows the mean vocabulary scores for the oral language, text-based group and waiting list control group, indicating small increases across all three groups from T1 to T2. A repeated measures ANOVA was used to analyse the effect of the intervention on vocabulary score (between participants factor: oral language, text-based and waiting list control groups) and time (within subjects' factor: before and after the intervention). There was a significant main effect of time between T1 and T2 scores ($F(1,105) = 39.5$, $p < .0001$), showing that across all groups vocabulary standard scores were higher at T2 than T1. There was also a significant effect of the Group ($F(2,105) = 3.495$, $p = .034$), and a significant interaction between Group and Time, ($F(2,105) = 5.066$, $p = .008$)

Pairwise post-hoc comparisons were then used to examine vocabulary scores of the groups averaged across T1 and T2. These showed that the vocabulary score was significantly lower for the text-based group when compared with the waiting list control group (mean difference = -6.33, $SE = 2.62$, $p = 0.05$). The vocabulary score was not significantly different between the oral language group and text-based group (mean difference = - 5.52 $SE = 2.58$, $p = 0.105$) or between the oral language group and the waiting list control group (mean difference = 0.809 $SE = 2.60$, $p = 1$).

To further investigate the Time by Group interaction, simple effects tests were carried out by running separate one-way ANOVAs to investigate the effect of Group on vocabulary

scores at each time point. Analysis to investigate the simple effect of Group at each time showed that the vocabulary differences between the groups at T1 were significant ($F(2,105) = 3.99$, $p = .021$). Post hoc Bonferroni test showed that the difference between the text-based group and waiting list control was significant (mean difference = 7.82, $SE = 2.89$, $p = .024$), with the control group score being higher. The mean vocabulary score for the text-based group at T1 was 84.78 ($SE = 2.33$) and the mean for the control group was 92.6 (SE = 1.10). There were no significant difference between the control and oral language groups (mean difference = 1.92, $p = 1$) or between the text-based and oral language groups (mean difference = 5.89, p=0.124). At T2, the mean differences between the groups were marginally significant ($F(2,105) = 2.91$, $p = .059$). With the simple effect of time, the groups showed a significant increase in vocabulary score from T1 to T2, three separate paired samples t-tests were used, with a Bonferroni correction applied, to compare the groups at T1 and T2 for each group separately. For the OL intervention, the mean difference was 2.973 (sd = 2.90) and was significant (t= 6.23, df = 36, p<0.001). For the TB group, the mean difference between T1 and T2 was 3.72 (sd = 6.33) and was significant (t = 3.53, df = 35, $p = 0.001$). For the control group, the mean difference was 0.743 (sd = 1.29) and was also significant (t= 3.40, df = 34, $p = 0.002$). The scores for all groups were significantly higher at T2 than at T1.

The above analysis is illustrated in Figure 14. There were significant gains in vocabulary standard score from T1 to T2 for all groups, with the control group showing small gains. Unfortunately, the score of the text-based group at T1 was significantly lower than that of the waiting list control, which has implications for the conclusions that can be drawn through analysis of the vocabulary data.

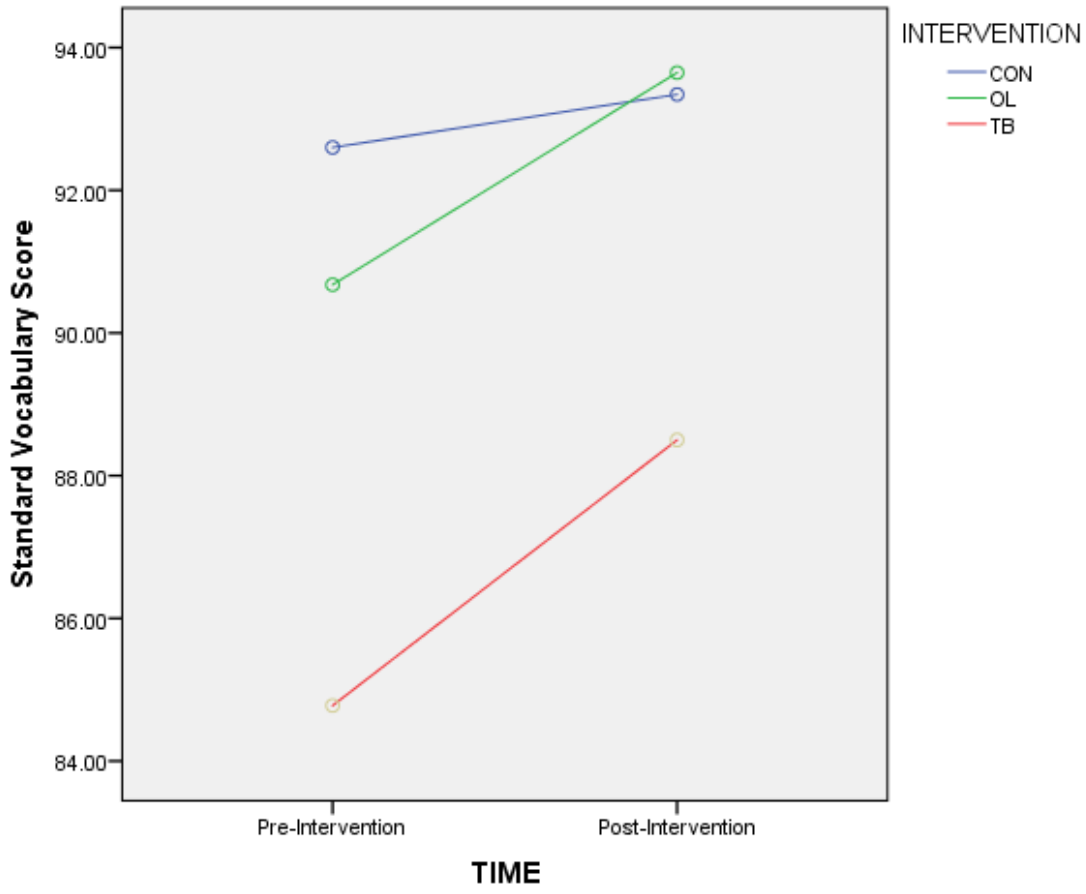


Figure 14: The means of the vocabulary score for each intervention group TB = text-based group WLC = waiting list control group OL = oral language group

The goal was first to examine if, after taking baseline reading comprehension levels into account, there was a difference between intervention groups in reading comprehension at Time 2, which could again demonstrate whether the interventions were successful. Including vocabulary at Time 1 in the statistical model would demonstrate if this apparent effect of the intervention was in fact mediated by the participants' a priori (Time 1) vocabulary levels.

In order to address whether the participants' prior vocabulary knowledge mediated the gain in reading comprehension, a general linear model routine was used to run an analysis of covariance with reading comprehension score (at T2) as the dependent variable, reading

comprehension score and vocabulary score (at T1) as covariates, and intervention group as fixed factor. While reading comprehension at T1 was a significant covariate of reading comprehension at T2 ($F(1,103) = 18.67$, $p < 0.00003$, vocabulary score at T1 was not ($F(1,103) = 0.41$, $p = 0.523$. The effect of the intervention (OL/TB/CON) was highly significant ($F(2,103) = 29.54$, $p = 7.2$, $p < .001$). Subsequent pairwise comparisons (with Bonferonni correction) showed that the oral language group comprehension score was significantly greater than the text-based group (mean difference = 6.60, se = 2.10, p < .0001) and the control group (mean difference = 15.87, se = 2.07, p < .0001). The oral language group mean score was significantly greater than the control group (mean difference = 9.27, se = 2.17, p = .0001). Therefore, there was a significant effect of the intervention group (i.e. the two intervention groups differed from each other and from the control group) after controlling for their reading comprehension and vocabulary scores at T1. The control group was significantly different from each of the intervention groups. There was no evidence that vocabulary at T1 mediates the reading comprehension score at Time 2.

Further analysis was carried out in order to analyse whether the gain in vocabulary (from T1 to T2) mediated the reading comprehension at T2. Reading comprehension score (at T2) was the dependent variable, with reading comprehension score (at T1) and gain in vocabulary score (T2-T1) as covariates, and intervention group as a fixed factor. The gain in vocabulary score was not a significant covariate ($F(1,103) = 0.763$, $p = 0.385$. As previously, the effect of the intervention was highly significant ($F(2,103) = 26.481$, $p < 0.0001$, and comprehension score at T1 was also a significant covariate ($F(1,103) = 19.779$, $p < 0.0001$. Subsequent pairwise analysis was undertaken, adjusting for multiple comparisons using the Bonferroni correction. The mean oral language reading comprehension score at T2 was significantly greater than either the control group mean (mean difference = 15.37, *se* = 2.11, $p < .0001$) or the text-based group mean (mean difference = 7.03, *se* = 2.06, $p = .003$). The

text-based group mean was significantly greater than the control group mean (mean difference = 7.03, *se* = 2.06, *p* = .003). All groups were significantly different from each other.

The standard scores data for reading comprehension score at T2 and the vocabulary scores at T1 for each of the intervention groups are plotted in the following graph, where one can see no obvious trend in the relationship between the two variables. There is no evidence that vocabulary knowledge at T1 or gain in vocabulary knowledge mediated the mean reading comprehension score at T2.

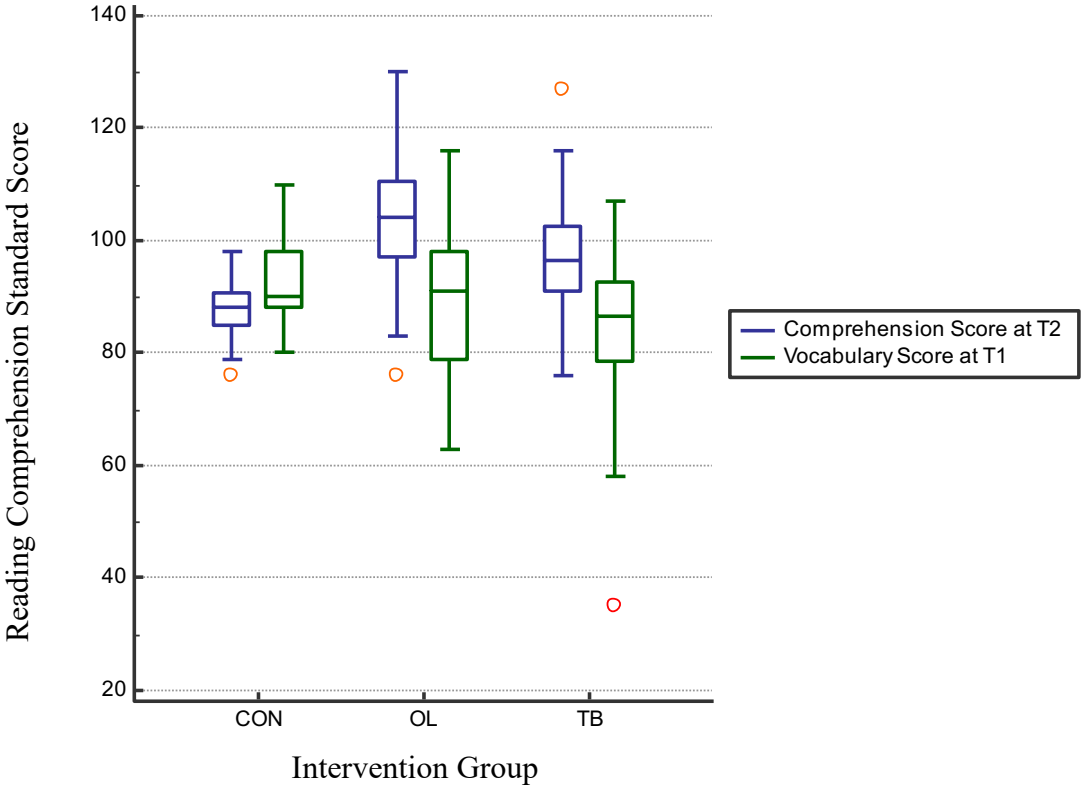


Figure 15: Clustered multiple variable box and whisker graph showing the standard scores for all comprehension scores at T2 and vocabulary scores at T1 for each of the intervention groups. This shows distribution of data into quartiles, highlighting the means and outliers.

4.3 Effect of intervention: Word Reading

Does targeting oral language skills and text-based skills improve the word reading standard score of secondary-age poor comprehenders, when compared with a waiting list control group?

Do improvements in word reading mediate improvements in reading comprehension?

In order to address these sub-questions, the following null hypotheses were generated:

- The oral language and text-based interventions were no more effective than the waiting list control group at improving the average word reading standard scores for students.
- In the oral language and text-based interventions improvements in word reading standard score did not mediate improvements in reading comprehension.

The alternative hypothesis was that:

- The text-based intervention led to significantly higher average word reading standard scores for students when compared with the oral language and waiting list control intervention groups.
- In the text-based intervention, improvements in word reading standard score mediated improvements in reading comprehension.

A repeated measures ANOVA was used to analyse the effect of the intervention (between subjects' factor: oral language, text-based and waiting list control groups) and time (within subjects' factor: before and after the intervention) on word reading score. The effect of the intervention type, time and the interaction between them were examined. Descriptive statistics are show in Table 23. There was a significant main effect of time ($F(1,105) = 3.250$, $p = 0.47$), a significant effect of the intervention ($F(2,105) = 3.165$, $p = .046$) and a non-

significant interaction between these two factors ($F(2,105) = 1.849$, $p = .163$).). Applying the post hoc Bonferroni multiple pairwise test to the three intervention groups across time, there was no significant difference between the mean oral language group score and the mean waiting list control group score (mean difference = 3.5, $SE = 2.19$, $p = 0.342$), however there was a significance difference between the mean text based group score and the control group mean (mean difference = 1.90, $SE = 2.21$, $p = 0.005$).

In order to analyse whether the mean reading comprehension at T2 was mediated by word reading gain, a general linear model routine was used to run an analysis of covariance (ANCOVA). Reading comprehension score (at T2) was the dependent variable, with reading comprehension score at T1 and gain in word reading score (T2-T1) as covariates, and intervention group as a fixed factor. The standard gain in word score was not a significant covariate in the model ($F(1,103) = 0.016$, $p = 0.899$) and therefore did not predict reading comprehension at T2 Applying the post hoc Bonferroni multiple pairwise test to the three intervention groups, there was a significant difference between the mean oral language group reading comprehension score at T2 and both the mean control group score (mean difference = 15.797, SE = 2.07, $p < .0001$) and the text-based group (mean difference =6.918, se =2.09, p=0.004). There was also a significance difference between the mean text based group score and the control group mean (mean difference = 8.879, SE = 2.11, $p < .0001$).

4.4 Effect of intervention: Numerical Operations

The following section is an analysis of the numerical operations data. Table 27 below shows the mean and standard deviations for numerical operations data before and after the interventions.

Table 27: The mean and standard deviations (sd) are shown for the numerical operations data before (T1) and after (T2) the interventions.

	Waiting List Control Group	Text Based Intervention Group	Oral Language Intervention Group
Pre-Intervention (SD)	87.17 (7.48)	88.33 (8.73)	87.62 (8.66)
Post-Intervention (SD)	88.43 (6.65)	89.22 (8.35)	88.51 (7.78)

A two-way mixed ANOVA was used to analyse the effect of the intervention type (between participants' factor: oral language, text-based and waiting list control groups) and time (within participants factor: before T1 and after T2 the intervention) on the numerical operations data. There was no significant effect of the intervention (($F(2,105) = 0.145$, $p = .865$) and there was also no significant interaction between the intervention and time (($F(2,105) = 483$, $p = .618$). However, there was a significant effect of time across all intervention groups ($F1,105) = 33.61$, $p < 0.0001$). At pre-intervention (T1), the mean numerical operations data score increased slightly from 87.71 ($sd = 8.26$) to 88.72 (sd = 7.57) at post-intervention (T2). Although statistically significant, the increase of one to two points across all three groups from T1 to T2 is of little practical significance as scores would be likely to improve over time without any intervention. It therefore seems clear that the effects of the interventions on reading comprehension and vocabulary knowledge are unlikely to be due to generalised improvements that relate to skills that were taught as part of the intervention programme.

4.5 Effect of intervention: Reading self-concept

The following section is an analysis of the reading self-concept data, which was carried out to address the following sub-question:

Do interventions in text based and oral language comprehension strategies improve the students' self-concept as a reader?

In order to address this research question, the null hypothesis was generated:

- The oral language and text-based interventions were no more or less effective than the waiting list control group at improving the students' self-concept as a reader.

The alternative hypothesis was that:

- The oral language and text-based interventions were significantly better at improving the average score for students' self-concept as a reader, when compared with the waiting list control group.

Measures of the perceived value of reading and students' self-concept as a reader were collected using the Motivation to Read, Revised Profile (MPR-P). The questionnaire, as described in the methodology section of this report, was answered by 150 students at T1 and T2. As the questionnaire was completed in a conversational interview, with the assessor alongside the student, all students answered all of the statements. The questionnaire provided an overall score for value of reading (based on 10 questions) and self-concept as a reader (based on 12 questions), and the average score for each group was calculated at T1 and T2.

Table 28 shows means, standard deviations and effect sizes for the reading self-concept of students in the three groups. Students who received the oral language intervention training had higher adjusted means for reading self-concept than the control group, resulting in a large effect size (ES = 0.86), while students in the text-based group reported similar reading self-concept scores to the waiting list control group, resulting in a smaller effect size (ES = 0.24).

Table 28: Means (M), Standard Deviations (SD) and Effect Sizes (Cohen's d) for Reading Self-Concept

	Waiting List Control Group	Text Based Intervention Group	Oral Language Intervention Group
Pre-Test M (SD)	2.43 (1.56)	2.30 (1.08)	2.36 (0.57)
Post-Test M (SD)	2.45 (1.46)	2.76 (1.63)	2.84 (0.61)
Effect Size		0.15	0.10

Note: The maximum possible score was 4

The mean scores show that the oral language group had a slightly higher overall post-test mean for reading self-concept than the text-based group or the waiting list control group. Higher overall scores are indicative of high attributions of their own reading ability, how others view their reading ability and of their reading ability when compared to their friends. However, it is important to note that this is a small change based on a subjective measure, and this limits the extent to which conclusive statements can be made.

For further analysis, the items for reading self-concept were categorised into three different aspects:

1. Perception of their own reading ability (based on 6 prompts)
2. Perception of how others view their reading ability (based on 3 prompts)
3. Perception of their reading ability compared to their friends (based on 2 prompts)

Table 29: Means, standard deviations and effect sizes (Cohen's d) for aspects of reading self-concept for each group at T1 and T2

Aspect of reading self-concept	WC1	WC2	TB1	TB 2	OL1	OL 2
Perception of how others view their reading ability	2.69 (0.45)	2.79 (0.35)	2.68 (0.25)	3.42 (0.32)	2.68 (0.47)	3.69 (0.42)
Perception of their reading ability compared to their friends (social comparison)	1.87 (0.32)	1.9 (0.67)	1.58 (0.76)	1.97 (0.43)	1.71 (0.64)	2.05 (0.97)
Perception of their own reading ability	2.67 (1.07)	2.73 (0.75)	2.65 (1.72)	2.88 (0.53)	2.7 (1.42)	2.86 (0.52)

Note: Mean scores (standard deviations) for each aspect of reading self-concept (1 lowest to 4 highest) 1 = pre-test 2 = post-test; WC=waiting list control; TB= Text based intervention group; OL= Oral language intervention group. The maximum possible score was 4.

At T1, there was little difference between the groups in the average scores for each aspect of reading self-concept. Overall, participants in all three groups had a low perception of their ability compared to their friends, and a slightly higher perception of how others view their reading ability and of their own reading ability. For all three groups at T2 the perception of how others view their reading ability remained high, whilst the perception of their reading ability compared to their friends remained relatively low.

As shown in Figure 16, overall the text-based group made the largest gains in their perception of how others view their reading ability (0.74). The oral language group made the largest gains in the perception of their reading ability compared to their friends (0.34) and in their perception of their own reading ability (0.16).

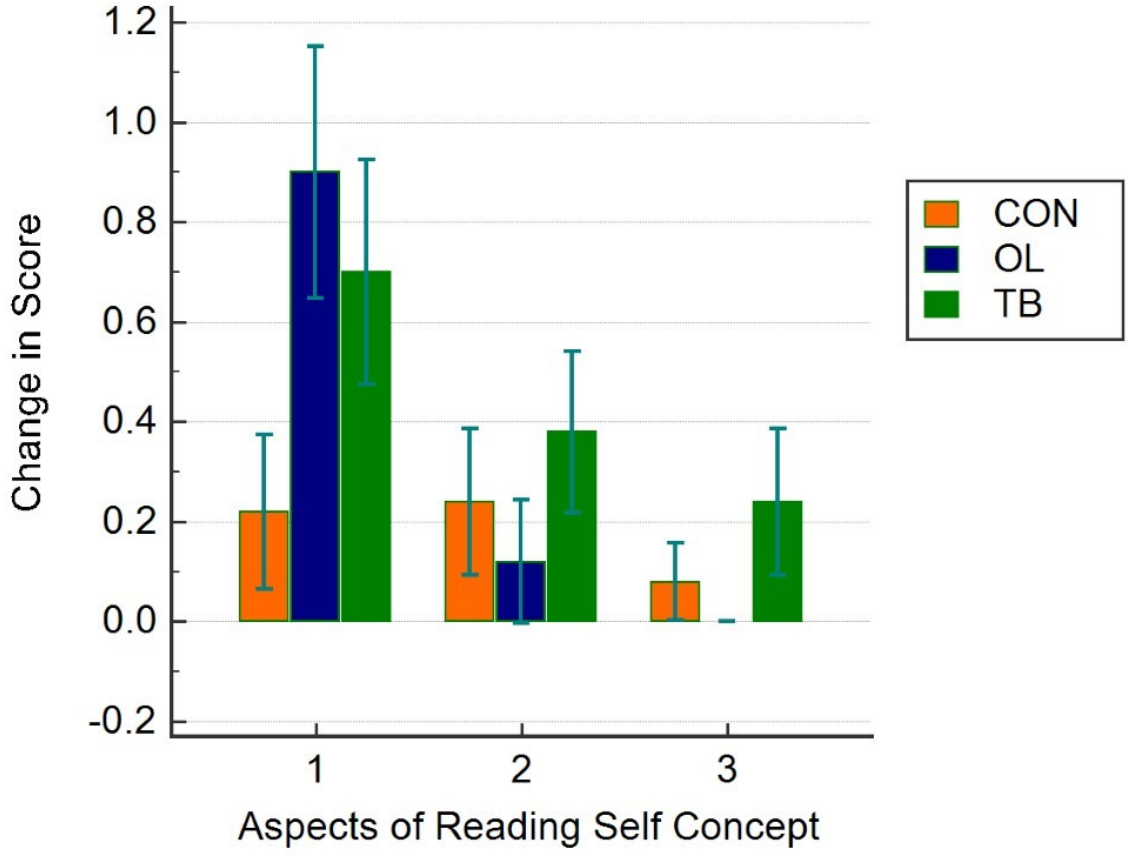


Figure 16: A graph to show the change in students' reading self-concept from T1 to T2 (mean +/- 95% CI). 1= perception of how others view their reading ability,, 2 = perception of their reading ability compared to friends and 3 = perception of their own reading ability.

Analysis of the change in the average score from T1 to T2, indicates that the students who received the oral language intervention overall experienced the greatest increase in terms of their perception of how others view their reading ability (an increase in the average score of 0.94). For the text-based intervention this increase was 0.74 (ES=0.67). The students who received the text-based intervention showed the highest increase across the three intervention groups in their perception of their reading ability compared to their friends, although this increase was also small at 0.39 (ES=0.35). The increase in the students' perception of their own reading ability across all three groups was small, and ranged from 0.23 for the text-based group to 0.04 for the control group.

As this data used ordinal data, Wilcoxon signed rank test was used to determine if there was a significant difference in scores between T1 and T2. This test compares two related samples to see if the rankings are different in the two groups. A Bonferroni correction was applied as multiple tests were carried out. This meant it was necessary to reduce the p-value for significance to p=.005. The p-value (0.05) was divided by 9 to obtain a criterion value as there were 9 tests carried out. Analysis of the data (summarised in Tables 30, 31 and 32) indicates that the text-based intervention group showed significant improvements in their scores between T1 and T2 across all three measures of reading self-concept. The oral language intervention group showed significant improvements in their scores between T1 and T2 for the students' perception of how others view their reading ability, but not for the other two measures of reading self-concept. Whilst for the waiting list control group the change in scores between T1 and T2 are not significantly different for any of the measures of reading self-concept used.

Table 30: Results from Wilcoxon signed rank test of whether the change in scores (T1 to T2) were significantly different for each group for students' perception of how others view their reading ability

Group	**Significance Value**	**After Bonferroni correction**
Waiting List Control	Z= -2.598, p=0.009	Not significantly different
Text based group	Z= -4.523, p<0.0001	Significantly different
Oral language group	Z= - 4.786, p<0.0001	Significant different

Table 31: Results from Wilcoxon signed rank test of whether the change in scores (T1 to T2) were significantly different for each group for students' perception of their own reading ability compared with their friends

Group	Significance Value	After Bonferroni correction
Waiting List Control	Z= -2.972, p=0.046	Not significantly different
Text based group	Z= - 3.945, p= 0.00008	Significantly different
Oral language group	Z= - 1.897, p=0.058	Not significantly different

Table 32: Results from Wilcoxon signed rank test of whether the change in scores (T1 to T2) were significantly different for each group for students' perception of their own reading ability

Group	Significance Value	After Bonferroni correction
Waiting List Control	Z= -2.00, p=0.046	Not significantly different
Text based group	Z= -2.972, p=0.003	Significantly different
Oral language group	Z= 0, p=1.0	Not significantly different

4.6 Effect of intervention: Value of Reading

The following section is an analysis of the value of reading data, which was carried out to address the following sub-question:

Do interventions in text based and oral language comprehension strategies improve the students' perceived value of reading?

In order to address this research question, the null hypothesis was generated:

- The oral language and text-based interventions were no more effective than the control group at improving the students' perceived value of reading.

The alternative hypothesis was that:

The oral language and text-based interventions were significantly different from the control group at improving the average score for students' perceived value of reading.

Table 33: Means, standard deviations and effect sizes for perceived value of reading for each group at T1 and T2

	Waiting List Control Group	Text Based Intervention Group	Oral Language Intervention Group
Pre-Test M (SD)	2.15 (0.66)	2.42 (0.96)	2.37 (0.51)
Post-Test M (SD)	1.40 (1.03)	3.01(0.70)	3.04 (0.78)
Effect Size		0.62	0.65

Note: the mean scores for value of reading were calculated by adding the total score for each group and dividing it by the total number of values. Maximum possible score of 4.

The oral language and text-based groups had similar scores at pre- and post-test, which resulted in a medium effect size for oral language (ES = 0.65) and text-based (ES = 0.62). The oral language group displayed a slightly higher score for the value of reading at post-test (M=3.04, SD = 0.78), and higher scores are indicative of higher student perception of the value of reading.

For the purpose of this analysis, the items for value of reading were divided into three categories:

1. Interest in reading (based on 3 prompts)
2. Engagement in reading (based on 4 prompts)
3. Intrinsic motivation (based on 3 prompts)

Table 34: Mean scores for three categories for the perceived value of reading at pre and post-intervention

	WLC 1	WLC2	TB 1	TB 2	OL 1	OL 2
Interest in reading	2.39 (0.43)	2.29 (0.54)	2.57 (0.49)	2.82 (0.87)	2.52 (0.23)	2.92 (0.76)
Engagement in reading	1.32 (0.32)	1.4 (0.42)	1.78 (1.32)	2.78 (0.60)	1.75 (0.26)	2.8 (0.65)
Intrinsic motivation	2.74 (0.23)	2.89 (0.65)	2.9 (1.39)	3.6 (0.97)	2.85 (0.45)	3.4 (0.63)

Note: 1 lowest to 4 highest 1= pre-test; 2 = post-test
Mean score with standard deviation in brackets
Scores out of a possible 4

As show in Figure 17 below, the largest gains were made by the text-based group in their engagement in reading (1.00), followed by their levels of intrinsic motivation (0.7). The oral language group made small gains across the variables in their interest in reading (0.40), engagement in reading (1.05) and intrinsic motivation (0.55). The waiting list control group also made very small gains in their engagement in reading (0.08) and intrinsic motivation (0.15), with a small drop in their interest in reading (-0.10).

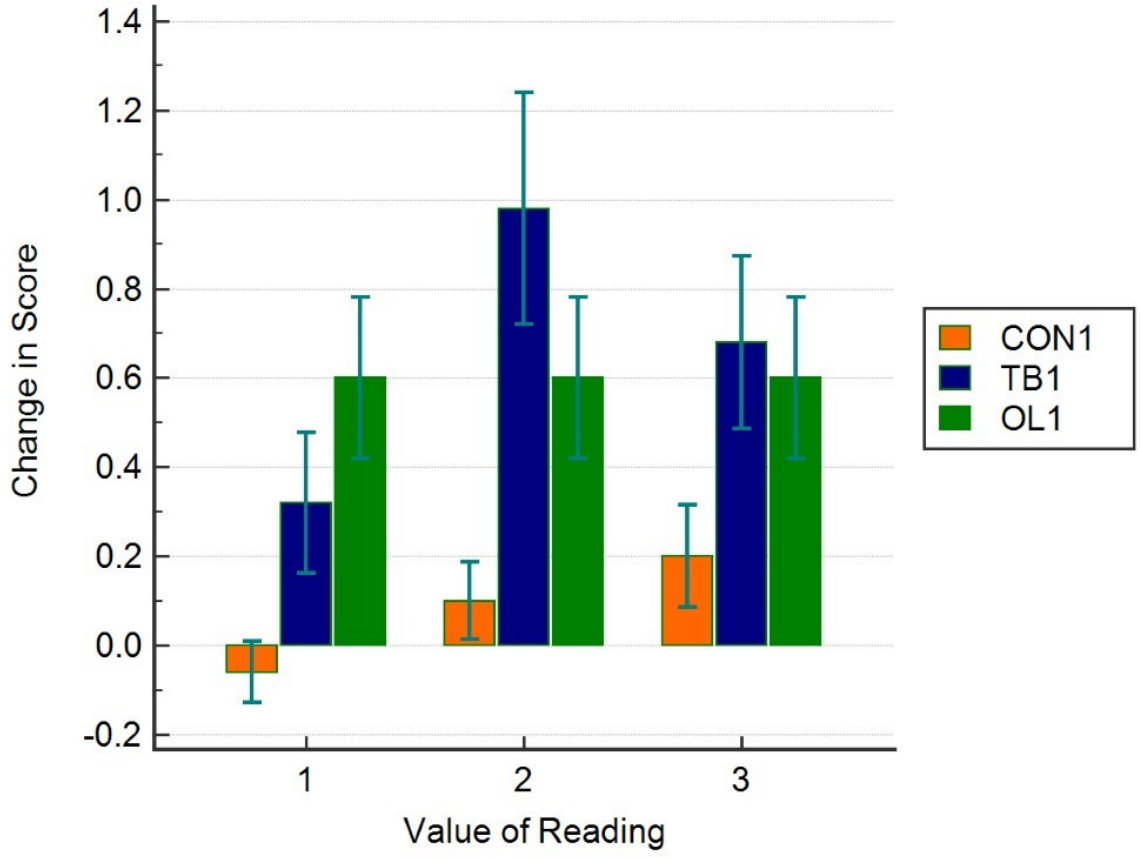


Figure 17: A graph to show the change in students' value of reading from T1 to T2 (mean +/- 95% CI). 1= interest in reading, 2 = engagement in reading, 3= intrinsic motivation.

Further analysis was carried out to test whether there were significant differences between the scores at T1 and T2 for each intervention group using Wilcoxon signed rank test. A Bonferroni correction was applied as multiple tests on the same data were being carried out, and this involves reducing the p-value for significance to p = 0.005. The p-value (0.05) was divided by 9 to obtain a criterion value as there were 9 tests carried out. As summarised in Figure 19, this analysis indicated that both the text-based and oral language group showed a significant improvement from T1 to T2 all three measures of value of reading, and the scores at T1 and T2 for intrinsic motivation were significantly different for the waiting list control group.

Table 35: Results from Wilcoxon signed rank test of whether the change in scores from T1 to T2 were significantly different for each group for interest in reading

Group	Significance Value	After Bonnferroni correction
Waiting List Control	Z= - 1.732, p=0.083	Not significantly different
Text based group	Z= - 3.557, p=0.0004	Significantly different
Oral language group	Z= -4.817, p= 0.000001	Significant different

Table 36: Results from Wilcoxon signed rank test of whether the change in scores from T1 to T2 were significantly different for each group for engagement in reading

Group	Significance Value	After Bonnferroni correction
Waiting List Control	Z= -2.236, p=0.025	Not significantly different
Text based group	Z= -4.983, p<0.00001	Significantly different
Oral language group	Z= -5.155, p<0.00001	Significant different

Table 37: Results from Wilcoxon signed rank test of whether the change in scores from T1 to T2 were significantly different for each group for intrinsic motivation

Group	Significance Value	After Bonnferroni correction
Waiting List Control	Z= -3.162, p=0.002	Significantly different
Text based group	Z= -4.919, p<0.00001	Significantly different
Oral language group	Z= -4.772, p<0.00001	Significantly different

Overall, the greatest gains were in student's perception of their engagement in reading, levels of intrinsic motivation and how others view their reading ability. It is hypothesised that the re-attribution training practices influenced student's reading self-concept and value of reading in positive ways. Further research is required to understand the relationship between reading self-concept, value of reading and reading comprehension, and distinguish between the effects of re-attribution training and reading comprehension strategy instruction.

4.7 Teacher Survey

The following section is an analysis of the teacher survey data, which was carried out to address the following sub-question:

- To what extent are teachers aware of/use evidence-based strategies to support children with reading comprehension difficulties?

As shown in Figure 18 below, the responses to how frequently teachers assessed pupils to ascertain a standard score for their reading comprehension was consistently 'frequently' (62% of respondents), and 'very frequently' (15% of respondents). The findings on the frequency in the assessment of reading comprehension were in contrast to the findings on the frequency with which interventions in reading comprehension for poor comprehenders were being delivered. Indeed, 93% of respondents stated that interventions for students with poor reading comprehension occurred 'never or rarely' or 'now and again' (71% and 22% respectively). Only 7% of respondents stated that interventions for students with poor reading comprehension occurred 'frequently'.

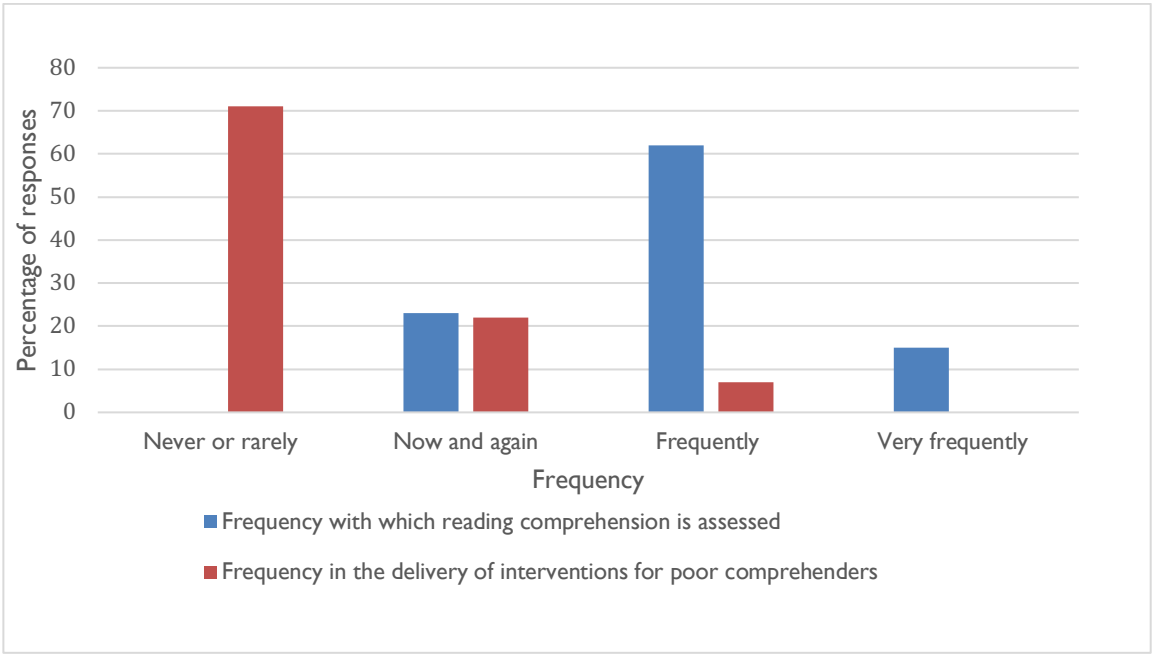


Figure 18: Frequency with which reading comprehension is assessed and reading comprehension interventions are delivered to poor comprehenders

To further explore the barriers to delivering interventions to students with poor reading comprehension in secondary schools, respondents were asked to respond to the open-ended question 'what are the barriers to delivering interventions in reading comprehension for secondary school students?' The most frequent answers that were provided are recorded in table 38 below. The responses indicate significant barriers in relation to resources, money and time. There were three respondents who made other suggestions, which included that the interventions took place after the age of 13, any intervention for difficulties with reading comprehension were addressed by the students' English teacher and reading (rather than reading comprehension) was the focus of the interventions.

Table 38: Barriers to delivering reading comprehension interventions to poor comprehenders of secondary school age

Barriers	Percent (%)
Insufficient teaching resources or expertise to deliver interventions to poor comprehenders	36
Insufficient money to deliver interventions to poor comprehenders	18
Insufficient amount of time to deliver interventions to poor comprehenders	22
Interventions for poor comprehenders are not delivered by the SEND/Learning Department	9
Other	15

Finally, to explore teachers' understanding of the causes of poor reading comprehension, teachers were asked what the focus of the intervention sessions delivered to poor comprehenders was from a list provided. The results from this question are summarised in Table 39.

Table 39: The focus for interventions delivered by teachers surveyed

Focus	Percentage
Vocabulary	36
Oral Language	27
Narrative production	9
Students' perceived value of reading	6
Students' self-concept as a reader	6
Verbal working memory	5
Metacognitive skills	4
Making inference	4
Reciprocal teaching	2
Other	0

For the majority of respondents (63%), the focus of the interventions for poor comprehenders was developing vocabulary knowledge (36% of respondents), or developing oral language (27% of respondents). This is a promising response as it suggests that teachers are delivering interventions focusing on important aspects of reading comprehension. The remaining responses were distributed in small numbers (ranging from 2-9%) across the options.

Overall, the survey data indicated that for the majority of respondents the assessment of reading comprehension occurs 'frequently'. In contrast, delivery of interventions for poor comprehenders occurs 'infrequently' or 'rarely or never', and the main barriers that were identified are around a lack of teaching resources, money and time. For the interventions that were delivered, the majority of respondents stated that the focus of interventions for poor comprehenders was either in developing vocabulary knowledge or oral language.

4.8 Treatment resistors

The data indicates that the interventions in this study led to significant improvements in the reading comprehension of students in both the text-based and oral language intervention groups. However, there were a number of students who did not respond to the

intervention, and further analysis is required to understand this unresponsive group who had received evidence-based reading comprehension instruction. This is in line with the three tier Response to Intervention framework (RTI). The first tier involves incorporating robust findings from reading comprehension research into general classroom instruction alongside data from screening, assessment and monitoring of pupils' reading comprehension. Beyond this critical foundation, this tiered system involves small group interventions with frequent progress monitoring in Tier 2. For those very few students who do not respond to these evidence-based tailored interventions, they will receive more intensive, focused and personalised interventions within tier 3. Between 2% and 6% of eleven to thirteen-year olds might be unresponsive to intervention efforts (Torgesen, 2000), and successful intervention studies have reported that at the end of their intervention a large proportion of children remain in need of literacy support (Bowyer-Crane et al., 2008).

Although there is no uniformly agreed definition of 'treatment resister', within the research it generally refers to a child who has failed to respond favourably to an otherwise effective form of reading intervention (Fuchs and Fuchs, 2006). One of the more common definitions describes students with standard scores below the 30th centile after receiving the intervention (Torgesen, 2000; Scanlon et al., 2005). Whereas other studies have used different criteria, for example Al Otaiba and Fuchs (2006) focused on the amount of growth in standard scores before and after students receive the intervention. Using this method to identify the students who made no or very little growth in reading comprehension standard score in this study, the data from students who gained no more than three points in their reading comprehension standard score between T1 and T2 were analysed. Based on this criterion, fifteen students who received either the oral language or text-based intervention did not gain more than three points in their reading comprehension standard score between T1 and T2,

representing minimal or no progress in reading comprehension. The intervention groups did not statistically differ in the proportions of adequate responders, $\chi 2(1) = 0.34$, $p > .05$.

The mean standard scores for this group of students (from oral language and text-based intervention groups combined) are summarised in the table 40 below.

Table 40: Descriptive statistics for treatment resistors

	Standard Score at T1	Standard Score at T2
Reading Comprehension	82	82
Word Reading	95	95
Verbal Analogies	72	71
Vocabulary	76	78
Verbal IQ	74	75

Note: n=15

Scrutiny of these descriptive data indicates that although the reading comprehension and word reading standard scores for this group of students did not change, the reading comprehension (standard score of 82) and word reading standard score (standard score of 95) at T1 were higher than the standard scores for verbal ability, vocabulary knowledge and verbal IQ. Indeed, from the analysis of the low standard scores for underlying verbal ability at T1 and T2, it could be hypothesised that verbal ability is one factor that influenced the efficacy of the interventions for some students in this unresponsive group of students. However, further research would be useful to explore the impact of interventions to support verbal abilities before or alongside delivering a reading comprehension intervention for poor comprehenders with low verbal IQ standard scores. Indeed, more broadly, additional experimental research is needed to provide effective intensive reading intervention for students who are demonstrating inadequate response to current instruction (Denton et al., 2013), as well as more information on any shared characteristics to ensure that schools take a pro-active approach to delivering appropriate interventions to poor comprehenders (Al Otaiba, Wagner & Miller, 2014).

Chapter 5: Discussion

Findings from the Randomised controlled trial

5.1 Response to Intervention: Reading Comprehension

Intervention studies are crucial if we are to understand the causal pathways between reading instruction and outcomes. This study set out to examine whether an oral language intervention and a text-based intervention would improve reading comprehension in adolescent readers compared to a waiting control group. Although we have the evidence that oral language interventions successfully lead to gains in reading comprehension for children of primary school age, it is not clear whether this finding can be applied when delivering interventions to adolescents in secondary schools.

Overall, this research shows that evidence-based interventions can be feasibly implemented within a school environment to ameliorate students' reading comprehension difficulties, and interventions directly targeting both students' oral language comprehension and text-based skills produce significant gains in the reading comprehension of secondary-age students relative to a waiting list control group. Students who were part of the interventions were able to close the gap between themselves and their peers, and on average the group who received the oral language intervention performed slightly better than would be expected for their mean chronological age following the intervention. There was a gain of 17.51 standard points for the oral language group, and the text-based group also experienced a gain, albeit slightly smaller, of 7.89. The effect size for the oral language intervention on reading comprehension was 0.67, and the effect size for the text-based intervention was 0.53.

5.1.2 Response to Intervention: Oral Language Intervention

The role of oral language comprehension in reading comprehension interventions is consistent with the conclusions that have been drawn in studies involving younger children (e.g. Clarke et al., 2010; Bianco et al., 2010; Bowyer-Crane et al., 2008; Fricke et al., 2013; Clarke et al. 2010), as well as theoretical models such as the Simple View of Reading (Hoover & Gough, 1990; Gough & Tunmer, 1986). Indeed, the significant improvements in reading comprehension for the oral language group supports the importance of delivering oral language training to poor comprehenders of secondary school age, and that oral language deficits are a critical factor in reading comprehension difficulties. Previous studies have also found oral language interventions to be more successful than text-based interventions in the long-term. For example, Clarke et al. (2010) found that the average reading comprehension standard score for students in the oral language intervention group increased by 3.03 standard points immediately after the intervention, and after 11 months the average reading comprehension standard score had increased by a further 2.34 points. Whilst the text-based group experienced an increase in average reading comprehension standard score of 2.28 points immediately after the intervention, with a smaller increase of 0.52 11 months after the intervention. As no data was collected at a delayed follow-up in this study, it was also not possible to determine maintenance of effects, and therefore it is unclear whether improvements in reading comprehension standard score were maintained, fell or further increased. It is important to understand whether or not the effects of an intervention have been maintained as it provides a good indication of whether the student is able to recall and implement the strategies that have been taught in their everyday reading to support their reading comprehension. Further data collected at delayed follow-up are required to assess whether the improvements found by Clarke et al. (2010) are in line with those experienced by students in this study at a delayed follow-up.

There are also unresolved theoretical issues regarding the nature of the relationship between oral language and reading comprehension. Indeed, according to the simple view of reading (Gough & Tunmer, 1986), once a text has been decoded, the only limit on comprehension is listening comprehension. However, it has been suggested that the language skills underlying listening comprehension such as vocabulary, language processing abilities and the understanding of non-literal language, grammar and morphosyntax may have direct effects on reading comprehension (Oakhill & Cain, 2012; Ouellette & Beers, 2010; Tunmer & Chapman, 2012, Silva & Cain, 2015). Whilst listening comprehension still has an important influence on reading comprehension (Gough & Tunmer, 1986), the language skills that provide the foundations for listening comprehension are still unclear. This study did not collect sufficient data to allow for a comparison on variations within different aspects of reading, for example, listening comprehension versus reading comprehension, and the role of listening comprehension in the simple view of reading (Gough & Tunmer, 1986). Including a measure of listening comprehension at T1 and T2 would facilitate a greater understanding of the constructs of listening comprehension and its role in influencing reading comprehension, as previous studies examining the effect of listening comprehension, and its sub-components, on reading comprehension have produced inconsistent results (Diakidoy et al., 2005).

Finally, it is important to note that the REACH study by Clarke et al. (2017) did not find significant gains in reading comprehension for either intervention group when reading comprehension was measured using the Wechsler Individual Achievement Test 2nd Edition (WIAT II; Wechsler, 2005), there are a number of possible reasons for these differences. One possible explanation for the differences is that the average reading comprehension, word reading and vocabulary standard scores for students at T1 in the REACH study were lower than those reported in this study. At T1 the students in the REACH study had a reading comprehension standard score that was 20 standard points lower, a word reading standard

score that was 22 standard points lower and a vocabulary standard score that was 25 points lower than the comparable data in this study. Therefore, in line with the Simple View of Reading(Gough & Tunmer, 1986), it is possible that the poor word reading skills of students in the REACH study placed important constraints on making comparable gains in reading comprehension, as students with weak word reading skills require different forms of intervention, targeted to their particular area/s of weakness (Snowling, Hayiou-Thomas, Nash & Hulme, 2019). Furthermore, in line with the 'dual deficit' stated by Whiteley et al. (2007), children with deficits in both phonological and non-phonological oral language are more likely to be unresponsive to reading intervention than are children with a single deficit (Al Otaiba & Fuchs, 2002; Duff, Fieldsend, Bowyer-Crane & Hulme, 2008). An alternative explanation is based on the differences between the interventions that were delivered. For example, in contrast to this study, part of the interventions in the REACH study targeted letter knowledge, word reading, and phonological work, which could affect the conclusions drawn, particularly as children who are least likely to benefit from phonologically based interventions are those with deficits in both letter knowledge and expressive vocabulary (*ibid*).

Finally, there were key differences between the participants involved in the studies. For example, in the REACH study 56.9% more participants had a statement of special educational needs, 7.8% more participants had English as an Additional Language and 18.1% more participants were eligible for Free School Meals when compared with the participants in this study. These factors are likely to place addition constraints on the progress made by some students in the REACH study. Indeed, Vellutino et al. (1996) hints that a dual deficit is more likely to typify children of lower socioeconomic status.

5.1.2 Response to Intervention: Text-Based Intervention

There were significant gains in reading comprehension for the text-based intervention group. One hypothesis for the significant improvements experienced by the text-based

intervention group is due to the significant improvement in the average word reading standard score for the text-based group when compared with the waiting list control group. Indeed, although both groups showed an improvement in their word reading standard score, only the text-based group showed significant improvements. The role of word reading in improvements to reading comprehension is supported by research highlighting the prominent role of word identification and decoding skills with regard to reading comprehension (García & Cain, 2014). In accordance with the Construction-Integration Model of Kintsch and Rawson (2005) graphic symbols must be decoded requiring phonological awareness, letter recognition and knowledge of grapheme-phoneme correspondences. Indeed, word reading errors contribute to problems in activating the correct meaning of words in the context of the passage (Perfetti, 2010), and difficulties with word identification and decoding skills means that more cognitive resources must be allocated for word reading (Perfetti, 1985), leading to less cognitive capacity for skills such as inference-making as slow, effortful word reading makes high demands on processing (Prior, Goldina, Shany, Geva, & Katzir, 2014). Furthermore, improvements in word reading accuracy could also have contributed to improvements in reading fluency, leading to improvements in reading comprehension (Mellard, Fall & Woods, 2010).

An alternative hypothesis for the gains in reading comprehension for the text-based group is due to the inference making and metacognition skills that were explicitly taught as part of the text-based intervention, but not in the oral language intervention (where instead students were taught about strategies for comprehending figurative language and developing vocabulary knowledge). It is hypothesised that the higher-order reading strategies of metacognition and inference making skills underlying a deep comprehension of text, helped to support readers to make connections between incoming information and previous information, in order to construct a coherent situation model or to re-stablish coherence in

their situation model (Kintsch & Rawson, 2005). This is particularly important as students get older and are required to comprehend more challenging texts. It is argued that the tasks within the inference section of the text-based intervention programme contributed to the successful transfer to improvements in generalised reading comprehension. For example, students were taught about single lexical inferences and the importance of looking for word clues that provide information about the meaning of the text, such as identifying certain words using clues from the text and elaborating on this word in the context of the passage. Students were also taught about linking multiple lexical inferences together to build a complete picture about what was happening in the story through the use of strategies such as drawings, keywords and thought bubbles to draw together the main aspects of the text.

This finding supports the augmented simple view of reading (Geva & Farnia, 2012; Oakhill & Cain, 2012) and multicomponent view of reading (Cain, 2009; Cain et al., 2004), as it suggests that components of reading comprehension that were taught in the text-based intervention, such as inference making and metacognitive skills, may have direct effects on reading comprehension which are not fully mediated by listening comprehension. Indeed, studies have found that inference making skills are a unique predictor of later reading comprehension beyond vocabulary and prior listening comprehension skills (Lepola, Lynch, Laakkonen, Silven & Niemi, 2012). However, there are some studies that have found no support for the augmented simple view, and have concluded that the effects of component language skills on reading comprehension are entirely accounted for by their effects on listening comprehension (Kim, 2015; Lervag, Hulme, and Melby-Lervag, 2018).

Future studies could investigate whether training in inference making and metacognitive skills are more important in improving the reading comprehension of poor comprehenders of secondary school age when compared with students of primary school age. Metacognition should develop in adolescence as students develop their knowledge of

their own cognitive processes using higher-order thinking skills (Weil, Fleming, Dumontheil, Kilford, Rees, Dolan & Blakemore, 2013), There should also be clear developmental improvements with inference making skills (Currie & Cain, 2015; Barnes, Dennis & Haefele-Kalvaitis, 1996) as older children become aware of the need to draw on background knowledge for understanding (Cain & Oakhill, 1999). For example, Barnes, Dennis and Haefele-Kalvaitis (1996) found substantial improvements in the ability to make local coherence inferences between the ages of 6 and 11 years of age, with smaller gains continuing up to 15 years of age (the oldest age group in their study). This provides evidence of the increasing importance of the development of inference making skills as students get older, and are required to make more connections between ideas described in the text with relevant background knowledge in order to construct a meaningful and coherent representation of the text (Kintsch, 1998). Therefore, future studies could assess the impact of training poor comprehenders of secondary school age in metacognitive skills and inference making skills on their reading comprehension, in comparison with students of primary school age. This research would of course require standardised measures of inference making and metacognitive skills to be collected before and after the intervention in order to avoid the possibility that inference making and metacognitive skills are needed more in the secondary York Assessment of Reading Comprehension than the primary version.

5.2 Response to Intervention: The issue of poor response to intervention

Although most students showed very good progress with their reading comprehension in this study, 15 students made no or very little growth in reading comprehension standard score despite meeting the strict inclusion criteria for this study. These students had more severe impairments in their verbal ability, which may explain why they made little progress in their reading comprehension.

For example, although the average age of these students was 11.6 years, measures of verbal ability and vocabulary knowledge (measured using Wechsler Abbreviated Scale of Intelligence, WASI), placed them on the 4th and 5th centile respectively, corresponding to the 7.6 and 7.8 year old level. Observations from this study suggest that in addition to the difficulties that these students had with engaging in text-level constructive processing (Cain & Oakhill, 1999), they also had more basic language weaknesses. It is possible that these students could be classified as having Developmental Language Disorder (i.e. language skills that fall below average and significantly below non-verbal ability), and that their co-occurring difficulties meant their progress was very slow. Indeed, the literature on children with developmental language disorder describes some children who can decode quite well, but as they have deficits in oral language, reading comprehension tends to be impaired (Nation & Norbury, 2005; Snowling et al., 2019). The role of verbal ability in influencing the response to a reading comprehension intervention is supported by other research (Berninger et al., 1999; Foorman et al., 1998; Torgesen and Davis, 1996). For example, Duff, Fieldsend, Bowyer-Crane, Hulme, Smith, Gibbs and Snowling (2008) identified a subgroup of poor readers who had not responded to an intensive intervention programme targeting reading and phonology due to their low language ability.

It is important to note that other researchers (Hatcher & Hulme, 1999; O'Shaughnessy & Swanson, 2000; Torgesen et al., 1999; Vadasy et al., 1997) have found no statistically significant relationship between verbal ability and the extent to which students respond to intervention. For example, Torgesen et al. (1999) found that the role of verbal ability was not a significant factor in determining treatment unresponsiveness once phonological skill and socioeconomic status were entered into a regression equation. Indeed, it is acknowledged that there are many other unmeasured variables that could account for a lack of response to intervention, such as phonological awareness weaknesses (Torgesen et al., 1994), naming-

speed deficits (Wolf and Bowers, 1999), cognitive limitations (Menyuk and Chesnick, 1997), or attention or behaviour problems (Ackerman, Dykman, and Gardner, 1990; Shaywitz and Shaywitz, 1996).

Adolescents with co-occurring language difficulties are at risk of becoming treatment resistors, meaning that more intensive and specialist provision is required both in oral language instruction and instruction in decoding. There is limited evidence available regarding the precise form that interventions for poor responders should take, and the factor/s that might explain 'resistance' to reading comprehension interventions are still unclear. Evidence from this study suggests that secondary age students with the weakest verbal ability could not access the intervention material and did not make progress in their reading comprehension during the reading comprehension intervention. This invites further research on how factors, such as verbal ability, are related to response to interventions targeting reading comprehension impairments (Gernsbacher & Faust, 1991; Lipsey & Wilson, 2001; Bishop, Nation & Patterson, 2014).

5.3 Response to Intervention: Vocabulary

Although many studies have found vocabulary instruction to only improve the vocabulary knowledge of words that have been taught within the intervention programme (Kamil & Chou, 2009), this study found that the vocabulary standard score for all groups showed significant improvements from T1 to T2.

The text-based group showed significant improvements in vocabulary standard score, which was unexpected as these students had not been taught specific strategies that targeted the development of vocabulary. In line with available research (Sampson et al., 1982; Oakhill, Cain & Elbro, 2015), it is possible that students in the text-based intervention group were able to use comprehension monitoring and inference making strategies to help acquire the

meaning of novel words from supportive contexts during reading (Sternberg and Powell, 1983; Nagy & Scott, 2000). Indeed, using text to infer meaning from context is a means of vocabulary development (Sternbery & Powell, 1983), and research indicates that once a child develops their reading comprehension, the majority of a child's vocabulary development occurs through reading, rather than being taught new words (Cunningham, 2005). For example, Daugaard, Cain & Elbro (2017) found that the effect of vocabulary knowledge on reading comprehension was partly mediated by inference making, and they made two proposals to explain this mediation effect. The first was that inference making taps semantic relations between words, which in turn helps to build up a more complete understanding of the text. The second is that as most words have several meanings, the relevant and precise meaning of a word in a text must be selected as appropriate to the context (Miyake, Just, & Carpenter, 1994). It is also possible that the students in the text-based group developed enhanced metacognitive skills, which resulted in greater engagement with language learning and more active use of a range of strategies (such as contextual strategies) that support vocabulary learning.

It is also important to note that at T1 the vocabulary standard score of the text-based group was significantly lower than that of the waiting list control. It is possible that this may have meant that they were able to make greater progress during the intervention due to the lower baseline score. It is unfortunate that despite randomisation being properly undertaken, the groups were different in an important covariate. Future research should ensure that stratified randomisation is undertaken, and that word reading standard score is a covariate that is balanced between the groups.

Analysis of the vocabulary standard score for the oral language intervention group showed a significant increase in vocabulary knowledge for this intervention group, indicating that there was a transfer of new vocabulary knowledge to standardised tests of vocabulary knowledge (with an average increase in the vocabulary knowledge standard score of 5.92).

This is in-line with the findings of Clarke et al. (2010) who found significant improvements in non-taught words following vocabulary instruction for the oral language intervention group. It is hypothesized that the oral language intervention led to gains in vocabulary knowledge due to the multiple strategy approach that incorporated learning new vocabulary through exposure to explicit oral vocabulary instruction, as well as having students make semantic connections among words, elaborate word meanings through discussion and verbalise those connections to support the learning of the target words. Furthermore, it is possible that the reciprocal teaching approach provided scaffolding for students to question, clarify, predict and co-construct the meanings of words throughout the intervention. These techniques that were practiced and refined in the cooperative group setting were successfully implemented when students were reading independently, leading to gains in standardised measures of vocabulary knowledge.

However, in this study neither the change in vocabulary standard score from T1 to T2 nor the vocabulary score mediated the reading comprehension standard score at T2. This is in contrast to the study by Clarke et al. (2010) who found that for the oral language group, the gain in vocabulary score mediated the improvements that they made in their reading comprehension standard score. A possible explanation for this difference is that the children included in Clarke et al. (2010) had on average lower vocabulary knowledge at T1 than the students included in this study. Although the National Early Literacy Panel's (2008) report suggests that targeted oral language intervention can be equally effective for typically developing children as for those who are at risk of later literacy difficulties. Ruston and Schwanenflugel (2010) reported the contrary that children entering their programme with lower vocabulary skills (1/2 SD below the mean) actually benefited more from the intervention than those who had higher vocabulary skills.

Overall, the present findings show that both a structured text and oral based intervention programme can lead to significant gains in vocabulary knowledge. Future research should be directed towards further understanding the role of training vocabulary to improve standardised measures of vocabulary knowledge and reading comprehension.

5.4 Response to Intervention: Perceived Value of Reading and Reading Self-Concept

Promising differences were found in perceived value of reading and reading self-concept after instruction for the text-based and oral language training relative to the waiting list control. As a student's perception of their reading and the value of reading is often engrained, due a complex interplay of socio-cultural factors alongside possible years of difficulty at school, the findings of overall improvements in the perceived value of reading and reading self-concept for both intervention groups over a short period of time are promising. If students are able to view improvements as a result of controllable factors (such as effort or strategy use) rather than uncontrollable factors (such as ability or luck) this has important implications for teaching practice, particularly if students are to persist in using reading strategies to maintain the effect of improvements in reading comprehension (Robertson, 2000; Miranda, Villaescusa, & Vidal-Abarca, 1997; Chan, 1996; Berkeley et al., 2011).

Specifically, the text-based group showed significant improvements in students' perception of how others view their reading ability, students' perception of their own reading ability compared with their friends, students' perception of their own reading ability, interest in reading, engagement in reading and intrinsic motivation. The oral language group also showed significant improvements in these aspects, apart from students' perception of their own reading ability compared with their friends and students' perception of their reading ability.

The causal mechanisms behind these improvements are unclear from this research, and it is possible that they are due to a number of interrelated factors. One explanation is that these improvements were a result of improvements in reading comprehension. Indeed, research indicates that there is a correlation between self-efficacy score (i.e. the expectation of being able to comprehend text) and reading comprehension score, even when previous performance was controlled (Schunk & Pajares, 2009; Mucherah & Yoder, 2008). Other possible explanations are due to improvements in reading comprehension, the additional time spent focusing on reading, focusing on reading comprehension within a safe, supportive sessions or improvements in self-esteem.

Research into reading comprehension has typically been based on objective measurements, whereas the data collected to measure the perceived value of reading and reading self-concept was subjective. These subjective measures offer meaningful insights into students' thoughts and feelings, and enrich the objective data with a greater depth in understanding of the impact of reading comprehension interventions. Combining subjective data with more objective measures, and measuring both cognitive and social-emotional factors provides the most complete understanding of the impact of interventions for the participants. Future qualitative research is required to better understand student perceptions of themselves as readers, including detailed analysis of their attitude, belief, self-concept, self-efficacy and mindset before and after receiving a reading comprehension intervention, as this may lead to powerful insights to the identity formation of poor comprehenders as readers. Indeed, this study did not identify the relative contributions of different dimensions of reading self-concept and perceived value of reading to reading comprehension, nor did it identify the processes that mediate the effects between reading self-concept/perceived value of reading and reading comprehension (Watkin & Coffey, 2004). Finally, there are also difficulties in accounting for the socially situated development of reading motivation that explains how an

individual's definition of reading self-concept or the perceived value of reading is different in different situations and changes over time that could not be captured within this study (Moje et al., 2008). Despite these limitations, the significant differences seen for both the text-based and oral language groups are a promising aspect of the intervention programmes designed for use in this study.

5.5 Impact of the way in which the interventions were delivered

It is hypothesised the significant effects on reading comprehension in both intervention groups was also due to the method in which the interventions were delivered. The core principle underpinning the delivery of this intervention was the work by Vygotsky (1962, 1978), and it is possible that incorporating attribution re-training, reciprocal teaching and using a collaborative learning approach throughout contributed to the success of these interventions. This hypothesis is supported by other training studies that have used some of the same approaches (Berkeley, Mastropieri, & Scruggs, 2011; Zentall & Lee, 2012). It is important to note that the delivery of the interventions required careful consideration and scripting of each session. For example, careful planning ensured that the scaffolding process was not directed by the adult at the expense of the active involvement of the child, and that in discursive tasks, students did not ask superficial questions, and instead were supported to make elaborations and reflections. In the REACH study although the teaching assistants received five days training, the REACH Education Endowment Foundation Report (2016) concluded that some of the teaching assistants experienced "a lack of confidence about delivering the intervention, felt overwhelmed by the amount of material that was covered in the training sessions and were concerned that there was no check on how the materials were being delivered after the training was over"(121). Therefore, before delivering the interventions in this study, additional training in student led discussion was undertaken to ensure that the interventions were delivered according to the key principles of reciprocal

teaching. Furthermore, the person delivering the interventions was a trained teacher, special educational needs co-ordinator and researcher with expertise in reading comprehension. This is a key difference to the majority of other studies in this field that have been designed to be delivered by teaching assistants within the case study school.

It is also possible that the inclusion of re-attribution training in both intervention programmes contributed to the improvements seen in reading comprehension standard scores for both intervention groups. The aim of the re-attribution training was to help students develop self-efficacy and encourage them to implement and persist in the use of a range of different reading strategies. These strategies may be particularly important for students with reading difficulties who, when compared with typically developing students, are more likely to attribute their success to external factors (such as the perceived quality of teaching) and failings to internal factors (such as level of intelligence) (Tabassam & Grainger, 2002). These beliefs demotivate students and decrease the likelihood that they will use appropriate reading comprehension strategies (Borkowski et al., 1998; Vaughn et al., 2000) and persist with the reading tasks (Gersten et al., 2001). It is possible that attribution re-training had a positive impact on the improvements made by students, and it may have boosted their learning in general. Indeed, it is not possible to analyse the specific impact of re-attribution training in detail, particularly as it was included in both intervention programmes. However, the hypothesis is in-line with the findings of other studies. For example, Berkeley et al (2011) found that the reading comprehension strategy with attribution re-training intervention condition (RCS + AR) was statistically higher on a measure of Meta-Comprehension Strategy Index (i.e. the reading strategies used by students before, during, and after reading) when compared with a control (RN), with a large effect size (ES = 1.10). On a measure of attributions for reading success, the RCS+AR condition was significantly higher than both the RCS group (p = .001) and the RN comparison condition (p = .001).

These differences represented large effect sizes for RCS+AR compared to the RCS group (ES = 1.01) and the control group (ES = .86). The study concluded that the maintained improvements of students in the RCS+AR condition of the current study may have been due to greater sustained use of strategies by those students. However, a limitation of this study was that measures of attributions for reading success and Meta-Comprehension Strategy Index relied on self-reporting by students that may not always be accurate.

5.6 Limitations of the Randomised controlled trial

Whilst the gains in reading comprehension, word reading, vocabulary, reading self-concept and value of reading are extremely positive, the research findings do not address the extent to which these improvements reflect generalised improvements in academic attainment, as the measures do not necessarily reflect reading comprehension skills needed to succeed in school. Information about the extent to which improvements are transferable would require the researcher to conduct a longitudinal study tracking the academic attainment of pupils involved in the intervention study.

Furthermore, the design of the intervention programmes does not allow one to identify the effect of the intervention separately from the provision of small group teaching and any increased time devoted to literacy, as students were typically withdrawn from lessons other than English. Further research could assess the impact of withdrawing pupils from lessons, consider trials involving the withdrawal of students only from English lessons or take students out of class and train them in something different such as Mathematics.

The randomised controlled trial methodology also affords limited explanatory purchase, particularly as the individual elements of the intervention programmes were not disaggregated and implemented separately. For example, it is hypothesised that this approach could be particularly beneficial for English as an additional language (EAL) learners. Through

dialogic teaching EAL learners can use their language resources to contribute to the ongoing discussion, and simultaneously learn the social and communicative strategies needed to access the academic content, such as how to express their ideas clearly using the appropriate discourse strategies (Haneda & wells, 2008). Furthermore, whilst we certainly need to know why this intervention led to such large effect sizes in so short a time, it is also important to understand the holistic character of the intervention as the intervention tracked a logical sequence. For example, implementation of the clarification strategy required students to draw on background knowledge, and use of the questionig strategy preceded extending students inference making skills.

The pedagogical approaches predominately used by teachers within the schools were unknown, meaning that it was not possible to fully understand the impact of the pedological approach used in this study. However, it is likely that the approach followed the dominant form in teacher-student interactions, which is thought to remain the traditional initiation-response-feedback (IRF) format (Wells & Arauz, 2006), The IRF format usual involves teachers asking closed questions with low cognitive demand, students producing short and simple answers, and teachers evaluating the responses based. Indeed, on the basis of observational research, Smith, Hardman , Wall and Morz conclude that 'in the whole class sections of literacy and numeracy lessons most of the questions asked were of a low cognitive demand designed to funnel students' responses towards a required answer' (2004; 14). These types of questions have been referred to as "guess what I am thinking" test questions, and reflect the requirements of the National Curriculum to recall facts rather than engage deeply with text (Nystrand et al., 1997). In contrast, productive classroom dialogue was firmly embedded in the interventions used in this study, and it is hypothesised that the way in which this pedagogy was delivered contributed to the large effect sizes seen in these interventions. Indeed, Mercer and Howe (2012) argue that whilst socio-cultural research findings have had

relatively little impact on educational policy and practice, the practical implications are quite profound both for understanding what normally goes on in the classroom and changing instruction to achieve better educational outcomes.

Despite the positive outcomes of these interventions, there is the issue of scalability (Howe & Mercer, 2017). In particular, successful implementation of the reciprocal teaching approach requires teachers to implement a broad repertoire of collaborative talk-based skills and strategies, steered by the appropriate procedures, in order to energise and engage students in purposeful, reciprocal and cumulative talk. It is important to note that the teacher in this study was trained in dialogic teaching practices in secondary schools for a number of years prior to implementing the intervention. In most successful programmes that have used similar talk-based strategies, there has been a large investment of time and effort from researchers and teachers to develop these skills. For example, Wilkinson et al. (2017) offered two 6-hour workshops, biweekly meetings with teachers and monthly individual coaching sessions of 30-40 minutes each. Sedova, Sedlacek and Svaricek (2016) offered a one-year training programme. This is important as a skilled practitioner might have more success with the interventions than a researcher without teaching experience might manage. It is also important to note that, according to the Index of Multiple Deprivation (2019, the interventions were delivered in state secondary schools located in the least deprived areas in the country). It is likely that there would be additional barriers and added complexity to delivering these interventions (including training teachers and allocation of appropriate time and resources) in areas that have higher levels of deprivation. In short, the potential for scaling this intervention up for other teachers, whilst maintaining the large effect on reading comprehension in such a short space of time, is questionable.

Finally, how reading comprehension is measured may affect the conclusions that are drawn as correlations between standardised tests of reading comprehension are modest,

indicating that they are not equivalent (Keenan & Meenan, 2014). This is largely because reading comprehension is a complex construct, there is separability in reading comprehension skills and very few children are poor in all the component skills. Reading comprehension assessments typically require individuals to read connected text and then demonstrate their understanding by responding to a number of questions. Beyond this, the exact nature of the tests varies enormously, along a variety of dimensions from passage length to vocabulary level and syntactic complexity, and different tests rely on different components of reading comprehension to a greater or lesser degree. For example, using the Wechsler Individual Achievement Test 2nd Edition (WIAT II; Wechsler, 2005) to measure reading comprehension before and after the intervention, Clarke et al. (2010) found significant gains in reading comprehension for an oral language intervention group (7.874, $p < .001$) and a text-based intervention group (5.195 $p = .028$). However, the same study did not find significant gains for reading comprehension in either group following analysis of reading comprehension data from the Neale Analysis of Reading Ability: Second Revised British Edition (NARA II, Form B; Neale, 1997). This is perhaps because the NARA has been shown to tap decoding more than reading comprehension (Lervag, Hulme, and Melby-Lervag, 2018). Clarke et al. (2017) also found that the improvements in reading comprehension for the Reading Intervention plus Comprehension intervention group were largely carried by the New Group Reading Test Digital (NGRT; GL Assessment, 2010), whilst the effects on reading comprehension using the Wechsler Individual Achievement Test–2nd Edition [WIAT-II]) were negligible for all groups. Across the tests used there are differences in the genre and format of the material, the nature of the information that is assessed and the administration procedure (Garcia and Cain, 2014). The assessments differ in the length of the text used, whether the text is narrative or expository, whether or not the student is able to refer back to the comprehension material, whether or not the assessment items are read by the assessor or by the participant, and

whether the students are asked to read silently or out loud. Regardless of the format of the test, the nature of the questions varies according to the degree of inference, knowledge of specific vocabulary and the background knowledge that is required (the nature of the reader's mental representations of the text base (Graesser et al., 1994; Garcia and Cain, 2014). Furthermore, tests of reading comprehension require a verbal response (Ricketts, 2014), and it is likely that this will underestimate reading comprehension in students with expressive language difficulties.

Therefore, when comparing the effect of interventions between different studies that are using different tests for reading comprehension, one must be aware that the test used to measure reading comprehension may have an impact on the conclusions that are drawn. Therefore, multiple tests of reading comprehension should be used within one study, and care should be taken when making comparison between studies that use different tests to measure reading comprehension.

5.7 Findings from the Teacher Survey

Analysis of the findings from the teacher survey indicates that for the majority of the teachers who responded to the survey, the barriers to delivering reading comprehension interventions were a lack of time, money, and human resources.

In response to the survey, teachers referred to the time needed to implement and iteratively refine intervention materials, as refinements to interventions are required based on the duration and number of sessions, the number of students in the intervention group and relevant pupil factors such as their cognitive profile and their specific area of difficulty. Teachers stated that the interventions require detailed planning, yet still may not work as they had intended, requiring them to evaluate the intervention and approach taken for a particular student by using available evidence. They felt that planning, implementation and refining stages require vast knowledge of relevant literature, as well as an understanding of

how to negotiate the dynamics within the school to ensure that the interventions are appropriately resourced and prioritised within a busy school day. Supporting these findings, Concannon-Gibneya & Murphy (2010) have argued that policy documentation and guidance has not appropriately supported teachers in delivering reading comprehension interventions. Although the policy documents make reference to the teacher modelling comprehension skills "through thinking aloud" (p. 63), there is limited guidance on how the teacher should teach them and what to do when students fail to meet the required standards.

Equally important, and intimately connected to time resources, is the need for monetary resources. In the survey, teachers commented on the pressures associated with deciding how best to prioritise monetary resources. More widely, researchers and teachers have argued that this is becoming more difficult as budgets are stretched. For example, the Education Policy Institute found that 30.3% of local authority maintained secondary schools were in deficit in 2017-18, which is four times that of 2014 (8.1%) and the average secondary school deficit was £483,569 (Education Policy Institute, 2018). Their report recommends either higher per pupil funding, further efficiency savings or changes in pupil numbers.

One must not underestimate the time required to design, facilitate and deliver the interventions. Indeed, teachers must be willing to devote their time to planning and implementing new pedagogical approaches based on the latest research findings. This resource is rare, as teachers have a number of significant demands that require them to decide where best to allocate their time. The research supports the argument that reading comprehension interventions have historically come at the bottom of the hierarchy due to an enduring misunderstanding, which regarded reading comprehension as un-teachable (Tovey 1976); the complexity of teaching comprehension strategies (Beard El-Dinary 2002); the over-use of workbooks and basal reading schemes (Government of Ireland 1990; Martin and Morgan 1994) and teaching cultures which are resistant to change (Hargreaves and Fullan 1993).

Analysis of responses from the teacher survey indicated that 70% of respondents rarely or never delivered reading comprehension interventions. Other research related to the prevalence of reading comprehension interventions in secondary schools is limited, however, a survey of 278 teachers by Concannon-Gibneya & Murphy (2010) found that there was a focus on decoding skills and reading for pleasure, rather than explicit instruction of strategies to help successful comprehension. The authors conclude that the teachers surveyed "were somewhat dissatisfied with the training that they had received (both pre-service and/or in-service) in relation to the teaching of reading and reading comprehension in particular" (Concannon-Gibneya & Murphy, 2010; 145).

Based on the questionnaire responses completed for this study, of the interventions that were delivered, 63% of respondents stated that the focus of their interventions was on oral language or vocabulary. This suggests that teachers have some awareness of the research that indicates these aspects are significant causes of reading comprehension difficulties (Clarke et al., 2010). Whilst the infrequent delivery of tailored interventions to poor comprehenders of secondary school age is a major cause for concern, it is positive step forward that teachers are more aware of the research regarding the type of interventions that should be delivered (Duff, Hulme, Grainger, Hardwick, & Snowling, 2014). However, it is not clear from this survey whether or not the interventions that the teachers were advocating were, in fact, evidence-based. Indeed, the extent to which conclusions can be drawn about how appropriate these interventions are is very limited due to a lack of information about them, including how the interventions are delivered, how students are chosen to be part of the intervention and how their performance is monitored whilst receiving the intervention.

The findings suggest that work is required to highlight to secondary school teachers that poor comprehension is relatively common, can be easily identified and remediable (Clarke et al., 2010). The Education Endowment Foundation (EEF) analysis indicates that on

average, reading comprehension interventions deliver an additional six months' progress, and gains of this magnitude are likely to have real educational significance. Furthermore, they conclude that the average cost of an intervention with appropriate training is approximately £1,200 per teacher or £48 per pupil (EEF, 2016). The available evidence indicates it is highly likely that reading comprehension intervention programmes are cost-effective in relation to their educational benefits. Thus, the findings from the small-scale questionnaire in this thesis suggest a tension between the available evidence and the constraints of delivering these types of interventions within schools.

The teacher survey indicated that for the teachers questioned, despite frequent assessment, interventions in reading comprehension were not being consistently delivered to students with poor reading comprehension. Teachers who were surveyed cited reasons such as time constraints, a lack of access to appropriate resources to deliver reading comprehension interventions, a lack of appropriate training, and financial costs and confusion over what resources are appropriate. This supports the research indicating secondary school teachers do not have the training, knowledge or appropriate skills to meet the educational needs of poor comprehenders in the classroom (MacMahon, 2014), and that it often falls to TAs to support the needs of these pupils. These findings support the research documenting a gap in the delivery of reading comprehension intervention for poor comprehenders (Greenwood & Abbot, 2001), and the recommendation that secondary school teachers must receive further training on identifying, monitoring and delivering evidence-based interventions for students with poor reading comprehension (Sencibaugh, 2007; Deshler & Schumaker, 2006).

A wide range of different strategies and interventions can be successful at improving the reading comprehension of secondary school students, but they need to be taught explicitly and consistently (Paul & Clarke, 2016). To enable poor comprehenders to access reading

comprehension interventions in secondary school, a number of barriers within schools must be first addressed. In particular, teachers require opportunities to reflect on their teaching (Eraut 1985) and understanding of the processes involved in reading comprehension. This must be alongside improvements in the access to information about which intervention have been shown to work as well as access to these intervention resources.

Chapter 6: Conclusion

This randomised controlled trial involving 150 poor comprehenders between 11- and 13- years old found that both the oral language and text-based intervention led to significant improvements in reading comprehension standard score when compared with a waiting list control group, and measured using the York Assessment of Reading Comprehension (YARC). The interventions led to large effect sizes in reading comprehension for the oral language intervention of 0.67 and for the text-based intervention group of 0.53. Following the intervention, the reading comprehension level of students in the oral language intervention group was slightly higher than would be expected for their chronological age and for the text-based intervention group it was slightly lower than would be expected for their chronological age.

This thesis argues that interventions focusing on either oral language skills or processes specific to text, such as inference making skills and metacognitive skills, can be effective at ameliorating reading comprehension difficulties for students of secondary school age. These findings support the Simple View of Reading (Gough & Tunmer, 1986), as they suggest that training linguistic comprehension or reading comprehension results in improvements. This supports the findings of Clarke et al. (2010) who concluded that both the text-based intervention and oral language intervention led to significant improvements in

reading comprehension relative to an untreated control group in students of primary school age when measured using WIAT-11-UK-T.

This study also shows that the text-based intervention group also experienced significant improvements in their word reading standard score. The improvements in word reading were unexpected as the intervention did not include direct instruction in morphology or phonology. It is possible that the improvements in word reading experienced by the text-based intervention group were due to students having access to the text during the intervention programme, and that this exposure to reading words in different contexts improved their ability to identify words. This hypothesis is supported by Nation's (2017) Lexical Legacy Hypothesis that exposure to written words in context will improve lexical quality, and therefore word reading. It also supports the findings of Nation and Snowling (1998) that when students are able to apply their phonological knowledge to unknown exception words, the partial decoding of the word may be close enough for the student to identify the word, but only if the word is within their lexicon.

All groups also showed statistically significant gains in vocabulary standard score. The statistically significant gain in vocabulary made by the oral language group is in line with the finding of Clarke et al. (2010) who found that the oral language intervention group made significant gains in their vocabulary standardised score from pre to post-test (this fell to non-significant levels when it was tested again 11 months after the intervention). It is speculated that the significant gains in vocabulary knowledge made by the oral language intervention group were due to the multiple strategy approach to vocabulary instruction that occurred alongside reciprocal teaching. This study also found significant gains in vocabulary standard score for the text-based intervention group. The gain in vocabulary standard score made by the text-based group shows that access to written text is an important source of vocabulary knowledge when children become fluent readers (Cunningham & Stanovich, 1998; Nagy &

Scott, 2000). Furthermore, it suggests that due to the range of vocabulary available, written text provides opportunities to extend the breadth and depth of vocabulary knowledge of a student (Nagy & Anderson, 1984). However, it is important to note that at T1 the vocabulary standard score of the text-based group was significantly lower than that of the waiting list control, which may impact the progress that was able to be made.

This thesis argues that the success of this study in improving the reading comprehension standard score of students in both intervention groups was due not only to the nature of the intervention, but also the method of its delivery, the inclusion of attribution re-training and the delivery of the interventions within small groups led by an expert teacher. In the context of interventions, like the programmes delivered here, where success is often evaluated solely by the change in student standardised score results, the motivational power of the approaches that have been used can be missed. In fact, motivation is an essential prerequisite for learning, and engagement for some students who find reading challenging is not easily won.

Finally, this thesis draws attention to the barriers facing secondary school teachers in delivering evidence-based interventions to poor comprehenders within secondary schools. Overall, teachers reported that time constraints, a lack of access to appropriate resources to deliver reading comprehension interventions, a lack of appropriate training, financial costs and confusion over what resources are appropriate as reasons why the majority of teachers delivered reading comprehensions to secondary school pupils only 'never or rarely'. This lends support to the recommendation that secondary school teachers must receive further training to deliver evidence-based interventions for students with poor reading comprehension (Sencibaugh, 2007; Deshler & Schumaker, 2006).

This thesis makes an original contribution to research in seeking to explore the most effective reading comprehension interventions for poor comprehenders in secondary schools

using a randomised controlled trial design. The initial objective of this study was to inform my practice in identifying and teaching students with poor reading comprehension, and it is hoped that the resources and findings will also be useful to other practitioners. The findings confirm that training in oral language and text-based processes can lead to significant improvements in the reading comprehension of poor comprehenders. Furthermore, it suggests that a small-group instruction method, with the interventions delivered by a teacher (rather than a teaching assistant), who is trained in reciprocal teaching methods, has potential benefits for the success of an intervention that could be explored further in future research.

Word Count: 65,790

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Appendix

Appendix 1: Ethical Approval, Information and Consent Forms

University of Reading
Institute of Education
Ethical Approval Form A (version May 2015)

Tick one:
Staff project: _____ PhD ____ EdD __X_

Name of applicant (s): Grace Elliott

Title of project: Do interventions in oral language and text-based strategies improve the reading comprehension of students with poor reading comprehension aged between 13 and 15?

Name of supervisor (for student projects): Dr Holly Joseph

Please complete the form below including relevant sections overleaf.

	YES	NO	
Have you prepared an Information Sheet for participants and/or their parents/carers that:			
a) explains the purpose(s) of the project	x		
b) explains how they have been selected as potential participants	x		
c) gives a full, fair and clear account of what will be asked of them and how the information that they provide will be used	x		
d) makes clear that participation in the project is voluntary	x		
e) explains the arrangements to allow participants to withdraw at any stage if they wish	x		
f) explains the arrangements to ensure the confidentiality of any material collected during the project, including secure arrangements for its storage, retention and disposal	x		
g) explains the arrangements for publishing the research results and, if confidentiality might be affected, for obtaining written consent for this	x		
h) explains the arrangements for providing participants with the research results if they wish to have them	x		
i) gives the name and designation of the member of staff with responsibility for the project together with contact details, including email . If any of the project investigators are students at the IoE, then this information must be included and their name provided	x		
k) explains, where applicable, the arrangements for expenses and other payments to be made to the participants	x		
j) includes a standard statement indicating the process of ethical review at the University undergone by the project, as follows: 'This project has been reviewed following the procedures of the University Research Ethics Committee and has been given a favourable ethical opinion for conduct'.	x		
k)includes a standard statement regarding insurance: "The University has the appropriate insurances in place. Full details are available on request".	x		
Please answer the following questions			
1) Will you provide participants involved in your research with all the information necessary to ensure that they are fully informed and not in any way deceived or misled as to the purpose(s) and nature of the research? (Please use the subheadings used in the example information sheets on blackboard to ensure this).	x		
2) Will you seek written or other formal consent from all participants, if they are able to provide it, in addition to (1)?	x		
3) Is there any risk that participants may experience physical or psychological distress in taking part in your research?		x	
4) Have you taken the online training modules in data protection and information security (which can be found here: http://www.reading.ac.uk/internal/imps/Staffpages/imps-training.aspx)?	x		
5) Have you read the Health and Safety booklet (available on Blackboard) and completed a Risk Assessment Form to be included with this ethics application?	x		
6) Does your research comply with the University's Code of Good Practice in Research?	x		
	YES	NO	N.A.
7) If your research is taking place in a school, have you prepared an information sheet and consent form to gain the permission in writing of the head teacher or other relevant supervisory professional?	x		
8) Has the data collector obtained satisfactory DBS clearance?	x		
9) If your research involves working with children under the age of 16 (or those whose special educational needs mean they are unable to give informed consent), have you prepared an information sheet and consent form for parents/carers to seek permission in writing, or to give parents/carers the opportunity to decline consent?	x		

10) If your research involves processing sensitive personal data[1], or if it involves audio/video recordings, have you obtained the explicit consent of participants/parents?	x		
11) If you are using a data processor to subcontract any part of your research, have you got a written contract with that contractor which (a) specifies that the contractor is required to act only on your instructions, and (b) provides for appropriate technical and organisational security measures to protect the data?			x
12a) Does your research involve data collection outside the UK?		x	
12b) If the answer to question 12a is "yes", does your research comply with the legal and ethical requirements for doing research in that country?			x
13a) Does your research involve collecting data in a language other than English?		x	
13b) If the answer to question 13a is "yes", please confirm that information sheets, consent forms, and research instruments, where appropriate, have been directly translated from the English versions submitted with this application.			x
14a. Does the proposed research involve children under the age of 5?		x	
14b. If the answer to question 14a is "yes": My Head of School (or authorised Head of Department) has given details of the proposed research to the University's insurance officer, and the research will not proceed until I have confirmation that insurance cover is in place.			x
If you have answered YES to Question 3, please complete Section B below			

Please complete **either** Section A **or** Section B and provide the details required in support of your application. Sign the form (Section C) then submit it with all relevant attachments (e.g. information sheets, consent forms, tests, questionnaires, interview schedules) to the Institute's Ethics Committee for consideration. Any missing information will result in the form being returned to you.

A: My research goes beyond the 'accepted custom and practice of teaching' but I consider that this project has **no** significant ethical implications. (Please tick the box.)	
Please state the total number of participants that will be involved in the project and give a breakdown of how many there are in each category e.g. teachers, parents, pupils etc. 130 pupils aged between 11 and 13	
Give a brief description of the aims and the methods (participants, instruments and procedures) of the project in up to 200 words noting: 1. title of project 2. purpose of project and its academic rationale 3. brief description of methods and measurements 4. participants: recruitment methods, number, age, gender, exclusion/inclusion criteria 5. consent and participant information arrangements, debriefing (attach forms where necessary) 6. a clear and concise statement of the ethical considerations raised by the project and how you intend to deal with then. 7. estimated start date and duration of project Title of the project: Do interventions in oral language and text-based strategies improve the reading comprehension of students with poor reading comprehension aged between 11 and 13? This investigation has a number of aims, which are listed below: • To investigate two approaches in improving reading comprehension • To compare these approaches to normal classroom practice through the use of a control group • To equip secondary school teachers with a wide range of effective and evidence based strategies to improve reading comprehension • To test whether findings from studies with primary school students can be applied to older students The following standardized assessments will be conducted with all pupils before the intervention, following the intervention and at follow-up (9 months after the intervention). For all the assessments students will be seen individually in a quiet area near their classroom, and will complete the assessments individually with the researcher. • York Assessment of Reading for Comprehension (YARC). This test measures reading comprehension. Students will be asked to read a passage, and then to summarise the passage in their own words and answer eight comprehension questions relating to the passage. They will do for two separate passages. • Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999) This is a measure of an individual's Sight Word Efficiency (ability to pronounce printed words) and Phonemic Decoding Efficiency	

[1] Sensitive personal data consists of information relating to the racial or ethnic origin of a data subject, their political opinions, religious beliefs, trade union membership, sexual life, physical or mental health or condition, or criminal offences or record.

(ability to pronounce phonemically regular non-words). In this test, students will be asked to read a list of words and non-words of increasing length and difficulty as quickly as they can. They have 45 seconds for each set of words.

- The vocabulary subtest of the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) requires the students to define a series of words to measure the depth and breadth of expressive vocabulary.
- WIAT II Numerical Operations subtest (Wechsler, 2005) is administered as a test of arithmetic ability with two sections. The Numerical Operations section requires students to solve written mathematical problems requiring addition, subtraction, multiplication, and division using whole numbers, fractions, and decimals. The Mathematical Reasoning section requires the student to solve a word or stated problem, requiring single or multiple steps and related to time, money, measurement, geometry, probability, and reading and interpreting graphs.

Pupils will be asked to complete a questionnaire following the intervention to feedback on what they thought about the teaching resources (the questionnaire has been included in the information provided).

There will be three intervention groups

1. Text based strategies
2. Oral language strategies
3. Waiting control group (normal classroom activities with no intervention)

The interventions will take place in a quiet place in the students' school, ideally within the Academic Support/Special Educational Needs Department. As the interventions will take place during the school day, it will mean that students will have to miss part of a lesson to receive the intervention.
The interventions will involve a range of different teaching activities. The text-based strategies will be based around reading and written narrative, as well as resources to help develop metacognitive skills. The oral language strategies will be based around spoken narrative, and students will receive strategies focused on developing their vocabulary.

Inclusion/Exclusion Criteria
Students that are appropriate (would benefit from) the study, will be identified by the school's Special Education Needs Co-ordinator. These are students with a reading comprehension standard score below 90 and reading accuracy score above 90. Parental and student consent will then be sought for these pupils.

The ethical considerations raised by the project and how I intend to deal with them

- I will have a waiting control group to mitigate any negative consequences of students not receiving the interventions.

- I will minimise the amount of lesson time that students will miss and will ensure that students do not miss part of the same subject two weeks in a row. The students' teachers will be informed of the timings of the interventions, and before students give consent to take part, I will explain that involvement in the study will require them to catch up any work missed in their own time.

- Consent forms will be collected from students and parents/carers from October to December, which will give a suitable amount of time for responses to be returned and collated. This will ensure that consent has been received from all students and their parents/carers who take part in the study.

- Should a student no longer want to take part in the study, the student or their parent/carer can contact me, or a teacher (who will inform me via the school SENCO).

- Parents/carers will give consent for students' reading comprehension and reading accuracy scores to be securely shared with me.

The project will take place following receipt of ethical approval until August 2017, and the intervention itself will take place over 8 weeks. The research design is based on the study by Clarke, P.J., Snowling, M.J., Truelove, E., & Hulme, C. (2010). Ameliorating children's reading comprehension difficulties: A randomised controlled trial. *Psychological Science*, 21, 1106–1116.

B: I consider that this project **may** have ethical implications that should be brought before the Institute's Ethics Committee.	

Please state the total number of participants that will be involved in the project and give a breakdown of how many there are in each category e.g. teachers, parents, pupils etc.

Give a brief description of the aims and the methods (participants, instruments and procedures) of the project in up to 200 words.

1. title of project
2. purpose of project and its academic rationale

3. brief description of methods and measurements
4. participants: recruitment methods, number, age, gender, exclusion/inclusion criteria
5. consent and participant information arrangements, debriefing (attach forms where necessary)
6. a clear and concise statement of the ethical considerations raised by the project and how you intend to deal with then.
7. estimated start date and duration of project

C: SIGNATURE OF APPLICANT:

Note: a signature is required. Typed names are not acceptable.

I have declared all relevant information regarding my proposed project and confirm that ethical good practice will be followed within the project.

Signed: Grace Elliott Date: 20/10/2016

STATEMENT OF ETHICAL APPROVAL FOR PROPOSALS SUBMITTED TO THE INSTITUTE ETHICS COMMITTEE

This project has been considered using agreed Institute procedures and is now approved.

Signed: ……  .. Print Name…Xiao Lan Curdt-Christiansen…. Date…01/12/2016….
(IoE Research Ethics Committee representative)*

* A decision to allow a project to proceed is not an expert assessment of its content or of the possible risks involved in the investigation, nor does it detract in any way from the ultimate responsibility which students/investigators must themselves have for these matters. Approval is granted on the basis of the information declared by the applicant.

University of Reading

Information for Parents and Carers

I would very much like to invite your child to take part in a study about improving reading comprehension for secondary school students.

What is the project?

Do interventions in oral language and text-based strategies improve the reading comprehension of students with poor reading comprehension aged between 13 and 15?

The study is being conducted through the University of Reading. Its aims are:

- To investigate different approaches to improve the reading comprehension of secondary school students
- To compare these interventions to normal classroom practice
- To equip secondary school teachers with a wide range of effective and evidence-based strategies to improve reading comprehension

The study will involve students selected by the Special Educational Needs Co-ordinator (SENCO) at their school who will receive a 30-minute intervention each week for eight weeks from the start of term in January. The intervention will be delivered by Grace Elliott who is the researcher carrying out this research. Students who are involved in the research will also be asked to complete an assessment testing their level of reading comprehension, word recognition, vocabulary and numerical operations at three points during the term (before the intervention starts, immediately after the intervention, and 6 months after the intervention).

Why has my child been chosen?

Your child has been selected by the SENCO at their school as someone who may benefit from receiving a 1:1 intervention each week over an eight-week period aimed at improving their reading comprehension levels.

Does my son/daughter have to take part?

It is entirely up to you whether your son/daughter participates. If you would like your son/daughter to take part in the study please complete the consent form below and give it to the SENCO at your school. Please note that you or the student may withdraw consent at any time during the project, without any repercussions. You can contact Grace Elliott to do this, or speak directly to the SENCO at your school.

What will happen if your son/daughter takes part?

If you would like your son/daughter to take part in the research, they will receive a 1:1 reading comprehension intervention each week over eight weeks at an appropriate time for them during the school day at their school. They will also be asked to complete an assessment before, immediately after and 6 months following the intervention.

What are the advantages and disadvantages of my son/daughter taking part?

The assessment data will remain confidential, and your son/daughter will not be identifiable in any published report resulting from the study. Information about individuals will not be shared with the school unless requested.

Participants in similar studies have found it interesting and useful to take part. It is anticipated that your child will develop useful reading comprehension strategies to use across a range of different subjects to help with their studies. The findings of the study will also be useful for teachers when addressing how to help secondary school students to develop their reading comprehension.

What will happen to the data?

Any data collected will be held in strict confidence and no real names will be used in this study or in any subsequent publications. The records of this study will be kept private. No identifiers linking you, the children or the school to the study will be included in any sort of report that might be published. Participants will be assigned a number and will be referred to by that number in all records. Research records will be stored securely in a locked filing cabinet and on a password-protected computer and only the research team will have access to the records. The data will be destroyed securely once the findings of the study are written up, after five years. The results of the study will be written in reports. We can send you electronic copies of these publications if you wish.

What happens if I change my mind?

You or your child can change their mind at any time without any repercussions. If at anytime your child changes their mind after data collection has ended, their data will be discarded.

Who has reviewed the study?

This project has been reviewed following the procedures of the University Research Ethics Committee and has been given a favourable ethical opinion for conduct. The University has the appropriate insurances in place. Full details are available on request.

What happens if something goes wrong?

In the unlikely case of concern or complaint, you can contact Dr Holly Joseph on h.joseph@reading.ac.uk who is the supervisor for this research at Reading University.

Where can I get more information?

If you would like more information, please contact Grace Elliott (contact details at the top of the page).

We do hope that you will agree to your participation in the study. If you do not want to be included in the study, please complete the form below.

Thank you for your time.

Parent/Carer Consent Form

I have read the Information Sheet about the project and received a copy of it.

I understand what the purpose of the project is and what is required of my child and me. All my questions have been answered.

Name of child: _____

Name of school that child attends: _____

Please tick as appropriate:

I consent to the school giving the researcher team details of my child's data for reading comprehension and reading accuracy ☐

I consent to my child receiving the 30-minute reading comprehension 1:1 sessions over eight weeks from January ☐

I consent to my child completing a questionnaire to provide feedback on the reading comprehension sessions ☐

Signed: _____

Name: _____

Date: _____

University of Reading

Information For Headteachers

I would very much like the students in year 9 and 10 with poor reading comprehension at your school to take part in a research study about improving reading comprehension for secondary school students. As teachers, we know that many of our pupils struggle to understand what they read, making it difficult to access the curriculum. I am running a reading comprehension intervention, especially targeted at children who struggle to understand what they read, and I

What is the research project?

The title of the research project is 'Do interventions in oral language and text-based strategies improve the reading comprehension of students with poor reading comprehension aged between 13 and 15?'
The study is being conducted at? the University of Reading.
Its aims are:

- To investigate different approaches to improve the reading comprehension of secondary school students
- To compare these interventions to normal classroom practice
- To equip secondary school teachers with a wide range of effective and evidence-based strategies to improve reading comprehension

Why has this school been chosen?

Grace Elliott who is conducting this research is Head of Academic Support at Wellington. Your school has been invited to take part in the study because it is a member of the group of Teaching Schools, and I think that your students would benefit from being involved in the study.

Does my school have to take part?

It is entirely up to you whether your school participates in this research. If you would like your school to take part in the study or would like further information, please contact Grace Elliott (gee@wellingtoncollege.org.uk).

What will happen if my school takes part?

For those schools that decide to take part in this research, the Special Educational Needs Co-ordinator (SENCO) will be asked to select between ten and fifteen students with poor reading comprehension skills. Information sheets will be sent to the child and parents/carers that have been selected, along with consent forms to be complete should the parent/carer want their child to take part in the research.

Students who take part in the research will complete an assessment before and immediately after the intervention. This assessment is made up of standardised assessments that test reading comprehension, word recognition, vocabulary and numerical operations. Students will also receive a 1:1 reading comprehension intervention each week over eight weeks, this will

be arranged at an appropriate time for the students during the school day, and will take place at their school.

What are the risks and benefits of taking part?

Participants in similar studies have found it interesting and useful to take part. It is anticipated that students will develop useful reading comprehension strategies to use across a range of different subjects that will help with their studies. The findings of the study will also be useful for teachers when developing strategies and resources to help secondary school students develop their reading comprehension skills. The assessment data will remain confidential, and students will not be identifiable in any published report resulting from the study. Students may miss sixty minutes of a lesson in order to receive the intervention, and they will have to complete the work that they miss in their own time. However, the benefit of improving their reading comprehension is likely to make this worthwhile?

What will happen to the data?

Any data collected will be held in strict confidence and no real names will be used in this study or in any subsequent publications. The records of this study will be kept private. No identifiers linking you, the children or the school to the study will be included in any sort of report that might be published. Participants will be assigned a number and will be referred to by that number in all records. Research records will be stored securely in a locked filing cabinet and on a password-protected computer and only the research team will have access to the records. The data will be destroyed securely once the findings of the study are written up, after five years. The results of the study will be written in reports. I can send you electronic copies of these publications if you wish.

What happens if students, parents or carers change my mind?
Students or parents/carers can change their mind at any time without any repercussions. If at any time they change their mind after data collection has ended, their data will be discarded.

Who has reviewed the study?
This project has been reviewed following the procedures of the University Research Ethics Committee and has been given a favourable ethical opinion for conduct. The University has the appropriate insurances in place. Full details are available on request.

What happens if something goes wrong?
In the unlikely case of concern or complaint, you can contact Dr Holly Joseph on h.joseph@reading.ac.uk who is the supervisor for this research at Reading University.
Where can I get more information?
If you would like more information, please contact Grace Elliott (gee@wellingtoncollege.org.uk).
I do hope that you will agree for your school to participate in this study.

Thank you for your time.

Child Consent Form

I have read the Information Sheet about the project and received a copy of it.

I understand what the purpose of the project is and what is required of me. All my questions have been answered.

Please tick as appropriate:

I agree to the school sharing my scores for reading comprehension and reading accuracy ☐

I agree to receiving the 30-minute reading comprehension 1:1 sessions over eight weeks from January ☐

I agree to completing a questionnaire to provide feedback on the reading comprehension sessions ☐

Signed: _____

Name: _____

School: _____

Date: _____

Information Sheet

I am doing a project to help teachers to understand what are the best ways to improve reading comprehension. I would like you to help me with the project. I have already asked your parents and Head Teacher if they are happy for you to help me.

Why have I been invited to take part?

You have been selected by your SENCO who thought that you would benefit from the strategies that we will teach to help with improving reading comprehension.

What will I have to do if I agree to take part?

You will be asked to complete a series of tests at the start and end of the programme. During the programme you will take part in a 30?-minute session each week for eight weeks during the school day. In the session you will be working with a teacher called Mrs Elliott. The session may be 1:1 or you may be part of a small group of students from your school.

Research Project

What are the best ways to improve your reading comprehension?

What happens next?

Your parents have been sent a letter and form to fill in if they would not like you to take part in the study.
We will check with you before we do the tasks that you are happy to help us with our project.

If you have any questions please speak to your senco.

Or you can contact

Mrs Grace Elliott

gee@wellingtoncollege.org.uk

This project has been reviewed following the procedures of the University of Reading Research Ethics Committee and has been given a favourable ethical opinion for conduct.

Institute of Education
London Road Campus
RG1 5EX

Will anyone know about my answers?

Only the people working on the project will know about your performance in the assessments. We won't tell your school or your parents how you did in the assessments

Will it help me if I take part?

I think you will find it interesting and you will develop useful strategies to help improve your reading comprehension skills.

Do I have to take part?

No, not at all. Also, you can stop helping us with our project at any time, without giving a reason. Just ask your SENCO or your parents to tell us if you want to stop.

Appendix 2: Resources used in the text based and oral language intervention programmes

Attribution re-training was included in the reading programme due to research that has indicated that it can help students to make connections between effort and achievement. The attribution retraining concepts and strategies used in each session of the programme are listed below.

Lesson Number	Description of the Attribution Retraining Concepts and Strategies
1	Partnership Agreement and Positive vs Negative Thoughts: Students discussed how they wanted to interact with each other in the group, what each participant wanted in order to feel comfortable to communicate openly, and how they wanted to support the progress of each member of the group. Individuals were then asked to sensitively and carefully consider external factors and personal attributes that might stop them from making optimal progress in the programme.
2	Reading Self-Concept: Students discussed and analysed their attitude towards reading and aspects of reading that they found difficult.
3	Positive vs. Negative Thoughts: Students were taught to understand the difference between positive and negative thoughts, and explored how positive thoughts can be self-promoting and negative thoughts can be self-defeating.
4	Using Self-talk (Simple Scenarios): Students were given simple positive and negative scenarios, and taught how to use self-talk statements to reinforce strategy use.
5	Using Self-talk (Complex Scenarios): Students were taught how to develop their self-talk when presented with complex positive and negative scenarios.
6	Using Self-talk (Promoting Persistence and Flexible Strategy Use): Students were taught how to apply self-talk during lessons to monitor their use of reading comprehension strategies. They were taught how to apply self-talk to task persistence, and when deciding on specific strategies to use.

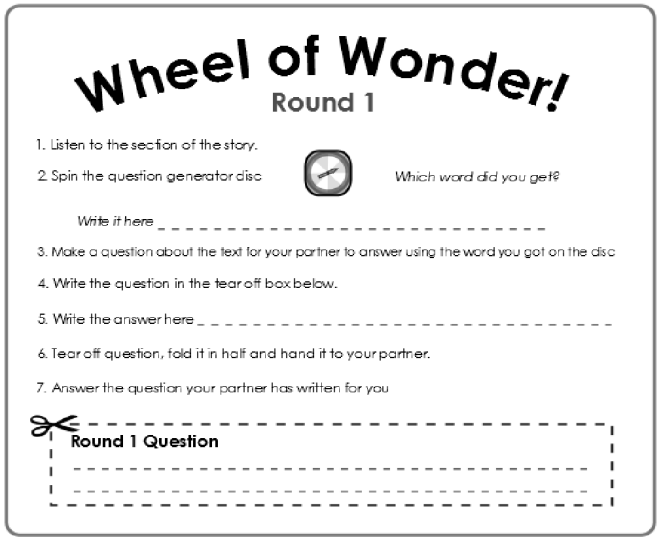
7	Attribution Feedback (Teacher to Student): After students answered reading comprehension questions about a passage, the feedback that was provided by the teacher was designed to help students to see the connection between use of strategies and the success at answering the reading comprehension correctly.
8	Attribution Feedback (Student to Student): Students gave peer feedback, modelled on the teacher feedback that was given to them in week 7, to help each student make connections between use of reading comprehension strategies, and the success at answering the reading comprehension correctly.

Attribution Retraining Concepts and Strategies (aspects taken and some aspects adapted from Berkley et al., 2010)

Samples of activities included in the interventions

A wide range of question activities and tasks were incorporated into the programme. For example, the instructions for the 'Wheel of Wonder' game is included below, which details how students had to listen to an extract of the story, use the spinner on the board to select an appropriate questioning word, then make a question about the text for their partner using the word that was selected on the spinning disc.

An example task for the questioning element of the oral language programme (from Clarke et al., 2010)



In the example activity provided below, students were given sentence starters, and an example summary from which they constructed 'success criteria' as a group (e.g. choose the most important points; write the summary in your own words), before they were asked to construct their own summary of a short passage.

Use the following sentence starters to help you when constructing summaries:

- *The most important ideas are…*
- *This was mostly about …*
- *This section was about …*
- *The story takes place …*
- *First…, next…, then…, finally…*
- *The main characters are…*
- *A problem occurs when …*
- *In the beginning…, middle…, end…*
- *A key event is when …*

Example Summary (of pages 1-7)

The story takes place in the summer of 1922 in America. This section is about two main characters called Joe and Wade (Wade is the narrator of the story). Joe and Wade were swimming in the river behind the old Mitchum farm, when they saw a carnival convoy called the Museum of Marvels. They wanted to go to the carnival, but wondered whether their Mum would let them. The story starts on Joe's 15th birthday.

Our Group Success Criteria for Summaries

-
-
-

An example of a clarification task that was used in week two of the oral language programme is show below.

Clarify

_____ is a difficult word, because _____

So, I (check the strategies that you used)

- Checked parts of the word that I know
- Sounded out the word
- Thought of a word that look like this
- Read on to find clues
- Reread to find clues
- Tried another word

_____ is a difficult idea

So I (check the strategies that you used)

- Read on
- Thought about what I know
- Talked to a friend

In week 5 of the intervention programme, one task (see Figure 22) required the use of clarification strategy alongside other reciprocal teaching strategies. As can be seen in an extract of the task below, students were asked to identify and work out the meaning of a word, sentence and section of the text that they found confusing. They were then asked to generate a question about the sentence they identified using the words 'what, when, where, why, how, or what if', and a question about the section of the text they had identified using 'why do you think…'. This ensured that the use of strategies in the teaching programme were progressive and integrated.

<table>
<tr><td colspan="2">Predict Before reading chapter 6
Think of a prediction (e.g. I think… will happen because…)</td></tr>
<tr><td colspan="2">DURING READING Chapter 6</td></tr>
<tr><td>Wonder Questions

On page ___ I am wondering:

On page ___ I am wondering:</td><td>Clarify Words
Word _____ on page ___

Be ready to explain how you figured about the meaning of these words.

Word _____ on page ___
How I figured it out:</td></tr>
<tr><td>Quiz Questions
Think of a question that starts with who, what, when, where, why, how, or what if about the sentence you have identified in the box to the right.</td><td>Clarify A Sentence
Find one or two confusing sentences.
Page _____

Be ready to explain how you figured about the meaning of these sentences.</td></tr>
<tr><td>Thinking Questions
Think of two questions for the group to discuss based on the scene that you have chosen in the box to the right.

Why do you think…….

Why do you think …….</td><td>Clarify A Scene
Which part of the passage was important to describe and set the scene for the story?

How did the author describe the scene?</td></tr>
<tr><td colspan="2">AFTER READING Chapter 6</td></tr>
<tr><td colspan="2">Construct a brief summary from pages _____ to _____.</td></tr>
</table>

Below are extracts from the text-based programme resource booklet in which questions were used to help students practise the re-read strategy and look back strategies.

An example of the re-read strategy used in the text-based programme

One way in which we can find out the answers is to read the passage again, thinking carefully about each word. This is called the re-read strategy. Re-read page 1 to find the answers to the questions below:

1. How does the author describe the trees on the river banks?
2. What did Joe do?
3. What did Joe learn?

There are some problems with the re-read strategy, what are the problems?

Below is an extract from the text-based programme resource booklet in lesson 1 when the look back strategy was introduced.

Another strategy that we can use is the look-back strategy. For this strategy you try and find the answer by scanning over the text trying to find a key word. Find the answers to the questions below using the look back strategy (pages 3-4).

1. What animals did the circus have last time?
2. Why did Joe and Wade watch the circus arrive?
3. What was the clown on the motorbike wearing?

What do you think about this strategy? What are the problems with this strategy?

Have you completed your strategy table?

Below is a list of some of the strategies that were included in the inference training component of the text-based intervention programme:

1. Words and sentences were obscured from a text, and children had to guess the missing parts of the sentences using inference and deduction from the surrounding text.
2. Children were provided with titles that described the main consequence of the story within the text. This provided the children with a framework to interpret the text,

when selecting and organising their ideas. To demonstrate the value of using a title, children were also asked to try to interpret text without a title.

3. When a student had made an inference, they were routinely asked 'How do you know?' By encouraging the students to verbalise how they had arrived at their assumptions and conclusions, it helped them to examine their thinking and learning
4. The teacher modelled their own thinking processes to show the students how she made inferential leaps from text.
5. Group work enabled pupils to share the thought processes that led them to make inferences.

The story mountain shown below was used in the narrative sections in both intervention programs.