Curtin School of Allied Health

Identification, profiling, and interventions for "poor comprehenders" in the middle-upper primary years

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This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

March 2022

Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007), updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (RDHS-183-15 and HRE2016-0438-01), and the Department of Education of Western Australia.

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Acknowledgement of Country

We acknowledge that Curtin University works across hundreds of traditional lands and custodial groups in Australia, and with First Nations people around the communities, past, present, and to their emerging leaders. Our passion and commitment to work with all Australians and peoples from across the world, including our First Nations peoples are at the core of the work we do, reflective of our institutions' values and commitment to our role as leaders in the Reconciliation space in Australia.

Acknowledgements

Where to start in thanking my brilliant supervisors, Associate Professor Suze Leitão and (now) Professor Anne Whitworth, who have stuck with me on this long journey? Thank you both for your guidance and support, for keeping me on track, and for dealing with my frustrations with the world of academic research and writing, particularly in the early stages as I was having to learn about each again. Thank you for all the encouragement, the many cups of coffee and cakes, and seemingly being available whenever I needed. This has been in no small part due to your religious setting of deadlines, Suze, which has been invaluable and without which I would have been lost. I have appreciated all your insightful and prompt feedback, and that we have managed to come out the other side of this still friends is a testament to your skills as a supervisor. Anne, your eagle editing eye and ability to focus in on the issue is amazing. Thank you also to Richard for stepping into the breach and assisting with the statistical analysis on my first paper.

Thank you to Hugh Catts who, unbeknown to him I think, set me on this path many years ago and whose work continues to inspire me. Thanks also to Kate Nation and Tiffany Hogan whose research provided a foundation for this programme of research and inspired me at many points along my research journey. Also, to Maggie Snowling and her team when I visited in the UK in 2007, and Shelley Gray and Catherine Snow and their teams when I visited the US in 2012, who gave me their time and access to their research on the Reading for Meaning and Reading for Understanding projects respectively. The research that has emerged from these projects has been drawn on in this PhD programme, as well as providing a huge expansion in our knowledge about reading comprehension.

To my friends who have checked in and provided much needed encouragement over the years – thank you. You know who you are, but a special mention to Libby Clark who has joined me for Zoom SUAW sessions over the last year or so. These have been a pleasure as much as work.

Thank you to my children Alex, Kathryn, and Adrienne, who have been on this journey with me and provided a constant reminder that life, good and bad, went on outside the world of doing a PhD. A special thank you to Alex for feeding me and keeping me entertained over these last couple of months of writing.

Last but by no means least, thank you to the children who participated in this research, their schools, and families, who generously offered their time and without which this research would not have been possible. Thank you also to all the other young people I have worked with over the years who inspired me to search for a better understanding of methods of intervention for these often under-identified and under-addressed reading comprehension difficulties. I hope the outcome from being involved in this research has been positive for you and will be for others in the future.

Abstract

Poor comprehenders are a significant subgroup of poor readers who have difficulty with reading comprehension despite adequate word reading accuracy and fluency. As a result of their intact word reading skills, they are often not identified until the middle primary school years or later, when the complexity of academic texts and task expectations increases. While there is now a substantial body of literature on the oral language, reading and cognitive skill profiles of poor comprehenders since this group came to attention in the 1980s, there continues to be a lack of research exploring identification and effective intervention for this under-identified group of poor readers. In response to these acknowledged gaps, this doctoral research aimed to (a) investigate the use of a short testing protocol to identify poor comprehenders, (b) obtain detailed profiles of the oral and written comprehension and cognitive processes of children identified as poor comprehenders using a theoretically informed assessment battery, and (c) design and evaluate interventions targeted at the specific difficulties identified in individual poor comprehenders.

The research to address these aims was conducted in two parts. Part A consisted of an overarching study (Study 1) with three phases and aimed to identify, and subsequently profile, a group of children who had been identified as poor comprehenders. Drawing on the findings from earlier investigations (Kelso et al., 2007), tasks in Phase 1 were selected to test phonological awareness and listening comprehension, both considered to be oral language underpinnings of word reading accuracy and reading comprehension respectively. The two tasks were administered to 218 unselected children, aged 7-12 years, in Australian school Years 3-6. Phase 2 involved confirming that the children (n=45) who met the pre-set criteria on the oral tasks in Phase 1, met criteria for classification as poor comprehenders using tests of nonword reading and reading comprehension, in accordance with reading tasks and criteria that had been used to identify these children reported in the literature. Results from this confirmation testing found that the oral language tasks had over-identified children as poor comprehenders, with only 24 of the 45 children meeting the criteria of having mid-average or above word reading accuracy and below average reading comprehension. During Phase 1 testing, teachers had been asked to make an informal judgement of the reading ability of each student in their class who had agreed to participate in the study, as either average, strong or weak. Only five of the 24 confirmed poor comprehenders were judged as weak readers. These findings highlight the importance of assessing reading skills to confirm poor comprehender status and, critically, of identifying effective and efficient methods of

recognising poor comprehenders in classrooms. Research translation into the educational setting was also highlighted to raise awareness of this group amongst teachers and enable teaching staff to be better utilised as a resource in the identification process.

Informed by a targeted review of the literature, Phase 3 involved the development and administration of a theoretically informed assessment battery. This aimed to obtain detailed profiles of oral and reading comprehension at the word, sentence, and text level, along with nonverbal IQ and verbal memory, of individual poor comprehenders. With a view to the translation of research into practice, tasks selected for use in the battery were commercially available or accessible to clinicians. Seventeen of the 24 confirmed poor comprehenders completed the comprehensive assessment battery. Participants were hypothesised to fall into two subtypes, the first having difficulty with comprehension of both lower-level oral and reading vocabulary and grammar and higher-level language, and the second subtype having difficulties primarily with higher-level inferencing skills. Unexpectedly, only two of the 17 participants were found to have difficulty with multiple lower-level language tasks, while the remaining 15 fell into the second subtype. Consistent with previous research, however, all participants had at least average range phonological and word reading accuracy skills overall, and the majority had difficulty with complex verbal working memory. The findings also supported the heterogeneity of poor comprehenders, with not all children performing poorly on the same tasks, highlighting the need to carry out more detailed testing beyond a single reading comprehension test. Certain tasks presented as being more indicative than others for use in a clinical setting and could be used to guide assessment to better inform intervention. This highlights the importance of future research with larger samples of participants to determine the diagnostic utility of this reduced test battery.

Following identification and profiling of a group of poor comprehenders, Part B of this doctoral research comprised two intervention studies, the first a novel higher-level language strategy-based intervention (Study 2), and the second a novel vocabulary intervention (Study 3). Study 2 involved the development of an inference-making and comprehension monitoring intervention, delivered individually, and was evaluated in a case series design. Eleven of the 15 participants (aged 9-12 years) who were identified as having higher-level language difficulties on the Phase 3 testing in Study 1 agreed to participate in the intervention. Following 10 x 45 minute intervention sessions, improvements were evident in oral inference-making and comprehension monitoring for most participants, while generalisation to improvement on standardised reading comprehension tests was more limited, consistent with previous research findings. Positively, the greatest gains on both the

oral and reading comprehension tasks was made by those children with the weakest pre-intervention skills. Study 3 comprised a single subject design with one of the poor comprehenders identified with lower-level language difficulties on Phase 3 testing in Study 1. This study involved the design and evaluation of a programme of 15 x 30 minute vocabulary intervention sessions, delivered over eight weeks. The participant made significant gains on the bespoke vocabulary measure for both treated and untreated words following the intervention, along with making clinically significant gains on both the standardised word comprehension measure and reading comprehension test. The improvement on the standardised reading comprehension test was unexpected and contrary to much of the previous research on vocabulary interventions. Both intervention studies provided promising preliminary results, along with direction for future research to replicate findings and explore any variability in response to the protocols, further informing the theoretical underpinnings of the profile of poor comprehenders. The programme manuals, including session plans, for both intervention studies have been made freely available for clinicians via https://www.languageandliteracyinyoungpeople.com/.

This doctoral research makes a valuable theoretical contribution to our understanding of effective and efficient methods for identification of this often-hidden group of poor readers through the use of an initial short testing phase, followed by a confirmation phase. While the initial short testing protocol over-identified poor comprehenders, supporting the need to test reading to confirm poor comprehender status, the results suggest that the two-phase protocol could be effective in School Years 4-6, once more sensitive listening comprehension tasks are identified. This novel research contributes to our understanding of the language profiles of poor comprehenders through employing a battery of standardised tests, the development of which was theoretically informed by Perfetti and Stafura's (2014) Reading Systems Framework, to assess language skills at the word, sentence and text/discourse level. The profiles confirm the presence of two subtypes of poor comprehenders and directly informs the selection of appropriate and targeted interventions tailored to the individual subtype and profile of the child. The programme of research provides preliminary evidence for empirically driven methods of assessment and intervention that are anticipated to be translated readily into clinical and teaching practice.

List of Peer-Reviewed Publications Arising from this Thesis

Kelso, K., Whitworth A., Parsons, R. & Leitão, S. (2020). Hidden reading difficulties: Identifying children who are poor comprehenders. *Learning Disability Quarterly*. Epub ahead of print 1 October 2020: 1-12. https://doi.org/10.1177/0731948720961766

Kelso, K., Whitworth, A., & Leitão, S. (2021a). Assessing poor comprehenders: A guide for teachers. *LDA Bulletin*. 53(1). 22-25.

Kelso, K., Whitworth, A. & Leitão, S. (2021b). Profiles of Oral and Reading Comprehension in Poor Comprehenders. *Reading & Writing Quarterly*. Epub ahead of print 29 Oct 2021: 1-18. https://doi.org/10.1080/10573569.2021.1982432

Author attribution statement:

As lead author, I had primary responsibility for the conceptualisation and design of the studies. I was solely responsible for all recruitment, data collection and preparation, and had the lead role in writing the manuscripts, including final approval and submission. SL and AW contributed to the conceptualisation and design of the studies, were involved in discussions regarding data interpretation and reporting, and were also involved in reviewing and editing the manuscripts prior to final submission. RP provided statistical analysis for the first listed paper.

Kelso, K., Whitworth A., & Leitão, S. (2022a). Higher-level language strategy-based intervention for poor comprehenders: A pilot single case experimental design. *Child Language, Teaching and Therapy*. Epub ahead of print 11 January 2022: 1-15. https://doi.org/10.1177/02656590211071003

Kelso, K., Whitworth, A., & Leitão, S. (2022b). A novel vocabulary intervention for poor comprehenders: A single case study. *Journal of Clinical Practice in Speech-Language Pathology*. *24*(1), 36-43.

Author attribution statement:

As lead author, I was solely responsible for the development of the intervention programmes and data collection. I had primary responsibility for writing and submitting the manuscripts. All co-authors contributed to discussions regarding the interventions and data, and SL and AW were responsible for reviewing and editing the manuscripts prior to final submission. AW provided statistical analysis for the second listed paper.

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List of Peer-Reviewed Presentations Arising from this Thesis

Kelso, K. (2017). *Identifying poor comprehenders: What do reading comprehension tests actually measure?* Presentation at the DSF Language, Literacy & Learning Conference, Perth, WA.

Kelso, K., Whitworth, A., & Leitão, S. (2019*). Identifying children with "hidden" reading difficulties in the classroom.* Presentation at the DSF Language, Literacy & Learning Conference, Perth, WA.

Kelso, K., Whitworth, A., & Leitão, S. (2019). *Single subject research design inference intervention for "poor comprehenders"*. Presentation at the DSF Language, Literacy & Learning Conference, Perth, WA.

Kelso, K., Whitworth, A., & Leitão, S. (2021). *Exploring the profile of "poor comprehenders"*. Presentation at the 1st International DLD Research Conference (Virtual).

Upcoming presentations

Kelso, K., Whitworth, A., & Leitão, S. *Implementing a novel vocabulary intervention to improve reading comprehension.* Presentation at the DSF Language, Literacy & Learning (Virtual) Conference in 19-22 April, 2022.

Kelso, K., Whitworth, A., & Leitão, S. *Poor comprehenders: Identification and intervention for children with reading comprehension difficulties.* Presentation at the DSF Language, Literacy & Learning (Virtual) Conference in 19-22 April, 2022.

Kelso, K., Whitworth, A., & Leitão, S. *Reading Comprehension: A clinical update on a hidden problem*. Presentation for Speech Pathology Australia in July 2022.

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CHAPTER 1:
Thesis Overview

> *Comprehension, arguably the backbone of cognition, is the processing of information to extract meaning. It is a complex cognitive process that is necessary for virtually all higher-level cognitive activities, including learning, reasoning, problem solving, and decision making (McNamara & Magliano, 2009, p.298).*

This doctoral research was driven by the clinical motivation to increase knowledge on how to intervene effectively to improve the reading comprehension of children who can read words accurately and fluently but struggle to comprehend what they read. To achieve this goal, these children, often referred to as poor comprehenders, first needed to be identified, and then their profiles understood to inform the development of the appropriate and targeted evidence-based intervention programmes.

This research programme is presented as a *thesis-by-compilation*. The component studies have been written as five standalone manuscripts, presented as chapters, each of which have been published in peer-reviewed journals. While every effort has been made to avoid repetition in the two dedicated linking chapters that focus on reviewing the literature and which provide context for the studies, and the chapters presenting the studies reported in each manuscript, overlap is unavoidable. Each chapter throughout this thesis begins with a brief Chapter Overview to provide context and facilitate cohesion throughout the thesis. The formatting of the accepted manuscripts (including headings, tables, and figures) has been altered to ensure consistency within the larger thesis document. Reference lists have been removed from the manuscripts and are presented as an integrated bibliography at the end of this thesis to maximise flow.

This thesis is organised to present the whole programme of research as depicted in Table 1.1.

Table 1.1

Overview of Thesis

Part	Chapter	Study	Format (published papers)
Thesis Overview	Chapter 1		Thesis overview
Part A: Identification and profiling	Chapter 2		Comprehensive literature review
	Chapter 3	Study 1: Phases 1 and 2	Published paper **Hidden reading difficulties: Identifying children who are poor comprehenders** *Learning Disability Quarterly*
	Chapter 4	Study 1: Phase 3	Published paper **Profiles of oral and reading comprehension in poor comprehenders** *Reading & Writing Quarterly*
	Chapter 5	Translation to practice	Published paper **Assessing poor comprehenders: A guide for teachers** *LDA Bulletin*
Part B: Intervention	Chapter 6		Literature review: intervention
	Chapter 7	Study 2	Published paper **Higher-level language strategy-based intervention for poor comprehenders: A pilot single case experimental design** *Child Language, Teaching & Therapy*
	Chapter 8	Study 3	Published paper **A novel vocabulary intervention for poor comprehenders: A single case study** *Journal of Clinical Practice in Speech-Language Pathology*
Discussion	Chapter 9		General Discussion
	Bibliography		
	Appendix		

Chapter 1 sets out an overview of the thesis, providing a structural framework for each of the individual studies and the additional linking chapters to create a cohesive narrative for the research. Part A consists of a comprehensive background (Chapter 2) to the programme of research, exploring theoretical perspectives on reading comprehension and reading comprehension difficulties, followed by an examination of the literature on the

language profiles of poor comprehenders. Chapter 2 concludes with the aims for Part A of this doctoral research which focus on the identification and profiling of children with these reading characteristics. Chapter 3 presents a published paper on the identification of a group of poor comprehenders (Phases 1 and 2). Chapter 4 presents a published paper on the detailed assessment profiles of this group on standardised measures (Phase 3). The final chapter in this section (Chapter 5) is a published paper that is presented as an example of research-to-practice translation, providing an overview of the language profile of poor comprehenders and information on assessment for teachers and educators.

Part B of this thesis comprises Chapters 6, 7 and 8 and addresses a primary aim of exploring appropriate intervention. A review of the intervention literature for reading comprehension is set out in Chapter 6. Chapter 7 (Study 2) presents a published paper investigating the effectiveness of an inference-making and comprehension monitoring intervention, while Chapter 7 (Study 3) presents a published paper investigating the effectiveness of a targeted vocabulary intervention.

A General Discussion, set out in Chapter 9, summarises and integrates the findings from the separate studies into the overall programme of research. These findings are related back to the existing literature on the language profiles, assessment, and intervention for poor comprehenders, and weak reading comprehension in general. The theoretical and clinical implications are highlighted, along with strengths, limitations, and future directions arising from this research.

PART A:

Identification and Profiling of Poor Comprehenders

CHAPTER 2

Background, Literature Review, and Research Aims

Chapter Overview

This chapter begins with an introduction to the process of reading comprehension and its complexity, the key area of difficulty for a subgroup of poor readers often referred to as poor comprehenders, who are the focus of this doctoral research. This is followed by an overview of key theories of reading and reading difficulties that have emerged over time, expanding on one theory which has been influential in guiding research into reading comprehension difficulties. A review of the literature investigating poor comprehenders is then provided, outlining methods of identification, discussing prevalence, and presenting an overview of the skill profile of strengths and weaknesses that has emerged from this literature which often makes poor comprehenders difficult to identify. The findings from this review are the underpinnings for the first part of this research. The chapter concludes with a statement of the aims for Part A.

The Complexity of Reading Comprehension

> *Learning to read is a complex task for beginners. They must coordinate many cognitive processes to read accurately and fluently, including recognizing words, constructing the meanings of sentences and text, and retaining the information read in memory (NRP: NICHD, 2000, p. 89).*

Learning to read involves learning to decode words accurately, read fluently and understand what has been read (Snowling & Hulme, 2011). To become a proficient reader, a child must develop skills in all three areas, with comprehension of written text being the ultimate goal. Text comprehension is not a single unitary process; instead, it is the product of a range of cognitive and linguistic processes that operate on the text, and interact with background knowledge, the features of the text and the purpose of the task (Castles et al., 2018; Kintsch & Kintsch, 2005; Snow, 2002). It has been described as involving the interaction of three separable but interacting levels of comprehension processes (Kintsch & Kintsch, 2005; Kintsch & Rawson, 2005). The reader constructs a mental model of the text across these three levels of comprehension processing which take place at different levels across units of language: word, sentence, and text/discourse (Perfetti et al., 2005). It is the

complexity of the mental representations created at each of these three levels, and the inference processes required to understand the text at an explicit and deeper level that can make reading comprehension such a difficult process (Kintsch & Kintsch, 2005).

Theoretical Perspectives

Historical

As children attended school more regularly in the second half of the nineteenth century with the introduction of mandatory school attendance, children who struggled to learn to read, despite adequate instruction, became more apparent to educators (Catts et al., 2014). While these children were initially thought to be poorly motivated or of low intelligence, the growing evidence for acquired reading difficulties resulting from brain damage in adults led the medical profession to identify similarities with the difficulties experienced by children, resulting in the emergence of neurological theories to explain these problems (Catts et al., 2014; Torgesen, 2004). Hinshelwood (1900) described these children as having 'congenital word blindness' resulting from a congenital defect to the visual memory centre in the brain for words and letters, while Orton (1937) argued the reading difficulties were due to a failure to develop dominance for language in the left side of the brain, such that the children saw mirror images of letters (e.g., b/d) and words (e.g., saw/was). Both Hinshelwood and Orton proposed that children with these difficulties could be taught to read words via a multisensory approach that focused on intensive, systematic, and explicit teaching of phoneme-grapheme links (Catts et al., 2014; Torgesen, 2004). This phonics approach to teaching reading was not widely accepted by educators as it was contrary to the 'look-and-say' meaning first (whole language) method of instruction more commonly used in US classrooms at the time, which continued to be dominant into the 1950s and 1960s (Adams, 1990), and continues to be a source of debate around the English-speaking world today (Castles et al., 2018).

The notion emerged that children with learning disabilities could be identified based on signs that indicated minimal brain injury (e.g., right-left confusion, difficulties with motor coordination, visual perception, perceptual motor skills, or individual psycholinguistic abilities such as auditory sequencing), and that intervention should focus on training these specific signs, rather than on the weak academic skill (Fletcher, 2012; Torgesen, 2004). As research emerged in the 1970s finding that training focused on specific perceptual skills, predominantly visual perceptual and visual motor skills, did not generalise to improvements in academic skills such as reading (e.g., Vellutino et al., 1977), the influence of these

neurological models of learning disabilities decreased. Some researchers shifted their focus more specifically to the role played by cognitive and language factors (Fletcher, 2012). In their seminal book on learning disabilities, Johnson and Myklebust (1967) described a reading disability they termed 'auditory dyslexia', in which children had a range of phonological processing difficulties, including breaking words into syllables and phonemes, and identifying phonemes in words. This work, along with the earlier work of Orton, laid the foundation for the view that reading difficulties arise from language deficits as opposed to deficits in visual perception or general cognitive ability (Catts et al., 2014). This viewpoint has been embraced and extended by many reading researchers since this time and provides the context for this thesis.

Simple View of Reading

To highlight the importance of decoding in the reading process, and at a time in the US when the role of decoding in reading was being strongly debated and the whole language approach to teaching reading continued to dominate, Gough and Tunmer (1986) proposed the Simple View of Reading (SVR). Gough and Tunmer argued that successful reading comprehension is, necessarily, the product of skill in both decoding (or word reading) i.e., the translation of printed words into speech, and language (reading and/or listening) comprehension. The SVR not only sets out the relationship between word reading and listening comprehension, it also helps describe the separate relationships between the two components and reading comprehension, and how these change over time (Gough et al., 1996; Hoover & Gough, 1990). In the early school years, reading comprehension is limited by word reading skills, while in later years, as word reading skills improve, listening comprehension becomes increasingly influential and more closely correlated with reading comprehension (e.g., Catts et al., 2005; Hoover & Gough, 1990; Language and Reading Research Consortium [LARRC], 2015). This reflects the fact that as children get older and a level of word reading proficiency has been attained, the limitation on reading comprehension will be the strength, or otherwise, of their listening comprehension (Nation, 2019; Perfetti et al., 2005).

The separability of the two components of the SVR provides a method for classifying reading disabilities along the dimensions of word reading and listening comprehension (Adlof & Hogan, 2018; Catts et al., 2006; Bishop & Snowling, 2004). Gough and Tunmer (1986) proposed that three forms of reading disability were present, referring to these as dyslexia, hyperlexia, and 'garden variety reading disability' respectively, each of which will

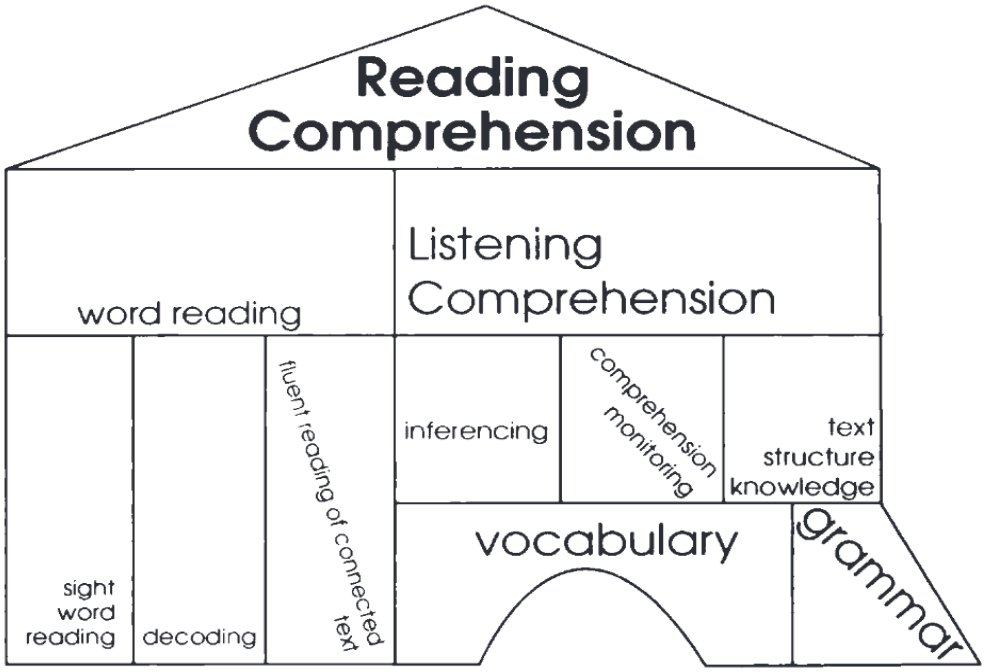
result in difficulty with reading comprehension. Children with dyslexia have poor word reading but good listening comprehension skills; the second group, now more frequently referred to as poor comprehenders, have the reverse profile of good word reading but poor listening comprehension; while the third group have difficulty with both (Catts et al., 2006). There is also evidence that children may move between these groups across the school years (Catts et al., 2005, 2012). In Catts et al.'s (2005) longitudinal study the percentage of poor comprehenders increased substantially between second and eighth grade, while the percentage of children classified as having dyslexia decreased. In addition, a recent meta-analysis of 86 studies with poor comprehenders (Spencer & Wagner, 2018) found further support for the findings from studies by Nation et al. (2004) and Catts et al., (2006) in which participants had more severe deficits in reading comprehension than oral language. This is consistent with the multiplicative effect between word reading and listening comprehension proposed in the SVR, as the interaction between the two components produces greater impairment in reading comprehension than if the effect was additive (Spencer & Wagner, 2018).

Since its initial conceptualisation, the SVR has received criticism that it does not take into account other factors that contribute to reading achievement (Joshi & Aaron, 2012), nor reflect the changing relationship between the components across the school years and the changes in text complexity and task demands for older students (e.g., Catts, 2018; Snow, 2018). Despite these criticisms, the SVR has considerable support among researchers for being both theoretically and empirically motivated, and has guided much of the research into reading disorders for over 30 years. Further, more recent research has found that these two components explain almost all, if not all, of the variance in reading comprehension at different stages of development (e.g., Hjetland et al., 2019; Kim, 2017; LARRC & Chiu, 2018; Lervag et al., 2018). The SVR, by its nature, however, does not specify the skills, or subcomponents, within each of the two components of word reading and listening comprehension (Catts, 2018). Instead, it provides "an overall framework for understanding the broad landscape of reading" (Kirby, & Savage, 2008, p.75). These two components "are upper-level skills that directly contribute to reading comprehension while they are predicted by a constellation of language and cognitive skills" (Kim, 2017, p.326). This constellation of skills thought to potentially contribute to either word reading or listening comprehension has been explored in research (for a summary, see Kim, 2017), and a number of key subcomponents have been identified. These subcomponents, and the relationship between

them, have been presented in visual representations of the SVR such as those proposed by Scarborough (2001) and Hogan et al. (2011) (see Figure 2.1).

Figure 2.1

Visual representation of the Simple View of Reading



Note: Reprinted from *"*Increasing Higher Level Language Skills to Improve Reading Comprehension*"* by T. Hogan et al., 2011. *Focus on Exceptional Children*, *44*(3), p.2. Copyright by Focus on Exceptional Children.

In this model, three subcomponents are identified as contributing to word reading: sight word reading, decoding and fluent reading, while the subcomponents of listening comprehension are divided into what are sometimes referred to as lower and higher-level language skills or factors (e.g., Hogan et al., 2011; Perfetti et al., 2005). The lower-level language skills, at the bottom level of the framework, vocabulary and grammar knowledge, support the understanding of individual words and sentences in a text and are used to construct the literal meaning of a text, or 'textbase' (Kim, 2017; Kintsch & Kintsch, 2005). These lower-level skills provide a foundation for the higher-level skills of a) integration and inferencing, b) comprehension monitoring, and c) text structure knowledge that are required to construct what Kintsch and Kintsch refer to as a 'situation model', or mental model of the situation described in an oral or written text. Further, the development of these higher-level skills allows good comprehenders to develop accurate mental models that provide the context for correct interpretation of each new word and sentence, including ambiguous vocabulary (Hogan et al., 2011).

Verbal Efficiency Theory and Lexical Quality Hypothesis

An alternate theory, proposed during the same time period as the SVR, also considered the relationship between word reading accuracy and comprehension. Perfetti's 'verbal efficiency theory' claimed that a substantial cause of reading comprehension difficulties was due to ineffective lower-level processes needed for word identification in a comprehension system with limited working memory capacity (see Perfetti, 2007; Perfetti & Hart, 2002; Perfetti et al., 1996). Central to word identification "were the phonological procedures that allowed a word (or a nonword) to be decoded, whether or not meaning was also retrieved" (Perfetti, 2007, p.358). The theory emphasised speed and automaticity of word processes, which would allow cognitive resources (working memory) to be freed up in a limited capacity system for the higher-level processes, such as making inferences to derive meaning, that reading and spoken language share. Subsequently, Perfetti acknowledged that, while broadly correct, the verbal efficiency theory was incomplete and that knowledge of word meanings, not just word reading speed, was required for the efficient word reading on which comprehension depends, as later elaborated in the "lexical quality hypothesis" (Perfetti, 2007; Perfetti & Hart, 2002). This later theory proposed that efficient word reading was the result of fast and precise (but also flexible to cope with similarities and differences in word meanings) retrieval of high-quality representations from knowledge of word forms (spellings, pronunciations, and grammatical class) *and* meaning (Perfetti, 2007; Perfetti & Hart, 2002). Limitations in either the quality of these lexical representations or working memory would result in inefficient word recognition, and thus problems with reading comprehension.

While poor comprehenders have not been found to be slow or inefficient word readers, some studies have identified semantic weaknesses which would impact on the quality of lexical representations (e.g., Nation & Snowling, 1998), while others have found that vocabulary knowledge not only impacts directly on reading comprehension, it also impacts indirectly on word recognition in unselected cohorts of children across grades 1-3 (e.g., LARRC, 2015; Tunmer & Chapman, 2012; Ricketts et al., 2007). These findings highlight the need for further research to understand the profiles of strengths and weaknesses within the lower and higher-level language and cognitive skills that underpin the reading comprehension difficulties experienced by poor comprehenders.

Poor Comprehenders – Identification and Prevalence

Poor comprehenders are a sizable subgroup of poor readers who have poor reading comprehension due to difficulties with listening comprehension. Due to their ability to read aloud accurately and fluently, these children are often poorly identified in the classroom, which contributes to this group receiving far less attention in contrast to the considerable research into the poor decoder (dyslexic) subgroup of poor readers.

There was early recognition in the literature of specific reading comprehension difficulties, without impairment in decoding and word recognition skills, in both college students (Cromer, 1970) and children with hyperlexia (Healy, 1982; Nation, 1999). It was Oakhill and colleagues, however, in the 1980s who began a detailed examination of children who presented with this type of reading difficulty (see Yuill & Oakhill, 1991). Poor comprehenders, reportedly, were not being identified in classrooms as they did not present with clinical indicators of difficulty in the early school years. After testing whole year groups of children aged 7-8 years, the participants in these studies were selected initially on achievement of an average range score on a word-to-picture matching vocabulary task. Following this, two criteria were applied: (1) reading accuracy no more than five months below chronological age, and (2) comprehension age at least six months below accuracy on an early version of the Neale Analysis of Reading Ability (NARA). Using these criteria, 10 – 15% of all children were identified as being less skilled, or poor, comprehenders (Yuill & Oakhill, 1991).

Building on this initial work, Stothard & Hulme (1995), also using the NARA, identified 9.5% of the 147 children in their unselected group of 7–8 year olds as having a poor comprehender profile. The criteria in this study differed to those of Oakhill as the children required a comprehension age at least six months below their reading accuracy and chronological age (CA), and a reading accuracy age no more than 12 months below CA. Nation and Snowling (1997) found a similar prevalence of 9.2% amongst a group of 184 children aged 7–9 years, selected based on the two components of the SVR, using the criteria of a score on listening comprehension (three aurally presented stories with questions) at least 1.5 standard deviations below average range decoding ability on a nonword reading task. These poor comprehenders also had poor reading comprehension on the NARA.

In a more recent study, Nation et al. (2010) found a comparable prevalence rate of 8.7% in a group of 172 children at 8 years of age, who had been followed from 5 years of age (school entry) as part of a longitudinal study. The poor comprehenders in this study were

selected using the criteria of a reading accuracy standard score above 90 on the NARA-II (British edition: Neale, 1997), and a comprehension score below 90, as well as a minimum discrepancy between the two scores of more than 10 standard score points. Using the same selection criteria as Nation et al. (2010) but different reading measures, Elwér et al. (2015) found a slightly lower prevalence rate (7.3%) in their retrospective longitudinal study of 772 twins, on grade 4 (10 years) reading measures. Similarly, Clarke et al. (2010) obtained a prevalence of 7.5% in their sample of 1,120 children aged 8-9 years, who had participated in whole class screening to select participants for their randomised controlled trial. Elwér et al. (2015) selected children, referred to as "specific poor reading comprehenders" (SPRC), based on discrepancy between a composite of real and non-word decoding measures, and a composite measure of cloze and multiple-choice answer reading comprehension tasks. Clarke et al.'s sample was selected based on a 1 SD discrepancy between reading accuracy on the Test of Word Reading Efficiency (TOWRE: Torgesen et al., 1999) and reading comprehension on the NARA-II Form B.

Catts et al. (2003) found a higher prevalence of 15.4% amongst a group of 183 second grade poor readers. The participants in this study, however, were part of a larger longitudinal study of children who had been identified as having language impairments in kindergarten (5–6 years). Catts and colleagues followed up these children and found that the prevalence of poor comprehenders increased across school grades to 30.1% in eighth grade (Catts et al., 2005). Data from the same study suggested that, within the general population, poor comprehenders comprised 3% in second grade, 6% in fourth grade, 7.8% in eighth grade, and 9.6% in 10th grade (cited in Hogan et al., 2014). In their investigation of late-emerging poor readers with participants drawn from the same longitudinal cohort study, Catts et al. (2012) identified 7% of the 493 participants followed from kindergarten (5-6years) through to 10th grade as having a late-emerging reading disability with deficits in comprehension. These comprehension deficits largely emerged between grades 2 and 4 and became more severe in grade 8 and 10. Similarly, in Catts et al. (2005), despite the grade 8 poor comprehenders performing significantly worse than the poor decoders (children with dyslexia) and control children in language comprehension across kindergarten, grade 2 and grade 4, many had not met the criteria for poor reading comprehension in grade 2. In addition, only approximatively one third of the children had met the criteria for language impairment in kindergarten, and only 18% had received any intervention in the early grades (Catts et al., 2006). This finding is consistent with a study of 8 year old children by Nation et al. (2004) who found that none of the 23 poor comprehenders in their study had been reported by their teachers as having any

language or reading impairment. This is despite many of the children meeting criteria for developmental language disorder on assessment (Nation et al., 2004).

Prevalence of poor comprehenders from a large sample of 1553 children aged 6-16 years for standardisation of the York Assessment of Reading for Comprehension (YARC) primary (Snowling et al., 2009) and secondary (Stothard et al., 2010) in the United Kingdom, were 5.3% and 5% respectively (Snowling, 2013). When the criteria for the primary school sample were set at a reading comprehension standard score of 90 or below and reading accuracy 90 or above, along with the 1 SD discrepancy, 3.3% of the sample were defined as having "clinically significant reading-comprehension difficulties" (Hulme & Snowling, 2011, p.140).

In summary, while poor comprehenders have been identified using a number of different tests and criteria based on the SVR, and prevalence estimates vary across many of these studies, approximately 7% of children in middle primary school might be expected to have difficulties with reading comprehension in the presence of appropriate levels of reading accuracy and fluency. Based on this profile, these children are often not identified as poor readers, a major consequence of this being that children progress through their educational years without reaching their potential. The under-identification of this group makes it critical to gain a greater understanding as to how the language profiles of these children might evolve over time, both to detect difficulties across the school years and to identify any predictors to support earlier identification.

Word Reading Skills in Poor Comprehenders

According to the SVR, poor word reading skills will limit reading comprehension. However, these have not been found to be the source of difficulty for poor comprehenders, although this can depend on how word reading (or decoding) is defined. In their original article, Gough and Tunmer (1986) acknowledged the difficulty in defining the term decoding. They recognised that some equated it with 'sounding out' (i.e., the use of letter-sound correspondence rules), a skill the beginning reader needs to acquire, while others equated it with word recognition, which in the skilled reader is the ability to "read isolated words quickly, accurately, and silently" (Gough & Tunmer, 1986, p.7).

In their visual representation of the SVR, Hogan et al. (2011) identified three subcomponents of word reading: decoding, which entails letter-sound correspondence and draws on phonemic awareness skills, sight word reading and reading fluency. Problems were not identified in any of these three subcomponents from the first identification and

subsequent exploration of the skill profile of children aged 7-8 years presenting with specific reading comprehension difficulties (see Yuill & Oakhill, 1991 for a summary of early work). These poor comprehenders, when matched with good comprehenders for word reading accuracy on an early version of the NARA, were able to (1) read and sort pairs of rhyming (visually similar and dissimilar) words and non-rhyming word pairs into groups, and (2) read nonwords and both high and low frequency real words, as rapidly as the controls. Further, training to increase decoding speed was not found to impact on comprehension levels (Yuill & Oakhill, 1991). Subsequent research with poor comprehenders, using stricter group selection criteria, provided further support for appropriately developed phonological processing and word reading skills across a range of tasks such as rhyme judgement and fluency, phoneme deletion, spoonerisms, nonword repetition, and timed and untimed real and nonword reading (Adlof & Catts, 2015; Cain et al., 2000; Catts et al., 2006; Nation et al., 2004; Nation et al., 2010; Nation & Snowling, 1998; Stothard & Hulme, 1995).

While Nation and Snowling (1998) found that poor comprehenders read words with regular spellings and high frequency words at an equivalent level of accuracy and speed as control children, they were less accurate and efficient at reading words with irregular spellings and low frequency words compared with controls, a finding replicated by Ricketts et al. (2007). Nation and Snowling (1998) proposed that these difficulties were the result of weaknesses in knowledge of word meanings which can be used, along with letter-sound mappings, to support word recognition. Support for this proposal was provided more recently by Tunmer and Chapman (2012), in a study of 122 third grade average readers, and LARRC (2015) with 371 participants in grades 1-3, which both found that vocabulary knowledge impacted indirectly on word recognition as well as impacting on reading comprehension.

Listening Comprehension Skills in Poor Comprehenders

Hogan et al's (2011) visual representation of the SVR (Figure 2.1) describes subcomponent skills necessary for listening comprehension as lower-level language skills (vocabulary and grammar) and higher-level language and cognitive skills (text structure knowledge, inferencing and comprehension monitoring). The lower-level skills provide the foundation for the higher-level skills which, when combined with a reader's prior knowledge, allow for the construction of a mental model of the situation described in the text (Hogan et al., 2011; Perfetti et al., 2005). These will now be explored in more detail.

Lower-level Language Skills

Vocabulary. While it is widely accepted that weak vocabulary skills will impact on reading comprehension, the findings for the influence of vocabulary in poor comprehenders are variable. The children in many of Oakhill and colleagues' studies (e.g., Cain et al., 2000; Cain et al., 2004; Yuill & Oakhill, 1991) were initially selected and matched with good comprehenders for word recognition, as well as chronological age, based on achievement of an average range score on a single word reading vocabulary task, in conjunction with reading accuracy on the NARA. The reading vocabulary task, the Gates-MacGinitie Primary Two Vocabulary Test (MacGinitie & MacGinitie, 1989) requires matching one of four written words to a picture, providing a measure of a child's ability to read and understand single words out of context, while the NARA measures word reading in context. The British Picture Vocabulary Scale (BPVS; Dunn et al., 1997)[1], a measure of receptive vocabulary, has also been utilised in the selection and matching of poor comprehenders with good comprehenders (e.g., Cain et al., 2004; Stothard & Hulme, 1992) consequently, receptive vocabulary did not present as an area of deficit for these participants. Results in other studies that have included measures of receptive vocabulary, but not used them as a selection measure, have been varied. Cain and Oakhill (2006), using the BPVS, found that while poor comprehenders as a group scored well below good comprehenders, the majority still scored at an age-appropriate level, and Cain et al. (2004), using both the BPVS and Gates-McGinitie, identified two groups of poor comprehenders, one with weak vocabulary skills and one without. Studies using the American equivalent of the BPVS, the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 2007), also found poor comprehenders to have weak receptive vocabulary compared to typically developing readers (Adlof & Catts, 2015; Catts et al., 2006; Colenbrander et al., 2016), although scores were not necessarily in the below average range. Longitudinal studies, however, have found these vocabulary weaknesses to be evident in kindergarten and persistent across time into high school, compared to controls (e.g., Catts et al., 2006; Elwér et al., 2015).

Tests of receptive vocabulary measure vocabulary breadth, the number of words a person knows, while other tasks, such as semantic fluency or providing word definitions, measure vocabulary depth, knowledge of the relations and associations between words (Oakhill et al., 2015). Nation and Snowling (1998) found that while the poor comprehenders performed as well as normal readers matched for age, nonword reading and non-verbal ability

[1] Where different versions of the same test are referred to the most recent version is referenced

on an experimental rhyme fluency task, they produced fewer words on a semantic fluency task requiring word associations. Not all poor comprehenders, however, have been found to perform poorly on semantic fluency tasks (Cain et al., 2004). The poor comprehenders in Nation and Snowling's (1998) study also scored poorly compared with controls on all the other semantic tasks, including those assessing vocabulary breadth (judging if words were synonyms) and depth; tasks requiring the provision of word definitions and two meanings of words (e.g., bat) from the Test of Word Knowledge (Wiig & Secord, 1992). Further studies by Nation and colleagues found support for poor comprehenders having difficulty on tasks of vocabulary depth such as word definitions and explaining how words go together (Nation et al., 2004; Nation et al., 2010; Nation et al., 2007), as well as learning the meanings of new words (Nation et al., 2007). In other studies, Adlof and Catts (2015) found poor comprehenders had difficulty identifying related words and explaining their relationship on the CELF-4 (Semel et al., 2006) Word Classes task, while Colenbrander et al. (2016) found they scored below controls on all vocabulary tasks administered.

Grammar. Knowledge of word meanings alone is insufficient to understand sentences; knowledge of syntactic structure is also important. Yuill and Oakhill (1991) found that their poor comprehenders were just as aware of semantic and syntactic constraints in sentences, were able to repeat back meaningful sentences verbatim, and understood grammatical constructions on the Test for Reception of Grammar (TROG, Bishop, 2003), as well as the good comprehenders matched for vocabulary and word recognition. Cain and Oakhill (2006) also found 7-8 year old poor comprehenders performed as well as controls on the TROG, but this has not always been the case (Cragg & Nation, 2006; Nation et al., 2004; Stothard & Hulme, 1992). Several studies have also found that poor comprehenders have greater difficulty than controls with verbatim recall of sentences on the CELF Recalling Sentences subtest (Adlof & Catts, 2015: Nation et al., 2004; Nation et al., 2007; Nation et al., 2010) and with other tasks of grammatical knowledge such as the Concepts and Directions (Adlof & Catts, 2015; Catts et al., 2006) and Sentence Structure (Nation et al., 2010) subtests from the CELF.

While the results on tests of receptive grammar such as the TROG have been inconsistent, a number of studies have identified poor comprehenders as having greater difficulty than good comprehenders on certain tasks of morphological and syntactic awareness (Adlof & Catts, 2015; Nation et al., 2004; Nation & Snowling, 2000; Nation et al., 2005; Tong et al., 2014; Tong et al., 2011). For example, poor comprehenders performed less well on a past tense elicitation task requiring them to complete sentences by changing the

verb from present to regular or irregular past tense (Nation et al., 2004). Nation and colleagues (2004, 2005) suggested that this difficulty with past tense could be attributed to semantic weaknesses or an increase in semantic complexity of sentences. Adlof and Catts (2015), however, found that weaknesses continued to be evident for poor comprehenders even when semantic factors were controlled. In several studies examining morphological awareness, Tong et al. (2011, 2014) found poor comprehenders performed significantly below good comprehenders on a word analogy and a syntactic awareness task in which the child had to correct a grammatical mistake in a sentence spoken by an experimenter. This was consistent with the difficulties shown by poor comprehenders in unscrambling sentences (Nation & Snowling, 2000).

Summary of Lower-level Language Skills. In summary, the results of studies investigating lower-level language skills highlight that, as a group, poor comprehenders present with difficulties across measures of semantics and syntax/grammar; however, not all poor comprehenders have difficulty across all measures (Adlof & Catts, 2015; Colenbrander et al., 2016; Nation et al., 2004). Nevertheless, what the results do provide evidence for is that poor comprehenders have difficulties with oral language and not just difficulties specific to reading. Given the variability in profile, and the fact that some poor comprehenders appear to have both adequate word level processing and semantic/ syntactic skills, a third level of focus has been on higher-level language skills and discourse level comprehension.

Higher-level Language Skills

Integration and Inference. To create an accurate mental model of a text the reader (or listener) needs to go beyond the information that is explicitly stated and integrate information and ideas across sentences and subsequent parts of the text, as well as make inferences and connect information in the text to their prior knowledge. In a series of studies in the 1980s with 7-8 year olds, using experimental tasks, Oakhill and Yuill (see Oakhill, 1993; Yuill & Oakhill, 1991 for an overview) found poor comprehenders had difficulty making inferences at the word, sentence and text level.

At the word level, Oakhill (1983) found good comprehenders recall of auditorily presented sentences was enhanced after a delay compared with poor comprehenders, if they were cued with a specific noun, rather than the original noun, (e.g., “shark” rather than “fish” to cue recall of “The fish frightened the swimmer”). This indicated that the good comprehenders were able to make instantiations (i.e., infer specific meanings of words based on the sentence context) more readily than poor comprehenders, allowing them to recall more

of the original sentences. In contrast, both groups recalled sentences at a similar level when cued with the original nouns, suggesting memory was not an issue. In addition, further testing revealed that both groups had the required knowledge that would allow them to make appropriate instantiations. Difficulty inferring meaning of words from context, was found in subsequent studies exploring poor comprehenders ability to infer the meaning of novel vocabulary, particularly if the information required to make the inference was separated from the word by additional filler sentences (Cain et al., 2003; Cain et al., 2004). Oakhill and Yuill also found that poor comprehenders had greater difficulty in making cohesive inferences in sentences, such as understanding pronoun referents and verb phrase ellipsis, even when directly questioned about what these stood for and with the text available as support (see Yuill & Oakhill, 1991). In contrast, in a more recent study Bowyer-Crane and Snowling (2005) found their group of poor comprehenders, in grades 2-6, answered questions requiring a cohesive inference at the same level as good comprehenders across two reading comprehension tests.

In a series of studies using experimental tasks, Oakhill and colleagues (Cain & Oakhill, 1999; Cain & Oakhill, 2006; Oakhill, 1982, 1984; Oakhill et al., 1986; Yuill & Oakhill, 1991) found poor comprehenders had greater difficulty than good comprehenders in integrating information to make inferences in texts. This occurred both in texts where information was explicitly provided, and where information was implied, requiring what Cain and Oakhill (1999) referred to as text-connecting (cohesive) and gap-filling (knowledge-based) inferences respectively. In an initial study exploring the ability to make text-connecting inferences in short stories, Oakhill (1982) found poor comprehenders incorrectly identified more sentences containing information unable to be inferred from the story as sentences they had heard previously, compared with good comprehenders. There was no significant difference between the two groups in recognition of original sentences. The experiment was repeated by Oakhill et al. (1986), without the prompt to remember the stories, and later replicated by Cain and Oakhill (2006), with the same results. This supported the conclusion that the poor comprehenders do not have a "straightforward memory deficit", rather they do not actively construct meaning from the text in the same way as good comprehenders (Yuill & Oakhill, 1991, p.69). In a second experiment, Oakhill (1984) explored the ability to make gap-filling inferences. As predicted, the poor comprehenders made more errors than good comprehenders on both literal and inference questions when the text was not present, however, the poor comprehenders continued to be significantly weaker on the inference questions even with the text available. The findings supported those of the

Oakhill (1982) study and indicated that poor comprehenders are less likely to integrate relevant general knowledge with information provided in the text to make inferences, even with the text available, and so do not form a coherent representation of the meaning of the text which, in turn, may have assisted their memory of the text (Yuill & Oakhill, 1991).

To explore whether poor comprehenders possessed the relevant general knowledge to make inferences when they failed to make them, Cain and Oakhill (1999) replicated Oakhill's (1984) study with the addition that, when a child gave an incorrect answer in the text available condition, they were directly prompted towards the information required to make the inference. In this condition, the poor comprehenders ability to make inferences improved to the same level as the good comprehenders and a younger comprehension-age matched group for text-connecting inferences, but not to the same level as good comprehenders for the gap-filling inferences. The direct prompting revealed that the children had the required general knowledge and ability to draw the inferences to answer the questions but failed to do so spontaneously (Cain & Oakhill, 1999). Cain et al. (2001) also found that a lack of general knowledge was not the source of inference making difficulties through teaching a novel knowledge base relevant to a short story. Both good and poor comprehenders were able to acquire the knowledge base, although the poor comprehenders required slightly more repetitions, but the poor comprehenders were significantly poorer at answering both literal (cf. Cain & Oakhill, 1999; Oakhill, 1982) and inference questions. As lack of knowledge had been ruled out as a reason for inference failure, Cain et al. (2001) explored other possible reasons and found that, consistent with previous findings, (a) poor comprehenders failed to select the relevant text information required to be integrated with the knowledge base to generate the inference, and (b) did not see the need to make inferences until explicitly directed to do so. Cain and Oakhill (1999) suggested that, unlike poor comprehenders who tend to focus more on word reading accuracy (e.g., Yuill & Oakhill, 1991), good comprehenders are more likely to make inferences and monitor their comprehension as they strive for coherence in a text.

Comprehension Monitoring. Readers (or listeners) who strive for coherence in their text representation need to monitor whether comprehension has been successful, and initiate repair strategies when comprehension fails. Poor comprehenders have been found to have difficulties detecting anomalies in text and in monitoring their comprehension (Cain & Oakhill, 2006; Oakhill et al., 2005; Yuill & Oakhill, 1991; Yuill et al., 1989). In an initial experiment with 7-8 year olds, Yuill et al. (1989) found that poor comprehenders had difficulty using information provided to resolve apparent inconsistencies in an adult's

emotional response towards a child's behaviour if the information was two sentences distant from the anomaly, but not if the information was in adjacent sentences. Using experimental passages, Oakhill et al. (2005) tested comprehension monitoring more directly with 9-10 year olds. In the first study, poor comprehenders were less likely to identify nonsense words and jumbled phrases, comment that a passage did not make sense, and answer comprehension questions correctly. In the second study, replicated by Cain and Oakhill (2006), the poor comprehenders had greater difficulty identifying if passages did not make sense and identifying the contradictory statements. Again, this was particularly the case if the inconsistent information was separated by several sentences, suggesting performance decreases as the memory load increases (Cain & Oakhill, 2006; Oakhill et al., 2005). Cataldo and Cornoldi (1998) found that poor comprehenders had difficulty answering questions when the information to answer the question was separated from the question. Performance did improve when the poor comprehenders were explicitly instructed to use a search strategy, leading Cataldo and Cornoldi to conclude that the poor comprehenders were able to search the text but failed to use a search strategy until instructed to do so, as found in the inference-making research.

Text Structure Knowledge. Knowledge of text structure and coherence assists in the identification and integration of important information to understand texts. As poor comprehenders had been found to have difficulty understanding stories they had heard (Oakhill et al., 1986) as well as those they read, Oakhill and colleagues investigated whether they also had difficulty producing structurally coherent narratives. In several early studies, Yuill and Oakhill (1991) found that poor comprehenders were less consistent in their use of text cohesion features such as connectives and referential ties (e.g., pronouns) than good comprehenders. When asked to tell a story from a picture sequence, the poor comprehenders tended to produce picture-by-picture rather than integrated stories. In a later study, Cain and Oakhill (1996) elicited stories using two prompt types: short topic titles and picture sequences. The groups of children, good and poor comprehenders and comprehension-age matched comprehenders, did not differ in their use of conventional story features such as settings and endings. The poor comprehenders had difficulty producing causally related narratives however, particularly in the topic prompt condition. When given more informative titles that provided information regarding the direction of the story, as provided in the picture sequences, poor comprehenders' stories had a more coherent structure (Cain, 2003). In other research, Cain (1996) found that poor comprehenders lacked awareness of the purpose of story titles compared to good comprehenders, a finding replicated by Cain and Oakhill (2006)

who also found that poor comprehenders had difficulty ordering cut-up stories correctly. Cragg and Nation (2006) found poor comprehenders were also weaker producing written narratives from picture sequences. Their stories did not differ in length or syntactic complexity from controls but included fewer main ideas from the story, and story structure was less sophisticated.

Summary of Higher-level Language Skills. In summary, the higher-level language skills of inference and integration, comprehension monitoring and text comprehension knowledge impact on listening comprehension component which, in turn, directly contributes to reading comprehension (see Figure 2.1). Skills in these subcomponent areas are required by the reader to go beyond the explicitly stated information and create a mental model of the situation described in a text. Research largely carried out by Oakhill, Cain and colleagues, has found poor comprehenders have difficulty in each of these areas. This was not necessarily due to a lack of the skills or the requisite knowledge, but the result of the poor comprehenders failing to select and integrate relevant information in the text, such as text structure features, and not actively constructing meaning or initiating comprehension repair strategies until instructed to do so. Difficulties were also found to increase when the distance between the pieces of information that needed to be integrated increased, placing a greater demand on memory.

Verbal Memory Skills in Poor Comprehenders

As reading comprehension involves the building of a coherent mental representation of the text, heavy demands are placed on working memory, a finite capacity system (Kintsch & Rawson, 2005). Perfetti highlighted the issue of limitations in working memory in his theories of word recognition discussed above (e.g., Perfetti, 2007; Perfetti & Hart, 2002) which, in turn, would result in problems with reading comprehension. A relationship between working memory and reading comprehension difficulties is therefore reasonably hypothesised and, indeed, some research has found that poor comprehenders do not perform as well as good comprehenders on verbal working memory tasks, where both storage and processing are required.

In a meta-analysis of studies involving poor comprehenders, Carretti et al (2009) identified difficulties on verbal complex span measures compared with good comprehenders, but not on verbal simple span or visual-spatial complex span measures. For example, poor comprehenders were able to recall lists of numbers of increasing length (e.g., Cain, 2006; Cain et al., 2004; Pimperton & Nation, 2010), complete nonword repetition tasks (e.g., Catts

et al., 2006), and repeat back groups of concrete words and nonwords of increasing length (Cain, 2006; Nation et al., 1999) as well as good comprehenders matched for age and reading accuracy. In the case of Cain's studies, the children were also matched for vocabulary knowledge. In addition, the poor comprehenders performed as well as good comprehenders on spatial working memory tasks (Nation et al., 1999; Pimperton & Nation, 2010).

In contrast, poor comprehenders experienced difficulty with complex verbal working memory tasks, such as a digit working memory task involving recalling the last digit in groups of number triplets (e.g., Oakhill et al., 2005), word suppression tasks (Cain, 2006; Pimperton & Nation, 2010), and listening span tasks which involve completing sentences or stating whether a sentence was true/false, then recalling the last words in the correct order in sets of sentences of increasing number (e.g., Cain, 2006; Cain et al., 2004; Nation et al, 1999). Interestingly, Stothard and Hulme (1992) found no group differences on the listening span task in their study, however the children were younger (7-8 years of age) and all participants found the task difficult.

Summary

There is now a large body of research that has clarified the strengths and weaknesses exhibited by poor comprehenders on various subcomponent skills of oral and written language compared with good comprehenders. Hogan et al. (2011) have outlined these subcomponent skills in their expanded visual representation of the SVR (Figure 2.1), and this has been drawn upon here as a framework to discuss previous research. Many studies, however, have only explored one subcomponent, and at times only used a single task which, as Catts (2018) has pointed out, does not allow a full exploration of the complexity of reading comprehension. Several longitudinal studies have used multiple measures to explore the profiles of poor comprehenders (e.g., Cain & Oakhill, 2006; Catts et al., 2006; Nation et al., 2010), while others have done this in prediction studies (e.g., Catts et al., 2015; Elwér et al., 2013) and modelling studies examining the effects of subcomponent skills on listening comprehension and word reading (e.g., Kim, 2017). A consistent finding is that poor comprehenders do not have phonological or word recognition difficulties, but rather have weaknesses in lower and higher-level language subcomponent skills and verbal working memory. Not all poor comprehenders, however, have been found to have difficulty on all skills, and not all poor comprehenders show weaknesses on a single measure in the same study (Cain, 2016). These differences may simply be due to individual variability, however other possible reasons that can be hypothesised include the measures used, the demands of

the task, the cut-off criteria, and/or the differing selection measures and criteria used to identify poor comprehenders.

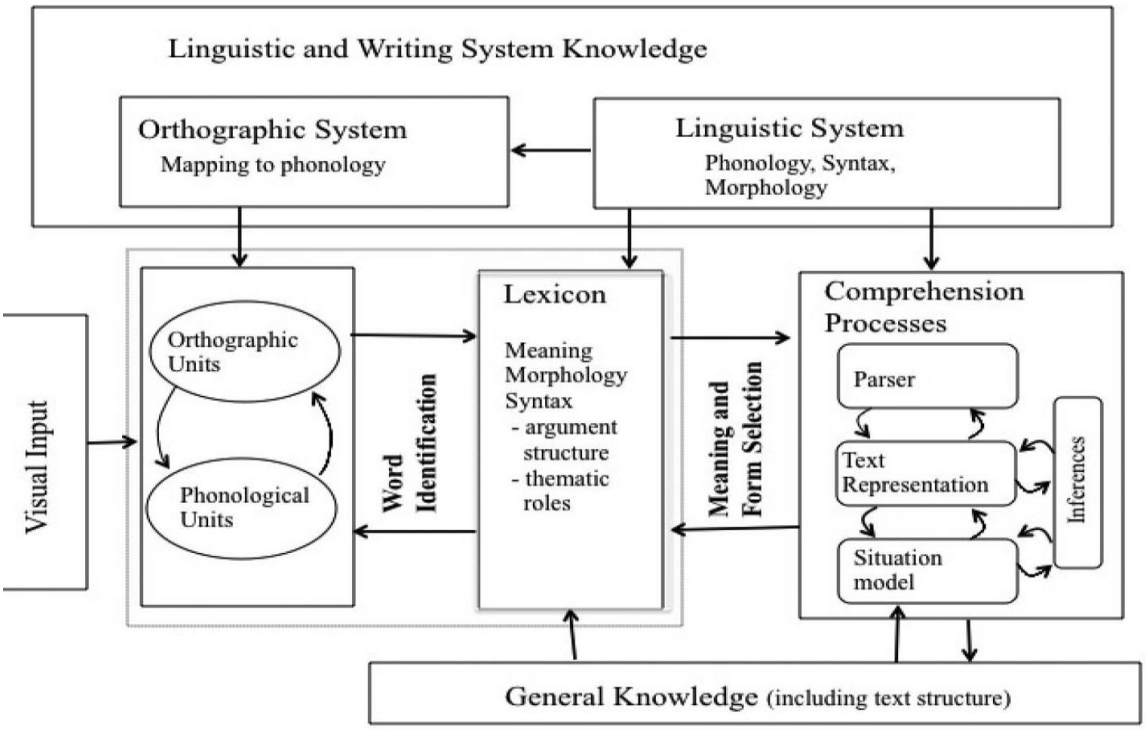
Reading Systems Framework

The SVR has been an influential model used in research to explore the two key components of reading comprehension, however, it does not explain how the complex set of cognitive and linguistic factors operate during the process of reading comprehension itself (Nation, 2019). In contrast, the Reading Systems Framework (RSF), developed by Perfetti and Stafura (2014) (see Figure 2.2), supports an approach for the exploration of the range of knowledge and processes involved in reading comprehension. While a number of text and discourse comprehension models have been developed (for a review, see McNamara & Magliano, 2009), Perfetti and Stafura (2014) proposed that there was value in a framework that outlined the components of reading comprehension more fully. The RSF evolved from earlier work (e.g., Perfetti 1999; Perfetti et al., 2005) and provides a view of the word-level processes of the connectionist model of word reading (Plaut et al., 1996) addressed in the lexical quality hypothesis (Perfetti & Hart, 2002), alongside the higher-level processes of the Construction-integration (CI) model of text comprehension (Kintsch, 1988; Kintsch & Kintsch, 2005). In this model, the word identification system (sublexical processes) activated by the visual input is unique to printed words, while the processes involved in the higher-level text comprehension system relate to oral as well as written language. In a key position, between and linking these two systems, is the lexicon i.e., the knowledge of written word forms and their meaning. The RSF sought to integrate the key processes and knowledge sources linked to each component, along with wider cognitive system requirements such as visual input and memory skills, into a general framework of reading

The utility of the RSF is that it allows hypotheses as to the development of, and factors underlying, difficulties with reading comprehension. As such, the RSF provides a comprehensive framework to develop a theoretically informed test battery to evaluate and profile the strengths and weaknesses of poor comprehenders to further our understanding of this group of children. To date, no study has used a theoretical framework, such as the RSF, to examine both the oral and written language subcomponent skills of poor comprehenders at the sublexical, lexical and text levels, exploring these alongside the general cognitive skills of memory and nonverbal IQ. This objective underpins the second aim of Study 1 in this programme of research, which draws on the RSF to profile the skills of a group of poor comprehenders, following identification.

Figure 2.2

The Reading Systems Framework



Note: Reprinted from "Word knowledge in a theory of reading comprehension" by C. Perfetti and J. Stafura, 2014, *Scientific Studies of Reading, 18*(1), p.24.Copyright Taylor and Francis Group. Available online at: www.tandfonline.com

Aims of Part A

While much is now known about the reading, language, and cognitive skill profiles of poor comprehenders, these children continue to be poorly identified in classrooms due to their accurate and fluent word reading skills. The aims of the first part of this programme of research were to:

1. Investigate the utility of a short testing protocol to *identify* poor comprehenders amongst unselected groups of children in the middle and upper primary school years when the shift from learning to read to reading to learn traditionally occurs, in conjunction with the increase in text complexity and demands.
2. *Profile* the oral and written language, and cognitive processes of a group of poor comprehenders, using a theoretically informed assessment battery drawing on the RSF, to guide the development of intervention programmes tailored to the individual's need.

CHAPTER 3

Hidden Reading Difficulties: Identifying children who are Poor Comprehenders

Chapter Overview

Chapter 3 presents the findings from Phases 1 and 2 of Study 1. Phase 1 explored the use of two oral language tasks to identify poor comprehenders, who tend to be under identified in classrooms as a result of their appropriately developed word reading skills. To capitalise on the access to classroom teachers in the study, participants' teachers were asked to make a judgement of the reading ability of each student in their class to explore if the findings reflected previous research that the reading difficulties of poor comprehenders were indeed 'hidden'. Phase 2 involved testing the participants' reading to confirm poor comprehender status and allowed for calculation of the prevalence of poor comprehenders in the original cohort, to compare with different levels of criteria reported in the literature in Chapter 2.

The development of a short testing protocol was driven by the motivation to find an efficient and effective way for teachers, or other professionals, to identify children at risk of reading comprehension difficulties that did not involve detailed one-on-one testing. Drawing on the SVR (Gough & Tunmer, 1986), which proposes that reading comprehension is the product of decoding/word reading (i.e., the translation of printed words into speech) and listening comprehension, it was hypothesised that both these domains could be assessed using oral tasks. The findings from an earlier Masters research programme (Kelso et al., 2007) found that a phonological awareness and a listening comprehension task predicted, in 90% of children, whether a child presented with the profile of a poor comprehender or generally poor reader (difficulties with both decoding and reading comprehension). These findings were drawn on in the selection of the oral language tasks used in the first phase of Study 1. To confirm that a child was a poor comprehender, testing of reading was required. As outlined in Chapter 2, this has been done in previous research through identification of a discrepancy in scores between tests of reading accuracy or phonological decoding (nonword reading) and reading comprehension, and this provided the basis for task selection in Phase 2.

The 24 participants confirmed as poor comprehenders following Phase 2 testing were subsequently invited to participate in the profiling study in Phase 3, reported in Chapter 4.

This chapter includes the accepted manuscript version of the research article titled *Hidden Reading Difficulties: Identifying children who are Poor Comprehenders* published by SAGE Publications on behalf of the Hammill Institute on Disabilities in Learning Disability Quarterly, published online on 1 October, 2020. Available online at: https://doi.org/10.1177/0731948720961766

Reference:

Kelso, K., Whitworth A., Parsons, R. & Leitão, S. (2020). Hidden reading difficulties: Identifying children who are poor comprehenders. *Learning Disability Quarterly*. Epub ahead of print 1 October 2020: 1-12. https://doi.org/10.1177/0731948720961766

Published Manuscript

Abstract

Poor comprehenders are a significant subgroup of poor readers who, due to their ability to read aloud accurately, are often difficult to identify. This study aimed to determine whether assessment using two oral language tasks, mapped onto the two components of the Simple View of Reading, would provide an efficient approach to identification. Children (N=218) from School Years 3-6 (aged 7;8 – 12;1) attending two schools in Australia were assessed, and 45 identified as potential poor comprehenders, based on a profile of average phonological awareness but poor listening comprehension. Subsequent assessment of decoding and text reading comprehension confirmed 24 of these children to be poor comprehenders, consistent with reported prevalence rates. Five of these children were judged to be weak readers by their classroom teacher. The oral tasks alone over-identified this group, however, the findings suggest that using the tasks as an initial phase, followed up with a reading assessment, could be effective in identifying poor comprehenders, and reduce time spent in testing as this would only involve at-risk children.

Keywords: poor comprehenders, reading comprehension, identification

Introduction

Children with impairments in reading comprehension (often referred to as *poor comprehenders*) 'can read aloud accurately and fluently at a level appropriate for their age but fail to understand much of what they read' (Hulme & Snowling, 2011, p. 139). Gough and his colleagues (Gough & Tunmer, 1986; Hoover & Gough, 1990) proposed the *Simple View of Reading* (SVR) as a way to conceptualise the key components of reading. The proponents of this view postulate that reading comprehension is the product of the complex processes involved in two components: decoding and language comprehension. Decoding is defined as the ability to identify words in print, while language comprehension is defined as the ability to understand spoken language; both are necessary for reading comprehension, while neither alone is sufficient (Nation, 2019). As the Simple View of Reading sees the development of reading skills as 'parasitic' on oral language skills (Hulme & Snowling, 2014, p.2), and given that poor comprehenders demonstrate strengths in decoding text coupled with weaknesses in reading comprehension, it can be hypothesised that this will be mirrored in the oral domains. Thus, poor comprehenders would show strengths in phonological awareness (which underpin

phonological decoding) and weaknesses in oral language/listening comprehension (Hulme & Snowling, 2014).

Since its initial conceptualisation, the SVR has received criticism that it does not take into account other factors that contribute to reading achievement beyond the cognitive domain, such as motivation and home environment (Joshi & Aaron, 2012). Nor does it reflect the changing relationship between reading components across the school years, or the changes in text complexity and task demands experienced by older students (e.g., Catts, 2018; Snow, 2018). Despite these criticisms, the SVR has considerable support among researchers for being both theoretically and empirically motivated, with the components providing a method for classifying poor readers using the two dimensions of decoding and oral language comprehension. Hoover and Gough (1990) found support for the dissociation of the two components, allowing for subgroups with reading comprehension difficulties resulting from either decoding or oral language problems alone (as well as problems with both), highlighting the existence of this group often referred to as poor comprehenders (Bishop & Snowling, 2004; Nation, 2019).

Prevalence of Poor Comprehenders

While early recognition of specific reading comprehension deficits in the presence of advance word recognition had been reported in the literature in groups of children referred to as having *hyperlexia* (e.g., Healy, 1982), it was Oakhill and colleagues who undertook a detailed examination of children selected on the basis of their reading comprehension lagging behind their decoding ability (see Yuill & Oakhill, 1991). These children were not, reportedly, being identified in classrooms as they did not present with clear clinical indicators of difficulty in the early school years. The first study on poor comprehenders published by Oakhill was in 1982, with the children in this, and subsequent, studies being selected from entire cohorts of children aged 7-8 who were tested to identify those who achieved an average score on a word-to-picture matching vocabulary task. Following this, two criteria were applied: (a) reading accuracy no more than five months below chronological age (CA), and (b) a comprehension age at least six months below accuracy on an early version of the Neale Analysis of Reading Ability (NARA). Using these criteria, 10–15% of all children in Yuill and Oakhill's (1991) samples were identified as being less skilled, or poor, comprehenders. Building on this initial work, Stothard and Hulme (1995), also using the NARA, assessed an unselected group of 147 children aged 7–8, and identified 9.5% as having a poor comprehender profile. (The criteria in this study differed to those of Oakhill with comprehension age required to be at least six

months below reading accuracy age and CA, and reading accuracy no more than 12 months below CA). Nation and Snowling (1997) found a similar prevalence of 9.2% amongst a group of 184 children aged 7–9, where listening comprehension (three aurally presented stories with questions) was at least 1.5 *SD* below average nonword reading. The children also performed poorly on the NARA.

More recently, Nation et al. (2010) found a comparable prevalence rate of 8.7% in a group of 172 children at 8 years of age, who had been followed since age 5 (school entry) as part of a longitudinal study. The poor comprehenders in this study were selected using the criteria of a reading accuracy standard score above 90 on the NARA-II (British edition: Neale, 1997), and a reading comprehension score below 90, as well as a minimum discrepancy between the two scores of more than 10 standard score points. Using the same selection criteria as Nation et al. (2010), but different reading measures, Elwér et al. (2015) found a slightly lower prevalence rate (7.3%) in their retrospective longitudinal study of 772 twins on US grade 4 (aged 9-10) reading measures. Similarly, Clarke et al. (2010) obtained a prevalence of 7.5% in their sample of 1,120 children aged 8-9, who had participated in whole class screening (including listening comprehension, nonverbal IQ and spelling) to select participants for their randomised controlled trial. Elwér et al. (2015) selected their children, referred to as "specific poor reading comprehenders", based on discrepancy between a composite of real and non-word decoding measures, and a composite measure of cloze and multiple-choice answer reading comprehension tasks. Clarke et al.'s (2010) sample was selected based on a 1 *SD* discrepancy between reading accuracy on the Test of Word Reading Efficiency (TOWRE) (Torgesen et al., 1999) and reading comprehension on the NARA-II Form B.

Prevalence figures from the standardisation of the York Assessment of Reading for Comprehension (YARC) primary (Snowling et al., 2009) and secondary (Stothard et al., 2010), taken from a large sample of 1553 children aged 6-16, were 5.3% and 5% respectively (Snowling, 2013). When the criteria for the primary sample were set at a reading comprehension standard score of 90 or below and reading accuracy 90 or above, along with the 1 *SD* discrepancy, 3.3% of the sample were defined as having "clinically significant reading-comprehension difficulties" (Hulme & Snowling, 2011, p. 140).

Catts et al. (2003) found a higher prevalence of 15.4% amongst a group of 183 US grade 2 (aged 7-8) poor readers, however, the participants in this study were part of a larger longitudinal study of children who had been identified as having language impairments in kindergarten (aged 5–6). Data from the same research suggested that, within the general

population, poor comprehenders comprised 3% in grade 2, and this percentage increased across the school years to 6% in grade 4 (aged 9-10), 7.8% in grade 8 (aged 13-14) and 9.6% in grade 10 (as cited by Hogan et al., 2014). Catts et al. (2005) found that despite the grade 8 poor comprehenders performing significantly worse than the poor decoders and control children in language comprehension across previous school years, many had not met the criteria for poor reading comprehension in grade 2. In addition, only approximatively one third of the children had met the criteria for language impairment in kindergarten, and only 18% had received any intervention in the early school years (Catts et al., 2006). This finding is consistent with a study of children aged 8 by Nation et al. (2004), in which none of the 23 poor comprehenders had been reported by their teachers as having any language or reading impairment, despite many meeting the criteria for Developmental Language Disorder (DLD: Bishop et al., 2017) on assessment.

In summary, this discussion of the key literature highlights that poor comprehenders have been identified using a number of different tests and criteria based on the SVR, and prevalence estimates vary across many of these studies. Overall, however, the body of research identifies that approximately 7% of children in the middle of their primary schooling (aged 7-9) might be expected to have difficulties with reading comprehension in the presence of appropriate levels of reading accuracy and fluency. These children are often not identified as poor readers, a major sequela of this being that children progress through their educational years without reaching their potential. Critical to identifying this group is gaining a greater understanding as to how the language profiles of these children might evolve over time, and to identify any predictors to support earlier identification.

The Developing Language Profile of Poor Comprehenders

In an early longitudinal study, Catts and colleagues found the oral language difficulties of 57 poor comprehenders identified on grade 8 (aged 13-14) reading measures to be more apparent on vocabulary and discourse comprehension measures than grammar; this was evident across kindergarten (aged 5-6), and grades 2, 4 and 8 (Catts et al., 2006). Poor decoders were also found to be weaker than the typically developing readers in all three language comprehension areas in kindergarten, but significantly stronger than poor comprehenders, and scored significantly lower than typical readers on the phonological processing measures in each of the four grades. In contrast, poor comprehenders only differed from the typical readers on the phonological awareness task (sound deletion) when assessed in kindergarten, but not later (Catts et al., 2006). This raises the possibility that poor

comprehenders make a slow start in phonological awareness and word reading skills which then quickly resolve (Nation et al., 2010).

Nation et al. (2010), in their longitudinal study, also found that the 15 poor comprehenders selected at age 8 from a cohort of 172 children, performed significantly worse on one of the phonological awareness tasks (sound matching) at 5 years of age. In contrast, and consistent with previous research (e.g., Cain et al., 2000; Nation et al., 2004; Stothard & Hulme, 1995), these children performed at similar levels to reading accuracy matched controls on all remaining phonological and reading measures at all time points (6, 7 and 8 years of age). The poor comprehenders scored at the lower end of average, and lower than the controls, on all oral language tasks at each time point, apart from expressive vocabulary at age 5 (Nation et al., 2010).

In keeping with the SVR, and in an attempt to avoid the complexities surrounding the issue of what reading comprehension tests do assess, Elwér et al. (2013) selected their participants based on *oral* comprehension and decoding skills. In their retrospective analysis, the 99 "poor oral comprehenders" identified in grade 4 (aged 10) displayed weaknesses in phonological awareness and performed worse than poor decoders in preschool (aged 4-5), at the same level as poor decoders in kindergarten (aged 5-6), then significantly better from grade 1. However, the group scored significantly lower than poor decoders on all oral language measures (vocabulary, grammar, verbal memory) at each test point. Elwér et al. (2015) had a similar pattern of results in their group of 56 specific poor reading comprehenders, selected from the same twin study cohort, where weaker early phonological awareness improved, but deficits were evident on all oral language tasks at all test times from preschool to grade 4 (ages 5–10). Similar to other research (e.g., Catts et al., 2006; Nation et al., 2010), this group of poor comprehenders obtained a lower score on a measure of non-verbal IQ than good comprehenders (Elwér et al., 2015).

In summary, and consistent with previous research on older cohorts of poor comprehenders, the children in these longitudinal studies may show early difficulties with phonological awareness, but generally perform at a similar level to typically developing readers on phonological and reading accuracy tasks once past the preschool years. In contrast, the poor comprehenders present with oral language difficulties from the outset and these are consistent across time. This might indicate the utility of using measures of phonological awareness and oral listening comprehension in identification of poor comprehenders.

Early Predictors of Reading Comprehension Difficulties

Investigation of early predictors of later reading comprehension difficulties has been pursued by Catts and colleagues (Catts et al., 2015; Catts et al., 2016). A group of 366 children, 263 of whom had been identified as at-risk on a school-based early literacy assessment at the beginning of kindergarten (aged 5-6), were assessed on a battery of word reading precursors (letter knowledge, phonological awareness, rapid naming) and oral language tasks. Of the children who were followed through to a final assessment of reading at the end of grade 3 (aged 8-9) oral language (measures of receptive and expressive vocabulary and narrative) was the strongest predictor of later reading comprehension (49%). This was followed by phonological awareness and rapid naming. These three components accounted for 79% of the variance in reading comprehension (Catts et al., 2015). Catts et al. (2016) further investigated whether response to a 26-week Tier 2 language intervention in kindergarten would add to the prediction of grade 3 reading comprehension outcomes. The language intervention, particularly the response to vocabulary instruction, was found to be a unique predictor over the word recognition and oral language measures (Catts et al., 2016). While Catts et al. (2015) recommended that oral language measures be added to screening of children, along with word reading precursors, the research is equivocal on the value of vocabulary and phonological awareness as early predictors in kindergarten. This line of research highlighted the need for an approach to identification that can be used in the middle primary school years (grades 3-4) when reading comprehension problems become more apparent.

Identification of Poor Comprehenders

Early identification of poor comprehenders is a challenge for educators. As regular screening of oral language is not consistently carried out in Australian schools, and the results from longitudinal or retrospective research show that the oral language difficulties of children who go on to be poor comprehenders are varied and scores are often at a subclinical level, detecting these children as early as possible in primary school remains an ongoing issue. Given the extensive body of research on decoding difficulties in comparison to comprehension difficulties, children with these difficulties are more widely recognised and early intervention put in place (e.g., Hulme & Snowling, 2011; Snowling, 2013). In contrast, the difficulties experienced by poor comprehenders are often "hidden" and less well recognised by teachers, due to the children's ability to read aloud accurately and fluently (Hulme & Snowling, 2011; Nation et al., 2004; Snowling, 2013). This was found to be the case in Nation et al.'s (2004)

study in which, of the 23 poor comprehenders, no child was identified by their teachers as having language or learning difficulties, such that many poor comprehenders and their teachers may be unaware of a reading comprehension problem until the children are tested (Hulme & Snowling, 2011; Nation et al., 2004).

Identifying efficient yet accurate methods of identification is another challenge. In an investigation into the presence of subgroups of children with reading comprehension difficulties among a group of Australian School Year 3 and 4 children (aged 7;7-9;5), originally diagnosed with DLD, Kelso et al. (2007) found that, among their battery of tasks, two tasks best predicted whether a child presented with the profile of a poor comprehender or generally poor reader (difficulties with both decoding and reading comprehension). Of the phonological awareness tasks, Phoneme Deletion, from the Queensland University Inventory of Literacy (QUIL) (Dodd et al., 1996) was the best predictor of group membership. Of the oral language tasks, the Listening to Paragraphs task from the Clinical Evaluation of Language Fundamentals (CELF-3) was the only task on which the two groups differed significantly. When a logistic regression analysis was performed using the two best predictor tasks, group membership was successfully predicted 90% of the time.

Identifying tasks that can efficiently discriminate those children at risk of this hidden condition remains critical if these children are to be managed appropriately, with Kelso et al.'s (2007) findings providing promising direction. Little empirical data is available, however, on suitable approaches to support identification of poor comprehenders in the classroom. As it is frequently the case that teachers have limited time and resources available, and are unlikely to conduct detailed one-on-one testing to confirm concerns, the use of tools that can be efficiently administered, either by teachers or other professionals, and are reliable in detecting the likelihood of difficulty, is critical if children with reading comprehension difficulties in the presence of appropriate levels of reading accuracy and fluency are to be identified accurately and efficiently.

Aims of the Study

Drawing on the work of Kelso et al. (2007), the purpose of this study was to investigate whether an approach using two oral language tasks assessing phonological awareness and listening comprehension could identify poor comprehenders in Australian school year cohorts of Year 3–6. The oral tasks are quick to administer. While the original study recruited children in Australian School Years 3 and 4 (aged 7-9), with DLD, this study sought to extend the age range to include children in School Year 6 (aged 10-12), and recruit a

wider sample from the regular school population. The study aimed to evaluate whether initial identification of a poor comprehender profile on the oral tasks, based on those used by Kelso et al. (2007), would be confirmed by a second phase of testing using reading tasks, enabling comparison of prevalence of poor comprehenders to that found in the literature.

To capitalise on the access to classroom teachers provided by the research, teachers were asked to make an informal judgement of the reading ability of the children in their class, with a view to future exploration of teachers as a key resource in achieving higher identification rates of poor comprehenders in the classroom.

Method

The study was conducted in two phases, with all children participating in Phase 1, and children who met the predetermined criteria on the oral tasks progressing to further assessment in Phase 2. Ethical approval was granted by Curtin University Human Research Ethics Committee (RDHS-183-15) and by the Government of Western Australia Department of Education. Written consent was obtained from participating school principals, teachers, students and their parents/guardians.

Participants

Two hundred and eighteen children were recruited to the study, across Australian School Years 3–6. The children attended one of two regular primary schools in inner metropolitan Perth, Western Australia (see Table 3.1), each drawing from a primarily middle to upper-middle income catchment area. At the commencement of the study, the children ranged in age from 7 years 8 months to 12 years 1 months (92 – 145 months).

Table 3.1

Number of children in each School Year level and school, and mean age (standard deviation) for each School Year in months

	School Year				
	Year 3	Year 4	Year 5	Year 6	Total
School 1	30	13	16	26	85
School 2	38	38	30	27	133
M (SD)	99.2 (4.1)	112.5 (3.6)	124.8 (4.7)	135.3 (4.1)	

Phase 1 Protocol

Phase 1 testing consisted of two measures, a phonological awareness task and a listening comprehension task, corresponding to the two tasks used in the Kelso et al. (2007)

study. The tasks were administered and scored according to the instructions in the test manuals. The responses on the listening comprehension task were audio-recorded for later transcription and analysis.

Measures.

***Phonological Awareness*.** The Elision subtest from the *Comprehensive Test of Phonological Processing – Second Edition (CTOPP-2)* (Wagner et al., 2013), an untimed test of phoneme manipulation, was used to measure phonological awareness. The participant was asked to repeat the word presented by the examiner, then say the word that remained when a phonological segment was removed. The internal consistency is .91 and the test-retest reliability .82.

***Listening Comprehension*.** The Understanding Spoken Paragraphs subtest from the *Clinical Evaluation of Language Fundamentals – Fourth Edition –Australian Standardised Edition (CELF-4 Australian)* (Semel et al., 2006) was selected to measure the ability to listen to short paragraphs and interpret factual and inferential information. Five different types of questions were asked for each paragraph. Test-retest reliability is .76 and internal consistency is .70.

Phase 1 Procedure.

The oral tasks were administered individually by the first author, in a room at the school away from the child's classroom. The phonological awareness task was presented first, followed by the listening comprehension task.

Criteria for Progression to Phase 2

Potential poor comprehenders were selected if their performance met two criteria drawn from the literature outlined above, based on the SVR, who then progressed to Phase 2 for confirmation assessment. The criteria were:

1. Scaled Score of 7 (16^{th} percentile) or less on the listening comprehension task: *CELF-4 (Australian) Understanding Spoken Paragraphs.* This is equivalent to a Standard Score of 85 (-1 *SD*), a cut-off used in previous studies (e.g., Catts et al., 2003; Nation et al., 2004).
2. Scaled Score of 9 (37^{th} percentile) or above on the phonological awareness task: *CTOPP-2 Elision*. This is equivalent to a Standard Score of 95, consistent with the cut-off used for reading accuracy of a Standard Score greater than 90 or 95 used in previous studies (e.g., Hulme & Snowling, 2011, Nation et al., 2004, Nation et al., 2010), as well as the 10 Standard Score point discrepancy used by Nation et al. (2010).

These criteria were used to ensure that the phonological awareness skills of children who progressed to Phase 2 were robust, with weakness in listening comprehension (-1 *SD* or greater). (Children who were potentially poor decoders or generally poor readers would not meet these criteria.)

Phase 2 Confirmation Testing Protocol

All children who met the above criteria were then assessed on two measures of reading, and a nonverbal intelligence task was administered.

Measures.

***Phonological Decoding*.** The Pseudoword Decoding subtest from the *Wechsler Individual Achievement Test-Second Edition - Australian Standardised Edition (WIAT-II Australian)* (Wechsler, 2007), an untimed test of the ability to decode nonsense words of increasing difficulty, was used to assess phonological decoding. The subtest contains 55 nonwords which the participant read horizontally across three columns until the discontinue criterion was met or the last nonword read. Average test-retest reliability across three age groups is .95, and internal consistency is .96 for age and .96 for grade.

***Reading Comprehension*.** The *York Assessment of Reading Comprehension Primary – Australian Edition (YARC Primary - Australian) – Form A* (Snowling et al., 2012) was used to evaluate reading comprehension. The assessment protocol, developed in the UK, was standardised in Australian schools in 2011. All participants commenced the test at the passage appropriate for their School Year level. The test was administered as per the manual instructions, including encouraging the participants to check back in the text before answering the comprehension questions. All responses were recorded for later transcription and analysis. The second reading passage was selected according to the criteria in the manual, apart from those children in School Year 6 who were all presented the Level 5A and Level 6A passages. Internal consistency for pairs of consecutive passages were .63 to .86.

***Nonverbal Intelligence*.** The *Test of Nonverbal Intelligence, Fourth Edition (TONI-4) -Form A (*Brown et al., 2010) was selected as a language-free test of intelligence, aptitude, abstract reasoning and problem solving. The participant was required to select, from the options presented, the abstract figure with the correct salient characteristics to complete each problem solving task. Testing was discontinued when 3 errors were made across 5 consecutive items. Test-retest reliability is .86-.89 and inter-rater reliability .99.

Phase 2 Procedure.

The tasks were administered following the same procedure set out in Phase 1. Reading tasks were completed in the first session (approx. 30 minutes) while the non-verbal IQ task (approx. 15 minutes), was completed in a second session.

Criteria for Classification as a Poor Comprehender

The criteria for confirmation of classification as a poor comprehender were as follows:

1. Scored in the average range for non-verbal intelligence on the *TONI-4*.
2. Scored at the 37th percentile (SS = 95) or above for phonological decoding on the *WIAT-II (Australian) Pseudoword Decoding* subtest, consistent with the cut-off on the oral phonological awareness task.
3. Met one of three levels of criteria for reading comprehension on the *YARC-Primary (Australian) Comprehension* based on criteria used in previous studies reported in the Introduction:
    a) At or below the 16th percentile (SS = 85) i.e., 1 *SD* or greater below the mean
    b) At or below the 25th percentile (SS = 90) i.e., in lowest quartile
    c) Below the 35th percentile (SS < 95) but with a percentile point gap of 20 points or more between their nonword reading and reading comprehension score.

Informal Teacher Judgements

During Phase 1, classroom teachers were asked to make a judgement of the reading ability of each child in their class, as either average, strong or weak. If the teacher judged the child's reading ability to be weak, they were asked "Is the reading difficulty in the area of reading accuracy (decoding), reading comprehension, or both?" Nineteen teachers answered these questions, five School Year 3 teachers and four for each of School Years 4, 5 and 6. None were new graduate teachers.

Data Analysis

Data were entered into an Excel spreadsheet, and then transferred into the SAS version 9.4 software (SAS Institute Inc., Cary, NC, USA, 2008) for analysis. Standard descriptive statistics (mean, standard deviation, range) were used to summarise the profile of the study participants. Flow-charts were used to describe the numbers of participants falling within particular combinations of results. An Analysis of Variance was used to assess whether there were significant differences in mean scores between year groups, and the Chi-

square test used to compare the proportions of poor comprehenders between year groups. A p-value < 0.05 was taken to indicate a statistically significant association in all tests.

Results

Phase 1

In keeping with the SVR framework, the 218 children who participated in Phase 1 were classified along the dimensions of listening comprehension and phonological awareness. The performance of each school year group on the two classification measures is presented in Table 3.2. No significant difference was present in scores across year groups for either measure (p=0.25 and p=0.66 respectively).

Table 3.2

Mean (standard deviation) and range of scaled scores on the oral tasks for each School Year level

Assessment Task	School Year			
	Year 3 *n*=68	Year 4 *n*=51	Year 5 *n*=46	Year 6 *n*=53
LC (CELF-4 USP)	9.7 (2.7) 2-13	9.7 (3.0) 4-14	8.8 (3.5) 1-15	9.0 (2.7) 4-15
PA (CTOPP-2 Elision)	9.4 (2.6) 3-15	10.0 (2.5) 5-15	9.8 (3.1) 5-15	9.8 (2.0) 5-13

Note. LC = Listening Comprehension; CELF-4 USP = *Clinical Evaluation of Language Fundamentals-4 –Australian Standardised Edition:* Understanding Spoken Paragraphs; PA = Phonological Awareness; CTOPP-2 = *Comprehensive Test of Phonological Processing-2*

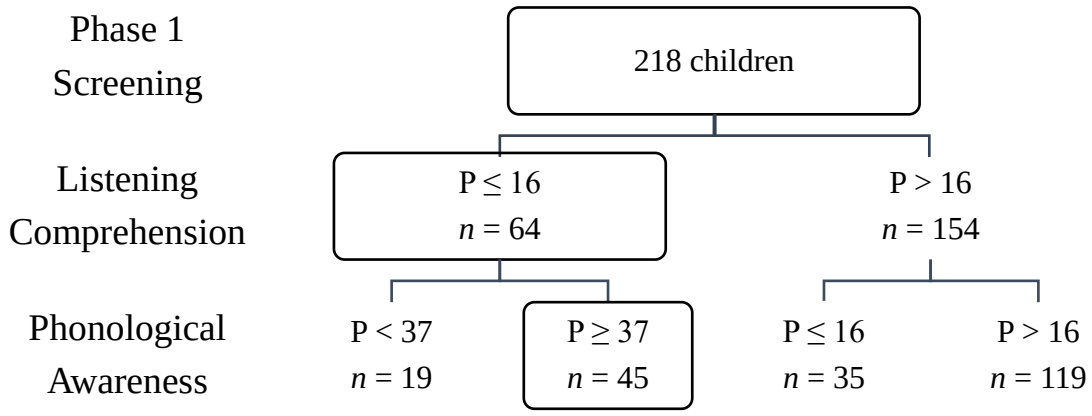
Total numbers of children progressing through to Phase 2 are seen in Figure 3.1. The children were initially classified using their score on the listening comprehension (LC) task, the CELF-4 (Australian) Understanding Spoken Paragraphs (CELF-4 USP) subtest. Sixty four children were found to meet the criteria of a Scaled Score at or below 7 (16^{th} percentile). Of these, 45 children met the criteria on the phonological awareness (PA) task (CTOPP-2 Elision) of a Scaled Score equal to or greater than 9 (37^{th} percentile) and were therefore considered as potential poor comprehenders. Analysis of Variance confirmed that there was no significant difference in mean score between year groups on the PA task (CTOPP-2 Elision) (p=0.268). There was a significant difference between the scores for LC (CELF-4 USP) (p=0.038) across year groups, primarily because scores in School Year 5 were significantly lower than in School Year 6 (p=0.005).

The number of potential poor comprehenders in each school year, and as a percentage of the whole year cohort, along with the means and standard deviations on the two Phase 1

measures in each school year group are shown in Table 3.3. The Chi-square test showed that differences in the proportions of poor comprehenders across year groups did not reach statistical significance (p=0.087). The Mantel-Haenszel Chi-square test, however, showed a significant trend across year groups (p=0.017). The remaining 19 children who achieved a Scaled Score at or below 7 (16th percentile) on the LC task also had difficulty on the PA task, and so were potentially generally poor readers, however, no further testing was undertaken to confirm this profile. Of the 154 children who achieved a score in the average range on the LC task, 35 obtained a Scaled Score of 7 or below on the PA task, CTOPP-2 Elision, placing them at risk of being poor decoders. These children were also not followed up in this study, such that this profile could not be confirmed. The remaining 119 children scored in the average range on both tasks.

Figure 3.1

Flow diagram for children progressing through Phase 1



Note. P = Percentile

Phase 2 Confirmation Assessment

All 45 children identified as potential poor comprehenders completed the second phase of testing to confirm whether membership of this group was supported, establish whether nonverbal intelligence was within the average range, and enable comparison of prevalence of this group to that identified in the literature. Mean, standard deviation and range of Standard Scores on the two reading and nonverbal IQ measures are presented in Table 3.3 for each school year group. All children scored in the average range on the TONI-4 nonverbal IQ task, (Standard Score > 85) ensuring that nonverbal IQ was not a confounding factor (see Table 3.3). Analysis of Variance confirmed that there was no significant difference between the mean scores on the nonverbal IQ (TONI-4), Decoding (WIAT-II

Pseudowords) and Comprehension (YARC Comp) measures between the school year groups: TONI-4 (p=0.879), WIAT-II Pseudowords (p=0.846), YARC Comp (p=0.816).

Table 3.3

Mean (standard deviation) and range of scaled scores on the Phase 1 tasks, and standard scores on the Phase 2 tasks, for potential poor comprehenders within School Year levels

	School Year			
Assessment Task	Year 3	Year 4	Year 5	Year 6
PC *n* (%)	*n* = 9 (13.2)	*n* = 10 (19.6)	*n* = 9 (19.6)	*n* = 17 (32.1)
LC (CELF-4 USP)	5.9 (0.9)	5.5 (1.4)	4.6 (1.9)	6.1 (1.0)
	4-7	4-7	2-7	4-7
PA (CTOPP-2	11.8 (1.6)	11.3 (1.7)	10.9 (2.1)	10.5 (1.4)
Elision)	10-15	9-13	9-14	9-13
NVIQ (TONI-4)	109.4 (10.6)	109.4 (6.8)	106.7 (8.2)	109.4 (9.6)
	91-130	100-124	99-124	94-128
Decoding (WIAT-II	106.6 (10.0)	105.3 (8.2)	107.0 (3.7)	104.7 (5.7)
Pseudowords)	89-118	95-118	100-111	93-111
Comprehension	93.9 (7.5)	93.3 (14.1)	89.9 (8.4)	93.9 (11.0)
(YARC Comp)	85-104	71-121	75-99	71-111

Note. LC = Listening Comprehension; PC = Poor comprehender; CELF-4 USP = *Clinical Evaluation of Language Fundamentals-4 –Australian Standardised Edition:* Understanding Spoken Paragraphs; PA = Phonological Awareness; CTOPP-2 = *Comprehensive Test of Phonological Processing-2;* NVIQ = Nonverbal IQ; TONI-4 = *Test of Nonverbal Intelligence-4;* WIAT-II Pseudowords = *Wechsler Individual Achievement Test-2 - Australian Standardised Edition:* Pseudoword Decoding; YARC Comp = *York Assessment of Reading Comprehension – Australian Edition*

Total numbers of children progressing through the decision-making stages of the reading assessment are seen in Figure 3.2.

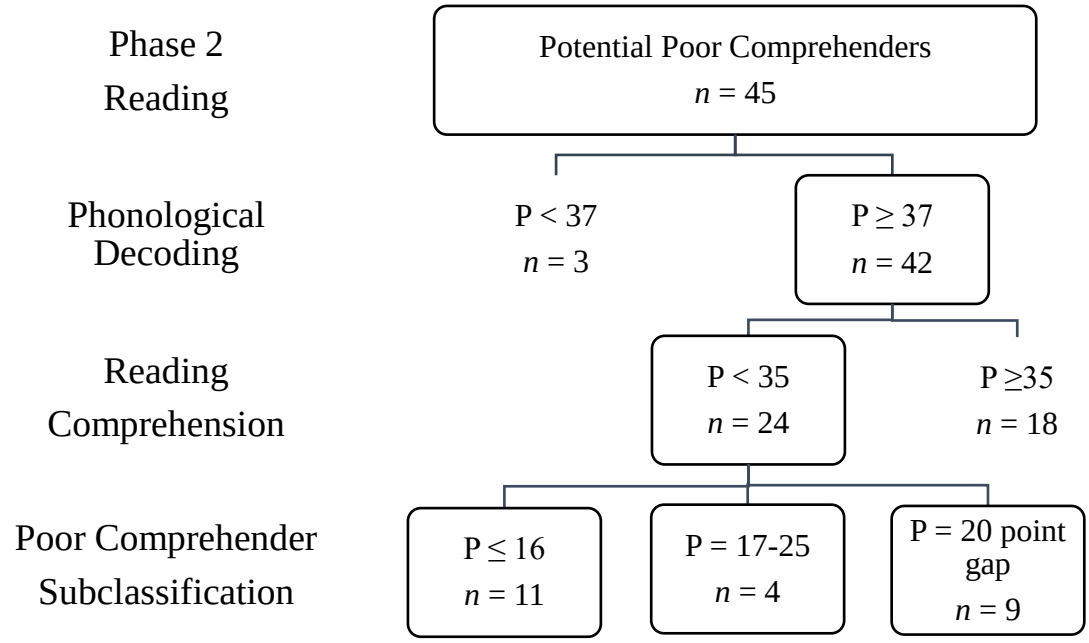
Step 1: The 45 children were initially examined on their phonological decoding (nonword reading) score from the WIAT-II (Australian) Pseudoword Decoding and 42 children met the criteria of a Standard Score (SS) equal to or greater than 95 (37th percentile). Based on their weaker score on this task, three children were not considered to meet the criteria to be a poor comprehender and were eliminated from the study (two in Australian School Year 3 and one in School Year 6).

Step 2: Scores for the 42 children with average phonological decoding were then examined on the reading comprehension measure, YARC-Primary (Australian) Comprehension, and 24 were confirmed as having difficulties (see Table 3.4). The remaining 18 children scored within the average range and so were considered to have typically developing reading skills.

Step 3: The 24 poor comprehenders identified in this phase, were further classified according to the three cut-off criteria listed earlier. Eleven children scored at or below the 16th percentile (SS = 85) and are referred to here as "classic" poor comprehenders. Four children scored at or below the 25th percentile (SS = 90), and are referred to as "discrepant" poor comprehenders, with the remaining nine scoring below the 35th percentile (SS < 95) but with a percentile point gap of 20 points or more between their nonword reading and reading comprehension score (see Figure 3.2). This last group are referred to as "discrepant-gap" poor comprehenders. The prevalence of poor comprehenders in the sample, using the strictest criterion, was 5%. This increased to 6.8% using the lowest quartile criterion, with 10.6% of the cohort meeting the broader 20 percentile point gap criterion.

Figure 3.2

Flow diagram for children progressing through Phase 2 reading testing



Note. P = Percentile

A breakdown of the poor comprehenders across both subgroup and school year group is seen in Table 3.5. The number of children identified as poor comprehenders in each year level as a percentage of those who underwent Phase 2 testing, and as a percentage of the whole year cohort, is also shown. Numbers within the different subgroups, separated into the year groups, were too small for statistical analysis.

Table 3.4

Mean (standard deviation) and range of standard scores on the Phase 2 confirmation tasks for poor comprehenders and typically developing readers

Assessment Task	Group				p-value
	Poor comprehenders (*n*=24)		Typically developing (*n*=18)		
	M (SD)	Range	*M (SD)*	Range	
TONI-4	108.2 (7.3)	97-124	110.2 (10.8)	91-130	0.479
WIAT-II Pseudo	105.2 (5.7)	95-114	108.7 (5.4)	95-118	0.050
YARC Comp	86.0 (6.9)	71-94	103.1 (6.0)	96-121	<0. 001*

Note. TONI-4 = *Test of Nonverbal Intelligence-4;* WIAT-II Pseudo = *Wechsler Individual Achievement Test-2 - Australian Standardised Edition:* Pseudoword Decoding; YARC Comp = *York Assessment of Reading Comprehension – Australian Edition*
* $p < .05$.

Informal Teacher Judgements

Of the 24 children confirmed as a poor comprehender (either classic, discrepant or discrepant-gap), five were judged to be a weak reader by their teacher: three in School Year 4 and one each in School Years 5 and 6. One of these children was identified as having comprehension difficulties, and the other four difficulties with both reading accuracy and comprehension. Seventeen of the 18 children who performed well on both reading tasks, therefore identified as typically developing readers, were judged to have average or above reading ability.

Table 3.5

Number of poor comprehenders by subgroup and School Year level

	School Year				
	Year 3	Year 4	Year 5	Year 6	Total
Potential PC at Phase 1	9	10	9	17	45
Confirmed PC at Phase 2	3	7	6	8	24
Classic PC	2	3	3	3	11
Discrepant PC	0	2	1	1	4
Discrepant-gap PC	1	2	2	4	9
%'age of Phase 1 identified PC	33	70	67	47	
%'age of year cohort identified PC	4.4	13.7	13.0	15.1	

Note. PC = Poor Comprehender

Discussion

This study investigated whether poor comprehenders in Australian School Years 3-6 (aged 7 to 12 years) attending two regular primary schools could be identified using a short testing protocol consisting of two oral language tasks: a phonological awareness and a

listening comprehension task, based on Kelso et al. (2007). Identification of potential poor comprehenders using these tasks was then confirmed through assessment of reading, and considered in the light of prevalence rates identified in the literature.

Effectiveness of Oral Measures in Identifying Poor Comprehenders

The results showed that, of those children identified by the oral tasks as potential poor comprehenders, only 53% were confirmed via performance on the second phase reading tasks. This contrasts with Kelso et al.'s (2007) finding that a phoneme deletion and listening comprehension task differentiated poor comprehenders with 90% accuracy. This differentiation, however, was between two groups of children with DLD rather than children in the broader population. Despite over-identification, the two oral tasks did narrow the number of children requiring more detailed testing of their reading from 218 to 45, thereby reducing the time spent in testing, suggesting a staged process of testing may be possible. This staged process may be useful to, firstly, identify potential poor comprehenders and, subsequently, more efficiently identify this group using reading tasks, such as those employed here, which are more time consuming to administer.

Results from the Phase 2 reading tasks revealed that, consistent with previous research (e.g., Catts et al., 2006; Elwér et al., 2015; Nation et al., 2004), the phonological decoding skills of the poor comprehenders did not differ significantly from those identified as typically developing readers. In addition, the two groups did not differ on nonverbal IQ and all poor comprehenders scored well in the average range or above, which was in contrast with previous research findings (Catts et al., 2006; Elwér et al., 2015; Nation et al., 2010).

Interestingly, an imbalance in identification of potential poor comprehenders was evident across the School Year levels with nearly twice as many Australian School Year 6 children identified compared to the number of children in School Years 3, 4 and 5. The number of School Year 6 children identified was also proportionally more of the School Year 6 cohort screened (32.1%), compared with 13.2% of the School Year 3 cohort, and 19.6% of both School Years 4 and 5. The most likely reason for greater over-identification in School Year 6 could be considered an artefact of the listening comprehension task's (CELF-4 USP) scoring, where there is a shift in the Scaled Score equivalents for raw scores between the norms for children aged 10 versus aged 11; the majority of School Year 6 children being aged 11 at the time of testing. For example, a Raw Score of 10 at age 10 is equivalent to a Scaled Score of 8, while at age 11 it is equivalent to a Scaled Score of 6, and a Raw Score of 11 is equivalent to a Scaled Score of 7. Of the 17 School Year 6 children identified as potential

poor comprehenders, 12 achieved a Raw Score of 10 or 11 on the listening comprehension task, but only four were found later to have weak reading comprehension (two each fell into the classic and discrepant-gap subgroups). The remaining five, who had Raw Scores lower than 10, all had weaknesses in reading comprehension.

While the oral tasks over-identified Australian School Year 6 children as potential poor comprehenders, a larger proportion of these children were confirmed as poor comprehenders on the Phase 2 reading tests compared with School Year 3 children: 47% compared to 33%. The robustness of the Phase 1 testing was stronger, however, for School Years 4 and 5, with 70% and 67% respectively of the children identified on the oral tasks found to be poor comprehenders. The number of children who met the poor comprehender criteria following Phase 2 testing also increased between School Year 3 and 4, which equates with the traditional shift in the focus of schools' curriculum from "learning to read" to "reading to learn" (Chall, 1983). Of the total cohort of School Year 3 children, 4.4% were confirmed as poor comprehenders, which is similar to the 3% of children in grade 2 suggested by Catts and colleagues research (cited by Hogan et al., 2014). The percentage of children meeting the poor comprehender criteria ranged from 13.7% in School Year 4 to 15.1% in School Year 6. These figures are higher than the population figures suggested by Catts and colleagues of 6% in grade 4 and 7.8% in grade 8, but reflect the same increase in prevalence across the school years. Why the prevalence figures are higher in the current study is unclear, but group size and selection methods may be contributing factors.

The oral tasks, combined with the follow-up assessment of reading, can therefore be viewed as being moderately effective in identifying poor comprehenders in School Year 4 and 5. Children in School Year 6 were, more than the other cohorts, over-identified by the oral tasks, largely hypothesised to be due to the structuring of the Australian norms for the listening comprehension task (CELF-4 USP). An alternative cut-off or listening comprehension task is therefore indicated for this age group.

Prevalence of Poor Comprehenders

We were also able to consider the proportion of poor comprehenders within the whole initial cohort of 218 children. Of the 24 children classified as poor comprehenders, the largest group of 11 children, comprising 5% of the original cohort, met the strictest criteria of scoring at or above the 37th percentile (SS = 95) on the phonological decoding task and at or below the 16th percentile (SS = 85) on the reading comprehension task. These standard score criteria were the same as those used by Nation et al. (2004), as well as being consistent with

the 1 *SD* discrepancy utilised by Snowling et al. (2009) in the YARC-Primary standardisation, and the minimum discrepancy of 10 standard score points between accuracy and comprehension used by Nation et al. (2010) and Elwér et al. (2015).

When the reading comprehension criterion was broadened to a score at or below the 25th percentile (SS = 90) used by a number of researchers (Elwér et al., 2015; Nation et al., 2010; Snowling et al., 2009), but without the strict discrepancy criterion, the prevalence increased to 6.8%, which is consistent with the approximately 7 % found in previous research (e.g., Clarke et al., 2010; Elwér et al., 2015; Nation et al., 2010). Finally, when the cut-off was set at below the 35th percentile (SS < 95), with a phonological decoding score 20 percentile points or greater higher, the prevalence figure of 10.6% was more consistent with the early research where poor comprehenders were identified using discrepancy on NARA scores (Stothard & Hulme, 1995; Yuill & Oakhill, 1991). For six of the nine children in this group, the gap in scores was also consistent with the 10 standard score point discrepancy used by Nation et al. (2010) and Elwér et al. (2015) while, for the other three, it was an 8 or 9 point gap.

Limitations and Future Research

In a non-population based study, the particular demographic sample from which participants are drawn does require consideration with respect to interpretation of findings for the broader population. Participants were recruited from only two schools which limited recruiting from a broad range of socio-economic backgrounds, potentially limiting generalisability of the findings. Participation was also dependent on parental/caregiver consent, whereby children in some year groups may have been under-represented. It was also beyond the scope of this study to conduct follow-up testing of reading on children who did not meet the criteria to be potential poor comprehenders in Phase 1 for progression to Phase 2 testing. It is therefore not known if some children with reading comprehension difficulties were not identified as potentially poor comprehenders by the oral tasks in Phase 1. Future longitudinal studies would assist in addressing these questions.

While not a specific research question for this study, the access to classroom teachers provided by the study was utilised to ask teachers to make an informal judgement of the reading ability of the children in their class, with a view to future exploration of teachers as a key resource in achieving higher identification rates of poor comprehenders. That only five of the 24 children confirmed as a poor comprehender following assessment of their reading were judged to be weak readers is consistent with previous research highlighting that the

difficulties of poor comprehenders are “hidden” (Hulme & Snowling, 2011; Nation et al., 2004, Snowling, 2013), and supports the need for future research into better methods of identification of this group.

Implications for Practice

Several implications for practice and professional development are identified by this study. The findings demonstrated that the tasks that targeted the two dimensions of the SVR at an oral language level, one testing phonological awareness and the other listening comprehension were not effective in identifying children with a “hidden” reading disorder in Australian School Years 3-6. Rather, the results provided compelling evidence that reading itself needs to be tested to confirm that a child is a poor comprehender. The results, however, did suggest that using the tasks as a Tier 1 measure that potentially could be administered at a group level to identify children at possible risk of a reading disorder, followed up with a reading assessment, could be effective in identifying children, as only the at-risk children would need to undergo further testing thus reducing the time spent in testing.

The variation in accuracy of identifying poor comprehenders across the different School Year levels suggests that alternative listening comprehension tasks that are both effective and efficient may be required at different School Year levels or ages. Selection of appropriate tasks to aid identification is particularly important if poor comprehenders are to be identified as early as possible in the primary school years for appropriate intervention to be put in place as, consistent with previous research, the prevalence of poor comprehenders in this study was found to increase across school year levels.

CHAPTER 4

Profiles of oral and reading comprehension in poor comprehenders

Chapter Overview

This chapter presents the published findings from Phase 3 of Study 1 which involved the detailed profiling of a group of 17 poor comprehenders who met the criteria for this phase and agreed to complete the full assessment battery involved in this phase of the research. As outlined in Chapter 2 and the published paper in this chapter, previous research has found that poor comprehenders have intact phonological and word reading accuracy skills but weaknesses in aspects of lower and higher-level oral language and verbal working memory. Not all poor comprehenders, however, have difficulty on all skills, and not all poor comprehenders show weaknesses on the same measure in the same study (Cain, 2016). In addition, many previous studies have focused on only one subcomponent of the skills or knowledge involved in the comprehension process, or only used a single task to test a skill, which does not allow for a full exploration of the complexity of reading comprehension (Catts, 2018). The goal of this phase of the research was to compile and subsequently administer a comprehensive theoretically informed assessment battery to obtain individual detailed profiles of the oral and written language and cognitive processes of a group of children identified as poor comprehenders.

As discussed in Chapter 2, the RSF (Perfetti & Stafura, 2014) provides a theoretical model of reading comprehension that connects the operations of the word identification system with the higher-level text comprehension system via the lexicon. This theoretical framework was used to guide the development of the assessment battery; something not previously reported. In selecting the tasks, standardised tests and those accessible to clinicians were intentionally chosen to facilitate the findings being more readily transferable to clinical practice, and thereby support the assessment and targeting of intervention with poor comprehenders.

This chapter includes the accepted manuscript version of the research article titled, *Profiles of Oral and Reading Comprehension in Poor Comprehenders* published online by Taylor & Francis Group in Reading & Writing Quarterly on 29 October, 2021. Available online at: https://wwww.tandfonline.com/ https://doi.org/10.1080/10573569.2021.1982432

Reference:

Kelso, K., Whitworth, A. & Leitão, S. (2021b). Profiles of Oral and Reading Comprehension in Poor Comprehenders. *Reading & Writing Quarterly*. Epub ahead of print 29 Oct 2021: 1-18. https://doi.org/10.1080/10573569.2021.1982432

Published Manuscript

Abstract

This study aimed to profile the sublexical, lexical, and text level language skills, and cognitive processes of a sub-group of children with poor reading comprehension known as poor comprehenders. An assessment protocol was developed to assess each of the components from Perfetti and Stafura's (2014) Reading Systems Framework. A comprehensive profile was obtained for 17 poor comprehenders in School Years 3-6 (aged 8-11 years), each assessed individually. Consistent with previous research, and irrespective of age, the poor comprehenders in this study did not have difficulty with sublexical and word reading skills overall. Unexpectedly, only two children had difficulty with the lower-level language tasks at the Lexicon and sentence sub-level of the Reading Systems Framework. In contrast, 15 poor comprehenders had difficulty with higher-level comprehension processes. All children had weak verbal working memory, supporting previous research findings. The study provides direction for clinical assessment tasks for use with this population.

Key words: reading comprehension, poor comprehenders, assessment, profiles

Introduction

Reading comprehension involves a complex set of knowledge and processes, any aspect of which can be a source of comprehension failure. Poor comprehenders are a subgroup of poor readers with weak reading comprehension who can be difficult to identify as they read accurately and fluently. Research exploring the underlying skills of poor comprehenders has been predominantly guided by the Simple View of Reading (SVR) which proposes that reading comprehension is the product of skills in two components: decoding (or word reading) and listening comprehension (Gough & Tunmer, 1986). The central claims of the SVR are that both components are of equal importance, skill in both is necessary for reading success, and the two components can be dissociated allowing for identification of three different subgroups of poor readers: poor comprehenders, poor decoders, and those who struggle with both decoding and comprehension (Hoover & Gough, 1990). Between 7-8% of children in the middle primary school years have been identified as poor comprehenders (e.g., Clarke et al., 2010; Nation et al., 2010), and this percentage has been found to increase across the year levels as decoding skills improve and listening comprehension becomes increasingly influential (e.g., Language and Reading Research Consortium [LARRC], 2015). The SVR, as originally conceptualised, does not specify subcomponents within each of these two components instead provides "an overall framework for understanding the broad landscape of

reading" (Kirby & Savage, 2008, p.75). Some longitudinal and prospective studies have used multiple measures to explore the profiles of poor comprehenders and the contribution of subcomponent skills to reading comprehension, (e.g., Cain & Oakhill, 2006; Catts et al., 2006; Kim, 2017; Nation et al., 2010). There has been high variability, however, in the type and range of language skills that have been assessed, limiting comparison of participant groups reported in the literature, necessitating a targeted procedure to profile the skills of this often hidden group of poor readers.

While a number of text and discourse comprehension models have been developed (for a review, see McNamara & Magliano, 2009), Perfetti and Stafura (2014) proposed that there was value in a framework that represented the components of reading more fully. The Reading Systems Framework (RSF: 2014) evolved from earlier work by Perfetti and colleagues (Perfetti 1999; Perfetti et al., 2005) and includes word-level processes alongside the higher-level processes focused on in much of the previous comprehension research, with the two components centrally connected by the lexicon, i.e., the knowledge of written word forms and their meaning. The RSF sought to identify key processes and knowledge sources that input into these component systems, along with wider cognitive system requirements such as visual input and memory skills, allowing for the development of hypotheses regarding the sources of reading comprehension difficulties (Perfetti & Stafura, 2014). By expanding on the two components of SVR, the RSF provides a more comprehensive framework for the creation of a theoretically informed test battery to profile the strengths and weaknesses of readers, including poor comprehenders.

To investigate how the RSF may achieve this aim, we first explore an expanded version of the SVR that has emerged since its initial conceptualisation over 30 years ago, through its use as a framework to guide research into reading comprehension. Using Hogan et al.'s (2011) visual representation of this expanded view, the characteristics of poor comprehenders as they are currently understood are then set out. Finally, how the more comprehensive framework of the RSF has guided the development of a theoretically informed assessment battery to profile the language skills of a group of poor comprehenders in this study, is explored.

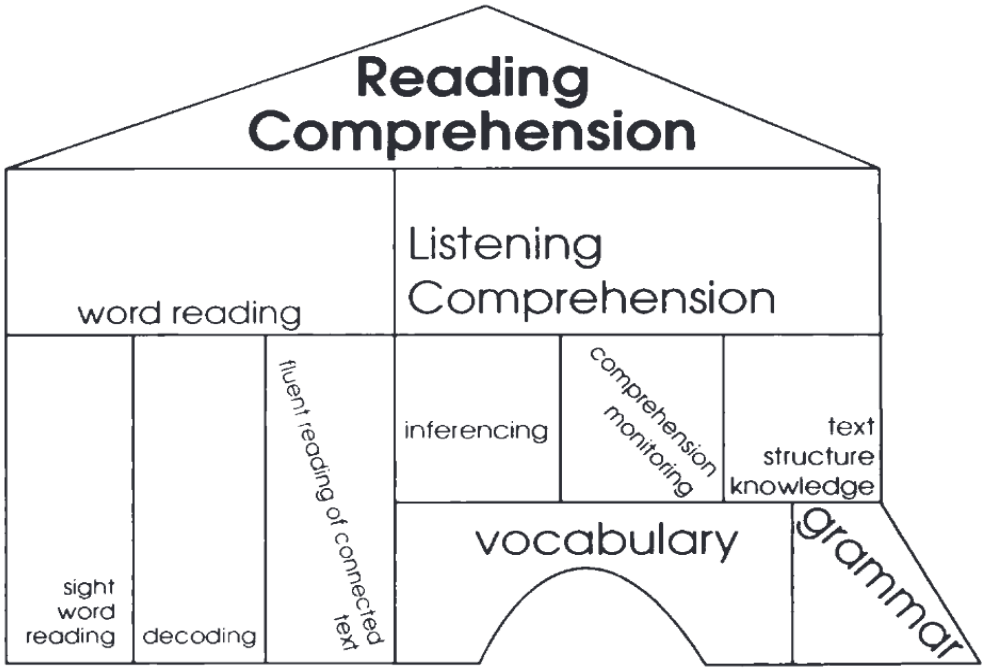
The Simple View of Reading

The two components of the SVR, decoding (also referred to as word reading) and listening comprehension, have been found to explain almost, if not all of the variance in reading comprehension at different stages of development (e.g., Kim, 2017). They are

"…upper-level skills that directly contribute to reading comprehension while they are predicted by a constellation of language and cognitive skills" (Kim, 2017, p.326). Figure 4.1 shows Hogan et al.'s (2011) representation of these upper-level and subcomponent skills within the SVR framework.

Figure 4.1

Visual representation of the Simple View of Reading



Note: Reprinted from *"*Increasing Higher Level Language Skills to Improve Reading Comprehension*"* by T. Hogan et al., 2011. *Focus on Exceptional Children*, *44*(3), p.2. Copyright by Focus on Exceptional Children.

The 'upper-level skill' of word reading is underpinned by sight word reading, decoding and fluent reading, while the subcomponents of listening comprehension are divided into what are sometimes referred to as lower and higher-level language skills or factors (e.g., Hogan et al., 2011; Perfetti et al., 2005). The lower-level language skills of vocabulary and grammar knowledge support the understanding of individual words and sentences in a text. They are used to construct the literal meaning of a text, or *textbase* (Kim, 2017; Kintsch & Kintsch, 2005). These lower-level skills provide a foundation for the higher-level skills of (a) integration and inferencing, (b) comprehension monitoring, and (c) text structure knowledge, each required to construct a *situation model*, or mental model of the situation described in an oral or written text (Hogan et.al., 2011; Kintsch & Kintsch, 2005).

Word reading skills in poor comprehenders

With respect to word reading skills, problems have not been identified in poor comprehenders in any of the three word reading subcomponents identified in Hogan et al.'s (2011) visual representation of the SVR. Yuill and Oakhill (1991) provide an overview of earlier work where poor comprehenders, when matched with good comprehenders for word reading accuracy on an early version of the Neale Analysis of Reading Ability (NARA[2]: Neale, 1997), were shown to be able to (1) read and sort pairs of rhyming and non-rhyming word pairs into groups, and (2) read nonwords and both high and low frequency real words, as rapidly as the controls. Further, training to increase decoding speed was not found to impact on comprehension levels (Yuill & Oakhill, 1991). Later research with poor comprehenders, using stricter group selection criteria, provided further support for appropriately developed phonological processing and word reading skills across a range of tasks such as rhyme judgement and fluency, phoneme deletion, nonword repetition, and timed and untimed real and nonword reading (Adlof & Catts, 2015; Cain et al., 2000; Catts et al., 2006; Nation et al., 2004; Nation et al., 2010; Nation & Snowling, 1998). Nation and Snowling (1998), however, found that while the 8-9 year old poor comprehenders in their study read high frequency words and those with regular spellings at an equivalent level of accuracy and speed to control children, they were less accurate and efficient reading low frequency and irregularly spelt words, a finding replicated by Ricketts et al. (2007).

Nation and Snowling proposed that these difficulties were the result of weaknesses in knowledge of word meanings which can be used, along with letter-sound mappings, to support word recognition. Support for this proposal was provided by Tunmer and Chapman (2012) who, in a study of 122 children aged 7 years, found that while vocabulary knowledge impacted directly on reading comprehension, it also impacted indirectly on word recognition. These semantic weaknesses are suggestive of broader language processing issues, leading researchers to turn their attention to other language subcomponents in their attempts to explain the difficulties underlying poor reading comprehension.

Listening comprehension skills in poor comprehenders

With respect to listening comprehension skills (see Figure 4.1), vocabulary and grammar provide a foundation for the higher-level skills (text structure knowledge, inferencing and comprehension monitoring) which, when combined with a reader's prior

[2] Where different versions of the same test are cited, the version used in the most recent study is referenced

knowledge, allow for the construction of a mental model of a text's meaning (Hogan et al., 2011; Perfetti et al., 2005). These will now be explored in more detail.

Lower-level language skills

Vocabulary. While it is widely accepted that weak vocabulary skills will impact on reading comprehension, the findings for the influence of vocabulary in poor comprehenders are variable. In many of Oakhill and colleagues' studies (e.g., Cain et al., 2000; Cain et al., 2004; Yuill & Oakhill, 1991), the Gates-MacGinitie Vocabulary subtest (MacGinitie & MacGinitie, 1989), a single-word reading vocabulary measure requiring matching one of four written words to a picture, was used in the selection and matching of their groups of good and poor comprehenders. Other studies have used the British Picture Vocabulary Scale (BPVS; Dunn et al., 1997) in the selection and matching process (e.g., Cain et al., 2004), showing that receptive vocabulary was not an area of deficit for the poor comprehenders in these studies. In a different study with 9-10 year old children, Cain et al. (2004), using both the BPVS and Gates-MacGinitie, identified one group of poor comprehenders with weak vocabulary skills and one without. The findings of studies that have assessed receptive vocabulary, but not used the tasks as a selection measure, have varied. Cain and Oakhill (2006) found that 7-8 year old poor comprehenders scored significantly below good comprehenders on the BPVS, although most still scored at an age-appropriate level, but not on the Gates-MacGinitie. Other studies using the Peabody Picture Vocabulary Test (PPVT: Dunn & Dunn, 2007) have found poor comprehenders to have weak receptive vocabulary (Adlof & Catts, 2015; Catts et al., 2006).

Tests of receptive vocabulary measure vocabulary breadth, the number of words a person knows, while other tasks measure vocabulary depth, knowledge about words and relations and associations between them (Oakhill et al., 2015). Nation and Snowling (1998) found that while the 8-9 year old poor comprehenders in their study performed as well as normal readers on a rhyme fluency task, they produced fewer words on a semantic fluency task. Not all poor comprehenders, however, have been found to perform poorly on semantic fluency tasks (Cain et al., 2004). The poor comprehenders in Nation and Snowling's (1998) study also scored poorly compared with controls on all the other semantic tasks assessing both vocabulary breadth (synonym judgement) and depth (word definitions, multiple meaning words). Subsequent studies found further support for poor comprehenders having difficulty on tasks of vocabulary depth such as word definitions and explaining how words go together (Nation et al., 2004; Nation et al., 2010; Nation et al., 2007), learning the meanings

of new words (Nation et al., 2007), and on the Clinical Evaluation of Language Fundamentals (CELF-4: Semel et al., 2006) Word Classes task which involves identifying and explaining word relationships (Adlof & Catts, 2015).

Grammar. Knowledge of word meanings alone is insufficient to understand sentences; knowledge of syntactic structure is also important. Yuill and Oakhill (1991) found that their groups of poor comprehenders were just as aware of semantic and syntactic constraints in sentences, were able to repeat back meaningful sentences verbatim, and understood grammatical constructions on the Test for Reception of Grammar (TROG: Bishop, 2003), as well as the good comprehenders matched for vocabulary and word recognition. Cain and Oakhill (2006) also found 7-8 year old poor comprehenders performed as well as controls on the TROG, but this finding has not been consistently supported (e.g., Nation et al., 2004). Several studies have also found that poor comprehenders have greater difficulty than controls with verbatim recall of sentences on the CELF Recalling Sentences subtest (Adlof & Catts, 2015: Nation et al., 2004; Nation et al., 2007; Nation et al., 2010), and with other subtests from the CELF involving grammatical knowledge such as Concepts and Directions (Adlof & Catts, 2015; Catts et al., 2006) and Sentence Structure (Nation et al., 2010). While the results on tests of receptive grammar such as the TROG have been inconsistent, other studies have found poor comprehenders perform below good comprehenders on certain experimental tasks of morphosyntax even when semantic factors were controlled (Adlof & Catts, 2015; Nation et al., 2004).

In summary, the results of studies investigating lower-level language skills highlight that, while poor comprehenders have oral language difficulties and not just difficulties specific to reading, not all poor comprehenders have difficulty across all measures of semantics and syntax/grammar. Given the variability in profiles, and the fact that some poor comprehenders appear to have both adequate word level processing and semantic/syntactic skills, a third level of focus has been on higher-level language skills and discourse level comprehension.

Higher-level language skills

Integration and inference. To create an accurate mental model of a text the reader (or listener) needs to go beyond the information that is explicitly stated and integrate information and ideas across sentences and subsequent parts of the text, as well as make inferences and connect information in the text to their prior knowledge. These skills comprise the inferencing subcomponent in Figure 4.1. In a series of studies using experimental tasks,

Oakhill and colleagues found 7-8 year old poor comprehenders had difficulty making inferences at the word, sentence and text level. Oakhill (1983) investigated children's ability to make word meaning inferences to assist recall of auditorily presented sentences. Poor comprehenders' recall was weaker than good comprehenders, despite both groups having the required knowledge to infer specific meanings of words based on the sentence context. Oakhill also found that poor comprehenders had greater difficulty making cohesive inferences in sentences, such as understanding pronoun referents and verb phrase ellipsis, even when directly questioned about what these stood for, and with the text available as support (Yuill & Oakhill, 1991). Bowyer-Crane and Snowling (2005), in contrast, found that their group of poor comprehenders across school Years 2-6 were able to answer questions requiring a cohesive inference on reading comprehension tests.

In another series of studies using experimental tasks, Oakhill and colleagues (Cain & Oakhill, 1999; Cain & Oakhill, 2006; Oakhill et al., 1986; Yuill & Oakhill, 1991) found poor comprehenders had greater difficulty than good comprehenders in integrating information to make inferences in texts. This occurred both in texts where information was explicitly provided and where information was implied, requiring text-connecting (cohesive) and gap-filling (knowledge-based) inferences respectively (Cain & Oakhill, 1999). These findings suggested that poor comprehenders do not actively construct meaning from the text spontaneously in the same way as good comprehenders. In addition, they are less likely to integrate relevant general knowledge with information provided in the text to make inferences, even when they possess the knowledge and are directed to the required information (Cain & Oakhill, 1999). As a result, they do not form a coherent representation of the meaning of the text which, in turn, may assist their recall (Yuill & Oakhill, 1991). Cain and Oakhill (1999) suggested that good comprehenders are more likely to make inferences and monitor their comprehension as they strive for coherence in a text, unlike poor comprehenders who tend to focus more on word reading accuracy (e.g., Yuill & Oakhill, 1991).

Comprehension monitoring. A second higher-level subcomponent is comprehension monitoring (see Figure 4.1). Readers (or listeners) who strive for coherence in their text representation need to monitor whether comprehension has been successful, and initiate repair strategies when comprehension fails. Poor comprehenders have been found to have difficulties detecting anomalies in text and in monitoring their comprehension (Cain & Oakhill, 2006; Oakhill et al., 2005; Yuill & Oakhill, 1991). Oakhill et al. (2005) found that poor comprehenders aged 9-10 years were less likely to identify nonsense words and jumbled

phrases in passages, say that a passage did not make sense, and answer comprehension questions correctly. In further studies, poor comprehenders had difficulty recognising that passages did not make sense and then identifying the contradictory statements, particularly if the inconsistent information was separated by several sentences, suggesting performance decreases as the memory load increases (Cain & Oakhill, 2006; Oakhill et al., 2005). Cataldo and Cornoldi (1998) also found that poor comprehenders had difficulty answering questions when the required information was separated from the question. When explicitly instructed to use a search strategy, performance did improve, leading Cataldo and Cornoldi to conclude that the poor comprehenders were able to search the text but failed to use the skill until instructed to do so, as found in the inference making research.

Text structure knowledge. Knowledge of text structure and coherence, the third higher-level language subcomponent in Figure 4.1, can help with identification and integration of important information to understand texts. As poor comprehenders had been found to have difficulty understanding stories they had heard (Oakhill et al., 1986), as well as those they read, Oakhill and colleagues investigated whether they also had difficulty producing structurally coherent narratives. In several early studies, Yuill and Oakhill (1991) found that poor comprehenders were less consistent in their use of text cohesion features, such as connectives and referential ties (e.g., pronouns), than good comprehenders. When asked to tell a story from a picture sequence, poor comprehenders tended to produce picture-by-picture rather than integrated stories. In a later study, Cain and Oakhill (1996) found poor comprehenders did not differ from controls in their use of conventional story features such as settings and endings but had difficulty producing causally related narratives.

To summarise, in research largely carried out by Oakhill, Cain and colleagues, poor comprehenders have been found to experience difficulties across each of the three higher-level language areas that contribute to the ‘upper-level skill’ of listening comprehension. It is proposed that poor comprehenders do not spontaneously form a coherent representation of a text and that their comprehension difficulty compounds as memory load increases. The role played by memory in reading comprehension is not addressed by the SVR, as is evident in Hogan et al.’s representation in Figure 4.1, however, the RSF acknowledges that reading comprehension takes place within a broader cognitive system. The building of a coherent mental model of the situation described by a text places heavy demands on working memory, a limited capacity system (Kintsch & Kintsch, 2005). It is therefore reasonable to hypothesise a relationship exists between working memory and reading comprehension difficulties.

Verbal memory skills in poor comprehenders

Poor comprehenders do not perform as well as good comprehenders on verbal working memory tasks where both storage and processing are required. In a meta-analysis of studies involving poor comprehenders, Carretti et al. (2009) identified difficulties on verbal complex span measures compared with good comprehenders, but not on verbal simple span or visual-spatial complex span measures. For example, poor comprehenders were able to recall lists of numbers of increasing length (e.g., Cain, 2006; Cain et al., 2004; Pimperton & Nation, 2010), complete nonword repetition tasks (e.g., Catts et al., 2006), and repeat back groups of concrete words and nonwords of increasing length (e.g., Cain, 2006), as well as good comprehenders matched for age and reading accuracy. In contrast, poor comprehenders experienced difficulty with complex verbal working memory tasks, such as tasks involving recalling the last digit in groups of number triplets (e.g., Oakhill et al., 2005), word suppression tasks (Cain, 2006; Pimperton & Nation, 2010), and listening span tasks involving completing sentences or stating whether they were true/false, then recalling last words in the correct order in sets of sentences of increasing number (e.g., Cain, 2006; Cain et al., 2004).

A new perspective on assessment: The Reading Systems Framework

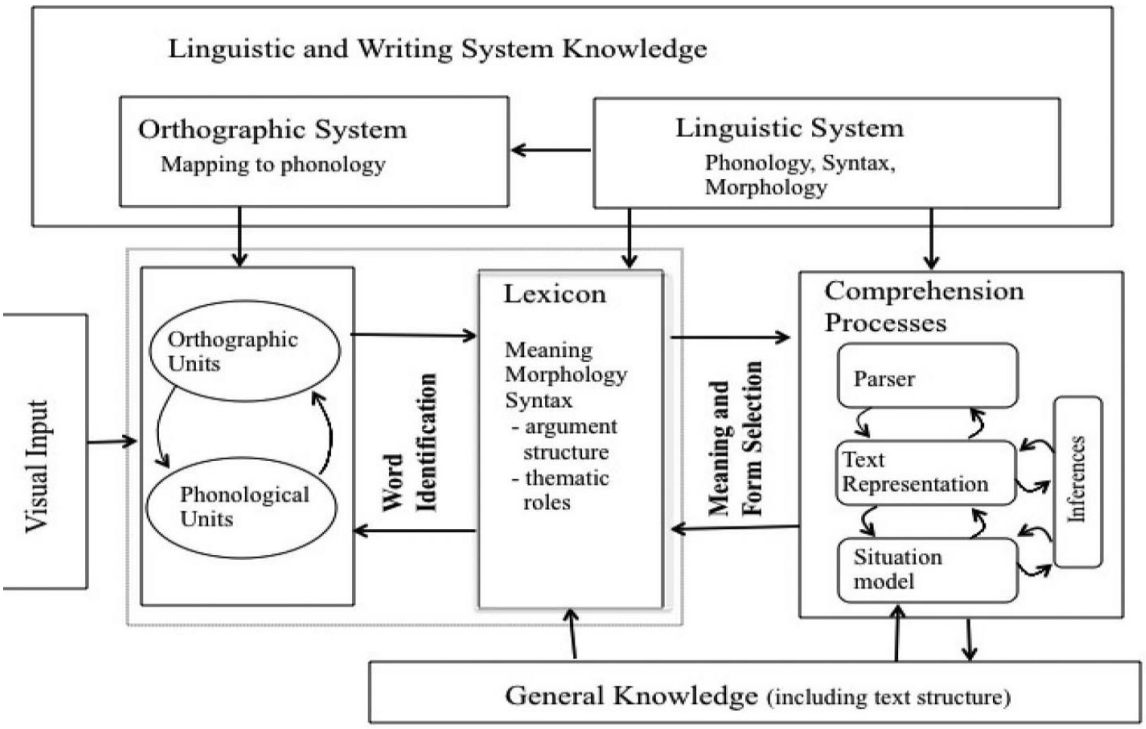
While the SVR has been influential in providing a framework for exploring reading comprehension, it does not explain how the complex set of cognitive and linguistic factors operate during the process of constructing meaning from a text (Nation, 2019). The RSF developed by Perfetti and Stafura (2014) supports a more detailed examination of the subcomponents of reading comprehension (see Figure 4.2). The word identification system set out in the RSF connects knowledge of the orthographic and phonological units (or sublexical processes), that are activated by the visual input, to allow for the decoding of words. This system is unique to printed words. The higher-level text comprehension system, involving the sentence parser, text representation and situation model, and drawing on linguistic and general knowledge, relates to oral as well as written language. Connecting these two systems is the lexicon/word knowledge, which has been found to play a role in both word identification and text comprehension (Tunmer & Chapman, 2012). These processes take place within a limited capacity memory system (Kintsch & Kintsch, 2005).

By setting out the sequential and reciprocal nature of interaction between the subcomponent skills and processes that underpin the ‘upper-level skills’ represented in the SVR, word reading and listening comprehension, the RSF provides the potential to develop a theoretically informed test battery that will allow for detailed profiling that may further our

understanding of the strengths and weaknesses of poor comprehenders. To date, no studies have used a theoretical framework such as the RSF to do this.

Figure 4.2

The Reading Systems Framework



Note: Reprinted from "Word knowledge in a theory of reading comprehension" by C. Perfetti and J. Stafura, 2014, *Scientific Studies of Reading, 18*(1), p.24.Copyright Taylor and Francis Group. Available online at: www.tandfonline.com

The current study

The aim of this study was to profile the oral and written language, and cognitive processes, of a group of poor comprehenders using a theoretically informed test battery guided by the RSF. A comprehensive assessment battery, drawn from tasks readily accessible to clinicians, was compiled to enable detailed examination of the profiles of strengths and weaknesses of poor comprehenders at each of the sublexical, lexical and text comprehension levels set out in the RSF. We hypothesised that this group of children would demonstrate appropriately developed word reading skills, but that two subtypes of poor comprehenders would emerge in approximately equal proportions. These would include children with lower- and higher-level language difficulties, and children whose difficulties were limited to higher-level discourse comprehension processes. It was anticipated that the findings of this study would both, inform our understanding of the language skills of poor comprehenders, and

identify key tasks for inclusion in a clinically manageable assessment battery that would guide intervention for subtypes of poor comprehenders.

Method

The participants recruited to the study were part of a larger research programme investigating the identification and profiling of poor comprehenders. This study focused on the profiling of those identified as poor comprehenders. Ethical approval was granted by Curtin University Human Research Ethics Committee (RDHS-183-15) and by the Government of Western Australia Department of Education. Written consent was obtained from participating school principals, teachers, students, and their parents/guardians.

Participants

Participants were identified in a two-phase process involving initial testing using a phonological awareness and a listening comprehension task, followed by confirmation testing using measures of nonword reading, reading comprehension and nonverbal IQ (Kelso et al., 2020). The initial testing was carried out on 218 children in School Years 3–6, aged 7;8 –12;1 years (at the time of initial testing) who attended one of two local primary schools serving a predominantly middle to upper-middle socioeconomic strata (SES) in inner metropolitan Perth, Western Australia. Twenty four children were confirmed as poor comprehenders and, from this subgroup, 17 children (eight boys and nine girls) aged 8;6-11;9 years completed the comprehensive assessment protocol reported here. Of the 24, four did not complete the full protocol as, despite nonword reading being well within the average range, their text reading accuracy score on the York Assessment of Reading for Comprehension-Primary, Australian Edition (YARC-P: Snowling et al., 2012) was either at the same level or weaker than their comprehension score. As such, reading accuracy could not be ruled out as a factor that was impacting on comprehension. A further two children withdrew consent during this phase, and testing was not completed on another child due to time constraints within the child's schedule and consent from parents was not provided to complete testing outside school hours.

Procedure

Individual testing was carried out by the first author with all children at their school, in a room away from their classroom. Testing was completed over six sessions, each containing a mix of oral and written tasks.

Table 4.1

Oral and written assessment tasks mapped to the Reading Systems Framework

Component of Model	Verbal Task (oral)	Written Task (reading)
Sublexical a) Orthographic-Phonological Mapping b) Word Identification	• CTOPP-2 Elision • CTOPP-2 Phoneme Isolation	• CTOPP-2 Rapid Letter Naming • CTOPP-2 Rapid Digit Naming • WIAT-II Pseudoword Decoding • TOWRE-2 Phonemic Decoding Efficiency • WIAT-II Word Reading • TOWRE-2 Sight Word Efficiency
Lexicon	• PPVT-4 • CELF-4 Receptive & Expressive Word Classes • CELF-4 Word Associations	• WRMT-III Word Comprehension
Comprehension Processes a) Sentence Level/ Parser b) Text Representation c) Situation Model	• TROG-2 • CELF-4 Concepts and Following Directions • Test of Narrative Language (TNL) • CELF-4 Understanding Spoken Paragraphs • TOPS-3 • CASL Inference • CASL Nonliteral Language	• CELF-4 Sentence Assembly • New Salford Sentence Reading & Comprehension Cards • YARC-P (Australian) • PROBE 2 fiction & non-fiction task NOTE: These tasks tap into Text Representation and Situation Model levels

Note. CTOPP-2 = Comprehensive Test of Phonological Processing-2; WIAT-II (Australian) = Wechsler Individual Achievement Test-II – Australian Standardised Edition; TOWRE-2 = Test of Word Reading Efficiency-2; PPVT-4 = The Peabody Picture Vocabulary Test-4; CELF-4 = Clinical Evaluation of Language Fundamentals-4 – Australian Standardised Edition; WRMT-III = Woodcock Reading Mastery Tests-III; TROG-2 = The Test for Reception of Grammar-2; YARC-P (Australian) = York Assessment of Reading Comprehension-Primary - Australian Edition; TOPS-3 = Test of Problem Solving-3; CASL = Comprehensive Assessment of Spoken Language.

Measures

A battery of tests was used to assess both oral and written language input skills within each of the three components of the RSF model (Sublexical, Lexicon, Comprehension Processes: see Table 4.1), along with assessments of verbal memory. Where standardised norm-referenced tests were not available, the battery included criterion referenced tasks. Each standardised measure reported good psychometric properties. A description of each measure is provided in Supplemental Material.

Sublexical component.

Two oral input tasks were included to assess phonological awareness: Elision and Phoneme Isolation from the Comprehensive Test of Phonological Processing–2nd edition (CTOPP-2: Wagner et al., 2013). Six visual input tasks were completed to assess orthographic-phonological mapping and word recognition: two rapid naming (RN) tasks (CTOPP-2 Rapid Letter and Rapid Digit Naming), two nonword and two real word reading tasks, one each of which was timed and the other untimed. The timed tasks were Phonemic Decoding Efficiency and Sight Word Efficiency from the Test of Word Reading Efficiency-2nd edition (TOWRE-2: Torgesen et al., 2012), and the untimed tasks were Pseudoword Decoding and Word Reading from the Wechsler Individual Achievement Test-2nd edition, Australian Standardised Edition (WIAT–II: Wechsler, 2007).

Lexicon component.

Four oral input vocabulary tasks were included. Vocabulary breadth was assessed using the PPVT-4, and vocabulary depth using the CELF-4 (Australian) Receptive and Expressive Word Classes and Word Associations tasks. One written input task of vocabulary depth was administered, the Woodcock Reading Mastery Tests – 3rd edition (WRMT-III) Word Comprehension subtest (Woodcock, 2011).

Comprehension processes component.

Two oral input tasks were completed at each of the sentence and text representation subcomponent levels of the RSF, and three at the situation model subcomponent level. At the sentence sub-level, grammatical knowledge was assessed on the TROG-2 (Bishop, 2003) and the CELF-4 Concepts and Following Directions task. The text representation tasks assessed understanding and production of narratives using the Test of Narrative Language (TNL: Gillam & Pearson, 2004) and oral text comprehension using the CELF-4 Understanding Spoken Paragraphs. Inferencing skills were assessed at the situation model sub-level using selected subtests from the Test of Problem Solving–3rd edition (TOPS-3: Bowers et al.,

2005), and the Inference and Nonliteral Language subtests from the Comprehensive Assessment of Spoken Language (CASL: Carrow-Woolfolk, 1999).

Sentence sub-level written input tasks included the CELF-4 Sentence Assembly as a reading task, and the New Salford Sentence Reading (NSSR) & Comprehension Cards (McCarty & Lallaway, 2012). Text reading was assessed using two measures that assessed both reading accuracy and comprehension, tapping into the text representation and situation model sub-levels. These tests were the YARC-P (Australian) and PROBE-2 Reading Comprehension Assessment (Parkin, & Parkin, 2011).

Verbal memory.

Five memory tasks were completed. Phonological memory was assessed on the CTOPP-2 Nonword Repetition task, digit span and working memory span on the CELF-4 Number Repetition Forwards and Backwards task, listening span using the Competing Language Processing Task (Gaulin, & Campbell, 1994), and verbatim sentence recall on the CELF-4 Recalling Sentences. This last task also draws on grammatical knowledge.

Results

A detailed profile of each child's oral and written language skills within each of the three components of the RSF model was obtained, along with their nonverbal IQ[3] and verbal memory performance. To provide consistency in reporting of scores between the different norm-referenced tasks, the criterion of a score below the 25th percentile (Standard Score <90; Scaled Score <8) was set as reflecting a relative weakness or 'below average' score for the profiles (shaded in Tables 4.2-4.5). Criteria for criterion referenced tasks are reported in the footnotes for the relevant tables.

Results of the oral and written Sublexical component tasks and the reading accuracy tests are reported first, followed by the results in each of the areas of the Lexicon, Comprehension Processes, and verbal memory.

[3] TONI-4 administered in identification study (Kelso et al., 2020)

Table 4.2

Results for each poor comprehender on the phonological processing and reading accuracy measures

Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
Sublexical - Oral Tasks																	
CTOPP-2 Elision # [a]	9	12	13	12	9	15	9	13	13	9	9	13	13	10	13	11	9
CTOPP-2 PI [a]	10	7	13	8	9	10	8	11	12	9	10	13	9	12	9	10	9
Sublexical - Written Tasks																	
CTOPP-2 RN Letters [a]	8	7	10	8	11	11	10	10	11	8	10	10	13	11	10	9	10
CTOPP-2 RN Total [b]	104	88	95	88	107	113	116	104	104	95	104	98	119	116	104	92	110
WIAT-II Pseudoword # [b]	95	113	109	109	100	114	108	109	114	99	99	95	112	103	110	106	105
WIAT-II Word [b]	92	109	113	107	94	120	99	101	115	95	105	98	105	101	116	103	109
TOWRE-2 PDE [b]	91	108	111	101	96	130	125	111	119	97	97	87	130	124	111	110	107
TOWRE-2 SWE [b]	94	115	107	108	82	123	111	105	105	82	108	91	131	103	102	93	110
Sentence and Text Level Reading Accuracy Tasks																	
Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
New Salford Accuracy [b]	96	130+	122	100	98	130+	100	130+	130+	101	94	89	130+	124	100	92	127
YARC-P Form A Accuracy [b]	89	102	101	89	93	109	98	97	103	95	104	91	101	103	103	100	107
PROBE-2 Fiction Accuracy [c]	97	99	98	99	99	100	99	100	99	98	99	97	100	99	98	98	99

PROBE-2 Nonfic Accuracy [c]	93	98	99	99	96	100	99	100	99	96	97	95	98	99	98	97	99

Note. See Table 4.1 Notes for test names; PI = Phoneme Isolation; RN = Rapid Naming; Pseudoword – Pseudoword Decoding; Word = Word Reading; PDE = Phonemic Decoding Efficiency; SWE = Sight Word Efficiency; Nonfic = Nonfiction.
# = identification task - criterion set at Scaled Score ≥ 9; Standard Score ≥ 95 (i.e. 37th percentile)
a = Scaled Score (ScaleS); b = Standard Score (SS); c = percentage correct [Pass criterion = 96% accuracy]

Table 4.3

Results for each poor comprehender on the lexicon and sentence level measures

Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
Lexicon - Oral Tasks																	
PPVT-4 [b]	110	113	109	111	85	99	96	100	99	85	113	103	103	108	104	103	123
CELF-4 WC Receptive [a]	10	11	10	12	8	12	12	10	11	12	13	9	10	13	13	10	13
CELF-4 WC Expressive [a]	10	12	12	12	10	11	12	9	11	10	13	11	7	12	8	9	11
CELF-4 Word Associations [c]	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lexicon - Written Tasks																	
WRMT-III– Word Comp [b]	84	118	109	114	73	115	102	93	98	84	96	86	104	110	113	99	102
Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
Comprehension Processes: Sentence Level – Oral Tasks																	
TROG-2 [b]	95	104	111	104	83	104	97	102	109	90	97	69	99	111	83	106	106
CELF-4 Concepts & Directions [a]	9	12	10	12	4	12	10	6	12	5	9	8	9	14	10	9	11
Comprehension Processes: Sentence Level – Written Tasks																	
CELF-4 Sentence Asssembly [a]	8	10	14	na	6	na	13	5	8	10	10	7	12	6	14	8	13
New Salford Comprehension [b]	99	119	105	104	95	113	91	98	114	94	98	93	110	112	95	101	114

Note. See Table 4.1 Notes for test names; WC = Word Classes; Word Comp = Word Comprehension
a = Scaled Score (ScaleS); b = Standard Score (SS); c = Pass/Fail criterion CELF-4 manual; na = age below available norms for task

Sublexical oral and written tasks, and text reading accuracy

The majority of participants had little or no difficulty on the phonological processing and word reading tasks (see Table 4.2). All 17, with only one exception (P2), achieved a score at the 25th percentile or above on the CTOPP-2 phonological awareness and rapid naming tasks. Table 4.2 shows most participants scored in the average range for accuracy on all single word reading tasks. On the NSSR sentence reading task, only one participant (P12) scored below the 25th percentile for accuracy, while two (P1, P4) scored below this for text reading accuracy on the YARC-P. No participant fell below the pass criterion of 96% accuracy on the PROBE-2 fiction task, while two (P1, P12) did not reach criterion on the non-fiction task.

Lexicon oral and written tasks

Of the five vocabulary measures in the Lexicon component, most participants scored in the average range or above on all tasks, and only two (P5, P10) were found to have weak skills on more than one task (see Table 4.3). Both scored below the 25th percentile on the oral vocabulary breadth task (PPVT-4) and the written vocabulary depth task (WRMT-III Word Comprehension). In addition, P5 was the only child who did not pass the criterion for their age on the semantic fluency task (CELF-4 Word Associations). Two further participants (P1, P12) scored below the 25th percentile on the written vocabulary depth task.

Comprehension processes – sentence level oral and written tasks

The findings for each participant on the oral and written input tasks at the sentence subcomponent level are also seen in Table 4.3, with only three having difficulty on more than one task (P5, P8, P12). Of the oral input tasks, three scored below the 25th percentile on the TROG-2 (P5, P12, P15) and three on the CELF-4 Concepts and Following Directions (P5, P8, P10). Two of these (P5, P10) were the same children who had weak skills on more than one Lexicon component task (PPVT-4 and WRMT-III Word Comprehension), as well as on the TOWRE-2 timed real word reading task. No participant scored below the 25th percentile on the NSSR Comprehension written input task, while four had difficulty on the CELF-4 Sentence Assembly (P5, P8, P12, P14), but a score could not be obtained for two School Year 3 children on the second task as they were too young for the available norms. P12 had also scored below the 25th percentile on the Lexicon written vocabulary breadth task (WRMT-III Word Comprehension) and three of the reading accuracy tasks (see Table 4.2).

Comprehension processes – text representation and situation model oral tasks

Results from oral input tasks at the text representation and situation model subcomponent levels are shown in Table 4.4. All participants scored below the 25th percentile on the CELF-4 Understanding Spoken Paragraphs, the oral text comprehension task used in the identification study (see Kelso et al., 2020). Of the 17 participants, 10 scored at the 9th percentile or below. In contrast, only two participants (P3, P5) scored below the 25th percentile on the second task at the text representation level, the TNL comprehension measure, one of whom was P5 who presented with weaknesses on Lexicon and sentence level tasks. Six participants, however, performed poorly on the TNL narrative production measure, again including P5. At the situation model subcomponent level, 15 participants scored below the 25th percentile on the TOPS-3 Inferences task, 10 on the Predicting task, including the two who scored in the average range on the Inferences task, and only two on the Problem Solving task (P2, P8). On the CASL tasks at this level, seven scored below the 25th percentile on the Inference task and only one (P5) on the Nonliteral Language task.

Comprehension processes – text representation and situation model written tasks

Reading comprehension task results are presented in Table 4.4. Five children scored between the 25th and 75th percentile (SS = 90-110) on the YARC-P Comprehension, however, no participant reached the comprehension criterion of 70% of questions correct on the PROBE-2 nonfiction passage for their age, and only three (P14, P15, P17) achieved this on the fiction task. Overall, 11 participants had weaker scores on all three of the text reading comprehension tests, including the two children (P5, P10) who had achieved weaker scores on comprehension tasks at each of the other levels of the RSF.

Verbal memory

Results on the verbal memory tasks varied across the participants and tasks. Only three participants (P2, P6, P14) scored above the mean for their age on the complex working memory task, the CLPT (see Table 4.5). Difficulties with phonological memory were also evident on the CTOPP-2 Nonword Repetition task, with only three children (P3, P4, P17) scoring at the 25th percentile or above. In contrast, 13 participants scored at the 25th percentile or above on both the digit span and working memory span tasks from the CELF-4 (Number Repetition Forwards and Backwards), and only two (P1, P12) scored below the 25th percentile on both tasks. In addition, 14 of the 17 participants performed well on the CELF-4 Recalling Sentences. One child (P12) scored below the cut-off on all memory tasks.

Table 4.4

Results for each poor comprehender on the text representation and situation model tasks

Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
Comprehension Processes: Text Representation Level – Oral Tasks																	
CELF-4 USP # [a]	5	6	5	5	5	7	7	4	7	4	7	4	7	5	3	5	7
TNL Comprehension [a]	9	12	7	12	5	11	11	9	10	10	12	9	10	10	10	10	12
TNL Narration [a]	9	6	7	9	4	12	9	7	10	9	8	6	9	13	6	8	11
Comprehension Processes: Situation Model Level – Oral Tasks																	
CASL Nonliteral Language [b]	95	112	97	103	70	107	97	98	100	91	102	93	103	112	104	93	100
CASL Inference [b]	89	109	78	112	71	107	94	87	104	76	103	87	98	99	81	97	100
TOPS-3 Inferences [b]	82	82	80	83	83	85	93	88	80	81	85	82	81	81	88	81	97
TOPS-3 Prob Solving [b]	104	88	98	95	91	102	93	86	102	96	106	98	95	98	95	91	100
TOPS-3 Predicting [b]	76	85	75	90	85	100	80	85	85	85	85	80	100	95	85	100	85
TOPS-3 Total [b]	86	86	85	92	81	94	92	81	86	86	92	81	85	91	86	86	94
Comprehension Processes: Text Representation/Situation Model Levels – Written Tasks																	
YARC-P Form A Comp # [b]	88	85	85	85	75	93	77	86	85	84	91	71	94	94	80	71	92
PROBE-2 Fiction Comp [c]	50	25	30	50	20	50	50	30	30	50	60	10	50	70	70	40	50

PROBE-2 Nonfic Comp [c]	30	62.5	20	38	0	38	10	20	60	20	60	0	40	30	30	20	50

Note. See Table 4.1 Notes for test names; USP = Understanding Spoken Paragraphs; Prob Solving = Problem Solving; Comp = Comprehension; Nonfic = Nonfiction

= selection task -(see Kelso et al., 2020)

a = Scaled Score (ScaleS); b = Standard Score (SS); c = percentage correct [Pass criterion = 70% comprehension questions correct]

Table 4.5

Results for each poor comprehender on the memory tasks

Child	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Year Level	4	3	5	3	5	3	6	4	4	4	6	4	4	4	5	6	5
CLPT [b]	38	62	55	57	43	62	52	52	52	43	52	52	55	76	60	62	55
CTOPP-2 NW Repetition [a]	6	2	10	9	6	7	6	6	3	7	4	3	3	6	7	2	9
CELF-4 Number Forwards [a]	6	9	15	14	14	10	7	10	12	12	11	7	10	14	18	10	13
CELF-4 Number Backwards [a]	7	13	12	13	9	14	11	9	12	9	7	7	12	16	13	11	13
CELF-4 Recalling Sentences [a]	9	8	11	12	8	8	8	8	9	7	10	5	7	14	11	13	12

Note. See Table 4.1 Notes for test names; CLPT = The Competing Language Processing Task; NW = Nonword.
a = Scaled Score (ScaleS); b = percentage correct – shaded if score below the mean for age

Discussion

This study sought to extend our understanding of the often hidden group of poor readers, known as poor comprehenders. A protocol, consistent with the broad framework of the SVR but informed by the interactional model of component systems offered by the RSF, was used to profile the oral and written language comprehension and cognitive skills of children identified as poor comprehenders.

As predicted, the poor comprehenders in this study did not have difficulty with tasks assessing phonological processing, rapid naming and single word reading skills at the Sublexical component level of the RSF, consistent with the profile of this subgroup of poor readers. Additionally, tasks assessing sentence and text level reading accuracy highlighted the word reading strengths of the participants with only two children scoring below the cut-off on two of the four reading tasks at these levels. Overall, these results support the findings of previous research that poor comprehenders have intact phonological and word reading skills, and that by the middle primary school years the influence of phonological skills on reading comprehension has diminished (e.g., Nation, 2019).

The cognitive and language profiles of the participants revealed some unexpected findings, particularly on the Lexicon component vocabulary tasks and sentence subcomponent level or grammar tasks. The implications of these findings for assessment for reading comprehension difficulties, intervention and future directions for research are discussed below.

Lower-level language skills - Lexical profile

Within the Lexicon component of the RSF, only two participants (P5, P10) scored below the 25th percentile on more than one task: the oral input vocabulary breadth task (PPVT-4) and the written input vocabulary depth task (WRMT-III Word Comprehension). These two also performed poorly on one of the oral input sentence sub-level tasks (CELF-4 Concepts and Direction), and both scored below average on the timed real word reading task (TOWRE-2 Sight Word Efficiency), suggesting reading fluency may be an issue. One of these children (P5) had difficulty with the majority of lexical and sentence sub-level tasks, therefore presented with the weakest lower-level language skills. All participants scored in the average range on the CELF-4 Word Classes Receptive and NSSR Comprehension, and only one scored below the 25th percentile on each of CELF-4 Word Associations (P5) and CELF-4 Word Classes Expressive (P13), suggesting that these tasks were less sensitive or useful measures to identify and profile poor comprehenders.

The finding that only two participants had difficulty on multiple vocabulary tasks was unexpected, as weak vocabulary skills are frequently cited as impacting on reading comprehension. This finding may have arisen from a lack of sensitivity of the standardised tests selected for our assessment battery, compared to more specific experimenter designed tasks. Equally, it may reflect the variable findings reported in previous research that suggest heterogeneity amongst poor comprehenders, or even be an artefact of the range of measures employed. While the participants in this study were not selected based on their receptive vocabulary, the finding that the majority did not have difficulty on the PPVT-4 is consistent with this not being an area of difficulty in the groups of poor comprehenders selected to have vocabulary in the average range by Oakhill, Cain and colleagues. That some poor comprehenders have been found to have receptive vocabulary difficulties in other studies may be indicative of the level of severity of their oral language difficulties, particularly in the cohorts described by Catts and colleagues (e.g., Catts et al., 2006) who were initially identified as being at risk due to language difficulties at age 4-5 years. This was evident in the current study, with the two participants who performed poorly on the PPVT-4 being the ones with the more pervasive oral language difficulties.

Higher-level language skills - Comprehension profile

The predominant profile for the participants in this study was difficulty with inferencing skills, which are required to construct a mental or situation model of a text. These children had little or no difficulty on the lower-level language tasks but were consistently challenged by higher-level tasks, paralleling the profile identified by Oakhill, Cain and colleagues in their studies with poor comprehenders. Interestingly, while all children scored below the 25th percentile on the CELF-4 Understanding Spoken Paragraphs (listening comprehension) task, only two scored below this on the second oral input comprehension measure at the text representation level of the RSF, the TNL Comprehension. Six of the 17 participants, however, had difficulty with narrative retelling and production, perhaps suggesting greater difficulty with free recall. While it is acknowledged that awareness of text structure is likely to help with text comprehension, the TNL was not found to be especially sensitive in identifying weaknesses in this area, in this group of poor comprehenders. In contrast, the TOPS-3 Inferences and Predicting subtests were considerably more sensitive to difficulties with higher-level oral language, with 15 and 12 of the 17 participants having difficulty on these tasks respectively at the situation model level of the RSF. The PROBE-2 Reading Comprehension Assessment, particularly non-fiction age level reading tasks, also

added value to the assessment battery in identifying the comprehension difficulties of this group of poor comprehenders. Unfortunately, as no commercially available tests of comprehension monitoring were identified, this area was not explored, but warrants further exploration in the future.

Verbal memory

With respect to the cognitive skills included in the test battery, all participants performed well within the average range on the nonverbal IQ task. On the verbal memory tasks, a finding consistent with previous research was the majority of the participants scoring below the mean for their age on the complex verbal working memory task, but not on the simple verbal span task (number repetition). One participant who had difficulty on the simple span task was P12, who encountered difficulty with all memory tasks. Contrary to previous findings, few participants had difficulty with verbatim recall of sentences on the CELF-4 Recalling Sentences, which other researchers have included as a grammar task (e.g., Adlof & Catts, 2015; Nation et al., 2010), while the majority had difficulty on the phonological memory task, CTOPP-2 Nonword Repetition (cf. Catts et al., 2006; Nation et al., 2004; Nation et al., 2010). Why this unexpected finding occurred on the phonological memory task is unclear, but possible reasons may relate to participants having difficulty with the sound quality of the CD audio-recording and/or accommodating to the accent of the presenter, to the different task (non-standardised) used in the Catts et al. (2006) and Nation et al. (2004) studies, or due to the children in the current study being generally older than those in Nation et al.'s (2010) study.

Limitations

There are several limitations to this study. Participants were recruited from only two schools which narrowed the range of socio-economic backgrounds; combined with the relatively small number of participants, this reduces generalisability of the findings. Limitations in the use of standardised measures to identify specific weaknesses in language skills is also acknowledged, however, an important consideration in task selection was to use measures that were readily available to clinicians and provided normative or criterion referenced scores.

Conclusion

As hypothesised, this study identified two subgroups of poor comprehenders, one with lower-level vocabulary/lexicon and grammar/sentence level difficulties in addition to higher-level language comprehension difficulties, and one with predominantly higher-level

difficulties, particularly with inferencing. Unexpectedly, there were few children with lower-level language difficulties, possibly indicating a lack of sensitivity to vocabulary and grammar difficulties on standardised tests. These poor comprehenders had appropriately developed word reading skills which supports previous research for this profile. The findings also support the heterogeneity of poor comprehenders, with not all children performing poorly on all tasks. Nevertheless, certain tasks presented as being more sensitive in identifying the poor comprehenders than others. In particular, separate assessments of word reading accuracy and reading comprehension are suggested as integral to identifying poor comprehenders, however, examination of the responses to different types of open-ended questions may be more indicative of language weaknesses than test scores alone on a reading comprehension test. Further exploration is required to examine this.

This study also provides direction for clinical assessment tasks for use with this population, drawing on the comprehensive protocol of tests in each of the components of the RSF used in this study. Certain language tasks presented as being more sensitive to identifying the weaknesses of poor comprehenders and could be included in a more manageable test battery. These included the PPVT-4, which assesses vocabulary breadth, and the WRMT-III Word Comprehension, which assesses vocabulary depth, in the Lexicon component of the RSF, and the CELF-4 Concepts and Directions, or equivalent tasks from the updated CELF, at the sentence sub-level of the framework. The most indicative higher-level language tasks at the text representation and situation model levels of the RSF were the CELF-4 Understanding Spoken Paragraphs and the TOPS-3 Inferences and Predicting subtests. A test of complex verbal working memory, such as a listening span task, should also be included in the modified battery. Assessing another group of children on this reduced test battery to determine its effectiveness would be a valuable future direction.

Finally, our findings highlight the need to carry out more detailed testing of a child's language skills, beyond a single reading comprehension test, which will in turn better inform intervention. While it is important to know what to target in intervention in groups of poor readers with word reading difficulties, or both word reading and listening comprehension difficulties, it is equally important to tailor the intervention with poor comprehenders to their specific needs to maximise effectiveness.

Acknowledgements

We would like to thank the schools, children and their families, who participated in this study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CHAPTER 5

Assessing poor comprehenders: A guide for teachers

Chapter Overview

This final chapter in Part A is a published paper that aimed to translate findings from the current research to practice within the educational setting. The article explicitly targeted teachers as the audience, with the aim of increasing awareness and identification of this often hidden group of poor readers in the classroom. The article begins by providing an overview of the profile of strengths and weaknesses of poor comprehenders in the two components of the SVR, word reading and listening comprehension, followed by a synopsis of the issues surrounding assessment. Suggestions for approaches to assessment that could be implemented in the classroom context are provided, concluding with recommendations for where future research is needed.

This chapter includes the accepted manuscript version of the research article titled, *Assessing poor comprehenders: A guide for teachers*. This article was published in the Learning Difficulties Australia (LDA) Bulletin, Volume 53, No 1, April 21. This article is available to download from: https://www.ldaustralia.org/app/uploads/2021/06/1146-LDA-Bulletin-April-2021_WEB.pdf

Reference:

Kelso, K., Whitworth, A., & Leitão, S. (2021a). Assessing poor comprehenders: A guide for teachers. *LDA Bulletin*. 53(1). 22-25.

Published Manuscript

This paper discusses a group of poor readers known as 'poor comprehenders'. These children have the opposite profile to children with 'classic' dyslexia, as they have difficulty understanding what they read in the presence of intact word reading skills. As a result of this profile, they tend to be less well identified. To assist in increasing awareness and identification of poor comprehenders, we will present an overview of the profile of their strengths and weaknesses, followed by a discussion of issues relating to assessment. We conclude with some practical ideas for identification and directions for future research.

Who are "Poor Comprehenders"?

The primary goal of reading is to comprehend what we read. Unsurprisingly, children who struggle to decode words accurately and read fluently, commonly referred to as having dyslexia, can have difficulty with reading comprehension (Snowling, 2013). This relationship between decoding and reading comprehension is represented in the simple view of reading (SVR) which proposes that reading comprehension is the product of decoding and language comprehension, and that skills in both these key components are necessary for comprehension to occur (Gough & Tunmer, 1986). Further, decoding is specific to reading while language comprehension skills are utilised in both listening and reading. Support has been found for the dissociation of the two components (Hoover & Gough, 1990), therefore, the SVR supports the existence of another group of poor readers, often referred to as poor comprehenders, who do not have difficulty with decoding but who have poor reading comprehension.

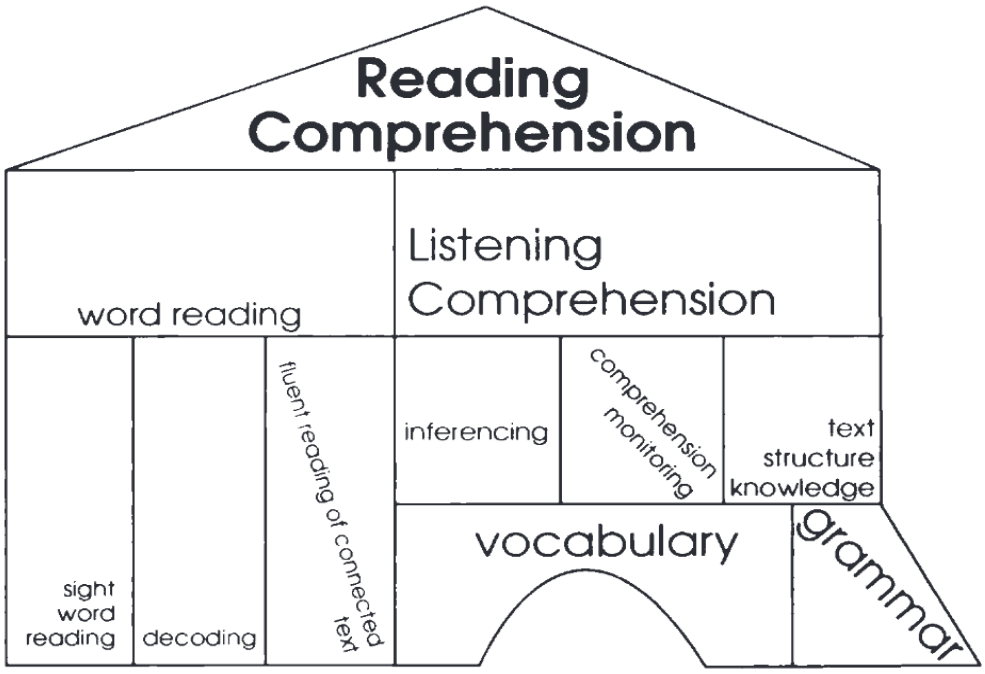
The reported prevalence of poor comprehenders has varied over time as selection criteria have differed between studies, however, current evidence suggests that around 7% of children in the middle primary school years can be classified as poor comprehenders (e.g., Elwér et al., 2015; Nation et al., 2010; Snowling, 2013). Further, this number increases across the school years from a reported prevalence of 16% in second grade (USA) to 30% in eighth grade amongst all children identified as having reading comprehension problems, while data from the same study indicated that, within the general population, the prevalence of poor comprehenders increased from 3% in second grade to 9.6% in tenth grade (cited in Hogan et al., 2014). Nevertheless, as a result of being able to read aloud accurately and fluently these children tend to be poorly identified in schools, particularly as their oral language comprehension difficulties may not be overt enough to warrant referral for assessment (Catts et al., 2006; Kelso et al., 2020).

The Skill Profile of Poor Comprehenders

Decoding (or word reading as it is more frequently referred to in recent literature) and language comprehension have been found to explain almost all the variability in reading comprehension in school age children (e.g., Kim, 2017). While these two components underpin reading comprehension they, in turn, rely on a number of subcomponent skills. Some of the key subcomponents that have been explored in the research are represented in an expanded visual representation of the SVR in Figure 5.1 (Hogan et al., 2011) under the upper-level headings of 'word reading' and 'listening comprehension'. This research has consistently found that poor comprehenders do not have difficulties with word reading, as evident by their ability to read real and nonwords accurately and fluently, along with having intact letter knowledge and adequate phonological processing skills, at least once beyond the preschool years. In contrast, poor comprehenders have been found to have difficulty with a range of oral language skills, and longitudinal and retrospective studies have shown that these difficulties are present in the early years although they may be at a subclinical level (e.g., Catts et al., 2006; Elwér et al., 2015; Nation et al., 2010).

Figure 5.1

Visual representation of the Simple View of Reading



Note: Reprinted from *"*Increasing Higher Level Language Skills to Improve Reading Comprehension*"* by T. Hogan et al., 2011. *Focus on Exceptional Children*, *44*(3), p.2. Copyright by Focus on Exceptional Children.

As can be seen in Figure 5.1, the oral language skills that contribute to listening comprehension are separated into what are sometimes referred to as lower and higher-level language skills. The lower-level language skills of vocabulary and grammar are used to construct the literal meaning of a text and provide the foundation for the higher-level language skills of inferencing, knowledge of text structure and comprehension monitoring. These higher-level skills are needed for the reader to obtain an overall representation, or mental model, of the meaning of a text i.e., the reader goes beyond the literal meaning of the text and makes inferences from background knowledge to construct a deeper understanding of what the author has written. Exploration of these lower- and higher-level language skills has found that not all poor comprehenders have difficulty in all skill areas (Nation et al., 2004), however, two broad hypotheses have emerged as to the source of the reading comprehension difficulties of poor comprehenders. Nation and colleagues have identified weaknesses on various measures of vocabulary and grammar (e.g., Nation et al., 2004, 2010) along with higher-level language difficulties, while Oakhill, Cain and colleagues have identified groups of poor comprehenders with only higher-level language difficulties (see Oakhill et al., 2015).

Assessment Methods for Identifying Poor Comprehenders

With so many potential areas of difficulty, and so much variation between poor comprehenders, it is not easy to effectively identify these children within the classroom context. Kelso et al. (2020) investigated using a short testing protocol based on the components of the SVR, consisting of two oral language tasks: (1) a phonological awareness task, the Elision subtest from the *Comprehensive Test of Phonological Processing-2* (CTOPP-2: Wagner et al., 2013), and (2) a listening comprehension task, the Understanding Spoken Paragraphs subtest from the *Clinical Evaluation of Language Fundamentals–4* (CELF-4) Australian Edition (Semel et al., 2006). Follow-up testing on reading tasks to confirm a poor comprehender profile found that children in School Years 3-6 were over-identified by the two oral tasks (Kelso et al., 2020). The findings suggested that the two-phase approach could be effective in identifying poor comprehenders and reduce the time spent in testing. It was unclear whether the short testing protocol missed potential poor comprehenders, as it was beyond the scope of the study to assess the reading skills of children who did not meet the criteria to move into the next phase of testing. Key findings therefore included (a) reading needed to be tested to confirm that a child was a poor

comprehender, and (b) based on their informal judgement, only five of the 24 confirmed poor comprehenders were judged to be weak readers by their teacher (Kelso et al., 2020).

Reading Comprehension Tests

Selecting which reading comprehension test to use to identify poor comprehenders is not straightforward, as they can differ in terms of what component contributes most to reading comprehension, such as word reading, listening comprehension, memory, and background knowledge (see Oakhill et al., 2015, for an overview). Further, the component that contributes can vary *within* a test, so that word recognition can explain more or less of the variance in reading comprehension for a child that scores at the 10th percentile than it does for a child who performs at the 90th percentile on the same test (Hua & Keenan, 2017). Tests can also vary in format in relation to their text type (e.g., narrative, expository, fiction, nonfiction), and length of the texts used (sentence, paragraph, passage). The tests may require texts to be read aloud or silently; they may be timed or untimed; and response format may involve picture selection, retell, multiple choice or opened ended questions, and cloze tasks (Collins & Lindström, 2021). Comprehension tests with an open-ended question format and longer texts are considered to be the most sensitive method of assessing comprehension, as answers are not cued by response options. There are, however, disadvantages to this approach, in particular that these tests usually need to be administered individually and can penalise children with expressive language difficulties (Oakhill et al., 2015). Best practice also suggests assessing real and nonword reading on a test separate to reading comprehension.

The most commonly used standardised reading comprehension test in Australia for many years was the *Neale Analysis of Reading Ability-3* (NARA-3: Neale, 1999), but in recent years many Education Departments have accepted the *York Assessment of Reading for Comprehension (Primary)* Australian Edition (YARC-P: Snowling et al., 2012). The YARC-P has the advantage of being quicker to administer than the NARA-3 as every child reads and answers questions on only two passages, rather than continuing to read passages until the specified number of reading accuracy errors are made or all passages are read, as is required with the NARA-3. Colenbrander et al. (2017) compared Form 1 of the NARA-3 and Form A of the YARC-P and found that, while comprehension scores were more dependent on decoding skills on the NARA-3 than on the YARC-P, the NARA-3 diagnosed more poor comprehenders. Possible explanations were that (1) more passages were read on the NARA-3 therefore a greater number of comprehension questions answered, and (2) that the higher-

level passages were more complex on the NARA-3 than on the YARC-P. This is particularly relevant to poor comprehenders with intact word reading skills, because on the NARA-3 they are likely to read more of the complex higher-level comprehension passages. Overall, however, the consistency of diagnosis between the two tests was relatively high compared with previous research (Colenbrander et al., 2017).

Kelso et al. (2020) selected the YARC-P as their reading comprehension measure as it allows for analysis of performance on the different types of comprehension questions (e.g., literal, vocabulary, inference). This might provide useful insights into a child's comprehension problems that are not available from an overall test score and, in turn, might inform intervention and prove useful in helping a teacher to determine whether or not the relatively higher-order comprehension skills are more affected. Another criterion referenced, rather than norm referenced, test that provides this breakdown of question types is the PROBE-2 (Parkin & Parkin, 2011).

Other Approaches to Assessment

While reading comprehension tests with open-ended questions present as the best way to identify poor comprehenders, they usually need to be administered individually and are therefore time consuming to administer, so other more practical methods of identification, based on the research, need to be considered for the classroom. The first step, at all times, should be for teachers to be on the look-out for students who fail to engage in classroom discussions about texts, or who ask questions unrelated to the current topic. This is not a straightforward expectation to place on teachers; recall that only a small fraction of the students identified as poor comprehenders in the Kelso (2020) study had been informally identified by their teachers as poor readers.

Some suggestions for more systematic assessment are outlined below. Further ideas on ways to assess subcomponent language skills are provided in Oakhill et al. (2015).

1. As listening comprehension has been found to be highly correlated with reading comprehension, texts could be read aloud by the class teacher. This approach would be more practical with younger children when comprehension is likely to be constrained by word reading ability. Some reading comprehension tests have parallel versions, so one set of passages could be presented orally and, with older children considered to be at risk, follow-up testing of reading comprehension carried out using the alternate version.

2. Children could write their answers to open-ended questions, although this is less practical with younger children, as well as for those with expressive language difficulties. If the texts are read aloud, a written copy would also need to be available for the child to refer to as they answer the questions.
3. Children could be asked to provide a short oral and/or written summary of a text they have read. This needs to be a cohesive summary of the main ideas of the text, rather than a verbatim recount of the entire text.
4. After a child has read a text, they could be asked to respond to higher-level questions requiring them to make predictions and inferences, or evaluate the text. Blank et al. (1978) have provided examples of four levels of questions relating to children's reading books, including both lower-and higher-order thinking skills, and this type of questioning could be adapted for use with children in the early childhood years and beyond.
5. Finally, while multiple-choice format tests can be administered to whole classes more readily, teachers need to be aware of the limitations of this type of test and be able to identify different question types (e.g., literal, inferential) to allow response analysis and/or follow-up.

Ideally comprehension assessment should assess all skill areas, but this is rarely possible in the classroom. If potential reading comprehension difficulties are identified, referral to a speech-language pathologist for more detailed testing of oral language skills that can inform intervention may be warranted.

Future Research

Using a short testing protocol, as explored by Kelso et al. (2020), is an option for an effective way to initially identify poor comprehenders. Further research, however, is required to see if more reliable tasks can be found, whether they can be administered at a small group or whole class level, and to determine whether poor comprehenders are under identified using this approach. The other key area where research is required is intervention as, while a great deal is now known about the language profile of poor comprehenders, there is still much to be learned about effective interventions for this subgroup of poor readers.

To find out more about reading comprehension and interventions further resources can be found at: https://www.cem.org/blog/10-essential-reads-to-improve-reading-comprehension/

PART B:

Intervention for Poor Comprehenders

CHAPTER 6

Background, Literature Review, and Research Aims

Chapter Overview

The motivation for this doctoral research programme was to increase knowledge on how to intervene effectively to improve the reading comprehension of poor comprehenders. To achieve this goal, these children first needed to be identified, and then their profiles understood (as reported in Part A of the thesis) to inform the development of the appropriate and targeted evidence-based intervention programmes.

This chapter provides an overview of the research investigating the effectiveness of inference and vocabulary interventions on improving reading comprehension in school-age children more broadly, and how this has been applied with poor comprehenders more specifically. The chapter concludes with a statement of the aims for Part B of this doctoral research, followed by two chapters which report the interventions developed and evaluated within this PhD.

Reviews of Reading Comprehension Instruction

In contrast to the large body of research into remediation of phonological and word reading difficulties, much remains to be learnt about effective intervention for reading comprehension. Reviewing the research on instruction for typically developing children in the areas of vocabulary and text comprehension, and teacher preparation to teach comprehension strategies, the National Reading Panel (NRP: NICHD, 2000) found support for (1) explicit vocabulary instruction, and (2) eight types of comprehension strategy instruction, which were effective and led to gains in comprehension. The NRP also found that when teachers are trained to use comprehension instruction methods effectively, this results in increasing students' awareness and use of strategies, which in turns leads to improvements in reading comprehension. The evidence suggested that teachers needed to (1) explain fully what they are teaching, (2) model their own thinking, (3) encourage students to ask and answer questions, and (4) provide tasks that kept students actively engaged in reading. It was also recommended that strategy instruction be incorporated into content area instruction, with teachers supporting students to select and modify the appropriate strategies are most effective within different content areas (NRP: NICHD, 2000).

Subsequently, the RAND Reading Study Group (RRSG) published their Reading for Understanding report (Snow, 2002) which proposed a research agenda focused on reading comprehension. This agenda was motivated by a number of issues, including the increasing demand for higher literacy skills in society along with evidence that students' reading comprehension had plateaued in the US in previous decades, and awareness that reading comprehension instruction was often minimal or ineffective and not integrated with content area instruction. Research in the area was deemed critical to ensure that students continued to build on the foundations of early-years reading programmes into middle-upper primary and high school, and become proficient readers. The RRSG proposed that reading comprehension involves three elements: the reader, the text, and the purpose of the activity or task. The reader brings capacities, cognitive abilities such as memory and attention, language knowledge and skills, motivations and interests, background knowledge, and experiences to the act of reading, and these variables have been the main focus of comprehension research. The text varies in terms of genre, subject matter, complexity, and form (e.g., paper or digital), and the purpose of reading can range from reading for enjoyment to studying for a test. These three elements influence reading comprehension, both independently and jointly, within a broader sociocultural context (e.g., where the reading occurs, the cultural value placed on reading), showing reading comprehension to be a dynamic and complex process. A heuristic was developed conceptualising these interrelationships to provide a way to organise research on reading comprehension (Snow, 2002).

The RRSG report provided the foundation for the Reading for Understanding (RfU) initiative which involved the funding of six research teams in 2010; one team focused on assessment, while five teams studied the development and teaching of reading comprehension across the school years pre-Kindergarten to grade 12 (Pearson et al., 2020). As outlined in Chapter 2, the SVR has provided a theoretical framework for much of the research into reading and reading difficulties since it was first proposed by Gough and Tunmer (1986), including the RfU initiative. It has been argued more recently, however, that the SVR focuses on the reader variables and not the other elements of the RAND heuristic (text and purpose of the activity) that become increasingly important, particularly for high school students and adults (e.g., Catts, 2021; Snow, 2018). In their synthesis of the findings from the RfU initiative, Pearson et al. (2020) concluded that it was within the reader element, along with task variables, that most was learnt from the work of the RfU, although understanding was advanced in each area of the heuristic. One of the key outcomes from the RfU was reinforcing the importance of early oral language skills and the extension of knowledge about

how different language subcomponents contribute to reading comprehension across the school years through to the end of high school. However, less was learnt about instruction to improve reading comprehension (Cervetti et al., 2020). A second key contribution of the RfU was to renew focus on, and increase understanding of, the role and importance of different types of knowledge in the comprehension process; not just how this knowledge impacts on comprehension but then how the knowledge can be applied to building new knowledge in other contexts, particularly with older students (Catts, 2021; Pearson et al., 2020).

A recent critical review of the literature on the influence of background knowledge on the reading comprehension of children in the middle-to-late primary school years (Reid et al., 2021) consistently found that higher background knowledge supported both skilled and low-skilled readers to better comprehend texts. The review identified studies that found strong knowledge could compensate for poor comprehension skills. This compensatory effect was most pronounced for recall and summarising of information to construct a basic understanding of the ideas and events, or textbase, but was less pronounced when the low-skill readers were required to make inferences in order to create a richer understanding, or situation model, of the text. Further, studies included in the review found that knowledge had a greater impact on reading expository texts compared with narrative texts. The review concluded that children would benefit from explicit teaching of background information along with being taught comprehension strategies to ensure application of this knowledge (Reid et al., 2021).

Vocabulary Interventions

Longitudinal studies have shown that early oral language skills predict later reading comprehension in both typically developing and at-risk children (e.g., Catts et al., 2015; Hjetland et al., 2019, Nation et al., 2010). It has also been found that there is a strong relationship between vocabulary and reading comprehension (e.g., Ricketts et al., 2007) and that vocabulary instruction can be effective. As reported above, in a review of published experimental and quasi-experimental studies evaluating vocabulary instruction prior to 2000, the National Reading Panel (NRP: NICHD, 2000) found vocabulary instruction to be generally effective in improving comprehension. Effective methods involved direct instruction, active engagement with word learning, and multiple repetitions and exposures to words in rich contexts. While the NRP provided recommendations based on the results of the review, the types of instruction in the studies included were varied, and those based exclusively on students with learning disabilities were excluded (Elleman et al., 2009).

Meta-analyses conducted by Elleman et al. (2009) and Wright and Cervetti (2017) focused specifically on the effect of vocabulary instruction on passage-level comprehension in children across grades pre-K to 12, with the majority focused on grades 3-5. Both included several studies with children identified as having reading difficulties. In the 37 studies that met selection criteria, Elleman et al. found that, following instruction, the vocabulary of children with and without reading difficulties improved on custom vocabulary measures, along with smaller gains on standardised vocabulary measures. Transfer to improvement in comprehension was evident on custom text comprehension measures containing target words but there was no significant effect on standardised comprehension measures, as was also found by the NRP. The comprehension effect on custom measures was greater for children with reading difficulties (Elleman et al., 2009).

Gains on custom measures, but a lack of transfer to improvement on standardised comprehension measures, was also found by Wright and Cervetti (2017) in their systematic review of 36 vocabulary intervention studies. Elleman et al. (2009) were unable to identify any specific vocabulary techniques or interventions that were more effective than others in improving comprehension. Wright and Cervetti (2017), however, found that instruction that focused on active exploration of the meaning of words typically had greater impact on developing vocabulary to support comprehension of texts containing target words. Active exploration included activities such as comparing and contrasting word meanings, answering questions about word meanings and generating definitions, as distinct from treatments where students were given word definitions or looked words up in dictionaries.

Language Comprehension Interventions

As vocabulary interventions have been found to result in only limited improvements on standardised reading comprehension measures for both typically developing and weak readers, more recent reviews have examined the impact of interventions containing multiple language components on reading comprehension. In a systematic review of 43 studies with a control group and a pre- to post-test design Rogde et al. (2019) examined the effectiveness of oral language comprehension instruction provided in educational settings. While the participants in the selected studies ranged from preschool to the end of secondary school, there were few secondary school cohorts and over half of the studies involved cohorts of children in Kindergarten or pre-Kindergarten programmes. Participants were from a variety of cohorts but children with a specific diagnosis, such as autistic spectrum disorder, or disability were excluded. Overall, the review found small positive immediate effects on

standardised tests of oral language comprehension (i.e., tests that did not included items trained in the intervention), however, the instruction had no immediate effects on standardised tests of reading comprehension, and the findings differed in the few studies that reported follow-up data (Rogde et al., 2019). Analysis of the immediate positive effect sizes in the different language areas, revealed they were small for vocabulary and grammatical understanding, and moderate on narrative and listening comprehension measures, with the effect for instruction in the latter two areas being maintained, although decreased, at follow-up. The review also found that the analyses of treatment effects on language or reading comprehension showed instruction in groups rather than whole classes tended to be more effective, but that dosage of intervention did not have an effect.

Subsequently, Silverman et al. (2020) conducted a similar meta-analysis of studies targeting language comprehension instruction, but with a narrower focus; studies conducted after 2010 in the US in Kindergarten to grade 5 educational settings with a range of participant groups. Forty three experimental or quasi-experimental studies were identified, the majority of which were multi-component and included a vocabulary outcome measure. As with the findings from Rogde et al.'s review, significant intervention effects were found for vocabulary, listening comprehension, and reading comprehension on custom measures, but not on standardised/generalised measures.

Inference and Strategy Interventions

Text comprehension draws on higher-level language skills, such as inference making and comprehension monitoring, in addition to lower-level vocabulary and grammar knowledge. These higher-level skills enable the reader to integrate the meaning within and across sentences, and make inferences to fill in the gaps where information has not been explicitly stated in order to construct a situation model of the text. The NRP review of studies of comprehension strategy instruction found support for the efficacy of eight strategies that developed higher-level language and led to gains in comprehension. These included training in comprehension monitoring, asking and answering questions, understanding of story structure, and summarising, along with multiple-strategy instruction, one of the most well-known of which is Reciprocal Teaching (Palincsar & Brown, 1984). In exploring methods to stimulate higher-level language skills, Hogan et al. (2011) reported studies that demonstrated empirical support for techniques to develop inferencing, comprehension monitoring and text structure knowledge in children from preschool to Grade 3 with and without oral and/or reading difficulties. More recently, in a meta-analysis of 64 studies exploring the effects of

comprehension interventions for struggling readers in grades 3 to 12, Filderman et al. (2022) found significant positive effects on reading comprehension outcomes although, consistent with previous findings, effects were much smaller on standardised reading comprehension measures. The largest effects were for interventions that taught background knowledge and/or comprehension strategies, with strategies involving identifying main ideas or summarising, generating inferences, retelling, and predicting having a greater effect than those that taught text structure. Instruction that involved comprehension monitoring was not found to be effective.

Inference generation, the ability to integrate information within or across texts and/or use background knowledge to fill in information not explicitly stated (Cain, 2010), is prominent in models of reading comprehension (for a review see McNamara & Magliano, 2009). A synthesis of nine studies (Hall, 2016) and a meta-analysis of 25 studies (Elleman, 2017), all reported in peer-reviewed journals, examined the impact of inference instruction on reading comprehension in primary and secondary school students. Participants in the studies reported in Hall's (2016) synthesis had been identified as struggling readers, however, the method of identification varied across studies, and the majority were in grades 4 and 5. Significant effect sizes were found on experimental measures of inferential reading comprehension in each of the studies, and in some studies also on standardised measures. The effective interventions taught students to (a) identify clues or key words in the text and use these to answer inferential questions (i.e., make text-based inferences), (b) activate prior knowledge to integrate with the information in the text (i.e., make knowledge-based inferences), or (c) generate questions as a way of knowing when to make inferences. Inference instruction was effective in increasing both skilled and less skilled readers' general and inferential comprehension in the studies in Elleman's (2017) meta-analysis, with the effect being greater for less skilled readers. Less-skilled readers not only improved substantially in forming accurate inferences, but also in literal comprehension of text, however, few studies used standardised or generalised reading comprehension outcome measures. Inference-level interventions were more effective in younger than older students, and small group instruction was more effective.

Two other multi-strategy inference instruction studies, one study with 67 typically developing children aged 8-12 years in regular school grades 3 and 4 in the Netherlands (Bos et al., 2016), and the other study with 32 struggling grade 6-8 readers aged 12-15 years in the US (Barth & Elleman, 2017), both found the intervention resulted in improvements on trained items and on standardised reading assessments. Bos et al.'s (2016) intervention

entailed training small groups of children to make text-based and knowledge-based inferences to support the construction of meaning at the situation model level, with the aim of deepening the level of comprehension of a text. The participants in Barth and Elleman's (2017) study were given explicit instruction in four strategies designed to teach how to generate text-based and knowledge-based inferences, using narrative and information texts chosen to build the required knowledge base needed to make inferences.

In summary, the above bodies of work have investigated interventions targeting comprehension more generally for school aged children, including groups of participants with and without language and/or reading difficulties. Positive effects have been found for various types of intervention, but this has been largely on custom measures with less evidence of transfer to standardised measures of reading comprehension. Interventions that have investigated interventions for poor comprehenders will now be discussed.

Intervention for Poor Comprehenders

A systematic review by Lee and Tsai (2017) identified 14 experimental reading comprehension intervention studies that included poor comprehenders, although the classification criteria varied between studies with the majority using cut-off criteria to select participants with low reading comprehension and average range word reading accuracy. Eight types of intervention were identified: five were single strategy interventions, and three were multiple-strategy interventions. Of the 14 studies in the review, eight employed multiple strategies, the most prevalent type of instruction being Reciprocal Teaching (Palincsar & Brown, 1984), which was also the intervention type that demonstrated the largest effect size on reading comprehension. Single strategy interventions that resulted in improvements on both custom and standardised tests were those involving inference making and mental imagery.

Multiple-component Interventions

The most comprehensive intervention conducted with poor comprehenders to date has been a randomised control trial by Clarke et al. (2010). Clarke et al. evaluated the effectiveness of three multi-component training programmes with poor comprehenders aged 8-9 years. The programmes, each delivering 30 hours of intervention over 20 weeks, were designed based on the two hypotheses as to the source of the reading comprehension difficulties in poor comprehenders (Snowling & Hulme, 2011), either difficulty with the lower-level language skills (semantics and syntax) required to understand sentences so the basic meaning can be extracted from the text (Nation, 2005), or with the higher-level

language and cognitive skills required to build a mental model of a text's meaning (Cain, 2010 for a summary). The oral language programme provided direct instruction of the lower and higher-level language skills of vocabulary, listening comprehension, figurative language and spoken narrative. The outcomes of this programme were compared with a similar text comprehension programme consisting of training in metacognitive strategies, reading comprehension, inferencing from text and written narrative, and a programme that combined components of both oral language and text comprehension (Clarke et al., 2010). All groups made significant gains on a reading comprehension test immediately after training, compared with a waiting control group, and these gains continued to be significant for all three groups on follow-up testing 11 months later, with those receiving the oral language training showing the most improvement (Clarke et al., 2010)). As the programmes contained multiple components, however, it is not clear which components of the interventions led to the gains in reading comprehension (Snowling & Hulme, 2011).

Single-component Inference Interventions

Interventions that have investigated the effect of single strategies on text comprehension have been training in drawing inferences (McGee & Johnson, 2003, Yuill & Oakhill, 1991), comprehension monitoring and use of text organisers (see Yuill & Oakhill, 1991), and mental imagery (Johnson-Glenberg, 2000, Oakhill & Patel, 1991). The first three approaches were effective in improving comprehension outcomes for poor comprehenders aged 7-8 years compared with controls in Oakhill and colleagues' studies, while mental imagery was shown to be effective with older participants aged 9-10 years. Of the approaches, inference training showed the greatest effect on both study outcome measures and on a standardised reading comprehension test. This finding was replicated by McGee and Johnson (2003) using a standardised measure in a group of 6-10 year old poor comprehenders.

Vocabulary Interventions

Very few studies have examined the effect of vocabulary intervention on the reading comprehension skills of poor comprehenders. Clarke et al. (2010) included vocabulary as one of the components in two of the three programmes in their intervention study: the oral language and combined programmes. Both groups demonstrated significant gains on the bespoke vocabulary knowledge measure post-intervention compared with controls, and the oral language group also made significant gains on the standardised word definitions measure. These findings were consistent with the findings of Elleman et al.'s (2009) meta-

analysis; however, the gains the oral language group made on the standardised measure were not maintained over time. Contrary to most previous research, significant gains were made on one of the standardised reading comprehension tests post-intervention by each of the intervention groups, with further greater gains being evident for the oral language group at follow-up 11 months later. The results of a mediation analysis led the authors to argue that the improvement in reading comprehension was mediated by the gains in vocabulary, and that deficits in oral vocabulary may be one of the underlying causes of reading comprehension difficulties in poor comprehenders (Clarke et al., 2010).

Aims of Part B

While there is now a growing body of research on the language and cognitive weaknesses of poor comprehenders, little is known about effective intervention tailored to the individual child's need(s). The aim of the second part of this programme of research was to design and evaluate novel interventions targeted at the child's specific difficulties. As hypothesised, two profiles of poor comprehender emerged from the profiling in Phase 3 of Study 1, requiring different intervention approaches: one focused on improving lower-level vocabulary skills, and the second focused on higher-level language skills. Two interventions were subsequently developed and implemented in two separate studies. Study 2 is reported in Chapter 7 and Study 3 is reported in Chapter 8.

The aims of Study 2 (Chapter 7) were to:

1. explore whether a pilot programme utilising a novel intervention designed to target higher-level language skills was effective in improving oral inference making and comprehension monitoring skills, and
2. investigate generalisation to tests of reading comprehension.

The aims of Study 3 (Chapter 8) were to:

1. explore whether a pilot programme utilising a novel vocabulary intervention was effective in improving word knowledge at both an oral and reading single word level, and
2. investigate generalisation of any therapy gains to reading comprehension.

CHAPTER 7

Higher-level language strategy-based intervention for poor comprehenders: A pilot single case experimental design

Chapter Overview

Chapter 7 presents Study 2 of this programme of doctoral research which aimed to develop and evaluate a novel intervention targeted at improving higher-level language in the poor comprehenders from Study 1 who had difficulty primarily with inference making. Drawing on the literature outlined in Chapter 6, which had found support for strategy intervention in improving comprehension, a strategy-based intervention was developed targeting inference-making and comprehension monitoring and the outcomes for both the targeted skills and reading comprehension explored. Standardised outcome measures were used for the inference and reading comprehension tasks, to maintain consistency with Study 1, however a standardised measure was unable to be sourced to assess comprehension monitoring.

This pilot study involved an intervention with 11 children who agreed to participate, out of the 15 poor comprehenders identified as having difficulties with inferencing making in Phase 3 of Study 1. The study utilised a single case design and comprised 10 individual 45 minute sessions. Testing was completed at three time points (pre-intervention, post-intervention, maintenance), in addition to the baseline Phase 3 testing.

The intervention programme session plans and summary sheets are available to download free from:
https://www.dropbox.com/sh/vn2was2q3yp2kld/AACK9FDWn4rDihnxG0DHItlua?dl=0

This chapter includes the accepted manuscript version of the research article titled, *Higher-level language strategy-based intervention for poor comprehenders: A pilot single case experimental design* published by SAGE Publications in the journal Child Language Teaching and Therapy; published online on January 11, 2022. Available online at: https://doi.org/10.1177/02656590211071003

Reference:

Kelso, K., Whitworth A., & Leitão, S. (2022a). Higher-level language strategy-based intervention for poor comprehenders: A pilot single case experimental design. *Child Language, Teaching and Therapy*. Epub ahead of print 11 January 2022: 1-15. https://doi.org/10.1177/02656590211071003

Published Manuscript

Abstract

In contrast to the large body of research investigating intervention for poor decoding skills, far fewer studies have evaluated interventions for reading comprehension. There is even less research on children with more specific difficulties with reading comprehension, often referred to as "poor comprehenders". Levels of effectiveness have varied for interventions targeting lower- and higher-level language, including inference making, on trained measures, with little transfer to generalised reading comprehension measures in both skilled and less-skilled readers. Outcomes have been more positive for poor comprehenders, however findings have been inconsistent as to which programme components have led to gains in reading comprehension. This pilot study utilised a case series design to explore whether a novel intervention targeting oral inference making and comprehension monitoring was effective in improving the targeted skills and reading comprehension of 11 children, aged 9;2 – 12;3 years, with average-for-age phonological and lower-level language skills but weak inferencing. All participants improved on the primary inference subtest post-intervention and continued to score higher at maintenance than at pre-intervention. Results on the remaining higher-level language tasks were more varied, as were the results for reading comprehension, with fewer participants demonstrating generalisation to these tasks, particularly the nonfiction texts. While the results are preliminary and descriptive, they suggest that improvements can be made in higher-level language in a 10-session intervention, and provide directions for future research.

Keywords: reading comprehension, poor comprehenders, intervention, inference making, comprehension monitoring

Introduction

A subgroup of poor readers with more specific difficulties with reading comprehension, often referred to as "poor comprehenders" in the literature, have marked deficits in comprehending what they read despite being able to read aloud accurately and fluently at an age-appropriate level. The reported prevalence of poor comprehenders has varied over the years depending on the tests and cut-off criteria, ranging from 10-15% based on comprehension being at least 6 months below age-appropriate text reading accuracy in earlier studies (Yuill and Oakhill, 1991), to 3.3% in more recent studies using strict criteria to identify children with clinically significant reading comprehension difficulties (Hulme and

Snowling, 2011). The current consensus is that approximately 7% of middle primary students can be classified as poor comprehenders (e.g., Clarke et al., 2010; Elwér et al., 2015), with this number increasing across the school years (e.g., Catts et al., 2005).

There is now a sizeable body of research exploring the language and cognitive profiles of poor comprehenders, with many studies identifying intact phonological skills which support age-appropriate word reading accuracy and fluency, but deficits on a range of oral comprehension skills (e.g., Adlof and Catts, 2015; Nation et al., 2010). Two alternative hypotheses as to the source of poor reading comprehension have been proposed (Snowling & Hulme, 2011). The first purports difficulty with lower-level language (vocabulary, morphology and grammar) required for understanding sentences so the basic meaning can be extracted from the text (e.g., Nation, 2005 for a review; Nation et al., 2010). Retrospective longitudinal studies have found these oral language weaknesses are evident before children learn to read (e.g., Catts et al., 2006; Elwér et al., 2015; Nation et al., 2010). A second hypothesis, highlighted by Oakhill and colleagues, proposes difficulty with higher-level language skills required to form a coherent mental model of a text's meaning (inferencing, understanding of text structure and comprehension monitoring - see Cain, 2010 for a review).

Comprehension Intervention

Research into classroom reading comprehension instruction is limited, as are studies on effective intervention tailored to the individual child's needs. This is in marked contrast to research into remediation of phonological and decoding difficulties. Reviewing the research on instruction for typically developing children, the National Reading Panel (NRP: NICHD, 2000) found support for the effectiveness of (1) specific vocabulary instruction and (2) eight types of comprehension strategy instruction. The NRP also found that when teachers were taught to use comprehension instruction methods effectively, students' awareness and use of strategies increased, which in turn led to improvements in reading comprehension.

A systematic review of 43 studies with a control group and a pre- to post-test design, evaluated the effectiveness of oral language instruction in cohorts of preschool and school age participants (Rogde et al., 2019). Small immediate and follow-up effects were identified on generalised tests (i.e., tests that did not include items trained in the intervention) of lower-level vocabulary and grammatical knowledge, and moderate effects on narrative and listening comprehension. There were no immediate effects, however, on generalised tests of reading comprehension, and equivocal findings in the few studies that reported follow-up.

The higher-level skill of inference generation is prominent in models of reading comprehension (see McNamara and Magliano, 2009 for a review). There is empirical support for techniques to develop the higher-level language skills of inferencing, comprehension monitoring and text structure knowledge in children from preschool to grade 3, with and without oral and/or reading difficulties (Hogan et al., 2011). A synthesis of nine studies (Hall, 2016) and a meta-analysis of 25 studies (Elleman, 2017), examined the impact of inference instruction on reading comprehension in primary and secondary school students. Significant effect sizes were found on experimental measures of inferential reading comprehension in each of the studies involving struggling readers in Hall's (2016) synthesis, and for some studies on standardised measures. Inference instruction was effective in increasing both skilled and less skilled readers' general and inferential comprehension (Elleman, 2017). Less-skilled readers not only improved substantially in forming accurate inferences, but also in literal comprehension of text; however, few studies used standardised or generalised reading comprehension outcome measures. Two recent inference instruction studies, one with Dutch participants aged 8-12 years in mainstream school (Bos et al., 2016) and the other in the USA targeting 12-15 year old struggling readers (Barth and Elleman, 2017), reported improvements on both trained items and on generalised reading comprehension measures.

Intervention for Poor Comprehenders

To date, few studies have evaluated interventions for poor comprehenders (see Snowling and Hulme, 2011, for a summary). Oakhill and colleagues investigated the effect of training on drawing inferences, comprehension monitoring, use of text organisers and mental imagery on text comprehension (Yuill and Oakhill, 1991). The first three approaches were effective in improving comprehension outcomes for poor comprehenders aged 7-8 years compared with controls, while mental imagery was effective with participants aged 9-10 years. Inference training showed the greatest effect on both study outcome measures and a standardised reading comprehension test. This finding was replicated by McGee and Johnson (2003) using a standardised measure in 6-10 year old poor comprehenders.

Clarke et al. (2010) evaluated the effectiveness of three training programmes for poor comprehenders aged 8-9 years in a randomised control trial. The programmes, each delivering 30 hours of intervention per child over 20 weeks, were driven by the two hypotheses as to the source of the reading comprehension difficulties in poor comprehenders (Snowling & Hulme, 2011). One programme focused on training the oral lower- and higher-level language skills of vocabulary, listening comprehension, figurative language and spoken

narrative. The outcomes were compared to those of two other programmes, one of which focused on developing text comprehension using written texts, comprising training in metacognitive strategies, reading comprehension, inferencing from text and written narrative, while the third integrated components of both programmes (Clarke et al., 2010). All groups made significant gains, compared with a waiting control group, on a reading comprehension test immediately after training. Gains continued to be significant for all three intervention groups on follow-up testing 11 months later, with those receiving the oral language training showing the most improvement (Clarke et al., 2010). As the programmes contained multiple components, however, it was not clear which components led to the gains in reading comprehension (Snowling and Hulme, 2011). Within the constraints of clinical and educational practice, it is important to select the most effective and efficient intervention approach. This study, therefore, aimed to explore the effect of a pilot programme, specifically designed to target higher-level language skills, on reading comprehension in a case series with 11 participants who presented with a profile of higher-level language difficulties (as reported in Kelso et al., 2021b).

The aims of this study were to

i. explore whether a pilot programme utilising a novel intervention designed to target higher-level language skills was effective in improving oral inference making and comprehension monitoring skills, and
ii. investigate generalisation to tests of reading comprehension.

Method

The participants recruited to this study were part of a larger research programme investigating the identification, profiling, and subsequent intervention with individual poor comprehenders. Ethical approval was granted by Curtin University Human Research Ethics Committee (HRE2016-0438-01) and the Government of Western Australia Department of Education. Written consent was obtained from participating school principals, teachers, students, and their parents/guardians.

Participants

Initial testing using a phonological awareness and a listening comprehension task was carried out with 218 children in School Years 3–6, aged 7;8 –12;1 years. The children attended one of two local primary schools serving predominantly middle and upper-middle class catchment areas in inner metropolitan Perth, Western Australia. Of these, 24 children were confirmed as poor comprehenders using measures of nonword reading (i.e., the ability

to decode nonsense words), reading comprehension and nonverbal IQ (Kelso et al., 2020). These children scored in the average range on the nonword reading accuracy and nonverbal IQ tasks but were classified as poor comprehenders on a reading comprehension task, the York Assessment of Reading Comprehension Primary – Australian Edition – Form A (Snowling et al., 2012), using cut-off scores as described in Kelso et al. (2020).

Seventeen of the 24 children (eight boys and nine girls, aged 8;8 – 11;9 years) subsequently completed a full assessment battery. This was comprised mainly of standardised tests for the purpose of profiling the oral and written language input skills within the Sublexical, Lexicon and Comprehension Processes component systems of Perfetti and Stafura's (2014) Reading Systems Framework (RSF), together with assessments of verbal memory. Of these 17 participants, the profile for 15 indicated difficulty with inferencing skills within the higher-level language Comprehension Processes component of the RSF, but no difficulty on the majority of vocabulary and grammar lower-level language tasks within the Lexicon and Sentence levels of the RSF, along with intact Sublexical component skills. The remaining two participants also had intact Sublexical component skills but had difficulty with Lexicon component vocabulary tasks, as well as at each of the three levels of the Comprehension Processes component of the RSF (Kelso et al., 2021b).

Table 7.1

Demographic and background information

P	Gender	School Year	Age years;months	Language Background
1	Female	4	9;9	Bilingual
2	Female	6	10;11	Bilingual
3	Male	4	9;2	Monolingual
4	Male	5	10;2	Bilingual
5	Male	5	10;6	Monolingual
6	Female	6	11;9	Monolingual
7	Male	7	12;3	Monolingual
8	Male	5	10;3	Monolingual
9	Male	5	10;10	Monolingual
10	Male	5	10;5	Monolingual
11	Female	6	10;11	Monolingual

Notes. P = participant

The 15 children identified with difficulty inferencing were invited to participate in a targeted 10-session intervention. Eleven children (aged 9;2 – 12;3 years) and their parents/ caregivers agreed to participate. Demographic information is set out in Table 7.1. Three

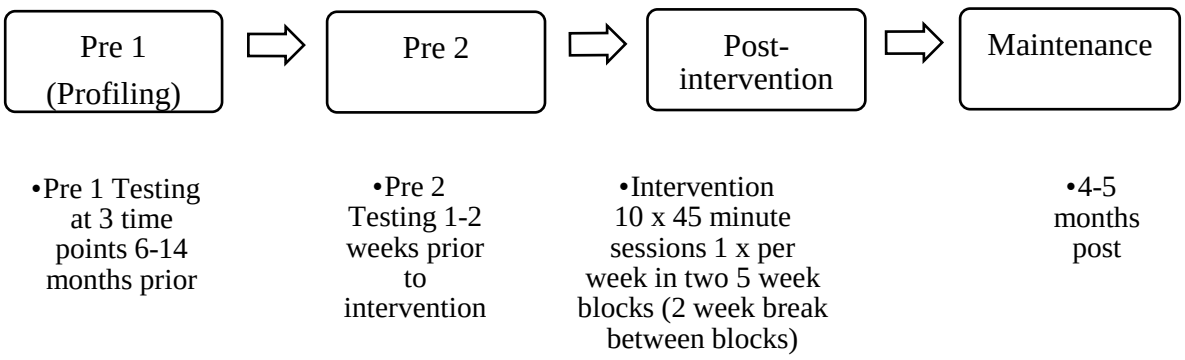
participants were bilingual (P1, P2, P4), with P1 and P2 having been exposed to English since birth and P4 for five years.

Procedure

The intervention consisted of 10 individual 45 minute sessions, one session per week, in two blocks of five sessions with a two week school holiday break between the blocks. The intervention was carried out by the first author in a room at the child's school or in clinic rooms. A case series design was implemented, replicated across each participant, and follows the SCRIBE reporting guidelines (Tate et al., 2016).

Figure 7.1

Testing Schedule



All measures, apart from the comprehension monitoring task, were administered at initial testing (Pre 1), pre-intervention (Pre 2) to facilitate some monitoring of any pre-intervention spontaneous change, post-intervention and maintenance. Data collection for initial testing (Pre 1) took place on three occasions, with phase 1 oral tasks carried out an average of 14 months prior to the intervention, confirmation reading testing 9-12 months prior (see Kelso et al., 2020), and detailed profiling testing completed an average 6 months prior to the commencement of the intervention (see Kelso et al., 2021b). Pre 2 testing was carried out 1-2 weeks prior to the intervention, post-intervention testing approximately four months after Pre 2, and maintenance testing four-five months later (see Figure 7.1). Alternate versions of the reading tests were used at different time points; however, these were not available for the oral language or comprehension monitoring tasks.

Measures

Oral Language Tasks.

***Clinical Evaluation of Language Fundamentals-4 (CELF-4 Australian Edition) Understanding Spoken Paragraphs*.** (Semel et al., 2006). This subtest measures ability to listen to three short paragraphs and answer five factual and inferential questions for each. Percentage of inferential questions (main idea, inference, prediction) correct is reported. The subtest has adequate internal consistency reliability ($r = .70$), test-retest reliability ($r = .76$), and appropriate construct validity.

Test of Problem Solving-3 Elementary (TOPS-3E). (Bowers et al., 2005). The TOPS-3E assesses critical thinking abilities, with test questions focusing on language-based thinking skills including clarifying, analysing, generating solutions, evaluating, and affective thinking. The total test has appropriate test-retest reliability ($r = .84$) and inter-rate agreement of 89%. Test-retest reliability for individual subtests reported in this study is: Making Inferences ($r = .79$), Problem Solving ($r = .75$) and Predicting ($r = .62$).

Comprehension Monitoring Tasks.

Two tasks (Jane Oakhill, 2016, personal communication) were used to assess comprehension monitoring based on age, one for participants aged 8-9 years (in School Year 4) and one for older participants. The task for younger participants consists of seven short texts, five of which include one piece of inconsistent information, separated in the text. Older participants are presented five stories, two of which make sense and three containing two or three inconsistent pairs of sentences, separated in the text, resulting in seven inconsistencies altogether. Following a demonstration, participants were asked to read each text silently, decide if the text made sense and, if not, underline the pairs of inconsistent information. Percentage of inconsistencies identified at each time point is reported.

Reading Comprehension Tests.

York Assessment of Reading for Comprehension (YARC – Australian Edition). The Primary (Snowling et al., 2012) or Secondary (Stothard et al., 2012) version was administered depending on participants' School Year. Each version (Form A and B) of the tests has appropriate reliability and content validity. Comprehension scores are reported as a standardised reading outcome measure, along with percentage of questions requiring an inference correct.

PROBE-2. (Parkin, and Parkin, 2011). PROBE-2 is a criterion-referenced assessment of reading comprehension for children from 7 years through to adults, drawing on 20 sets of

graded texts (for decoding-age levels 5;0 – 15;6 years). Each set, comprised of a fiction and nonfiction text, covers an age span of 12 months, with consecutive sets overlapping by 6 months. The pre-intervention texts for the youngest participant (decoding-age 8;6-9;6 years) have 8 comprehension questions (7 inferential) and those for decoding-age 9 years and above have 10 questions (9 inferential). The criteria for determining a reading age are achieving a minimum of 96% decoding accuracy and 70% comprehension, with only the comprehension percentage being reported in this study. Participants' texts were selected at each test-time based on their chronological age being approximately the middle of the 12 month reading-age range.

Intervention Structure

The structure of the intervention is set out in Table 7.2. All students received the intervention as per the available protocol. The first five sessions revolved around three aims: (a) highlighting awareness of the role of inference-making in text comprehension, (b) introducing inference types using the Question Answer Relationship (QAR) framework (Raphael et al., 2006), and (c) teaching strategies for use throughout the Reading Cycle. A procedure based on the Transactional Strategies Instruction approach (in Klingner et al., 2015), utilising a think-aloud "I do/We do/You do" (Fisher and Frey, 2013) process, was used to introduce strategies. Questions were asked at the start and end of each session to check recall of what had been taught, and a sheet summarising what had been covered was provided after these five sessions. The second five sessions aimed to practise application of the strategies taught using longer fiction and non-fiction texts. A copy of all handouts was given to each participant in the last session. The intervention programme session plans and summary sheets are available to download free from: https://www.dropbox.com/sh/vn2was2q3yp2kld/AACK9FDWn4rDihnxG0DHItlua?dl=0

Results

To address the first aim, we present the oral inferential comprehension and comprehension monitoring outcomes, followed by the reading comprehension measures to explore the second aim of generalisation. Data for each task at each time point is reported, along with the change in score, Pre 1 to Pre 2, Pre 2 to post-intervention, and post-intervention to maintenance. Observed and clinically significant changes, such as standard score increases of $\geq 1SD$, or crossing of a clinical boundary, are also reported.

Table 7.2

Intervention session outline.

Session	Target/Strategy	References/ Resources
1	Importance of inference making Text vs Knowledge Based inferences Being a Reading Detective Visualising	Bos et al. (2016); Core QARs - Raphael et al. (2006); Shanahan et al. (2010); Visualizing and Verbalizing Stories Book 1 (VV1) Level 3 short texts (Bell 2007)
2	Visualising Predicting	VV1 Level 3 short texts
3	Predicting, Visualising Comprehension Monitoring – Click vs Clunk	Klingner et al. (2015); VV1 Level 3 and 4 short texts
4	Expanded QAR sources of information Comprehension Monitoring Fix-Up strategies for Clunks Reading Cycle	Raphael et al. (2006); VV1 Level 4 short text; Lubliner (2005); Klingner et al. (2015)
5	QAR practise Summarising	Raphael et al. (2006); VV1 Level 4 short text; Lubliner (2005); Klingner et al. (2015)
6 - 10	Practise making inferences and applying strategies taught in longer texts using "Boxing Up" QAR Graphic Organiser	Key Into Inference fiction and nonfiction texts (Parkin et al. (2002) Comprehend It texts (Tuffin and Henderson, 1993) Pardo et al. (2011)

Oral Inferential Comprehension

On the Making Inferences subtest of the TOPS-3E, seven participants had an increased Standard Score (SS) of between 1 and 10 points Pre 1 to Pre 2 (see Table 7.3), with five crossing a clinical boundary into the low average range (SS 86-90: shaded). All 11 participants improved their score Pre 2 to post-intervention. Four (P1, P2, P4, P9) gained 15 SS points or greater (a shift of $\geq 1SD$), and the scores for two of these (P4, P9) also moved across a clinical boundary into the average range (SS >85: shaded). A further four participants made an 8-11 SS point gain (P7, P8, P10, P11), while the SS for P6, P7, P10 and P11 moved into the average range. At maintenance, seven participants achieved the same post-intervention SS or higher. Two participants (P6, P10) who had made a small gain Pre 2 to post-intervention, gained $\geq 1SD$ at maintenance, with P6 crossing a further clinical boundary. While four participants achieved a lower SS at maintenance compared to post-intervention, all scores were higher than at Pre 2 and in the average range.

Table 7.3

Oral inferential comprehension measures.

Participant School Year		P1 4	P2 6	P3 4	P4 5	P5 5	P6 6	P7 7	P8 5	P9 5	P10 5	P11 6
Test	**Time**											
TOPS Infer [a]	Pre 1	82	80	83	80	82	88	81	82	88	81	97
	Pre 2	90	90	90	82	88	85	82	90	82	80	85
	Post	109	107	95	100	93	89	92	100	103	88	96
	Main	97	114	97	97	96	115	86	100	107	110	93
Pre 1–Pre 2 △		+8	+10	+7	+2	+6	-3	+1	+8	-6	-1	-12
Pre 2-Post △		+19	+17	+5	+18	+5	+4	+10	+10	+21	+8	+11
Post-Main △		-12	+7	+2	-3	+3	+26	-6	=	+4	+22	-3
TOPS Predict [a]	Pre 1	85	75	90	85	80	85	100	76	85	100	85
	Pre 2	80	75	95	80	80	80	95	85	85	106	103
	Post	85	90	110	103	80	100	95	85	80	106	100
	Main	90	105	95	106	90	90	95	90	100	110	90
Pre 1–Pre 2 △		-5	=	+5	-5	=	-5	-5	+9	=	+6	+18
Pre 2-Post △		+5	+15	+15	+23	=	+20	=	=	-5	=	-3
Post-Main △		+5	+15	-15	+3	+10	-10	=	+5	+20	+4	-10
TOPS PS [a]	Pre 1	88	98	95	102	98	95	91	104	86	95	100
	Pre 2	100	85	102	86	98	88	84	98	91	95	102
	Post	90	100	114	102	102	91	91	98	105	95	106
	Main	113	105	114	111	106	100	103	108	100	105	116
Pre 1–Pre 2 △		+12	-13	+7	-16	=	-7	-7	-6	+5	=	+2
Pre 2-Post △		-10	+15	+12	+16	+4	+3	+7	=	+14	=	+4
Post-Main △		+23	+5	=	+9	+4	+9	+12	+10	-5	+10	+10
CELF-4 USP [b]	Pre 1	45	45	56	33	0	56	67	33	33	56	67
	Pre 2	56	67	78	67	67	89	67	66	22	67	78
	Post	89	89	89	67	56	78	100	89	67	89	78
	Main	100	78	78	89	89	67	100	78	56	78	89

Note. PC = Poor Comprehender; TOPS = Test of Problem Solving; Infer = Making Inferences subtest; Predict = Predicting subtest; PS = Problem Solving subtest; CELF = Clinical Evaluation of Language Fundamentals; USP = Understanding Spoken Paragraphs; Main = maintenance testing time point; △ = change in Standard Score points
a = Standard Score (Mean =100 ± 15); b = percentage of inference questions correct out of 9
Shaded cells indicate: crossed clinical boundary into average range

Table 7.4

Percentage of inconsistencies identified on comprehension monitoring measure.

Participant **School Year**		**P1** **4**	**P2** **6**	**P3** **4**	**P4** **5**	**P5** **5**	**P6** **6**	**P7** **7**	**P8** **5**	**P9** **5**	**P10** **5**	**P11** **6**
Test	**Time**											
Monitoring	Pre	20	14	20	14	0	0	14	0	0	0	0
	Post	80	43	80	43	0	0	43	0	14	14	14
	Main	80	57	80	29	0	29	43	0	29	86	29

Note. PC = Poor Comprehender; Main = maintenance testing time point

On the Predicting subtest, all participants obtained a similar SS Pre 1 to Pre 2, apart from P11 whose score had increased 18 SS points and crossed a clinical boundary (see Table 7.3). Four participants made a shift ≥1*SD* Pre 2 to post-intervention, and three of these (P2, P4, P6) moved across a clinical boundary into the average range (SS >85: shaded). The remaining seven made little or no change. At maintenance, seven participants obtained a higher SS than post-intervention, with two making a gain ≥1*SD* (P2, P9), and P9's score moving into the average range. This also occurred for P1, P5 and P8, with SS increases of 5-10 points. Of the remaining four participants, three scored 10-15 SS points below their post intervention score; two being P3 and P6 who had gained ≥1*SD* Pre 2 to post intervention.

On the Problem Solving subtest, four participants had an increased SS Pre 1 to Pre 2, while the remaining seven obtained the same or lower SS (see Table 7.3). Two participants (P2, P4) gained ≥1*SD* Pre 2 to post-intervention, two improved 10-14 SS points (P3, P9), six made a small or no gain, and P1 scored 10 SS points lower. Two participants (P2, P7)crossed a clinical boundary to score in the average range (SS >85: shaded). Post-intervention to maintenance, P1's SS increased ≥1*SD*, four participants gained 10-12 SS points (P7, P8, P10, P11), and the remaining six had little or no change in score.

On the CELF-4 Understanding Spoken Paragraph subtest, nine participants answered a greater number of inference questions correctly Pre 1 to Pre 2, with six being able to answer two or more questions correctly (see Table 7.3). Seven participants increased their percentage of questions correct Pre 2 to post intervention, six of these answering two or more questions correctly, two answered the same percentage correct (P4, P11), and two answered one question less (P5, P6). Four participants made further gains post-intervention to maintenance (P1, P4, P5, P11), with the remaining participants achieving a similar percentage correct.

Comprehension Monitoring

Five participants (P1, P2, P3, P4, P7) were able to identify one inconsistency at Pre 2, while post-intervention eight could identify one or more inconsistency (see Table 7.4). At maintenance, all participants except P5 and P9 identified two or more inconsistencies, and eight were able to identify the same number or greater than at post-intervention.

Table 7.5

YARC Comprehension standard scores and percentage of inference questions answered correctly.

Participant		**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**
School Year		**4**	**6**	**4**	**5**	**5**	**6**	**7**	**5**	**5**	**5**	**6**
Test	**Time**											
Reading Comp [a]	Pre 1 [c]	85	85	85	85	71	80	71	88	86	94	92
	Pre 2 [c]	94	80	100	96	89	105	89	91	78	94	101
	Post [d]	114	111	103	103	84	108	88	91	96	101	95
	Main [c]	93	102	107	107	85	118	94	106	98	104	106
Pre 1-Pre 2 △		+9	-5	+15	+11	+18	+25	+18	+3	-8	=	+9
Pre 2-Post △		+20	+31	+3	+7	-5	+3	-	=	+18	+7	-6
Post-Main △		-21	-9	+4	+4	+1	+10	+6	+15	+2	+3	+11
Inference Questions [b]	Pre 1 [c]	11	34	11	25	25	34	20	58	58	58	50
	Pre 2 [c]	42	27	42	50	33	73	50	42	25	50	60
	Post [d]	64	67	45	67	36	78	31	27	67	67	56
	Main [c]	42	67	58	87	33	87	57	67	60	67	73
Pre 1-Pre 2 △		+31	-7	+31	+25	+8	+39	+30	-16	-33	-8	+10
Pre 2-Post △		+22	+40	+3	+17	+3	+5	-19	-15	+42	+17	-4
Post-Main △		-22	=	+13	+20	-3	+9	+26	+40	-7	=	+17

Note. YARC = York Assessment of Reading Comprehension; Comp = Comprehension; Main = maintenance testing time point; △ = change in Standard Score points

a = Standard Score Mean =100 ± 15; b = percentage of inference questions correct; c = YARC Form A; d = YARC Form B

Shaded cells indicate: crossed clinical boundary into average range

Reading Comprehension

YARC–Australian. In the intervening 9-12 months since initially being identified with poor reading comprehension on the YARC, eight participants' SS had improved, with four now obtaining a SS >95 (P3, P4, P6, P11), and only P2 and P9 obtaining a SS <85. However, as participants presented with ongoing difficulties answering inference questions on both the YARC and PROBE-2, all continued to be considered poor comprehenders for the purposes of this study.

Table 7.5 shows the YARC reading comprehension SS and change in SS at each time point. The score for four participants (P3, P5, P6, P7) increased ≥1*SD* Pre1 to Pre 2. Their scores also crossed a clinical boundary into the average range (SS >85: shaded), as did the scores for P1 and P4. Three participants made a shift ≥1*SD* Pre 2 to post-intervention (P1, P2, P9), and both P2 and P9 moved across a clinical boundary. The remaining participants had little or no change in SS post-intervention. At maintenance, all participants apart from P5, whose score had regressed across a clinical boundary, obtained a SS >90 and eight a SS >95. P8 scored ≥1*SD* higher and P6 crossed a clinical boundary into the above average range (SS >115), while P1's SS regressed to the same as at pre-intervention.

Five of the six participants whose SS had crossed a clinical boundary Pre 1 to Pre 2 (P1, P3, P4, P6, P7) demonstrated a noticeable increase in the percentage of inference questions answered correctly. The percentage of questions correct for the remaining six participants was either similar or less at Pre 2 than at Pre 1 (see Table 7.5). Five participants answered noticeably more inference questions correctly post-intervention (P1, P2, P4, P9, P10), including the three who made a SS shift ≥1*SD* at post-intervention, whereas P7 and P8 answered less questions correctly. At maintenance, five participants (P3, P4, P7, P8, P11) improved in the percentage of questions answered correctly while, apart from P1, the remaining participants showed little or no change.

PROBE-2. Table 7.6 shows the percentage of comprehension questions answered correctly on the fiction and nonfiction text at each time point, and whether participants achieved the minimum comprehension criterion of 70% of questions correct. At Pre 1, completed on average 6 months prior to Pre 2, two participants (P6, P11) reached the minimum criterion on the fiction text for their age, and no participant reached the criterion on the nonfiction text. At Pre 2, P11 was the only participant to reach the criterion on the fiction text, and again no participant reached the criterion on the nonfiction text. Post-intervention,

Table 7.6

PROBE-2 percentage of comprehension questions correct and pass/fail criterion at each time point.

Participant		**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**
School Year		**4**	**6**	**4**	**5**	**5**	**6**	**7**	**5**	**5**	**5**	**6**
Test	**Time**											
PROBE-F	Pre 1	25	30	50	30	10	70	40	50	30	50	70
Comp	Pre 2	40	60	0	50	30	40	30	20	60	50	80
	Post	50	50	60	60	60	50	70	80	80	70	80
	Main	70	80	60	80	70	70	70	50	50	70	70
Pre 1-Pre 2 [a]		×	×	×	×	×	×	×	×	×	×	✓
Pre 2-Post [a]		×	×	×	×	×	×	✓	✓	✓	✓	✓
Post-Main [a]		✓	✓	×	✓	✓	✓	✓	×	×	✓	✓
PROBE-NF	Pre 1	62.5	20	38	60	0	30	20	30	20	40	50
Comp	Pre 2	50	40	12.5	60	30	40	40	30	30	40	20
	Post	50	70	60	80	50	60	80	40	50	50	40
	Main	80	50	70	70	50	70	60	60	20	50	50
Pre 1-Pre 2 [a]		×	×	×	×	×	×	×	×	×	×	×
Pre 2-Post [a]		×	✓	×	✓	×	×	✓	×	×	×	×
Post-Main [a]		✓	×	✓	✓	×	✓	×	×	×	×	×

Note. PROBE-F = PROBE-2 fiction text; PROBE-NF – PROBE-2 nonfiction text; Comp = Comprehension; Main = maintenance testing time point

a = Meets 70% comprehension questions correct criterion

five participants reached the criterion on the fiction text (P7, P8, P9, P10, P11) and three (P2, P4, P7) on the nonfiction text, with only P7 reaching the comprehension criterion on both. At maintenance, five further participants reached the criterion on the fiction text, while P8 and P9 no longer achieved 70% of questions correct and P3 maintained the same 60% correct obtained post-intervention Again, fewer participants reached the comprehension criterion at maintenance on the nonfiction text (P1, P3, P4, P6), with only P4 achieving this at both post-intervention and maintenance.

Each text had one literal question. Examination of responses to this question at each time point showed that three participants (P1, P4, P9) answered the literal question incorrectly on the fiction text and five (P2, P5, P8, P9 P10) on the nonfiction text at Pre 1. At Pre 2, seven participants answered the question incorrectly on the fiction text and six on the nonfiction text, while at maintenance no participant answered the literal question correctly and three (P3, P5, P10) answered incorrectly on the nonfiction text.

Discussion

While there is evidence to support the effectiveness of interventions for poor comprehenders, most programmes target skills at multiple levels, making it difficult to identify the active ingredients. In this study, following the seminal work of Oakhill and colleagues (Yuill and Oakhill, 1991), we chose to focus on poor comprehenders who presented with difficulties with inferencing but adequate vocabulary, and design and evaluate a pilot programme that directly targeted inferencing. This study, therefore, aimed to explore the effectiveness of a novel intervention, specifically targeting higher-level language skills, in improving oral inference making and comprehension monitoring, and examine any evidence of generalisation to reading comprehension.

Oral Inferential Comprehension

Overall, the results showed that oral inference making improved post-intervention for most participants. This was reflected by improved scores for all 11 participants on the TOPS-3E Making Inferences subtest, with shifts across clinical boundaries for six post-intervention. This was also reflected in the increase in correct responses to inference questions by seven participants on the CELF-4 Understanding Spoken Paragraphs. These gains were maintained or improved upon for most participants at maintenance. The change in SS for the TOPS-3E Predicting subtest was less clear, with four participants making clinically significant gains post-intervention, while for four others this was seen at maintenance. Less clinically significant change was evident on the Problem Solving subtest, likely due to stronger scores

pre-intervention for many participants compared with the other inference subtests, although all participants had made positive gains pre-intervention to maintenance.

Comprehension Monitoring

Following intervention, improvement in comprehension monitoring was evident for eight of the 11 participants, and at maintenance for a further participant (P6) who had been unable to identify any inconsistencies previously.

Reading Comprehension

The second aim was to investigate generalisation to reading comprehension measures. In summary, there was less change in participants' performance on either the YARC standardised or PROBE-2 criterion-referenced measures of reading comprehension than on the oral inference making and comprehension monitoring measures. In the case of the YARC, this is likely due to nine of the 11 participants' reading comprehension SS improving in the intervening 9-12 months between Pre 1 and Pre 2 to then fall in the average range (SS >85) pre-intervention. Only two participants' scores (P2, P9) crossed a clinical boundary Pre 2 to post-intervention and maintained this 4-5 months later. These were the only two participants who scored below average on the YARC pre-intervention, suggesting that the improvement can generalise to reading comprehension tests for those with clinically significant reading comprehension difficulties, as classified by Hulme and Snowling (2011).

All participants continued to fail to reach the minimum comprehension criterion of 70% questions correct on the PROBE-2 at Pre 2 on both the fiction and nonfiction texts, apart from P11 on the fiction text. Following intervention, the strongest improvements were on the fiction texts, with non-fiction texts remaining difficult for most participants. On the fiction text relevant to their age, five participants reached the minimum comprehension criterion of 70% of questions correct post-intervention, while eight attained the criterion at maintenance, although this did not include P8 and P9 who had reached the criterion post-intervention. On the non-fiction text, only three participants reached the minimum criterion post-intervention and four at maintenance. Why the participants had greater difficulty on the nonfiction texts is unclear from the results, but factors such as knowledge-base, level of interest and the types of inference required to comprehend a factual text need to be considered.

Analysis of the percentage of inference questions answered correctly on the YARC revealed that, in line with their clinically significant improvement in SS, P2 and P9 had made the greatest gain post-intervention. At maintenance, P8 whose SS had increased $\geq 1SD$, obtained the greatest increase, while P3, P4, P7 and P11, whose SS had remained reasonably

stable across Pre 2, post-intervention and maintenance, also made good gains. This analysis at the question level suggests the intervention has the potential to improve children's ability to make inferences when reading. Interestingly, ability to answer literal questions correctly improved both post-intervention and at maintenance, consistent with findings of the meta-analysis carried out by Elleman (2017). When studied in conjunction with the comprehension monitoring results, these findings also suggest that examining a child's performance on different types of comprehension question may be beneficial in order to identify poor comprehenders, rather than just considering the overall reading comprehension score.

Future directions

This was an exploratory study, and more research is required to replicate the findings on a larger scale, with more participants, including those poor comprehenders from older age groups. Implementation in small groups could be investigated to increase the intervention's applicability in educational settings, such as in classrooms delivered by teachers. Future replications should also strengthen the design through the inclusion of repeated measures. The reduced transfer to generalised measures of reading comprehension highlights the need for future research to investigate a longer period of intervention, inclusion of a second phase with more focus on applying the skills to written texts, and/or the inclusion of consolidation activities between sessions.

The issue of lack of sensitivity to identifying weaknesses and change on standardised tests is apparent on the YARC, however, and suggests that analysis of responses to different question types may be more clinically or educationally beneficial than the overall reading comprehension score, with the PROBE-2 being more sensitive here. Further, future research should conduct intervention studies concurrently with initial diagnosis of poor comprehenders, as the YARC SS of most participants had shifted to within the average range pre-intervention, even though they continued to demonstrate marked weaknesses making inferences. Finally, further rigour would be added by moving to a waitlist control design, introducing blinded pre-post assessment, and gathering further background information, such as developmental and medical history, to identify other factors that may impact on performance.

Conclusions and clinical implications

While the results of this pilot intervention study are preliminary, they provide the educator and clinician with early evidence that targeting oral inference making and comprehension monitoring can be effective after only 10 sessions of individual intervention,

and for children with varying severity of reading comprehension difficulty. The study identified that for some individual poor comprehenders, who present with adequate vocabulary and grammar but poor higher-level language skills, this targeted approach can be effective. It also identified that generalisation, albeit reduced, can be obtained to standardised measures of reading comprehension for these individuals.

Full details of the intervention, including session plans can be freely downloaded from:
https://www.dropbox.com/sh/vn2was2q3yp2kld/AACK9FDWn4rDihnxG0DHItlua?dl=0

CHAPTER 8

A Novel Vocabulary Intervention for Poor Comprehenders: A single case study

Chapter Overview

The current chapter presents Study 3 which developed and evaluated a novel intervention targeted at improving vocabulary knowledge and explored the impact on reading comprehension. While weak vocabulary skills are widely accepted as contributing to poor reading comprehension, and the effectiveness of vocabulary interventions on increasing comprehension has been investigated extensively in previous research, very few studies have explored this in poor comprehenders.

As, unexpectedly, only two children presented with a profile of difficulties with both lower and higher-level language skills in Study 1, and only one agreed to participate in the intervention, this is a case study involving one participant. This 8-week pilot intervention consisted of biweekly 30 minute sessions and focused on active exploration of semantic organisation and meaning of words. Testing was completed pre-intervention, post-intervention and at maintenance, using a combination of formal and informal tasks as the primary outcome measures.

The chapter was written for a clinical audience to facilitate rapid translation and clinical discussion through both the peer review process and circulation to the large membership of Speech Pathology Australia via the Journal of Clinical Practice in Speech-Language Pathology.

This chapter includes the accepted manuscript version of the research article titled, *A novel vocabulary intervention for poor comprehenders: A single case study*. The article was published by The Speech Pathology Association of Australia Limited in Journal of Clinical Practice in Speech-Language Pathology Volume 24, No 1, 2022. An overview of the intervention programme, a sample session plan, and materials used in the study are also available to download free from: *https://www.languageandliteracyinyoungpeople.com*

Reference:

Kelso, K., Whitworth, A., & Leitão, S. (2022b). A novel vocabulary intervention for poor comprehenders: A single case study. *Journal of Clinical Practice in Speech-Language Pathology*. *24*(1), 36-43.

Published Manuscript

Abstract

Poor comprehenders have difficulty with reading comprehension despite adequate word reading accuracy and fluency. Weaknesses have been identified with lower-level vocabulary and grammar skills, and higher-level language skills such as inference making. It is important that speech-language pathologists (SLPs) tailor intervention to meet the specific needs of individuals; however, there is a lack of research on intervention for poor comprehenders, who comprise a heterogenous group. This case study aimed to explore whether a pilot 8-week novel vocabulary intervention was (a) effective in improving word knowledge, and (b) if gains generalised to reading comprehension. Following intervention, significant improvements were found on the semantic subtasks and in word knowledge for treated words on the Word Knowledge Profile measure; improvement was also seen for untreated words at six-month follow-up. There were also gains on the standardised word and reading comprehension measures, providing promising preliminary evidence for the usefulness of the intervention.

Keywords: vocabulary intervention, poor comprehenders, reading comprehension, case study

Introduction

Poor comprehenders are a subgroup of poor readers who have difficulty understanding what they read despite being able to decode words fluently and accurately. Prevalence rates have varied depending on the selection criteria and the age of the participants, but more recent research, with large cohorts, has identified 5 – 7% of children as poor comprehenders (e.g., Clarke et al., 2010; Elwér et al., 2015; Hulme & Snowling, 2011). These children comprise a heterogenous group, as not all poor comprehenders perform well or poorly on the same oral language tasks (Nation et al., 2010). Broadly, there are (1) those who have difficulty with lower-level language skills (vocabulary, morphology, and grammar) which impacts on understanding the meaning of sentences and, in turn, texts, and (2) those who have difficulty with higher-level language skills (inferencing, understanding of text structure, and comprehension monitoring) needed to create a mental model of a text's meaning (see Cain, 2010 for an overview).

Vocabulary Skills in Poor Comprehenders

Weak vocabulary skills are widely accepted as contributing to poor reading comprehension; however, available evidence indicates that not all poor comprehenders have inadequate vocabulary. In many of their studies, Oakhill, Cain and colleagues used receptive vocabulary tasks as part of the selection of their groups of poor comprehenders, predominantly aged 7-8 years (e.g., Cain et al., 2004; Yuill & Oakhill, 1991). These children were matched to controls with age-appropriate vocabulary and reading accuracy but differing levels of reading comprehension on the Neale Analysis of Reading Ability – Revised British Edition (NARA: Neale, 1989), indicating that receptive vocabulary was not weak in these poor comprehenders.

Some studies have tested receptive vocabulary but not used these measures to select participants. In these studies, poor comprehenders generally performed significantly below good comprehenders, although not necessarily scoring in the below average range (e.g., Adlof & Catts, 2015; Cain & Oakhill, 2006). This difference has been identified in kindergarten children in longitudinal studies and shown to persist across school years (e.g., Elwér et al., 2015). Tests of receptive vocabulary measure vocabulary breadth, or how many words a person knows, in contrast to tasks measuring vocabulary depth: knowledge about the relations or associations between words-that is how words are organised semantically in the mental lexicon (Cain, 2010). Poor comprehenders have weaker skills, compared to controls, at a group level on tasks assessing vocabulary depth such as semantic fluency, providing word definitions and multiple meanings, and explaining word relationships (Adlof & Catts, 2015; Nation et al., 2004: Nation et al., 2010; Nation & Snowling, 1998). When task scores are examined at an individual level, however, variability is seen across the groups and the tasks, and not all children have vocabulary deficits (Colenbrander et al., 2016; Nation et al., 2004).

Impact of Vocabulary Intervention on Reading Comprehension

The effectiveness of vocabulary interventions on increasing comprehension in children has been investigated extensively. In a review of published experimental and quasi-experimental studies evaluating vocabulary instruction prior to 2000, the National Reading Panel (NRP: NICHD, 2000) concluded that instruction was generally effective in improving comprehension. The types of instruction in the studies included in the review were varied, however, and excluded studies involving only students with learning disabilities (Elleman et al., 2009). Recommendations for instruction were provided based on the results, including

providing explicit instruction and having students actively engage in learning new vocabulary from context. Based on the findings of their review, the NRP also recommended that non-standardised assessment instruments matched to instruction were needed for efficacy of instruction to be measured. In relation to which words should be selected for instruction, it was suggested that words should be those that the learner would encounter sufficiently often and find useful in many contexts (NICHD, 2000). Beck et al. (2013) refer to these words as Tier 2 words: words beyond the basic level that are characteristic of written text but not oral conversation.

Meta-analyses conducted by Elleman et al. (2009) and Wright and Cervetti (2017) both included several studies with children identified as having reading difficulties. The meta-analyses included 37 and 36 studies, respectively, that met selection criteria. The studies focused specifically on the effect of vocabulary instruction on passage-level comprehension in children across grades pre-K to 12, with the majority focused on grades 3-5. Elleman et al. (2009) found that children with and without reading difficulties made gains from instruction on both custom and standardised vocabulary measures, but that comprehension only increased on custom text comprehension measures containing target words. Gains on custom measures, but a lack of transfer to improvement on standardised comprehension measures, was also found by Wright and Cervetti (2017). Elleman et al. (2009) were unable to identify any specific vocabulary techniques or interventions that were more effective than others in improving comprehension. Wright and Cervetti (2017), however, found that instruction focused on active exploration of the meaning of words typically had greater impact on developing vocabulary to support comprehension of texts containing target words, than treatments where students were given word definitions or searched word meanings up in dictionaries.

Very few studies have examined the effect of vocabulary intervention on the reading comprehension skills of poor comprehenders. In a study with 7 to 8-year-old children identified as having poor vocabulary, although it is not clear from the data if they were poor comprehenders, Nash and Snowling (2006) investigated the effect of two vocabulary teaching methods on vocabulary knowledge and reading comprehension. One method involved teaching word definitions, and the other teaching a strategy to derive meanings from context clues in the text. Both methods resulted in significant gains in knowledge of taught words post-intervention but, three months later, the context group were significantly better at expressing word meanings and comprehending texts containing taught words. Clarke et al. (2010) conducted a randomized controlled trial that examined the efficacy of three

intervention programmes in improving the reading comprehension of poor comprehenders aged 8 to 9 years. One programme trained oral language skills (vocabulary, listening comprehension, figurative language, and oral narrative), the second targeted these skills in written texts, and the third combined elements of both. All resulted in significant improvements on a standardised reading comprehension measure post-intervention compared with a waiting control group. These gains were maintained at 11-month follow-up, with the oral language group making further gains compared with the other two. As these were multi-component interventions, it was difficult to determine the essential component(s) that may have produced the change in reading comprehension. However, the oral language and combined programme groups also made significant gains on the vocabulary knowledge measures post-intervention, and a mediation analysis revealed that these gains either partially or fully accounted for the improvements in reading comprehension at the 11 month follow-up (Clarke et al., 2010).

The current study

The case reported here was part of a larger research programme exploring the identification, profiling, and subsequent targeted intervention with individual poor comprehenders. As reported in Kelso et al. (2020), 24 children were identified as poor comprehenders following a two-phase testing protocol, and 17 subsequently completed detailed profiling of their oral and written language, and cognitive processes (Kelso et al., 2021b). Only two of the 17 children had difficulty on multiple lower-level oral and written vocabulary and grammar comprehension tasks; the remainder having difficulty with higher-level discourse comprehension (intervention study reported in Kelso et al., 2022a).

We identified few studies investigating the effect of vocabulary instruction on the reading comprehension of poor comprehenders. The study by Clarke et al. (2010) included multiple components but suggested that the gains in vocabulary mediated subsequent improvements in reading comprehension. We developed and evaluated a theoretically informed and individually targeted intervention that focused on actively developing vocabulary depth using a semantic organisation approach.

The aims of this case study were to:

i. explore whether a pilot programme utilising a novel vocabulary intervention was effective in improving word knowledge at both an oral and reading single word level, and
ii. investigate generalisation of any therapy gains to improvement in reading comprehension.

Table 8.1

Background Assessment Data

Measure	Phonological Skills/ Word Reading		Lower-level Vocab/Grammar		Discourse-level Comprehension	
	Oral	Reading	Oral	Reading	Oral	Reading
CTOPP-2 Elision [a]	9					
CTOPP-2 PI [a]	9					
CTOPP-2 RN Letters [a]		11				
CTOPP-2 Total [b]		107				
WIAT-II Pseudowords [b]		100				
WIAT-II Word Reading [b]		94				
TOWRE-2 Total [b]		88				
YARC-P Accuracy [b]		93				
PROBE-2 F Accuracy [c]		99				
PROBE-2 NF Accuracy [c]		96				
PPVT-4 [b]			85			
CELF-4 WC Receptive [a]			8			
CELF-4 WC Expressive [a]			10			
CELF-4 Word Definition [a]			5			
CELF-4 Associations [d]			F			
WRMT-III Word Comp [b]				73		
TROG-2 [b]			83			
CELF-4 Concepts [a]			4			
CELF-4 Sent Assembly [a]				6		
NSSRT Sentence Comp [b]				95		
CELF-4 USP [a]					5	
TNL Comprehension [a]					5	
TNL Narrative [a]					4	
CASL Nonliteral Lang [b]					70	
CASL Inference [b]					71	
TOPS-3 Total [b]					81	
YARC-P Comprehension [b]						75
PROBE-2 F Comp [c]						20
PROBE-2 NF Comp [c]						0

Note. CTOPP-2 = Comprehensive Test of Phonological Processing-2; PI = Phoneme Isolation; RN = Rapid Naming; WIAT-II = Wechsler Individual Achievement Test-II – Australian Edition; TOWRE-2 = Test of Word Reading Efficiency-2; YARC-P = York Assessment of Reading for Comprehension-Primary - Australian Edition; F – Fiction; NF = Nonfiction; PPVT-4 = Peabody Picture Vocabulary Test-4; CELF-4 = Clinical Evaluation of Language Fundamentals-4 – Australian Edition; WC = Word Classes; WRMT-III = Woodcock Reading Mastery Tests-III; Comp = Comprehension; TROG-2 = Test for Reception of Grammar-2; Concepts = Concepts and Following Directions; Sent = Sentence; NSSRT = New Salford Sentence Reading Test; USP = Understanding Spoken Paragraphs; TNL = Test of Narrative Language; CASL = Comprehensive Assessment of Spoken Language; Lang = Language; TOPS-3 = Test of Problem Solving-3.
Shaded = Outcome Measures used in this study
a = Scaled Score; b = Standard Score; c = percentage correct; d = pass/fail criterion

Method

Two participants with lower-level language difficulties on profiling were invited to participate and one agreed. Ethical approval was granted by Curtin University Human Research Ethics Committee (HRE2016-0438-01) and the Government of Western Australia Department of Education.

Participant

Danni (pseudonym) was in Year 5 (aged 10;0 years) at the time of entry into the study, and 11;6 years in Year 6 at the commencement of the intervention. Danni was not exposed to English until adopted at age 5; however, since then, Australian English has been the only language spoken. Table 8.1 shows the profile of Danni's oral language and reading skills from the background assessment. Results on the nonverbal IQ and memory tasks are in Table 8.2, and further details of each test can be found in Kelso et al. (2021).

Table 8.2

Results of Nonverbal IQ and Memory Tasks

Measure	Score
TONI-4 Nonverbal IQ [a]	99
CTOPP-2 Nonword Repetition [b]	6
CELF-4 Number Repetition-Forwards [b]	14
CELF-4 Number Repetition-Backwards [b]	9
CELF-4 Recalling Sentences [b]	8
Competing Language Processing Test [c]	43

Note. TONI-4 = Test of Nonverbal Intelligence-4; CTOPP-2 and CELF-4 (see Table 8.1)
a = Standard Score; b = Scaled Score; c = percentage correct

Procedure

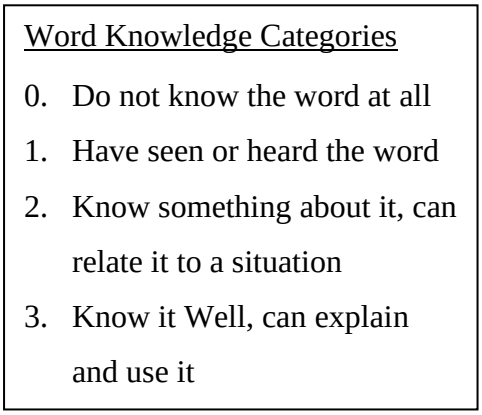
All sessions took place in the first author's clinic. Word selection was carried out 2 months prior to the commencement of intervention, at the same time as the pre-intervention testing on these standardised tasks: Woodcock Reading Mastery Tests–3rd edition (WRMT-III Form B) Word Comprehension (Woodcock, 2011), York Assessment of Reading Comprehension Primary – Australian Edition (YARC-P: Snowling et al., 2012) and Clinical Evaluation of Language Fundamentals–4th Edition, Australian Edition (CELF-4)[4] Word Definitions (Semel et al., 2006). The first two of these tasks were readministered 2 months after intervention and followed up 6 months later to assess maintenance of any change, and CELF-4 Word Definitions at the 6-month follow-up only. The Word Knowledge Profile

[4] CELF-4 was current at the time of data collection

(Spencer et al., 2017) was administered immediately prior to intervention (Time1), immediately following (Time2), and 6 months later (Time3).

Figure 8.1

Word knowledge chart based on Beck et al. (2013)



Word selection. To select the words used in the intervention, the first author read each of the Level 2 fiction texts (decoding age 10-12 years in line with Danni's decoding level) from KEY into inference and KEY into evaluation (Parkin et al., 2002; 2005) to identify Tier 2 words (Beck et al., 2013). A total of 102 words were selected from five texts. Danni was asked to tick the category that applied for each word using the word knowledge chart based on Beck et al. (2013) as shown in Figure 8.1. Twenty-six words rated 0-2 were selected as treated words (nine nouns, eight verbs, nine adjectives/ adverbs). Each of these was matched as closely as possible with a word from the same category and part of speech. These served as untreated control items.

Intervention. The intervention consisted of two 30-min sessions per week over 8 weeks. It was developed to contain the same overall amount of intervention time (450 min) as the higher-level language intervention conducted as part of this research programme (Kelso et al., 2022a), and based on the structure (length of sessions and number of words taught per session) used by Nash and Snowling (2006).

In the initial session, the structure of the sessions was explained, followed by the participant reading the first text and answering the comprehension questions to provide context for the treated words. In each treatment session, two words from the text were explored, and the participant was encouraged to complete take-home tasks using these words. Words from the previous session were briefly reviewed at the start of each session. When all words in a text were completed, the next text was read and the comprehension questions answered (Session 5, 8, 11, 13) prior to the introduction of the treated words for that text. The protocol for exploring each treated word is seen in Figure 8.2, with the same sequence followed each time.

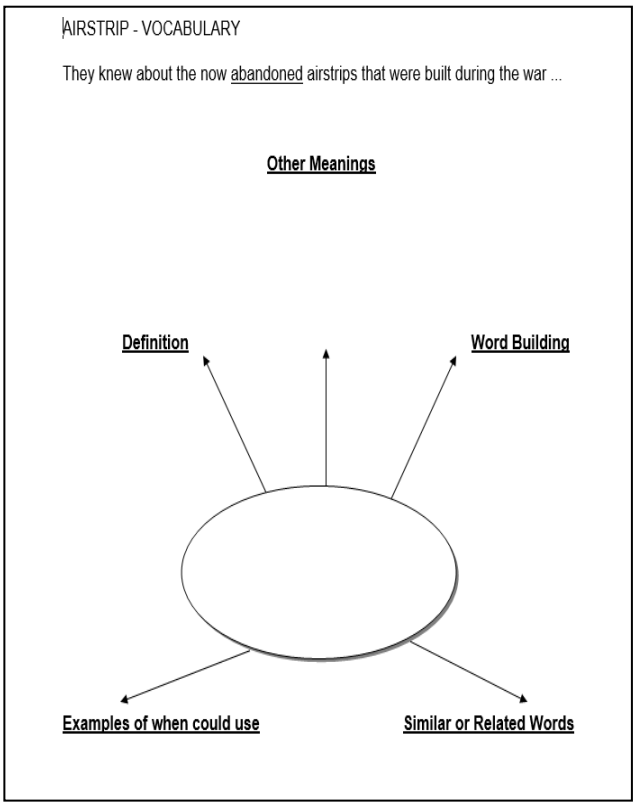
Outcome Measures

Word Knowledge Profile (WKP). This task was used as the primary outcome measure to assess change in depth of word knowledge. This profiling tool measures a

participant's phonological and semantic knowledge of individual words across eight subtasks: (1) repeat word, (2) produce rhyming word, (3) spell, (4) rate own knowledge of word, (5) use word in a spoken sentence, (6) define word meaning, (7) provide example of when/where might use word, and (8) give example of personal context of use (not used in this study). Each item was scored 0 or 1, apart from word knowledge which was rated 0-3 using Beck et al.'s (2013) categories (see above).

Figure 8.2

Structure for Exploration of Treated Words



Target word.

1. Read sentence with target word and discuss what meaning might be
2. Student writes word in middle of "mind map" sheet
3. Generate child friendly definition of word together – use dictionary, discuss. SLP writes definition down on sheet
4. Think of example situations where word might be used
5. Word Analysis
   - Identify "Part of Speech" using sentence
   - Word Building - Investigate prefixes/suffixes (add, take away)
   - Identify if word has more than one meaning, and discuss if it does
   - Think of synonyms, opposite meaning words

WRMT-III Form B Word Comprehension. This task, standardised on a large US sample, was used as a test of reading-input vocabulary depth. It consists of three sections, Antonyms, Synonyms, and Analogies, each requiring the reading of stimuli word/s then a verbal response. Scores from each are summed to create a total raw score which is used to determine the Standard Score.

YARC-P. This is an individually administered test of two texts designed to evaluate reading accuracy, rate, and comprehension in primary school children and was used as a standardised measure of reading comprehension.

CELF-4 Word Definitions. This task was used to check change in oral-input vocabulary depth on a standardised measure. It requires the examinee to define words.

Results

Word Knowledge Profile

Table 8.3 sets out Danni's knowledge ratings for treated (n=26) and untreated words (n=26) (nouns, verbs, adjectives/adverbs, total) at three time points: immediately prior to intervention (Time1), immediately following intervention (Time2), and 6 months later (Time3). A Wilcoxon two sample t-test was calculated to look for significant differences between the total scores at Time1 and Time2, and Time1 and Time3. Knowledge ratings improved significantly for the treated words Time1 to Time2 (z=3.81, $p<.001$, two tailed) and continued to be significant Time1 to Time3 (z=2.13, $p=.034$, two tailed). Knowledge ratings for untreated words did not show significant evidence of change Time1 to Time2; however, they were significantly improved Time1 to Time3 (z=3.03, $p=.003$, two tailed).

Table 8.3

Knowledge Ratings across Word Classes and Time.

	Pre (Time1)								**Post (Time2)**								**Follow-Up (Time3)**							
	Treated				Untreated				Treated				Untreated				Treated				Untreated			
	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**
KR0	1	1	0	**2**	1	1	2	**4**	0	2	2	**4**	3	0	3	**6**	1	3	0	**4**	0	1	1	**2**
KR1	4	4	6	**14**	4	4	4	**12**	1	0	0	**1**	0	1	2	**3**	1	2	2	**5**	2	1	2	**5**
KR2	4	3	3	**10**	4	3	3	**10**	1	0	2	**3**	3	5	1	**9**	3	2	2	**7**	4	2	3	**9**
KR3	0	0	0	**0**	0	0	0	**0**	7	6	5	**18**	3	2	3	**8**	4	1	5	**10**	3	4	3	**10**

Note. KR = Knowledge Rating; N = Noun; V = Verb; A = Adjective/Adverb; T = Total

Table 8.4 sets out Danni's performance for treated (n=26) and untreated words (n=26) at each of the three time points across a range of subtasks on the Word Knowledge Profile (WKP). McNemar's test (two tailed) was used to explore the presence of significant change for total words on each subtask over time, comparingTime1 to Time2 and Time1 to Time3.

While performance on each of the phonological tasks (Word Repetition, Rhyme Production, Spelling) for treated and untreated words was at, or close to, ceiling prior to the intervention and remained so at each time point, significant changes were seen in the semantic subtasks for both treated and untreated words. For treated words, a significant increase was seen Time1 to Time 2 in Use in Sentences ($p=.016$), Word Meaning ($p=.039$), and When/Where examples ($p<.001$). Although raw scores continued to be higher at Time3 than at Time1 for each subtask, this only continued to be significant for use of When/Where

examples (p=.006). For untreated words, the use of When/Where examples showed significance (p=.016) Time1 to Time2, while significant gains were seen for untreated words in each of Use in Sentences (p=.022), Word Meaning (p<.001) and When/Where examples (p<.001) Time1 to Time3.

Table 8.4

Word Knowledge Profile across Tasks, Word Classes, Treatment Condition and Time.

	Pre (Time1)								**Post (Time2)**								**Follow-Up (Time3)**							
	Treated				Untreated				Treated				Untreated				Treated				Untreated			
	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**	N	V	A	**T**
WR	9	8	9	**26**	9	8	9	**26**	9	8	9	**26**	9	8	9	**26**	9	8	9	**26**	9	8	9	**26**
RP	9	8	9	**26**	9	8	9	**26**	-	-	-	**-**	-	-	-	**-**	9	8	9	**26**	9	7	9	**25**
SP	8	6	6	**20**	7	7	9	**23**	9	6	4	**19**	9	8	8	**25**	9	7	8	**24**	8	8	8	**24**
US	4	1	6	**11**	5	3	1	**9**	7	5	6	**18***	6	7	2	**15**	5	3	6	**14**	7	7	3	**17***
WM	4	2	4	**10**	2	3	1	**6**	6	4	7	**17***	4	3	0	**7**	4	3	7	**14**	8	6	4	**18****
WW	2	0	1	**3**	3	0	0	**3**	5	5	6	**16****	4	4	2	**10***	5	3	6	**14****	7	6	5	**18****

Note. WR = Word Repetition; RP = Rhyme Production; SP = Spelling; US = Use in Sentence; WM = Word Meaning; WW = When/ Where use; N = Noun; V = Verb; A = Adjective/Adverb; T = Total
*p<.05, **p<.01

Standardised Outcome Measures

At pre-intervention testing, Danni's scores on the standardised oral and word reading vocabulary knowledge tasks continued to be below average and her reading comprehension on the YARC-P weak (see Table 8.5). At post-intervention testing, Danni's scores had crossed a clinical boundary into the low average range (Standard Score >85) on both standardised outcome measures. Minimal further gains were evident on the WRMT-III Word Comprehension task at follow-up 6 months later, and there was no progress on the CELF-4 Word Definitions. Further gains were evident on the YARC-P, however, with Danni's standard score now having moved further into the average range. This improvement is considered clinically significant as it represents a gain of ≥1SD from pre-intervention. She was also able to answer two of the four vocabulary dependent questions correctly at this time having not answered any correctly at previous test times.

Table 8.5

Oral and Reading Vocabulary, and Reading Comprehension Outcome Measures

Measure	Pre	Post	Follow-Up
WRMT Word Comp [a]	85	90	92
CELF-4 Definitions [b]	7		6
YARC Comp [a]	76	86	95

Note. a = Standard Score; b = Scaled Score

Discussion

This single case study sought to explore whether a pilot of a novel vocabulary intervention, focused on active exploration of the meaning and semantic organisation of words, was effective in improving word knowledge in a poor comprehender. Consistent with the profile of poor comprehenders, Danni did not have difficulty with the phonological subtasks on the WKP at any time point, reflecting a strength in encoding and laying down phonological representations. As expected, based on her results on the background assessment, her knowledge was much weaker on the semantic subtasks on the WKP prior to the intervention (Time1). The finding of significant improvements on these semantic subtasks post-intervention (Time2) for treated words, along with significant gains in word knowledge, provides further support, albeit small, for previous research showing intervention can be effective in improving vocabulary on bespoke measures for children with reading difficulties (Clarke et al., 2010; Elleman et al., 2009; Wright & Cervetti, 2017). Additionally, this finding supports that improvement can be made with a relatively small amount of instruction, as per Wright and Cervetti (2017). Further, this case study provides evidence that these gains can be maintained over time (Time3), although the gains on the Use in Sentences and Word Meaning subtasks were no longer significant at Time3. Another feature of this study is that it provides evidence that improvement can transfer to untreated words. Clarke et al. (2010) found a small but significant improvement, compared with controls, on untreated words for their oral language group post-intervention, while in this case study such gains were not evident across subtasks and word knowledge ratings until 6 months after intervention at Time3 follow-up. This delayed effect suggests that Danni may have needed time to apply word learning strategies to deepen her knowledge of words that were not directly taught.

In contrast with the significant gains on the bespoke vocabulary measure, improvement on the standardised vocabulary measures was more limited. Danni's score on the standardised reading-input outcome measure (WRMT-III Word Comprehension) crossed a clinical boundary into the average range after intervention but had made minimal

improvement 6 months later at follow-up, and there was no improvement on the CELF-4 Word Definitions task. While the meta-analysis by Elleman et al. (2009) found evidence of improvement on standardised vocabulary measures following intervention, Clarke et al. (2010) only identified a significant improvement for the oral language group after intervention, but this gain was not significantly different from pre-intervention levels at follow-up 11 months later. These results support the recommendation of the NRP (2000), that non-standardised assessment instruments matched to instruction are needed for efficacy of instruction to be measured.

The second aim of this case study was to investigate generalisation of any therapy gains to reading comprehension. Consistent with Clarke et al. (2010), but contrary to most other studies investigating the impact of vocabulary instruction on standardised reading comprehension measures, Danni had crossed a clinical boundary into the average range on the reading comprehension outcome measure (YARC-P) following intervention. Her reading comprehension then improved further at follow-up, and this gain from prior to intervention was considered clinically significant. Analysis of the question types on the YARC-P also revealed that she was able to answer vocabulary dependent questions at follow-up, which she had not been able to do previously.

Limitations and Future Directions

Given the exploratory nature of this novel intervention with a single participant, further research is required to replicate the methods and examine outcomes with a larger sample to overcome the subjectivity of the word selection and word knowledge ratings from a single participant. Additionally, the study would be strengthened by (1) presenting the words in the context of the passage rather than only a sentence, (2) ensuring home tasks are completed consistently between sessions and measuring time spent on home practice, and (3) readministering the comprehension passages from KEY into inference/evaluation, despite the questions on these tasks being designed to test inference-making rather than vocabulary knowledge. Finally, further rigour would be introduced through blinded pre-post assessment, a feature that could not be addressed in the current study.

Clinical Implications

Implications for practice that arise from this case study include the need for SLPs to be aware that, as previously identified (Elleman et al., 2009; NRP: NICHD, 2000), bespoke measures are likely to be required to measure change following vocabulary intervention. Standardised measures can be useful in identifying children with poor vocabulary and for

measuring growth in vocabulary over time but, typically, are not sensitive enough to measure proximal outcomes resulting from intervention. Most research exploring the effect of vocabulary intervention on reading comprehension has found that gains are made on custom measures containing target words, but this improvement does not transfer to standardised measures. The results for poor comprehenders from Clarke et al. (2010) and this case study show a greater level of support for the benefits of vocabulary intervention for children with weak reading comprehension (Duff, 2019; Elleman at al., 2009). SLPs need to remain aware, however, that while vocabulary is important, reading comprehension is complex, such that intervention is likely to need to go beyond improving depth of vocabulary to ensure lasting improvements in reading comprehension. The procedure developed for this intervention provides a framework that SLPs could adapt for use with a wider range of children. While the words used in the case study were specific to Danni, vocabulary and texts could be tailored to different learning situations.[5]

[5] The programme template will be made available during 2022 via the LaLYP website: https://www.languageandliteracyinyoungpeople.com

DISCUSSION

CHAPTER 9

General Discussion and Conclusions for the Programme of Research

Chapter Overview

This concluding chapter summarises the findings of the individual studies presented in this thesis and discusses these in the context of the research objectives, relevant theories, and past literature. The unique contribution of this research to the knowledge base on poor comprehenders, and reading comprehension more broadly, particularly in relation to intervention, is highlighted, along with the main clinical implications. The chapter concludes with an outline of the key strengths and limitations of the research and suggestions for future directions for research in this area.

Overview of the Aims and Findings

Poor comprehenders are a subgroup of poor readers who can read accurately and fluently but struggle to comprehend what they read (Cain, 2016; Nation et al., 2010). As a result of their age-appropriate, or above, word reading skills, these children tend to be poorly identified until the middle primary school years or later, when the complexity of texts and the demands of tasks increase. As outlined in Chapter 2 there is now a substantial body of literature detailing the profile of strengths and weaknesses in oral language, reading and cognitive skills of poor comprehenders. This research, however, has often focused on a single skill area and, at times, only utilised a single test to assess participants, negating the complexity and multidimensional nature of comprehending text (Cain, 2016; Catts, 2018). The general profile that has emerged is that poor comprehenders have intact phonological skills, which underpin their intact word reading skills, but weaknesses in oral language and verbal working memory. The oral language weaknesses can be with lower-level language skills (i.e., vocabulary, grammar, morphology – see Nation, 2005 for an overview) and/or higher-level language and cognitive skills (integration and inference making, comprehension monitoring, text-structure knowledge – see Cain 2016). Poor comprehenders are a heterogeneous group, however, so not all poor comprehenders perform poorly on the same task, such that the overall profile varies across children (Cain & Oakhill, 2006; Cornoldi et al., 1996; Nation et al., 2004, 2010). The research has generally identified two broad profiles: those with both lower- and higher-level language difficulties, and those with higher-level language skill difficulties more specifically. As reported by Colenbrander et al. (2016), this

suggests that it is probable that different children will need interventions targeted at different areas of oral language.

The likely outcome that poor comprehenders need different interventions based on different language profiles was the clinical motivation driving this doctoral research, which sought to increase knowledge on how to intervene effectively to improve reading comprehension. To achieve this aim, this group of children first needed to be identified and then their profiles understood to inform the development of intervention programmes. The first aim of this research programme was, therefore, to explore the use of a short testing protocol, drawing on earlier research (Kelso et al., 2007), to identify these often hidden poor readers, which could potentially then be used to improve identification of these children in classrooms. Following initial identification, the second aim was to complete detailed profiles of the oral and reading comprehension of individual children at the word, sentence, and text level, along with key cognitive processes, using a theoretically informed assessment battery to further understand the nature of the profile seen in this group. The development of this battery was guided by the Reading Systems Framework (RSF: Perfetti & Stafura, 2014). Based on the existing research, it was hypothesised that two subgroups of poor comprehenders would emerge: one with lower and higher-level language difficulties, and one with higher-level language difficulties alone, each having different intervention needs. A secondary aim of the detailed profiling was to identify key tasks that could be included in a smaller, more manageable assessment battery for use in clinical practice. Once individual needs had been identified and profiled on assessment, the third aim of this doctoral research could be addressed: the development and trialling of novel interventions targeted at identified areas of weakness. This research was intended to deepen our theoretical understanding of poor comprehenders, directly enhance clinical practice by increasing the evidence base on the characteristics of this group, and enable further directions for assessment and intervention to be identified.

In Part A, the first study in this programme of research was presented which aimed to first explore the use of a short testing protocol to identify poor comprehenders and, subsequently, obtain detailed assessment profiles in the areas of the oral and written language and key cognitive processes. Study 1 was conducted in three phases, with the first phase involving the administration of the short testing protocol, followed by a second phase of confirmation testing using assessments of reading and nonverbal IQ. The third phase involved the detailed profiling of selected oral language, reading and cognitive skills. The tasks utilised in the short protocol were selected based on the results of Kelso et al. (2007),

who found that a phonological awareness and listening comprehension task differentiated poor comprehenders from generally poor readers with 90% accuracy. The children in this study had presented with a diagnosis of Specific Language Impairment, rather than Developmental Language Disorder, as the study was carried out prior to the Delphi consensus study and subsequent adopting of this terminology (Bishop et al., 2017). Following phase 2 confirmation testing on tasks of nonword reading, reading comprehension and nonverbal IQ, the short testing protocol had over-identified poor comprehenders in the current programme of research by almost 50%.

Examination of the data highlighted an imbalance in the number of children identified on the phase 1 testing protocol within each year level, with nearly twice as many children in Australian School Year 6 identified as potential poor comprehenders compared with School Years 3, 4 and 5. The most likely reason for this was considered to be an artefact of the scoring for the listening comprehension task: CELF-4 Understanding Spoken Paragraphs. Despite this, the percentage of children then confirmed as poor comprehenders on phase 2 reading testing was still greater for School Year 6 (47%) compared with School Year 3 (33%), with the robustness of the phase 1 protocol being strongest for School Years 4 and 5 at 70% and 67% respectively. Due to the over-identification on the short testing protocol, the results provided strong support for elements of the reading process to be tested to confirm that a child was a poor comprehender. The results did suggest, however, that a two-phase process of testing could be effective in identifying children at possible risk of a reading disorder in School Years 4-6, once more sensitive listening comprehension tasks were identified. The finding that the percentage of School Year 3 children identified as poor comprehenders was lower, as a proportion of the total School Year 3 cohort, than for the other year levels was consistent with previous research which had identified that the percentage of poor comprehenders increases across the school years (e.g., Catts et al., 2005, 2012). This is considered here to be due to word reading skills becoming more automatic, whereby the influence of word reading skills on reading comprehension decreases while that of listening comprehension increases. As such, by middle primary, skills in these two areas become separated and more distinct than in earlier school years (e.g., Catts et al., 2005; Elwér et al. 2015; LARCC, 2015). Middle primary is also the time when the school curriculum traditionally shifts from ‘learning to read’ to ‘reading to learn’ (Chall, 1983) and text complexity and task demands increase (Catts, 2018; Snow, 2018).

Results from the phase 2 testing provided further support for previous research on the skill profile of poor comprehenders that had found (a) the phonological decoding skills of

poor comprehenders did not differ from typically developing readers (e.g., Catts et al., 2006; Elwer et al., 2015; Nation et al., 2004), and (b) nonverbal IQ did not differ between the groups and was in the mid-average range or above (Cain & Oakhill, 2006; Nation et al., 2004). This second finding is in contrast with other studies (Catts et al., 2006, 2012; Elwer et al., 2015; Nation et al., 2010) that have found the nonverbal IQ of poor comprehenders to be in the low-average range and significantly lower than that of control children. Following phase 2, the prevalence of poor comprehenders within the whole cohort of children who had participated in phase 1 testing was able to be considered. This revealed prevalence figures similar to those found previously, of 10.6%, 6.8% and 5%, when increasingly strict cut-off criteria drawn from the literature were applied. Finally, of the 24 children confirmed as poor comprehenders following phase 2 testing, only five had been judged as weak readers on an informal judgement made by their classroom teacher as part of phase 1. Only one of these children was identified as having difficulty solely with reading comprehension, and not with reading accuracy, and confirmed as a poor comprehender. This is consistent with Nation et al.'s (2004) study, in which none of the 23 poor comprehenders were identified as having any language or learning difficulties by their teacher despite many meeting the criteria for DLD on assessment. These findings highlight the need for teacher education to increase awareness of this subgroup of poor readers as their difficulties tend to be hidden, along with improved methods of identification of poor comprehenders in the classroom, potentially using a two-phase protocol such as described in Study 1. It may be possible to administer the two oral language tasks at a group level, followed by a reading assessment, thereby reducing the amount of time in testing as only children identified as being at risk would undergo further testing. Other practical methods of identification and assessment that could be used by teachers in the classroom are outlined in Chapter 5 (Kelso et al., 2021a) and Oakhill et al. (2015).

Phase 3 consisted of the detailed profiling using a theoretically informed battery of standardised tasks, the development of which was informed by Perfetti and Stafura's (2014) RSF. The RSF supported a comprehensive examination of the subcomponents of reading comprehension at the sublexical, lexical/word, and higher-level text comprehension system. It also allowed for consideration of knowledge sources and cognitive inputs including memory. While other studies have undertaken detailed testing across a range of language and cognitive skills in groups of poor comprehenders (Cain & Oakhill, 2006; Catts et al., 2006; Elwér et al., 2015; Nation et al., 2004, 2010), no study had previously used a theoretical framework such as the RSF to guide the development of an assessment battery. This battery

was developed to examine both the oral and written language input subcomponent skills of individual poor comprehenders at the word, sentence, and text levels, exploring these alongside the general cognitive skills of memory and nonverbal IQ. With a view to the translation of research into practice, standardised tasks were selected that were commercially available or accessible to clinicians.

Consistent with previous research outlined in Chapter 2, all 17 participants who completed the comprehensive assessment battery had at least average range phonological and word reading accuracy skills overall, and all had weak verbal working memory. Findings on several of the other memory tasks were contradictory to previous research, with only three children having difficulty on the verbatim memory CELF-4 Recalling Sentences, which other authors had included as a grammar task (cf. Adlof & Catts, 2015: Nation et al., 2004; Nation et al., 2007; Nation et al., 2010), and the majority having difficulty with nonword repetition (cf. Catts et al., 2006; Nation et al., 2004). It was postulated that the difficulty with the latter task may have been the result of the poor sound quality of the CD audio-recording and accommodating to the US accent of the presenter. In relation to skills at the Lexicon and Comprehension Processes levels of the RSF, it was hypothesised that two subtypes would emerge from phase 3 testing in approximately equal numbers. However, only two of the 17 participants were found to have difficulty with multiple lower-level oral and reading vocabulary and grammar comprehension tasks, along with higher-level language tasks. This was not in keeping with the prediction proposed based on the large body of research that has found poor comprehenders have weaknesses compared with controls in vocabulary (e.g., Cain & Oakhill, 2006; Colenbrander et al., 2016; Nation & Snowling, 1998), grammar (Cragg & Nation, 2006; Nation & Snowling, 2000; Tong et al., 2014) or both (e.g., Adlof & Catts, 2015; Catts et al., 2006, Elwer et al., 2015; Nation et al., 2004, 2010), although not necessarily obtaining scores in the below average range. A number of the studies conducted by Oakhill, Cain and colleagues, however, have not found weaknesses in these lower-level language skills (e.g., Cain et al., 2004; Yuill & Oakhill, 1991), and this was the case for the majority of participants in this study. That only two children had difficulty on multiple lower-level language tasks may reflect the heterogeneity of poor comprehenders, as this study reported on individual performance rather than group means. Alternatively, it may reflect a lack of sensitivity in standardised tasks, as recognised by the NRP (NICHD, 2000) in the case of vocabulary tasks. Further, poor comprehenders have generally been found to have greater difficulty with tasks of vocabulary depth than breadth, and morphology rather than syntax, as outlined in Chapter 2, so more robust tests in these areas may have been required. The

method used to select the participants in phase 1 may have been too broad-based to pick up children with these more pervasive language difficulties or, alternatively, children with such a profile may have been excluded as their scores did not meet the criteria to move into the next phase of testing. Finally, this was a non-population based study, and the participants were generally older than many of the other studies with poor comprehenders, both of which may have impacted on the findings.

The remaining 15 participants were found to have weaknesses primarily with higher-level inferencing skills. The majority of these children had difficulty on each of the following tasks: (a) CELF-4 Understanding Spoken Paragraphs, (b) TOPS-3 Making Inferences subtest, and (c) TOPS-3 Predicting subtest. Out of the full 17 phase 3 participants, seven also had difficulty on the CASL Inferences task, and six scored below average (Scaled Score<8) on the TNL Narration, again reinforcing that not all children perform poorly on the same tasks. This variability in individual performance across language tasks highlights the necessity of carrying out more detailed testing, beyond a single reading comprehension test, to identify where to target intervention to address individual needs. From the comprehensive phase 3 assessment battery, certain tasks at each of the levels of the RSF presented as being more indicative than others for use in a clinical setting and could be used to guide assessment to better inform intervention. These tasks are presented in Table 9.1. It should be noted that several of these tests now have updated versions. This information may also be used as a guide to develop and investigate more recent tests to identify the most appropriate tasks to tap into each level.

Part B of this thesis reported on two intervention studies, one evaluating a novel higher-level language strategy-based intervention (Study 2) and the other a novel vocabulary intervention (Study 3). These interventions were developed in response to the areas of weakness identified on the detailed language testing completed in phase 3 of Study 1, rather than on the broader basis that the children were identified as poor comprehenders. Study 2 involved the design and evaluation of an inference-making and comprehension monitoring intervention using an individual case series design. Following the intervention, all 11 participants achieved scores in the average range on the primary inference outcome measure, TOPS-3E Making Inferences, and this improvement was maintained 4-5 months post-intervention. The majority also improved on the percentage of inference questions correct on the CELF-4 Understanding Spoken Paragraphs at maintenance. Gains were evident on the other outcome measures, as described in Chapter 7, but were variable across participants,

Table 9.1

Modified oral and written assessment battery for clinical use

Component of Model	Verbal Task (oral)	Written Task (reading)
Sublexical a) Orthographic-Phonological Mapping	• CTOPP-2 Elision	• CTOPP-2 Rapid Letter Naming • WIAT-II Pseudoword Decoding (untimed) • TOWRE-2 Phonemic Decoding Efficiency (timed)
b) Word Identification		• WIAT-II Word Reading (untimed) • TOWRE-2 Sight Word Efficiency (timed)
Lexicon	• PPVT-4	• WRMT-III Word Comprehension
Comprehension Processes a) Sentence Level/ Parser	• CELF-4 Concepts and Following Directions	• CELF-4 Sentence Assembly
b) Text Representation	• CELF-4 Understanding Spoken Paragraphs	• YARC-P (Australian) • PROBE 2 fiction & non-fiction task
c) Situation Model	• TOPS-3 Inferences and Predicting subtests	
Verbal Memory	• Competing Language Processing Task (Gaulin & Campbell, 1994)	

Note. CTOPP-2 = Comprehensive Test of Phonological Processing-2; WIAT-II (Australian) = Wechsler Individual Achievement Test-II – Australian Standardised Edition; TOWRE-2 = Test of Word Reading Efficiency-2; PPVT-4 = The Peabody Picture Vocabulary Test-4; CELF-4 = Clinical Evaluation of Language Fundamentals-4 – Australian Standardised Edition; WRMT-III = Woodcock Reading Mastery Tests-III; YARC-P (Australian) = York Assessment of Reading Comprehension-Primary - Australian Edition; TOPS-3 = Test of Problem Solving-3.

reinforcing again that poor comprehenders are a heterogenous group. These findings indicate that a strategy-based intervention targeting oral inferencing-making and comprehension monitoring can be successful in improving skills on proximal measures. The results also indicate that the intervention was successful in improving the skills of those children with the weakest skills prior to intervention. There was little or no change, however, for those who had stronger initial scores on these tasks, nor on the TOPS-3E Problem Solving subtest on which all participants had stronger pre-intervention scores.

While the finding that the intervention had led to gains on proximal measures was important, of greater significance was whether these gains had transferred to standardised measures of reading comprehension. As outlined in Chapter 6, inference and strategy interventions have been found to be effective in improving reading comprehension on custom measures with both struggling and typically developing readers. There is less evidence of transfer to standardised reading comprehension measures, although the findings have been more positive for poor comprehenders. There is also limited support for instruction in comprehension monitoring as a single strategy intervention in improving reading comprehension in struggling readers (Filderman et al., 2021; Yuill & Oakhill, 1991). Prior to the intervention, nine of the 11 children in Study 2 had increased their overall comprehension scores from initial identification on the YARC, the norm-referenced reading comprehension task, and were now achieving standard scores (SS) in the average range. Despite this improvement, only two were able to answer more than 50% of the inference questions correctly. Post-intervention, the two children with below average scores prior to intervention had made significant gains, each improving their score >15 SS points into the average range, supporting the findings from the proximal measures and previous research that children with the weakest skills make the greatest gains. Seven other children had reading comprehension scores that trended upwards from pre-intervention to maintenance, a trend also evident for each of the nine children that had made gains in their ability to answer inference questions correctly. The greatest transfer to improvement in reading comprehension, however, was on the criterion-referenced measure, the PROBE-2. Prior to intervention, only one child was meeting the comprehension criterion of answering 70% of questions correct on the fiction task and none met this criterion on the nonfiction task. Post-intervention, five children were achieving the criterion on the fiction task and eight at maintenance testing. Improvement on the nonfiction task was more limited with only three children achieving criterion post-intervention and four at maintenance testing. This possibly reflects reader and text factors, such as a lack of background knowledge about the topic and level of interest, along with

difficulty making the different types of inferences required to understand nonfiction texts. Overall, transfer to improvement on standardised reading comprehension measures was less than on the proximal outcome measures, as is often reported in the research discussed in Chapter 6. This study, however, does provide further support for previous studies with poor comprehenders, that show training in inference-making and comprehension monitoring can lead to improvements in reading comprehension (McGee & Johnson, 2003; Yuill & Oakhill, 1991). The findings also suggest that analysis of a child's performance on the different types of comprehension questions in a test may be more beneficial for identifying poor comprehenders and where to target intervention, than overall test scores.

The second intervention study, Study 3 was a case study with one of the poor comprehenders identified with lower-level language difficulties on phase 3 testing in Study 1. This involved the design and evaluation of a pilot vocabulary intervention. Chapter 6 outlined the large body of research that has explored the effectiveness of vocabulary intervention on improving reading comprehension, predominantly involving cohorts of typically developing readers. These studies have either targeted vocabulary specifically or included vocabulary as part of a multi-component intervention. Clarke et al. (2010) included vocabulary as part of their oral language multi-component intervention with poor comprehenders, however, no study was identified that had solely targeted vocabulary with this subgroup of poor readers. Drawing on the literature that had reported methods of vocabulary instruction that had been effective in improving reading comprehension (NRP: NICHD, 2000; Nash & Snowling, 2006; Wright & Cervetti, 2017), an intervention was developed that focused on actively exploring the meaning of words to improve vocabulary depth utilising a semantic organisation approach. The results showed significant gains on the bespoke vocabulary measure for treated words following the intervention, consistent with previous research that has shown intervention can be effective in improving vocabulary on custom measures for children with reading difficulties (Clarke et al., 2010; Elleman et al., 2009; Wright & Cervetti, 2017). The intervention also resulted in transfer to significant improvement on untreated words, and the crossing of a clinical boundary into the average range (SS>85) on the standardised word comprehension measure. Positively, but unexpectedly given the findings of previous research, improvement was also seen on the standardised reading comprehension measure (YARC) post-intervention, with this gain becoming clinically significant at follow-up 6 months later as it represented a gain of $\geq$1SD from pre-intervention. While this study only involves a single case, it provides promising preliminary evidence that an intervention targeted at improving vocabulary depth can transfer to gains in reading

comprehension for a poor comprehender. The study provides direction for future research to determine if the findings can be replicated.

Theoretical Implications

Identification and Assessment

The finding of a group of poor readers, with intact phonological and word reading skills but weak reading comprehension following the first two phases of testing in Study 1, provides further support for the existence of the poor reader subgroup known as poor comprehenders. Prevalence rates calculated following phase 2 reading testing, using three sets of increasingly strict criteria taken from the literature, were also found to be consistent with previously reported prevalence rates. The high rate of over-identification of children as potential poor comprehenders on the two-task oral testing protocol used in phase 1, was of concern and contrary to the expected usefulness of this protocol based on the findings of Kelso et al. (2007), and the notion encapsulated by the SVR (Gough & Tunmer, 1096) and the connectionist model of word reading (Plaut et al., 1996) that the development of reading skills is 'parasitic' on oral language skills (Hulme & Snowling, 2014). The over-identification revealed (a) that the short oral language protocol was not effective in isolation and reading needed to be tested to confirm poor comprehender status, and (b) the need to identify more appropriate listening comprehension tasks, particularly for children in School Year 6.

The SVR has guided much of the research into the two key components of reading comprehension, word reading and listening comprehension, however, it does not specify the complex set of skills and factors that operate within each of these components (Catts, 2018, Kirby, & Savage, 2008, Nation, 2019). Perfetti & Stafura's (2014) RSF, in contrast, provided a more comprehensive framework that allowed for exploration of word reading skills at the sublexical and lexical level, alongside word and text level comprehension skills. The RSF was used in Study 1 to guide the development of a detailed assessment battery to explore the subcomponent skills of the group of children identified as poor comprehenders following phase 2 testing. In addition to tasks at the sublexical, lexical and text level, the framework allowed for inclusion of both oral and written input comprehension tasks in the battery (see Table 4.1), along with tests of memory and nonverbal IQ. Using the framework as a guide, standardised and predominantly norm-referenced tasks were able to be identified and mapped to each of the aforementioned areas outlined in the RSF. The framework also provided the flexibility to substitute tasks if more appropriate tasks were identified during the development of the battery. The detailed profiles of the individual poor comprehenders focused on the

reader element of the heuristic proposed by the RAND RRSG (Snow, 2002), with limited attention to the influence of text and task characteristics on reading comprehension. Further research is required into how the text and task elements can be explored within the framework provided by the RSF.

Profiles

The language profile of poor comprehenders that has emerged over nearly 40 years of investigation is that as a group they have intact phonological skills which underpin their at least average for age word reading skills, with weaknesses in oral language and verbal working memory (as outlined in Chapters 2 and 4). Oral language weaknesses have been identified with lower-level language skills (vocabulary, grammar, morphology) and/or higher-level language and cognitive skills (integration and inference making, comprehension monitoring, text-structure knowledge) resulting in the emergence of two broad profiles of poor comprehender. The results of the detailed profiling in Study 1 found, consistent with previous research, that the group of poor comprehenders did not have difficulty with phonological or word reading accuracy skills overall but did have weak verbal working memory. The profiling provided further support for the findings of Cain & Oakhill (2006) and Nation et al. (2004) that not all poor comprehenders have nonverbal IQ in the low-average range, and for the existence of the two profiles of poor comprehender. However, only two of the 17 participants presented with weaknesses on multiple lower and higher-level language tasks, which was contrary to what was predicted. The possible reasons for this are outlined above but, in particular, appear to reflect the heterogeneity amongst poor comprehenders in oral language skills, and the need to investigate skill profiles at an individual rather than a group level if effective interventions are to be developed.

With a view to heterogeneity on specific tasks, only the two participants who experienced difficulty across a number of the same lower and higher-level language tasks scored below average on RSF Lexicon level vocabulary breadth task, the PPVT-4. A further two participants also had difficulty on the WRMT-III Word Comprehension, a task of vocabulary depth; the type of vocabulary task on which poor comprehenders have been found to have greater difficulty. More participants had difficulty on the RSF sentence sublevel tasks. Task performance differed between individuals, however, and the only task that both participants with vocabulary weaknesses had difficulty on was CELF-4 Concepts and Following Directions. There was less heterogeneity in performance on the higher-level and more demanding Comprehension Processes tasks. This was expected as it was at this level of

the RSF that all participants had difficulty. Aside from the selection task (CELF-4 Understanding Spoken Paragraphs), however, not all participants performed poorly on the remaining oral language tasks, and it was only on the PROBE-2 nonfiction reading comprehension task that all participants failed to meet the pass criterion. This heterogeneity highlights the need for such detailed theoretically informed profiling. The tasks outlined here for possible inclusion in a smaller, more manageable assessment battery were presented in Table 9.1.

Intervention

The two interventions developed for this research provide promising preliminary evidence for the effectiveness of interventions targeted at individual areas of weakness in poor comprehenders. While a large body of research had found support for the effectiveness of vocabulary and inference interventions in both skilled and unskilled readers, there was little specifically focused on poor comprehenders. Much of the research, outlined in Chapter 6, had shown gains on proximal measures or customised reading comprehension measures but there had been less evidence that these gains transfer to improvements on standardised measures of reading comprehension. This is likely due to the complexity of reading comprehension and the multiple factors that can have an influence, as outlined in the heuristic provided by the RAND RRSG (Snow, 2002) and, in particular, the important role played by background knowledge (Catts, 2021; Pearson et al., 2020; Reid et al., 2021). Most research, including in this PhD programme, has explored reader characteristics with less focus on variability in background knowledge, awareness of different text types, purpose of reading and the sociocultural context in which reading takes place. This provides strong directions for areas of future research building on the work to date.

The higher-level language intervention resulted in gains on both oral inference-making and comprehension monitoring tasks for most participants following intervention. Transfer to improvement on reading comprehension measures was also evident, but to a lesser extent than seen on the proximal measures, except for those with the weakest reading comprehension initially, who therefore had the most skills to develop. This is consistent with previous research reported in Chapter 6. That participants with the weakest initial reading comprehension benefitted the most is encouraging and supports the premise that improving underlying oral language skills and teaching specific strategies to aid comprehension of texts can transfer to improvements in reading comprehension. The vocabulary intervention provides more promising preliminary outcomes as, not only did statistically significant

improvement occur on the bespoke vocabulary measure, improvement was also seen on the standardised reading comprehension measure. These results provide potential support for Clarke et al.'s (2010) finding that gains in reading comprehension may be mediated by improvements in vocabulary. While encouraging, however, these results should be viewed with caution until replicated as they only relate to a single case.

Clinical Implications

Identification of poor comprehenders

That only five of the 24 confirmed poor comprehenders were identified as weak readers by their classroom teacher on an informal judgement completed as part of Study 1 reinforced earlier findings that poor comprehenders are under-identified in middle primary (e.g., Nation et al., 2004). The aim of administering the short oral test protocol in phase 1 of Study 1 was to explore whether this would provide an effective method of identification, but it resulted in over-identification of potential poor comprehenders. The tasks used in the test protocol were moderately effective in identifying poor comprehenders in School Years 4 and 5; however, identifying more sensitive listening comprehension tasks is indicated, particularly for School Year 6. The equivalent task in the current version of the CELF (CELF-5) may be more sensitive as it has an additional question for each question type and updated norms. The results also provided support for the need to test reading to confirm that a child is a poor comprehender. Further, due to the high level of over-identification in School Year 3, and the likely ongoing influence of word reading on reading comprehension at this year level, the more appropriate time to conduct such a test protocol is likely to be in School Year 4 when skills in the two components become more distinct, and text and task demands increase.

Despite these issues, a modified short oral test protocol followed by assessment of reading may provide a method for improving identification of children at risk of reading difficulties more generally, and poor reading comprehension in particular. The two-phase approach potentially reduces the number of children requiring subsequent referral to a speech-language pathologist for more detailed assessment of oral language to identify individual weaknesses requiring targeted intervention. There is also the potential for the oral language tasks to be administered at a group level, and group administered reading assessments are also available. The results further suggest that analysis of performance on the different types of questions on a reading comprehension test may be more indicative for identifying poor comprehenders than an overall test score. A factor affecting the applicability

of the two-phase testing protocol in educational settings, however, is that classroom teachers do not have the required qualifications to administer the tasks used in this research, therefore investigation to find effective tasks that could be administered by teachers is recommended as a future direction. Possible practical methods for use in the classroom are outlined in Chapter 5 (Kelso et al., 2021a) and Oakhill et al. (2015).

Guidelines for Assessment and Intervention

In addition to exploring a method to improve identification of poor comprehenders, an assessment battery was developed, informed by the RSF, and administered as part of this programme of research. The findings have added to the knowledge base on the individual skill profiles of poor comprehenders, reinforcing that they are a heterogenous group and that, as proposed by Colenbrander et al. (2016), different children require different interventions targeted at their individual needs. With a view to the translation of this research into clinical practice, tasks selected for inclusion in the detailed battery were standardised and commercially available or accessible to clinicians. Key tasks emerged from this detailed testing that identified whether intervention needed to be focused on lower-level language skills initially, or higher-level language skills that were more proximal to reading comprehension. These tasks, presented in Table 9.1, form a smaller, more clinically manageable assessment battery. The advantages of using the theoretical framework offered by the RSF are that it (a) outlines the components that need to be assessed to identify the source(s) of reading comprehension difficulty in individuals and how they integrate with each other, and (b) provides flexibility so tasks can be substituted in the different components as newer assessment tasks are identified or become available.

The interventions developed and evaluated as part of this programme of research both provided promising preliminary evidence that targeting specific areas of weakness can result in transfer to improved reading comprehension on standardised measures, in addition to gains on the skills targeted in the intervention. In keeping with what would be predicted, this was, encouragingly, most evident for children with the weakest initial reading comprehension. While the vocabulary intervention case study reported significant gains on a standardised reading comprehension measure, it is not proposed that improving vocabulary alone is sufficient to sustain long-term improvements in reading comprehension; higher-level language skills also need to be targeted. Clarke et al. (2010) found that vocabulary mediated improvement in reading comprehension in their intervention study but, as shown in Hogan et al.'s (2011) visual representation of the SVR in Chapter 2, vocabulary is distal to reading

comprehension. Vocabulary, along with grammar, is used to construct the literal meaning of a text, or the textbase. These provide the foundation for the higher-level language subcomponent skills which, in turn, impact on the upper-level skill of listening comprehension that directly contributes to reading comprehension (Hogan et al., 20011; Kim, 2017). Therefore, for a child with lower-level language difficulties, higher-level language skills also need to be treated, either serially or in a multi-component intervention such as the one implemented by Clarke et al. (2010). Of note is that the intervention reported by Clarke et al (2010) involved more intervention hours (30) than the combined hours of the two interventions in this programme of research (15 hours). An advantage of Clarke et al.'s (2010) intervention is that it was carried out in small groups; however, there is potential for the interventions in this research to be carried out in groups following further investigation. The session plans for the higher-level language strategy-based intervention and a sample session plan and resources for the vocabulary intervention are available to be downloaded from *https://www.languageandliteracyinyoungpeople.com*

Limitations and Future Directions

This programme of research was subject to a number of limitations which have been acknowledged in the respective published studies. The children recruited for Study 1 were a non-population based sample drawn from two schools with a narrow range of socio-economic groups, and some School Year groups were under-represented relative to others. While this reduces the generalisability of the findings, the identified prevalence rates of poor comprehenders following phase 2 testing were consistent with previous research. A key limitation was that the phase 2 reading testing was not carried out on all 218 children that completed phase 1 testing to determine whether (a) some poor comprehenders were missed by the short oral test protocol, and (b) the protocol could be effective in identifying children with different types of reading difficulties. This testing was beyond the scope of this PhD programme but is recommended as an area of future research with a broader, more representative range of participants being tested on the two-phase testing protocol. Prior to this, however, further investigation is required to identify more sensitive listening comprehension tasks, as the task used in phase 1 in this research resulted in over-identification of poor comprehenders. Another issue with the phase 1 testing protocol is that it is not able to be administered by teachers due to qualification requirements by test publishers, hence other tasks or methods of identification of potential poor comprehenders in

the classroom need to be investigated, with a view to finding ones that could be administered by an educator to a small group or whole class.

The sensitivity of standardised measures to identify language weaknesses and measure change following intervention has been questioned in previous research, therefore may have restricted the findings in this programme of research. Standardised measures were specifically selected for use in the Study 1 phase 3 profiling and intervention studies with a view to making the findings from the research more clinically transferable. A smaller, more manageable assessment battery has been compiled from the most indicative tasks in the detailed battery, which could be trialled in the clinical setting to determine its useability and effectiveness in identifying strengths and weaknesses to select appropriate intervention targets. As several of the tests now have updated versions, the subtests in these current versions should be investigated for use in the smaller battery, along with new tests as they emerge. It may also be appropriate to investigate the development of more sensitive tasks and/or less time-consuming ones within the Lexicon and Comprehension Processes components of the RSF.

The intervention studies were exploratory, and more research is required to replicate the findings on a larger scale with more participants and across a wider range of age groups. A number of limitations identified in these studies need to be addressed in future research, a main one being the lag time between initial identification of the poor comprehenders and the commencement of the interventions. Aside from intervention occurring concurrently with identification, future research would benefit from the inclusion of repeated measures, a waitlist control design, and blinded pre-post assessment. It would also be beneficial to gather background information to investigate other factors that may have impacted on the development of reading comprehension skills and intervention outcomes such as developmental and medical history, previous intervention, and the participants' attitudes or feelings about the intervention. To increase transfer of gains on proximal measures to reading comprehension, longer periods of intervention could be explored and/or the inclusion of consolidation activities between sessions, ensuring that these are completed consistently. Finally, investigating whether the interventions could be implemented in small groups by teachers or trained education assistants, would make the interventions more educationally applicable in the school setting.

Several other future directions emerge from this research. First, consistent with previous research (Nation et al., 2004), the poor comprehenders in this research were poorly identified by their teachers. Therefore, there is an imperative for teacher education to improve

identification of this hidden subgroup of poor readers. Prevalence rates indicate that approximately 7% of middle-primary school children struggle with reading comprehension, and this rate increases into the high school years, particularly for children with a history of language difficulties. Hence, if they are not being identified, these children will not receive the support they need. Second, longitudinal studies have shown that children who go on to be poor comprehenders have oral language difficulties in the beginning school years prior to the commencement of formal reading instruction, although often at subclinical levels (e.g., Catts et al., 2006, 2012; Elwér et al., 2015; Nation et al., 2010; Petscher et al., 2018). Catts et al. (2006) also found that, of those children with severe enough difficulties to meet the criteria for DLD in the early school years, only 18% had been referred for speech or language intervention. Therefore, not only is there a need for better identification of poor comprehenders in the middle primary school years and beyond, but there is also a need for oral language measures to be included in pre-school screenings, alongside tasks currently commonly administered to screen for children at risk of word reading difficulties, to improve early identification of *all* at risk readers (Adlof & Hogan, 2019, Catts et al., 2015). Further, following further investigation for more appropriate tasks, the two-phase testing protocol implemented in this research could be investigated for use in identifying children in the early primary years before reading comprehension skills start to fail. Finally, until recently, research on poor comprehenders has largely been carried out by psychologists. However, as speech-language pathologists increasingly have become involved in the research in this field, along with the increased awareness and research on DLD, there has been a consideration of the overlap between DLD and poor comprehenders (Catts et al., 2005; Adlof & Hogan, 2018). Previously, children with DLD were considered to have difficulties with both phonological and non-phonological language skills and fit in the lower left ('garden variety' poor readers) quadrant of the SVR, despite previous research showing that not all children with DLD have phonological and word reading difficulties (e.g., Bishop & Adams, 2000; Bishop et al. 2009; Kelso et al., 2007). Further research is required to investigate this overlap and the implications for identification and intervention.

Conclusion

This programme of research explored an under-researched and often hidden subgroup of poor readers known as poor comprehenders. The first two phases of Study 1 investigated the use of a testing protocol to improve identification of poor comprehenders in the middle and upper primary school years when reading comprehension difficulties have been found to

increase as text and task demands increase. While the two-task oral testing protocol was found to over identify potential poor comprehenders following testing of reading, it was moderately successful in identifying children at risk in School Years 4 and 5, and the study provided direction for further research into making such a testing protocol more effective and applicable. The third phase of Study 1 involved the development of a comprehensive assessment protocol, theoretically informed by Perfetti and Stafura's (2014) RSF, and aimed at obtaining detailed profiles of individual poor comprehenders, once identified, across each of the components in the RSF. The findings highlighted the heterogeneity of poor comprehenders and the need to carry out this more detailed language testing to better inform and target intervention. The findings also identified a reduced, more manageable assessment battery for clinical use which includes the most indicative tasks within each of the components of the RSF. To make the assessment battery more clinically useful, standardised tasks were utilised that were readily available or accessible to speech-language pathologists. Finally, to support research translation to clinical practice, the interventions that have been developed are freely available to clinicians and educators from *https://www.languageandliteracyinyoungpeople.com*

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Thank you for your interest in Hogan et al's contributions.

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Elizabeth B. Kozleski, Professor
Learning Differences and the Future of Special Education Initiative
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