

2016

## Utilising voice recognition software to improve reading fluency of struggling adolescent readers

Peter Count  
*Edith Cowan University*

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**UTILISING VOICE RECOGNITION SOFTWARE TO IMPROVE  
READING FLUENCY OF STRUGGLING ADOLESCENT READERS**

By

Peter Count

B.A. (English); Grad. Dip. Ed; B. Ed.; M.Ed.(Man.)

A Thesis Submitted in Fulfilment of the  
Requirements for the Award of Doctor of Philosophy (Education)  
at the School of Education  
Edith Cowan University

2016

## **ABSTRACT**

Approximately 15-20% of secondary students in Australia experience reading difficulties. For many, the cognitive effort required to decode words or the lack of automaticity in the elements that contribute to fluent reading prevents effective reading comprehension. Because reading comprehension is of critical importance across the curriculum, students with difficulties in this area are at significant academic risk.

One effective method of improving reading fluency is 'repeated readings' (NICHD, 2000). The purpose of this study was to examine whether the use of repeated readings delivered via a home-based program employing voice recognition software (VRS) could improve the reading fluency and self-perception as readers of adolescent students experiencing reading difficulties. The intervention was designed to overcome the problems associated with delivering a repeated reading program within a secondary English classroom. These problems relate to the amount of time required to conduct such a program within the constraints of the existing curriculum, and the reluctance of students to participate in a program that would draw attention to their reading difficulties.

A treatment group participated in a home-based repeated reading program using VRS over a 20-week period and their results were compared to a comparison group who participated in a more traditional school-based repeated reading program. Reading fluency, comprehensions and reader self-perception were measured before and after the intervention. Data were analysed using descriptive statistics and case studies.

The intervention reported in this study resulted in improved reading rate, accuracy and comprehension for both the home-based treatment group and a school-based comparison group, with evidence of larger gains in the treatment group. The students' perceptions of themselves as readers, however, did not show significant gains.

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Date.....

## ACKNOWLEDGEMENTS

Carrying out the requisite work and then writing this thesis was, undoubtedly, the most arduous task I have undertaken. I felt very alone on the long nights of writing, staring at the computer whilst struggling to articulate what I thought were some impressive findings in a coherent way. In reality, though, I was not alone thanks to a group of dedicated people who have supported me over the many years.

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The support I received at my school was excellent and I would like to thank my teaching colleague, who worked so closely with the comparison group, and gave up many hours of her time, not just to help me with this research, but out of genuine concern for her students. The staff at my school, including the Principal, whose cooperation contributed to the smooth data collection during that phase of the study, also deserve thanks.

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## **Glossary**

### ***Alphabetic Principle***

This term refers to an awareness of how the sounds within words (phonemes) are represented by letters of the alphabet (graphemes). A grapheme can be a single letter, such as /s/ in the word *sat*; two letters that represent a single phoneme, such as /th/ in *the*; three letters, such as /tch/ in *scratch*, or four letters, such as in /ough/ on *although*.

### ***Automaticity***

As words are encountered in reading, the reader initiates a decoding process to correctly identify the word. With repeated exposure to the word, the sight of the word stimulates retrieval as well as decoding. When the process of retrieval is faster than the process of decoding, the reader is achieving automaticity (Rawson, 2010).

### ***Discourse***

Discourse refers to an extended communication in writing or verbally (often interactive) dealing with some particular topic.

### ***Fluency***

Fluency refers to smooth and effortless reading of connected text and has three components: automatic and accurate word recognition, an appropriate rate, and prosody or intonation. Fluency will depend on the difficulty of the text, with normally fluent readers having difficulty with text that includes terminology outside their area of knowledge or expertise.

### ***Learning Difficulties***

This term describes a group of conditions that interfere with the learning of a person. It is an umbrella term covering disorders related to listening, speaking, reading, reasoning and mathematical calculation. Individuals affected have average or above average intelligence. Since these disorders are not explained by an intellectual disability or other obvious impairment, they are difficult to diagnose (Harwell, 2001).

### ***Literacy***

Reading Literacy is an individual's capacity to understand, use and reflect on written texts, in order to achieve one's goals, to develop one's knowledge and potential and to participate in society (Organization for Economic Co-operation and Development, 2006, p. 46).

### ***Prosody***

Prosody refers to reading with appropriate expression or intonation coupled with phrasing that allows for the maintenance of meaning. Prosody captures the rise and falls of pitch, rhythm, and stress: the pausing, lengthening, and elision surrounding certain words and phrases that is found within linguistic communication (Kuhn, Schwanenflugel, & Meisinger, 2010).

### ***Text to speech***

Also known as *speech synthesis*, a text to speech (TTS) system converts written text into artificially generated human speech. It is commonly used to allow people with vision impairments to access written text.

### ***Treatment group/comparison group***

As this study was not strictly experimental with random distribution of participants, the term *treatment group* has been used instead of the term *experimental group* and *comparison group* has been used instead of *control group*.

### ***Voice recognition software***

Voice recognition software allows the translation of spoken words into written text. It is sometimes referred to as *speech to text* software.

## Chapter One: Introduction

Few skills are considered as important in our society as the ability to read. Kofi Annan, Secretary General to the United Nations from 1997 to 2007, and recipient of the 2001 Nobel Peace Prize stated: “Literacy is a bridge from misery to hope. It is a tool for daily life in modern society. It is a bulwark against poverty, and a building block of development, an essential complement to investments in roads, dams, clinics and factories. Literacy is a platform for democratization, and a vehicle for the promotion of cultural and national identity” (United Nations, 1997). The consequences for individuals lacking this vital skill can be dire and severely affect their ability to participate fully in society.

Despite decades of research into reading and educational reform, a significant proportion of students are still entering secondary schools without the reading skills commensurate with the demands of the curriculum. Most secondary English teachers are not trained to remediate reading difficulties (Milton, Rohl, & House, 2007; Rohl & Greaves, 2005) and yet, even in mainstream classes, they are often confronted by students who cannot read adequately (Department of Education Science and Training, 2005; Thomson, De Bortoli, & Buckley, 2012). This was the context that confronted the Researcher and that initiated the study. This chapter, as outlined in Figure 1, provides the purpose, background and context to the research, which lead to the research questions, and a discussion of why the study of reading fluency and how to improve it is of such significance. Finally, this chapter explains the delimitations of the study and presents the overall organisation of the thesis.

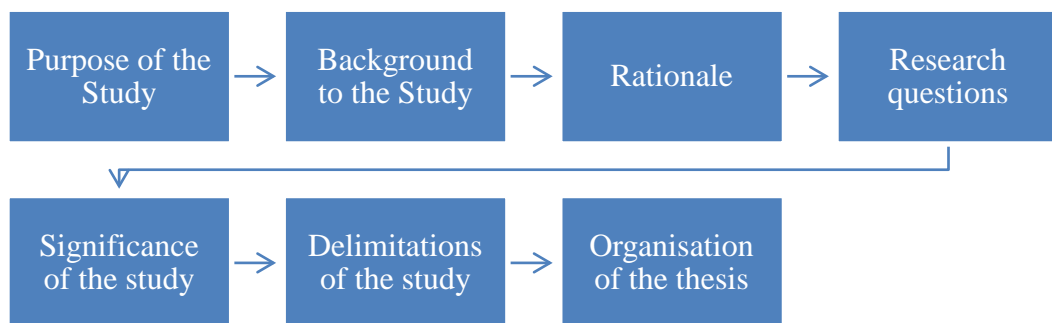


Figure 1. Organisation of the introductory chapter

## **The Purpose of the Study**

The broad purpose of this study was to examine the use of voice recognition software (VRS), sometimes referred to as speech recognition software, to implement a home-based program of repeated readings, as a way of improving the reading fluency and self-perception as readers of Year 8 and 9 students experiencing reading difficulties. The study examined whether VRS can improve the different elements of reading fluency - rate, accuracy and prosody - over a twenty-week period. It also investigated whether reading comprehension and self-perception as readers among secondary students with poor reading fluency improved over that period.

The intervention was designed to overcome the difficulties associated with delivering a repeated reading program within a secondary English classroom. These difficulties relate to the time required to conduct such a program within the constraints of the existing curriculum, and the reluctance of students to participate in the public forum of a secondary classroom.

## **Background to the Study**

In Australia there is evidence that between 10 to 20% of students experience reading difficulties (DEST, 2005), although some research points to a figure of between 20 to 30% (Callery, 2005, p. 1); and that this has been a longstanding problem. Differences in definitions and methodologies make it difficult to arrive at a consensus on the scale of reading difficulties experienced by Australian adolescents but, by all measures, the number of people affected is significant. This translates at best into lost opportunities as people fail to reach their full potential. At worst, it can result in failure to complete secondary school, unemployment, poverty, involvement in crime and/or mental health issues, and even suicide (Rice, Care & Griffin, 2012). The effects of long-term reading difficulties will be explored more fully in Chapter Two, but it is clear that they represent significant challenges for both the individuals concerned and the broader community. The prevalence of reading difficulties in Australia is explored further in the following section.

A decade ago, the National Inquiry into the Teaching of Literacy estimated that low achievement in reading among 15 year olds ranged from 12% in the ACT to 28% in the Northern Territory, and up to 35% among indigenous students. At that time, approximately 20% of Australians aged between 15 and 74 had very poor

literacy skills suggesting that difficulties experienced during schooling persist over time (DEST, 2005, p. 6). More recent research reveals that little has changed.

In the 2012 Programme for International Student Assessment (PISA)<sup>1</sup> results for reading literacy among 15 year-olds (the latest data available at the time of writing), Australia was ranked 14<sup>th</sup> among OECD countries for reading literacy (Thomson et al., 2012). The Australian Council for Educational Research (ACER) identify Level 3 as the minimum level of reading proficiency on the PISA scale in Australia, although attainment of Level 2 (see Table 1) is considered the minimum acceptable level in the OECD (Thomson, De Bortoli, & Buckley, 2013). In 2012, 13% of Australian students achieved below Level 3. When gender was taken into account, 9% of girls and 17% of boys achieved below Level 3. Although this result was unchanged from 2006, it represented a small increase in the percentage of students achieving below the minimum level from 12% in 2003.

Table 1  
*OECD reading proficiency levels*

	<b>Students at this level can ...</b>
Level 6	make multiple inferences, comparisons and contrasts, demonstrate a full and detailed understanding of one or more texts; integrate information from more than one text; deal with unfamiliar ideas in the presence of prominent competing information.
Level 5	locate and organise several pieces of deeply embedded information, inferring which information in the text is relevant; critically evaluate or hypothesise, drawing on specialised knowledge.
Level 4	locate and organise several pieces of embedded information, interpret the meaning of nuances of language in a section of text, demonstrate an accurate understanding of long or complex texts whose content or form may be unfamiliar.
Level 3	locate, and in some cases recognise the relationship between, several pieces of information; integrate several parts of a text in order to identify a main idea; locate required information that is not prominent or where there is much competing information; demonstrate a fine understanding of the text in relation to familiar, everyday knowledge.
Level 2	locate one or more pieces of information; recognise the main idea in a text; understand relationships, or construe meaning within a limited part of the text when the information is not prominent and the reader must make low level inferences.
Level 1a	locate one or more independent pieces of explicitly stated information; recognise the main theme or author's purpose in a text about a familiar topic; make simple connections.
Level 1b	locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text.

(Thomson, De Bortoli, Nicholas, Hillman, & Buckley, 2009, p. 7)

<sup>1</sup> PISA is a worldwide study by the OECD of 15-year-old school pupils' scholastic performance on mathematics, science, and reading. It was first performed in 2000 and has been repeated every three years with a view to improving education policies and outcomes. In 2012, nearly 510,000 students from 65 countries participated in the testing.

There is clear evidence that reading difficulties persist into adulthood. In 2011-12, The Australian Bureau of Statistics (ABS) examined adult literacy rates from a sample of 15-74 year-olds as part of a broader study conducted within selected OECD countries. The results indicated that on a five-point scale (1 being the lowest, 5 being the highest), 44.2% of Australians were at level 1 or 2 for literacy. Level 3 is regarded by the survey developers as the minimum required for individuals to meet the complex demands of everyday life and work in the emerging knowledge-based economy (ABS, 2014).

The ABS figures in the previous paragraph, and those from the 2005 DEST report, highlight the difficulty of determining an accurate percentage of the population experiencing reading difficulties. The organisations conducting these surveys use different definitions of literacy difficulties and different methodologies for determining their figures. It can be concluded from these reports, however, that a significant proportion of Australians do not meet expected standards of literacy.

In the 2014 National Assessment Plan–Literacy and Numeracy (NAPLAN)<sup>2</sup> reading results for Year 9 students across Australia, an average of 6.1% of students were assessed at band 5 or below. Band 6 is considered the minimum standard for Year 9. These results varied from 4.3% of Year 9 students below Band 6 in the Australian Capital Territory to 29% in the Northern Territory (ACARA, 2014, p. 194). Table 2 summarises the performance of Year 9 students in each state between 2008 and 2014. The results show that between 2008 and 2014, approximately seven to eight per cent of students across most of Australia failed to meet the minimum standards of reading in Year 9, with figures consistently over 30% in the Northern Territory.

---

<sup>2</sup> The National Assessment Program – Literacy and Numeracy (NAPLAN) is an annual assessment for students in Years 3, 5, 7 and 9. It has been employed in all schools in Australia since 2008 and are administered by the Australian Curriculum, Assessment and Reporting Authority [ACARA]. NAPLAN tests broadly reflect aspects of literacy and numeracy common to curricula in all States and Territories and the test formats and questions are chosen so that they are familiar to teachers and students across Australia. The tests are designed to be carried out on the same days all across Australia in any given year.



Table 2  
*Percentage of students who met or exceeded minimum reading levels in Year 9 NAPLAN reading tests 2008-14*

	NSW %	VIC %	QLD %	WA %	SA %	TAS %	ACT %	NT %	AUS %
2008	94.4	94.7	90.5	91.8	91.7	93.0	96.6	69.9	92.9
2009	93.6	94.3	90.0	89.9	92.1	91.2	94.1	69.1	92.2
2010	91.2	93.3	89.0	89.5	89.9	90.1	93.9	68.2	90.7
2011	92.9	94.1	91.6	91.1	91.5	90.8	94.6	69.4	92.4
2012	91.8	93.0	90.5	90.6	91.1	89.8	94.5	65.1	91.3
2013	94.1	94.5	92.5	93.0	92.3	92.0	96.0	69.5	93.4
2014	92.6	93.3	91.2	92.9	90.3	90.5	93.9	68.8	92.1

The NAPLAN reading assessment is, however, a narrow test that measures reading comprehension of short passages through the use of multiple-choice questions. In addition, the participation rate for NAPLAN averages around 90% of eligible Year 9 students. It is speculated that many of those who do not participate are unlikely to have achieved the minimum result (Donnelly, 2010). It is therefore likely that the reading ability of adolescents is worse than these results would indicate and more likely reflects the results published in the OECD PISA results reported earlier.

### **Rationale**

There is a large, though generally unquantified, number of students leaving primary school with insufficient mastery of literacy skills to manage the reading tasks required in secondary school (ACARA, 2013; Buckingham, Wheldall, & Beaman-Wheldall, 2013b). Whilst it is apparent that many are able to decode most words, they lack the automaticity and fluency required to support comprehension (Archer, Gleason, & Vachon, 2003; Whithair, 2008, 2011). Poor reading comprehension will almost certainly have a deleterious effect on academic performance and many

students fail to achieve success at school for this reason (Alvermann, 2002; Lai, Wilson, McNaughton, & Hsiao, 2014). This study explored a practical method of improving students' reading fluency as a necessary step towards facilitating their greater participation in the secondary curriculum.

### **The importance of fluency in skilled reading**

Fluency, the ability to read a text quickly, accurately and with appropriate pitch, stress and intonation (Zutell & Rasinski, 1991) has been described as the most neglected reading skill (Dudley & Mather, 2005). Fluency consists of three parts. The first is accuracy: without reading the words correctly, the reader will not understand the meaning conveyed by the author. The second is rate: if reading is slow and laborious then the meaning of the text will be lost. Finally, prosody is important because without it, words can be chunked inappropriately and meaning is compromised (Miller & Schwanenflugel, 2008).

Fluency will depend on the difficulty of the text, with normally fluent readers having difficulty with text that includes terminology outside their area of knowledge or expertise (Barth, Catts, & Anthony, 2009). It is one of the defining characteristics of good readers, and a lack of fluency is a common characteristic of poor readers (Kuhn, Schwanenflugel, & Meisinger, 2010). Students experiencing fluency problems at the secondary school level are usually able to decode words in continuous text but the effort to do so consumes most of their available attention, leaving little or none for comprehension of that text (Archer et al., 2003).

### ***Effect of repeated reading on the development of fluency***

Samuels (1997) describes repeated reading as a common strategy used to improve fluency. It involves the reading of short passages at the reader's independent level four or five times or until the required levels of rate and accuracy are achieved. This also gradually builds the reader's prosody, resulting in expressive and meaningful oral reading. Over time, passages of increasing complexity are used which can also contribute to vocabulary development and greater familiarity with more complex language structures (Therrien & Kubina, 2006).

A significant body of research has demonstrated that repeated readings are effective in improving rate, accuracy and prosody among students experiencing

reading fluency problems (Samuels, 1988; Valleley & Shriver, 2003). The National Reading Panel report found that interventions such as repeated reading had a moderate effect on improving reading fluency, with their meta-analysis revealing an effect size of 0.44 (National Institute of Child Health and Human Development, 2000).

### ***Constraints of the secondary classroom on a repeated reading program***

In many secondary English classes, there is not the time for the practice and subsequent testing required for a repeated reading intervention. To put such a program in place, students must be tested for their initial reading ability, readings need to be modelled, and a more competent reader must listen to the student read and provide feedback. These processes cannot usually be accommodated in an English class where time is already limited to teach an extensive syllabus (Whithear, 2011).

In addition, there are significant student motivation and classroom management issues to consider. Secondary students with poor reading skills have spent years trying to conceal their difficulties from peers and teachers, and are generally very reluctant to participate in a class-based repeated reading program (McGeown, Norgate, Warhurst, 2012; Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). This fact alone makes repeated readings difficult to implement in a mainstream secondary classroom.

Numerous methods have been employed to accommodate repeated reading programs in classrooms. These include peer-reading, where a target student is paired with a more proficient peer who can model the reading of the passage and provide feedback (Mastropieri, Leinart, & Scruggs, 1999). Other repeated reading strategies include choral reading, where a group of students read a passage in unison (Welsch, 2006) and Readers' Theatre, whereby students rehearse a passage, individually or in a group, until it can be read fluently (Worthy & Prater, 2002). Peer reading is time intensive because the peer tutors must be taught specific skills and attitudes in order to provide the proper support to struggling readers. In addition, the time required for reading practice is significant. With choral reading, it is relatively easy for struggling readers to avoid reading or to feign participation. The employment of Readers' Theatre, a whole-class method of reading practice, can overcome the stigma felt by an individual; however, it is generally too time-intensive for mainstream secondary

classes. This is particularly the case when only two or three students may be experiencing fluency problems.

### ***The use of Voice Recognition Software to remediate reading problems***

The use of VRS to support students with fluency problems has a number of advantages. The VRS is able to recognise spoken words and convert them into print. It can automate much of the process of repeated reading, and so reduce the time and effort a teacher or teaching assistant would have to provide (Günizi, 2006). Voice recognition software can also be employed from home, while the program can remain under the guidance of the class teacher. This eliminates the public nature of an in-class program, and the embarrassment that would accompany it for so many students. Software facilitates modelling of the correct pronunciation of a short written passage and recording of students' reading attempts, both verbally and by transposing the verbal reading to written text. Most importantly, it provides instant feedback to students about the accuracy of their reading. Through the use of email, the teacher can provide the student with each passage and collect the completed oral reading recording.

Voice recognition software does require, however, a degree of training. This involves the user reading a number of passages until the software familiarises itself with the user's voice and pronunciation. Over time and successive versions of the software, this training has become more efficient and, in addition, the software has become more sensitive to the voices of children, a significant impediment in early versions of VRS (Frankenberger, 2016). The software also requires adequate hardware to operate it. Dragon Naturally Speaking® Version 10, the software used in this research, requires as a minimum an Intel Pentium4 1 Ghz CPU, 512 MB of RAM and at least 1 GB of free hard disk space.

In summary, VRS and email provide the means to assist in the implementation of a repeated reading program to support reading fluency development. Whilst some training and teacher involvement is required, technology can overcome, or at least minimise, many of the obstacles to implementing a repeated reading program for secondary students.

With studies showing approximately 10%-20% of adolescents experience reading difficulties (Callery, 2005; DEST, 2005), it is clear that significant numbers of students are entering secondary school without having secured these critical skills. Very few secondary teachers, even in the English learning area, have training or experience in remediating reading difficulties (Fritz, Cooner, & Stevenson, 2009). As a consequence, thousands of students are not able to successfully access the secondary curriculum, and are thus at risk of not achieving their academic potential, and experiencing a range of secondary effects of academic failure. These students, whether or not they complete secondary schooling, have fewer post-school options and, as a consequence, are more likely to experience unemployment and poverty and their associated negative effects (Daniel et al., 2006; Peterson, Caverly, Nicholson, O'Neal, & Cusenbary, 2000).

### **Research Questions**

The overall purpose for this research was to determine whether VRS could be used to deliver a home-based repeated reading program to improve the reading fluency of struggling adolescent readers compared to a more traditional classroom-based repeated reading program. Whilst there is a heavy emphasis on determining whether reading fluency, and ultimately, reading comprehension could be improved, it was also considered important to establish whether self-perception of poor readers would improve if they made improvements in their reading ability. Perceiving themselves as better readers could have an ongoing positive impact on students' willingness to read the significant amount of text required in secondary school, and therefore potentially on overall academic progress. Within this context, there were three specific research questions:

1. What impact does a home-based repeated reading program using VRS have on the *reading fluency* of adolescents with reading difficulties, relative to a traditional repeated reading program?
2. What impact does a home-based repeated reading program using VRS have on the *reading comprehension* of adolescents with reading difficulties, relative to a traditional repeated reading program?
3. What impact does a home-based repeated reading program using VRS have on the *self-perception as readers* of adolescents with reading difficulties, relative to a traditional repeated reading program?

## Significance of the Study

The curriculum at the secondary level assumes that students have acquired functional reading ability<sup>3</sup> yet, as highlighted earlier, between 10%-20% of students fall short of this level. Poor reading fluency is a major cause of reading difficulties in secondary schools resulting in poor reading comprehension and poor academic achievement (Whithear, 2008). The need to address poor fluency and improve comprehension is of paramount importance in secondary school due to the increased volume and sophistication of the reading demands across the curriculum. If these difficulties are not addressed, the likelihood of academic failure and non-completion of school increases, as does the range of short and long-term negative outcomes that so often ensue (Dudley & Mather, 2005; Guerin & Murphy, 2015).

The persistent reading difficulties of secondary students who have failed to keep pace with their peers may result in negative attitudes to reading, and indeed to school overall (Kelly, 2013; Mastropieri, Scruggs, & Graetz, 2003). A great deal of time and effort, and significant resources, are dedicated to controlling the disruptive behaviour that often accompanies reading difficulties in secondary schools. In contrast, relatively little effort is expended on diagnosing reading problems and formulating remedial programs (Paterson & Elliott, 2006; Whithear, 2008).

Secondary English teachers are, as a rule, not trained to recognise and remediate reading difficulties in their students (Rennie, 2016; Rohl & Greaves, 2005; Snow, 2002; Strutt & Konza, 2014). The outcome of attempting to teach these students is a high degree of frustration on the part of both teacher and student, and disruption to the teaching-learning process within the classroom. The intervention described in this study has the potential to provide teachers with a practical strategy to address reading difficulties among their students.

This study investigates the use of technology to improve reading fluency in a time efficient manner and at low cost by overcoming some of the constraints that characterise teaching in secondary classrooms. Voice recognition software has been used for decades with blind and visually impaired students with some success, and

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<sup>3</sup> The School Curriculum and Standards Authority (SCSA) of Western Australia provide details of expected skills and knowledge for each year group in its P-10 English Curriculum.

more recently with adults with clear articulation. It is only within the last few years that accurate transcription of words spoken at an average rate by adolescents has been possible (Shadiey, Wu-Yuin, Chen, & Yueh-Min, 2014). The significance of this is that the technology can now be incorporated into a repeated reading program for secondary students to help overcome the time constraints such a program would have typically entailed.

Previously, VRS has been used to help students with learning difficulties to compose written work, and students with physical disabilities to both write and control basic computer functions (Garrett et al., 2011). Voice recognition technology has not been implemented for a repeated reading program with mainstream secondary students before. Now it has the potential to alleviate the reading difficulties, and therefore the potential negative outcomes, experienced by so many students. This technology also has the potential to provide teachers with a technique that is easy to implement and requires minimal training. Apart from the efficient use of time this technique offers, the financial cost of implementation with individual students is minimal.

Whilst the participants in this study were secondary students, the techniques and procedures could easily be applied to students in primary school. By introducing the intervention as soon as difficulties are detected, its potential impact could be amplified. Students will have experienced less frustration and would potentially be more receptive to the intervention. Primary school teachers have much greater contact with their students compared to secondary teachers so would be more likely to provide additional support and encouragement to students. Implementation during the primary years of schooling would help prepare students more effectively for secondary school (Park, Chaparro, Preciado, & Cummings, 2015).

### **Delimitations of the Study**

This research placed strong emphasis on the *fluency* aspect of reading due to its important contribution to reading comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001). Although only one of the components of skilled reading, fluency is required for the rapid and meaningful reading of text material (NICHHD, 2000). A certain rate of reading is required for comprehension (Armbruster, Lehr, & Osborn, 2001), and to manage the volume of reading required at the secondary level. It was difficulties

with fluency that, in the Researcher's experience, represented a significant barrier to reading comprehension at the secondary school level. Thus, fluency was the focus of this research.

Students were chosen from Years 8 and 9 on the principle that intervention should occur as early as possible, and these year levels were, at the time of data collection, the first two years of secondary schooling in the state in which the research was located. Thus, older secondary students were not invited to participate in this research.

Only students who had a computer in their home with the capacity required for installation of the VRS could be involved in the home-based intervention. Students without this capability could be involved in the school-based comparison program.

The number of participants was purposefully capped at twenty to ensure that data collection and analysis was manageable within the response time required for feedback to students. The number of potential participants was therefore limited.

The research was conducted with students from a single secondary school, which was the only realistic possibility if the researcher were to be responsible for all data collection. It represented convenience sampling, as the school was also the researcher's workplace, but it did facilitate communication with students and parents, as the researcher was known to them. The location of the research also constituted a limitation, the implications of which are discussed in the final chapter.

Data were collected within one school year to ensure continuity, and to minimise the effects of the long vacation break and student movement out of the school. As already stated, students with reading difficulties often leave secondary school before its completion, and there was a relatively high rate of transience at the school concerned. Thus, it was recognised in the planning stages that only the short-term effects of the 20-week intervention could be determined for most participants. Further data collection did occur with students who were still at the school one year later to assess the intervention's longer-term outcomes with these participants.



## **Organisation of the Thesis**

This chapter has outlined the purpose, background and context to the study, and provided the rationale for an investigation of a repeated reading program to improve the reading fluency of struggling secondary students. The research questions were then presented, followed by the significance of the study, and its delimitations.

Chapter Two begins with a description of the reading process as it is currently understood and looks specifically at the role of reading fluency in that process. It looks at the effects of reading difficulties and the impact on students in school and beyond. The impact of motivation, self-efficacy, gender, locus of control and parental involvement on reading are explored. It then revisits reading fluency, its relationship to comprehension, and how it can be improved through repeated readings. Finally, the chapter examines the role that technology has played in remediating difficulties in reading, with specific reference to the use of VRS.

The third chapter of the thesis details the methodology, describing the methodological approach, research site, selection of participants, data collection instruments and procedures employed in the intervention. A description of data analysis procedures concludes the chapter.

Chapter Four presents and discusses the results obtained from the 20-week intervention, and for some students, the outcome after a further 12 months. A general overview of the results along with key findings obtained by the treatment and comparison groups is presented. A number of case studies follow, and explore not only individual student results, but also how the experience of the intervention affected them personally. The chapter then discusses the different outcomes of the treatment and comparison groups and offers possible explanations as to why these differences exist.

The final chapter of the thesis draws conclusions from the results and discussion. It acknowledges the limitations of the study and how they may be ameliorated in future studies. It concludes with a series of recommendations for the classroom application of procedures used in this study, and suggestions for future research.

## Chapter Two: Review of the Literature

### Overview

In Chapter One, the background to this study was presented, with evidence that reading is a problem for 10-20% of students in secondary schools. Poor reading fluency is seen to be central to the reading difficulties of many of these students (Rasinski, Rikli, & Johnston, 2009; Sample, 2005).

This chapter initially presents three models of the reading process in order to provide a context for the study of fluency before examining the impact of adolescent reading problems. It explores the role that motivation and self-efficacy play in students' experience of reading difficulties, as the impact of failing to master this essential skill pervades the broader life of the secondary student. The particular component of *fluency* is then examined in more depth as many secondary students with reading problems have some level of word recognition and basic control over letter-sound relationships to decode words they do not recognise, but have not acquired the speed of recognition—the automaticity—required for comprehension.

The chapter also reviews research relating to efforts to improve reading fluency using technology, with an emphasis on VRS. Figure 2 presents an overview of the literature review in diagrammatic form.

Note: The focus of the study is on reading in secondary schools. Many of the studies in this review use the term *literacy*. Literacy encompasses more than just reading ability, but when this term is used in the review of the literature, there is a specific emphasis on the reading component.

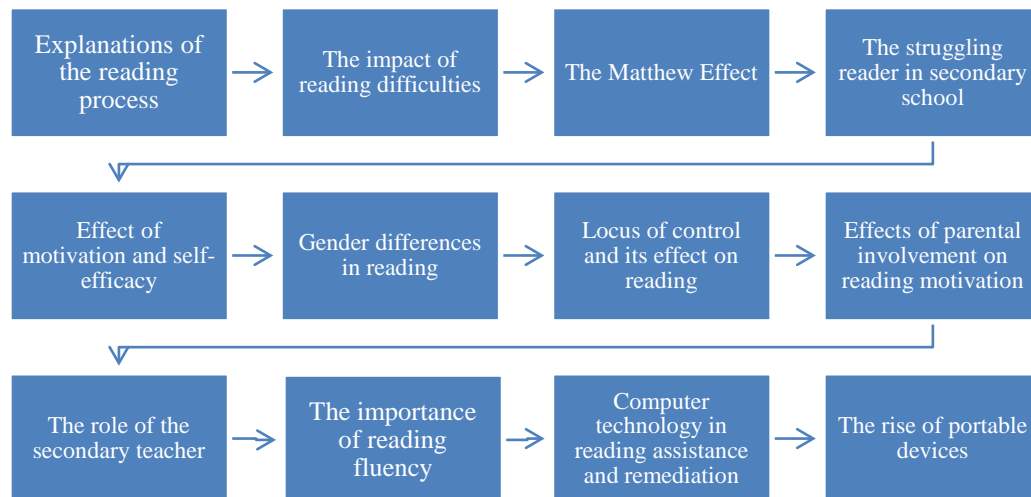


Figure 2. Organisation of the literature review

## Explanations of the Reading Process

For more than four decades there has been significant debate around reading development, and a number of different models have emerged (Chall, 1983; Clay, 1998; Ehri, 1995; Gough & Tunmer, 1986; Smith, 1992). All acknowledge that multiple components contribute to this highly complex cognitive process. For the purposes of this thesis, several models that have attempted to explain the different components are briefly discussed in order to explain the role of fluency in meaningful reading.

The *psycholinguistic model of reading* under-pinned the *whole language* explanation of the reading process, which gained great traction with teachers and teacher educators in the 1980s and 1990s (Cohen-Cole, 2015). It incorporates the *three-cueing system of reading* (Cambourne, 1979). Whilst the precise origin of the three-cueing system is unclear (Adams, 1998), it consists of three intersecting circles (see Figure 3). The first circle represents the reader's *semantic* knowledge, which draws on background knowledge and vocabulary, as well as contextual clues in the text. It suggests that students with a strong vocabulary and oral language base will be advantaged in learning to read over students with a more limited language background. The second circle represents the reader's *syntactic* knowledge, which draws upon the knowledge of language patterns and how word order affects meaning.

The final circle represents grapho-phonetic (letter-sound) knowledge, referred to as the *alphabetic principle* (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2002). The arrows in Figure 3 represent the influence of the top-down concepts of semantic and syntactic knowledge meeting the bottom-up knowledge of grapho-phonetic knowledge.

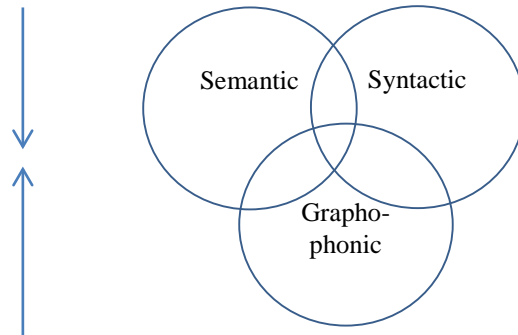


Figure 3. Schematic diagram of the psycholinguistic reading model (Pearson, 1976)

The theoretical basis for the model stems from research conducted by Kenneth Goodman in 1965. He found that reading accuracy improved by 60%-80% when students read words in the context of a story rather than from a list of words. He posited that contextual clues played a much larger role in making meaning from text than alphabetic knowledge and word decoding, and concluded that alphabetic knowledge played only a minor role in the reading process, and therefore did not need explicit teaching (Goodman, 1965). This interpretation had great attraction for teachers, who were encouraged to replace early readers containing brief sentences of stilted language with interesting and exciting stories containing rich and descriptive language as the basis of reading instruction (Pearson, 1989). What this model does not incorporate, however, is the understanding that *initial reading* does not develop in most students simply from exposure to print. Systematic and explicit instruction of phonics is necessary for most readers to decode unfamiliar words, which is a requirement for independent reading. In the psycholinguistic model, all three circles are the same size, implying equal importance. In the whole language approach to reading, however, semantic and syntactic knowledge received much greater emphasis. This model received extensive criticism because it underplayed the role of decoding in meaningful reading (Hempenstall, 2003; Truch, 1991).

A development of the three-cueing system was the *Searchlight Model of Reading* (Clay & Cazden, 1990), which explains the reading process as involving four sources of knowledge, or *searchlights* to ‘illuminate’ their processing. The four sources are phonic knowledge (sounds and spelling); grammatical knowledge; word recognition and graphic knowledge; and knowledge of context, as presented in Figure 4. The searchlight model acknowledges that different types of knowledge and skills are required for meaningful reading, but does not explain the relationship between word reading and text comprehension: that in fact word reading is a *prerequisite* for text comprehension. Comprehension is dependent on knowledge of the relevant vocabulary, grammatical knowledge and understanding of the context, *but also depends on the reader’s knowledge of the alphabetic system* that underpins the written form of the English language (DEST, 2005; NICHHD, 2000). Word reading in the first instance most often demands the ability to decode. Decoding of unknown words eventually results in the automatic recognition of these words, which are then stored in the reader’s mental lexicon. Rapid retrieval of these words supports fluent reading and therefore comprehension.

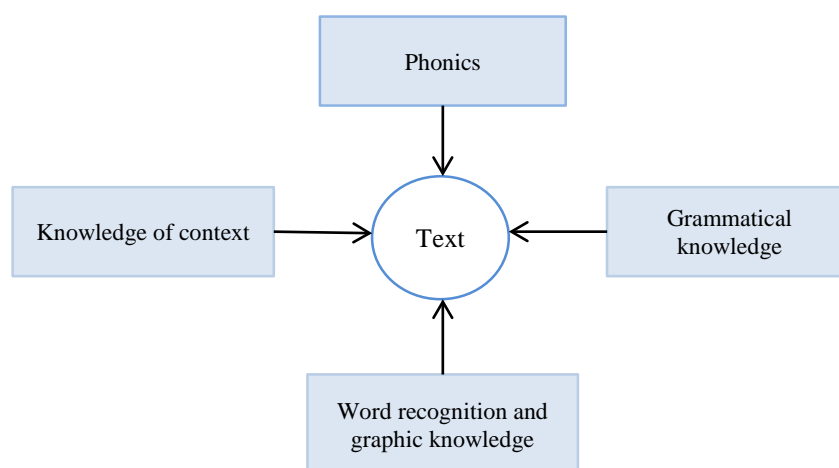


Figure 4. The searchlight model of reading (Clay & Cazden, 1990)

Stuart, Stainthorp and Snowling (2008) point out that, through the emphasis on context, the Searchlights model places an undue weighting on strategies such as guessing what the reader thinks might be appropriate rather than attempting to decode the actual word on the page. This has important ramifications for fluency which will not develop without a large repertoire of words that can be recognised immediately

and the decoding skills to access unknown words, and unless fluency develops, comprehension will be compromised (Nation & Angell, 2006; Walker, 2006).

The British Department of Education and Skills adopted the Searchlights model when it implemented the National Literacy Strategy (NLS) in 1998 in an attempt to improve literacy in schools (Riley, 2001) and in 2005, Sir Jim Rose was commissioned to investigate the effectiveness of the NLS. The outcome was the delivery in 2006 of the *Independent Review of the Teaching of Early Reading* (the *Rose Review*), which noted that after nine years of implementation, the NLS had done little to improve reading performance. The Rose Review recommended that the Searchlight Model of reading be replaced by *the Simple View of Reading* (SVR) as a theoretical grounding for improving standards in reading instruction (Rose, 2006). This decision rested on the importance of explicitly distinguishing between word recognition processes and language comprehension processes in the development of reading.

According to Stuart, Stainthorp and Snowling (2008), there are at least four reasons why the SVR replaced the Searchlights model: (1) different factors predict word reading from those that predict comprehension; (2) there are children who have word recognition difficulties in the absence of language comprehension difficulties; (3) there are children who have language comprehension difficulties in the absence of word recognition difficulties; and (4) there are differences between the effects of context that operate at word and at text levels. The latter point refers to the fact that children with poor word recognition skills rely more on context to decipher words; whereas children with fluent word recognition skills use context to construct a coherent mental representation of the text as a whole.

First proposed by Gough and Tunmer (1986), the SVR views reading as requiring both word recognition and comprehension, but each of those has multiple elements. The *word recognition component* encompasses efficient decoding, accurate sight-word recognition, fluent word reading and access to appropriate words in the reader's mental lexicon that provides semantic information at the word level. *Comprehension* refers to linguistic (not reading) comprehension—often referred to as listening comprehension—which requires knowledge of facts and

concepts, vocabulary, language and text structures, and verbal reasoning structures and strategies.

Gough and Tunmer (1986) stressed that word recognition is necessary but not sufficient for reading because the ability to pronounce printed words does not guarantee understanding of individual words, or of connected text or discourse as a whole. Linguistic comprehension is also necessary, but not sufficient, for reading: if words cannot be decoded, it is impossible to access the meaning necessary for the application of linguistic processes that lead to comprehension. Both dimensions are essential for skilled reading. This encapsulates the Simple View of Reading as illustrated in Figure 5.

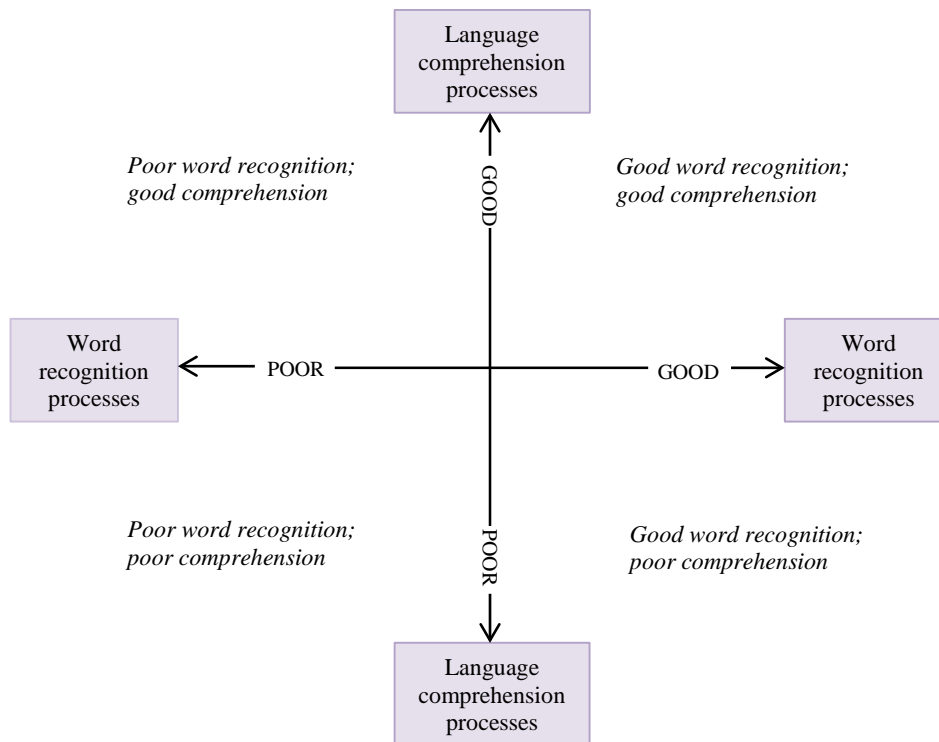


Figure 5. The simple view of reading (Gough & Tunmer, 1986)

The SVR has become the most widely accepted model of reading in contemporary research (Catts, Adlof, & Weismer, 2006; Kendeou, Savage, & van den Broek, 2009). It has particular relevance to this study because it helps to identify the particular students who would benefit most from the planned intervention. Comprehension is the ultimate aim of reading and it requires rapid word recognition and listening comprehension. From the SVR we can infer that students with good listening comprehension but poor or slow word recognition would benefit most from

an intervention designed to increase fluency. Word recognition implies accuracy, but fluency requires both accuracy and automaticity.

The SVR has remained an important model for explaining the reading process (Catts, Adler, & Weismer, 2006); however, it has been refined and expanded and one such refinement is the Scarborough Rope Model (Scarborough, 2001). This model focuses on two domains: word recognition and language comprehension. Each domain consists of several sub-skills, or strands, that are fine-tuned, executed with increasing automaticity, and eventually interwoven into skilled reading.

The domain of word recognition consists of three strands: phonological awareness, decoding and sight recognition. Phonological awareness is a reader's understanding that spoken words are made up of a series of sounds, and their ability to recognise and distinguish those sounds. Decoding refers to the reader's ability to recognise how phonemes, or sounds within words, are represented by graphemes—either a letter or group of letters. This is sometimes referred to as the alphabetic principle. Decoding is the ability to convert the graphemes into the sounds they represent. Finally, sight recognition occurs when words become familiar enough that they are recognised automatically, without the need for decoding. As all three strands are developed, reading becomes increasingly automatic, or fluent. With increased automaticity and fluency, the second domain of language comprehension becomes more relevant (Scarborough, 2001).

The domain of language comprehension consists of five strands: background knowledge, vocabulary, language structures, verbal reasoning and literacy knowledge. Background knowledge is the reader's knowledge of facts and concepts related to the reading material allowing an understanding of what is being read. Vocabulary relates to the breadth and depth of words known by the reader and enables meaning to be made of the written text. Knowledge of language structures relates to the reader's understanding of semantics, syntax, and how sentences and text forms are constructed. The extent to which a reader can make inferences, understand metaphor and other such devices refers to a reader's verbal reasoning. It is the ability to derive meaning beyond the literal. Finally, literacy knowledge is a reader's understanding of print concepts, genres and so on. As all five strands within the domain develop, comprehension of reading material improves (Scarborough, 2001).



As the strands within each domain are developed and improved, the strands intertwine more tightly around each other and then the two domains twist tightly around each other, hence the rope metaphor. The more tightly the strands are entwined, the stronger the rope, or the more skilled the reading. Conversely, if any of the strands are poorly developed, the rope itself becomes weaker. Scarborough acknowledged that most reading disabilities are consequences of poor phonemic awareness and poor decoding skills. She did, however, note that language comprehension deficits also play a significant role in the reading challenges of older children and that early language impairments are highly predictive of future reading impairment (Farrall, 2012).

The advantage of the Rope Model is that it expands on the SVR by labelling the sub-skills that comprise language comprehension and word recognition. Unlike the SVR, it makes the role of automatic word recognition and fluency in the reading process clearer. Fluent treading is an essential part of reading comprehension, as explained in the Rationale in Chapter One.

McKenna and Stahl (2009) also contributed to the understanding of the reading process with their Cognitive Model of Reading (Figure 6). The ultimate goal of comprehension is dependent on three constructs: automatic word recognition (or fluency), comprehension of the language of the text, and the ability to use strategies needed to achieve particular purposes for reading. Each of these three constructs can be broken down into sub-skills.

Like the Scarborough Rope Model, McKenna and Stahl (2009) include the role of fluency, or automatic recognition of words as a vital pre-requisite to reading comprehension. In order to achieve this, the reader must be able to read connected text fluently. This, in turn, is dependent on the reader's ability to decode words rapidly, on automatic recognition of high-frequency words, and their knowledge of print concepts as well as phonological awareness.

Also consistent with the Rope Model, the Cognitive Model of Reading highlights the role played by language comprehension, which is facilitated by general, or background, knowledge related to the text being read. In addition, the reader must understand different text types, the syntactic structure of the language,

and have knowledge of the vocabulary that is relevant to the specific text. The Cognitive Model also acknowledges the importance of *strategic knowledge*; of understanding the different purposes of reading; and of strategies such as sounding out unfamiliar words, monitoring understanding, and visual imaging (Stahl & McKenna, 2013).

The strength of the McKenna and Stahl model lies in the addition of strategic knowledge as the third distinct contributor to reading comprehension. Strategic knowledge develops in young children with an initial understanding that reading can be entertaining or informative. Other students think strategically when they use their knowledge of genres and content to be selective in their reading and when they extend their comprehension through the judicious use of strategies (Farrall, 2012).

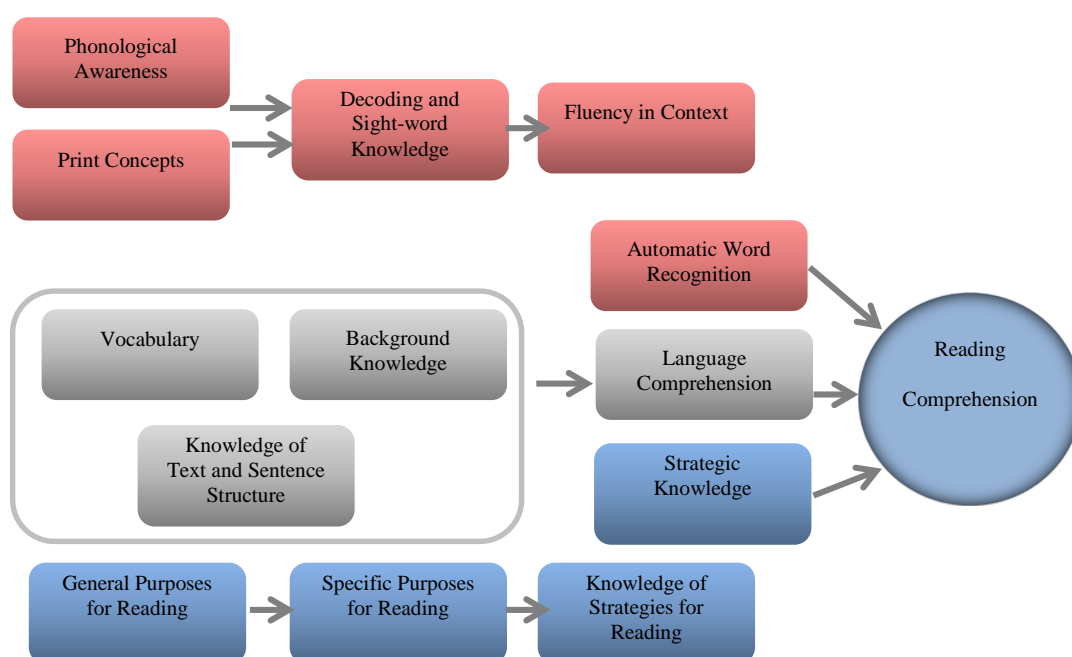


Figure 6. The Cognitive Model of Reading (McKenna & Stahl, 2009)

As the understanding of the reading process has developed over the decades, the evolution of reading models has demonstrated an increasing level of importance on the role of reading fluency in the development of skilled reading. It is now recognised as a critical factor in the development of reading comprehension (Dudley & Mather, 2005; Kuhn et al., 2010)

### **Identification of fluency as a core component of reading: Contribution of the Report of the National Reading Panel**

In 1997, the United States Congress commissioned the National Institute of Child Health and Development and the US Department of Education, to form the National Reading Panel (NRP) to review the empirical research on how children learn to read and determine, from this evidence, the most effective methods of teaching reading. It was the largest and most comprehensive review of research relating to the development of reading ever undertaken. Five essential elements of the reading process were identified: phonemic awareness, phonics, fluency, vocabulary development and comprehension strategies, and the need for explicit instruction in each of the elements was highlighted (NICHHD, 2000).

The inclusion of fluency was important because it had been a relatively neglected area of research despite evidence to show large numbers of students (44% in a nationally representative sample in a 1995 study by Pinnell et al.) lacked fluency when reading grade-appropriate texts (Dudley & Mather, 2005). Reading fluency is the ability to “read connected text rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding” (Meyer & Felton, 1999, p.284). A later definition refers to “efficient, effective word-recognition skills that permit a reader to construct the meaning of a text. Fluency is manifested in accurate, rapid, expressive oral reading and is applied during, and makes possible, silent reading comprehension” (Pikulski & Chard, 2005, p. 510). As Pikulski and Chard stated, fluency is the bridge between decoding and comprehension (2005).

Perhaps the most precise definition is that “reading fluency is the ability to decode and comprehend text at the same time” (Samuels, 2006, p. 9). In fluent oral reading the reading appears effortless: readers group or chunk words into meaningful phrases and clauses, and use pitch, stress, and intonation appropriately to convey the meanings and feelings the author intended (Zutell & Rasinski, 1991). When word recognition or decoding of words is too slow, a ‘bottleneck’ occurs in working memory which impedes the flow of thought and hinders comprehension of the text (Therrien & Kubina, 2007). When fluency is in place, the reader can concentrate on the meaning of the text rather than the process of working out what the individual

words are. Fluency marks the transition from *learning to read* to *reading to learn*. As mentioned in Chapter One, the three key elements that comprise fluency are *accurate* reading of connected text at a conversational *rate* with appropriate *prosody* or expression (Hudson, Lane, & Pullen, 2005).

*Accuracy* is the ability to recognise and decode words correctly. It requires a wide knowledge of letter-sound relationships, the ability to blend sounds together and, in many circumstances, concurrently use other cues to identify words. It requires the reader to generate a phonological representation of each word, either because it is part of the reader's sight-word vocabulary or through the use of a decoding strategy (T. Rasinski, 2006). Gillett and Temple (1986) suggest 97% accuracy is required for independent reading, and that anything below 90% is at frustration level. The term *independent reading* means that students are able to accurately identify at least 97% of words encountered in a text *and* understand what they have read. Accuracy below this level is likely to be an impediment to reading fluency. To develop fluency learners must also develop automatic word recognition through extensive reading of connected text rather than simply developing the ability to rapidly recognise words in isolation (Applegate, Applegate, & Modla, 2009; Kuhn, 2004; NICHD, 2000; Pikulski & Chard, 2005).

Some students have sufficient word recognition and knowledge of letter-sound correspondences to decode unknown words to meet the accuracy requirement of fluency, but they cannot read at the required *rate* to deliver the information in understandable chunks (Benjamin & Schwanenflugel, 2010). A reading rate of less than 100-120 words per minute in itself hinders comprehension and rates under 75 words per minute make comprehension unlikely (Rasinski, 2000). Reading *rate* is usually expressed as the number of words per minute that are read accurately. As children practise their reading, they come to recognise more and more words by sight. The faster that words are recognised, the less decoding effort is required and the more quickly the rate increases. This is also referred to as automaticity. For effective fluency, students at the secondary level should be reading at least 100 words per minute as a minimum, preferably between 120 and 150 words per minute (Armbruster, Lehr, & Osborn, 1999; Meyer & Felton, 1999).

Hasbrouck and Tindal (2006) report the oral reading fluency scores in words correct per minute (WCPM) of between 15,000-20,000 students in grade levels two to five across a number of diverse school districts in the United States. They state that WCPM is a strong indicator of overall reading ability and, especially among younger students, there is a close correlation between oral reading fluency and comprehension. Despite this assertion, the authors state that reading rate alone is not necessarily an indication of effective reading, but students reading at 20% or more below the 50<sup>th</sup> percentile are at risk of reduced levels of comprehension.

Finally, *prosody* refers to the intonation and expression that animates oral reading, (Miller & Schwanenflugel, 2008). Correct prosody is apparent when the words of a passage are ‘chunked’ together in ways that make sense; and where punctuation is clearly guiding expression (Hook & Jones, 2002). Prosody is an indicator that the reader is constructing meaning of the passage that is being read (Torgesen & Hudson, 2006). Numerous studies have linked reading fluency with the comprehension of reading passages, and are discussed in the following section (Applegate, et al., 2009; Pikulski & Chard, 2005; Silberglitt, Burns, Madyun, & Lail, 2006; Therrien, 2004).

A large longitudinal study of students in grades 3, 5, 7 and 8, found that reading fluency scores significantly predicted performance on the Minnesota Comprehensive Assessments – Reading (MCA-R). Students were tested for reading fluency and their scores were compared with their results on a standardised reading comprehension test. The correlation between fluency and performance on the MCA-R was .71 for Grade Three students and .51 for Eighth Grade students. This falling correlation reflects previous studies that show reading growth decelerates as students progress through primary school (Silberglitt et al., 2006).

Although there is a strong link between fluency and comprehension, fluent reading does not guarantee comprehension, as demonstrated in the Simple View of Reading. It has been suggested that fluency and comprehension are ‘intertwined’ with other factors such as the reader’s level of interest, their ability to make inferences, and to respond to the material reflectively (Applegate, et al., 2009; Pikulski & Chard, 2005). Frequent practice improves automaticity and the number of words recognised.

Unfortunately, reluctant readers avoid this practice (Rasinski, 2000; Stanovich, 1986) and as a result, fluency may not reach a level to support comprehension.

The focus of this research is specifically centred on reading fluency. In the experience of the Researcher, the majority of students in mainstream English classes experiencing reading difficulties are capable of decoding words—in other words, their letter sound-knowledge is adequate—but there is a lack of automaticity, or speed of retrieval of sight words that hinders their fluency. Approximately 10 to 15% of mainstream students are unable to read with adequate fluency (Rasinski et al., 2005), which has an inevitable impact on their academic achievement at secondary school, and an increased likelihood of other negative outcomes across their lifespan. The following section reviews the research evidence relating to the impact of reading difficulties, highlighting the importance of addressing this serious and long-term difficulty experienced by a significant percentage of secondary students.

### **The impact of reading difficulties**

For secondary students with poor reading skills, there can be both short and long-term consequences. Their inability to manage the volume of reading required at secondary school and to fully comprehend it inevitably leads to difficulty achieving academic success. This increases the likelihood of failure to complete secondary school, and the consequent impact on vocational and economic opportunities.

Australian Bureau of Statistics (ABS) figures from 2013, the latest figures available at the time of writing, reveal a correlation between literacy skills and length of unemployment. Of those Australians unemployed for one year, a quarter were categorised as having very poor literacy skills, and of those who were unemployed for two years or more, over half were categorised as having very poor literacy skills (Shoghi, Willersdorf, Braganza, & McDonald, 2013).

The ABS report is consistent with an earlier study from the United Kingdom. A group of 42 poor readers from the Isle of Wight identified at the age of 14-15 years were followed up thirty years later to see the effect of time on their literacy performance. They were compared with a cohort of 82 normal readers followed up after the same period. All participants were interviewed and administered a spelling test. The interviews revealed that the poor readers had fewer qualifications and

entered vocations with more limited literacy demands compared to the normally reading peers. The spelling test revealed a strong correlation in performance over the extended time period ( $r = 0.91$  for poor readers,  $r = 0.89$  for normal readers). The researchers concluded that poor literacy skills in adolescence persist into adulthood (Maughan et al., 2009). Other research reveals that approximately 70% of people who cannot read by the age of nine never achieve satisfactory literacy levels (Shaywitz, 2003).

The link between poor literacy and limited vocational opportunities has strengthened since the 1970s and 80s. The number of unskilled jobs that require little or no reading ability has dramatically reduced. Through increased use and improvements in technology and greater globalisation of Western economies, it has become increasingly difficult to find employment and participate fully in life without adequate education, especially the ability to read. The tendency to learn skills on the job has been replaced by an increased emphasis on formal qualifications gained through external training providers and/or study. Poor literacy skills are therefore becoming more and more of a disadvantage (Bynner, 2004; Ziomek-Daigle & Andrews, 2009).

Poor literacy does not just have a detrimental effect on employment prospects. A detailed study of the health of Australians in 2011 revealed a strong link between education and general health. Those with no post-school qualifications rated their health more poorly and reported certain illnesses more frequently than those with a Bachelor degree or higher. The authors speculated that the reason education contributes to better health is that literacy leads to greater awareness of health issues, particularly awareness of risk and protective factors. They also speculated that greater literacy led to safer, more secure and better paid employment, and that this has a beneficial effect on health (Australian Institute of Health and Welfare, 2011).

Persistent reading difficulties can greatly affect the self-esteem of students, and have been linked to emotional and behavioural disorders (Kamhi, 1991; Margolis & McCabe, 2004). Years of failing at what is deemed a fundamental skill can result in anxiety and low self-esteem that affect personal and interpersonal relationships (Peterson, Caverly, Nicholson, O'Neal & Cusenbary, 2000).

Studies in the United States have shown a high correlation between poor academic performance, especially in reading, and involvement with the juvenile justice system. Brunner (1993) reported, in his study on recidivism in adolescents who had been detained in correctional facilities, that prior reading ability among this population predicted later subsequent delinquency, and poor reading achievement increased the likelihood of serious delinquency persisting over time. His findings included that reading failure causes frustration levels that result in delinquent behaviour; a high percentage of juvenile detainees were diagnosed with reading difficulties and, reading teachers were mostly unable to remediate reading difficulties because of their lack of knowledge about effective reading instruction. Supporting the findings of Brunner's study, Leone, Krezmien, Mason, & Meisel (2005) found that as many as 60%-70% of incarcerated youth were identified as having reading difficulties and receiving special educational services compared to a national average of 12.7% of public school students receiving such services. Poor reading achievement and delinquency appeared to mutually influence each other.

More recently, Christle and Yell (2008) also reported that poor literacy skills, particularly reading, are a predictor of youth incarceration. Whilst there were other factors that contributed to incarceration, low academic ability appeared to be common to nearly all those incarcerated. In a survey of teachers conducting reading programs for incarcerated adolescents, 89% reported that they had students who required remediation in reading skills. The average incarcerated youth in the US was 15 years and six months of age but read at a Grade 4 level, with 38% reading below the Grade 4 level (Barnard-Brak & Sulak, 2010). Thus poor reading at an early age leads, for many people, into a downward spiral that results in negative outcomes well beyond school.

Of even greater concern are the results of a study in 2006 that examined the relationship between poor reading ability and suicide ideation. The longitudinal study of 188 15-year-olds found that those with poor reading ability were more likely to drop out of school and have suicide ideation or attempts than their peers with typical reading ability, even after controlling for socio-demographic and psychiatric variables. Furthermore, school dropout and suicide ideation were strongly associated with each other (Daniel et al., 2006). The potential for serious and long-term negative



effects for young people who do not achieve functional literacy skills has thus been well established, and provides a strong case for further research in the area of remediating reading difficulties.

### **The *Matthew Effect* in relation to reading development**

*“For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath.”* (Matthew 25:29 as cited in the King James Bible)

The *Matthew Effect* is a term derived from the biblical quote above, and may be broadly rephrased as ‘the rich get richer and the poor get poorer’. Stanovich (1986), in relating it to reading development, describes two possible outcomes of early language and literacy development. The positive Matthew Effect depicts the probable outcome for children who come to school with a rich language background, a large vocabulary and many positive experiences with print. These children are primed to take advantage of formal reading instruction, and experience early success in reading. They find pleasure and reward in reading, are motivated to read more, and thereby experience even more success as their skills improve.

Conversely, the negative Matthew Effect describes the outcome for children who do not have the advantage of a rich literacy background, or who have specific reading difficulties. These students will not experience early success in reading. Early frustration usually results in avoidance of reading, and therefore the practice that would support automaticity and fluency. Without remediation, their reading ability slips further behind their competent peers and their difficulties increase as the demands of the syllabus grow.

The first group of students find themselves on an upward spiral of reading success; the second group find themselves in a downward spiral of reading failure. Research discussed in this section suggests that poor reading ability at an early age does not correct itself. Without intervention, reading problems continue and are exacerbated as reading tasks become more complex. Thus, as Stanovich pointed out, the rich get richer and the poor get poorer, resulting in the wide divergence of reading abilities demonstrated by students in secondary schools.

## **The struggling reader in secondary school**

The ultimate goal of reading in the secondary school setting is to learn, which is achieved to a substantial extent through reading comprehension. Secondary school readers must be able to decode, have a vast store of words that they can immediately recognise, read with fluency, understand increasingly complex vocabulary, link new knowledge with their existing knowledge and critically comprehend a diverse range of texts. They must maintain the motivation and devote the time to improve their reading skills to enable them to achieve these challenging tasks, as all subject areas in secondary schools have a significant reading component.

Most students with reading difficulties in mainstream secondary classes have mastered to some extent the accuracy component of reading: they have acquired basic letter-sound knowledge and know most high frequency words. In many cases however, they cannot retrieve letter-sound information quickly to decode unknown words because it has not been learned to the point of automaticity. Additionally, their lack of wide reading has resulted in a limited sight word vocabulary and a poorer knowledge of the broader vocabulary that extensive reading brings. Thus when reading, much of their attention is focused on accessing the actual words, rather than on understanding the overarching meaning. Reading is a slow, laborious and ultimately unrewarding experience for them, and hinders their progress across all subjects. It is not surprising, therefore, that struggling readers are increasingly less likely to succeed with the demands of secondary school (Whithear, 2008).

By the time students reach secondary school, struggling readers have had insufficient practice for many years and are significantly behind their peers who have been reading at age-appropriate levels. This is combined with larger and more complex reading demands from teachers who see the students for four hours per week or less, and have little or no knowledge of how to diagnose particular reading problems, or opportunities to implement remediation. It is not difficult to understand how these factors may affect students' motivation and willingness to persist in tasks they find so difficult (Deshler & Hock, 2006; Paige, 2011).

### **Effect of motivation and self-efficacy on reading**

Reading success depends on more than the mechanics of effective reading instruction: it is also strongly influenced by the reader's motivation (Wigfield, Guthrie, Tonks, & Perencevich, 2004). A successful reader feels competent at the task and views reading as being of personal value and practical importance. Motivation to read is often explained in terms of *expectancy-value theory*, which posits that motivation is dependent on two key factors: the extent to which an individual expects success or failure on a task (self-efficacy); and the value or appeal the individual ascribes to that task (Applegate & Applegate, 2010; Gambrell, Palmer, Codling, & Mazzoni, 1996). This theory reinforces the consequences described by the Matthew Effect: struggling readers have a low sense of self-efficacy and reading tasks present limited appeal leading to low motivation to complete reading tasks. Conversely, strong readers feel competent in reading and view the reading task as either pleasurable or important to their education, or both.

Self-efficacy influences task choice, effort, persistence and achievement (Schunk & Mullen, 2012). Students with a low sense of self-efficacy are less likely to participate in tasks, less likely to work hard and less likely to persist when difficulties arise. Unsurprisingly, students do not engage in activities they believe will lead to negative outcomes (Schunk & Zimmerman, 1997). According to Carroll et al. (2009), research indicates that students who develop strong academic and self-regulatory self-efficacy beliefs are better able to manage their learning and to resist the temptations and social pressures to engage in behaviours such as delinquency that can further undermine their academic achievements. Students with strong self-efficacy beliefs are more likely to successfully complete their education and be better equipped for a range of vocational options.

Thus, if reading improvement is to be achieved, it is important that negative self-beliefs are overcome so that students invest sufficient effort, persist when difficulties arise and take on increasingly challenging tasks. In order to do this, however, tasks must be set at individual students' instructional level. Only then can students build upon what they know and experience challenge rather than frustration (Margolis & McCabe, 2004). Secondary students with reading difficulties are, almost by definition, regularly faced with tasks that are beyond their instructional level,

which would greatly reduce their motivation to invest the necessary time and effort to succeed.

Baker and Wigfield (1999) examined the multidimensional nature of reading motivation in a study involving 371 fifth and sixth grade students who were tested with the *Motivation for Reading Questionnaire* (MRQ) developed by Wigfield and Guthrie (1997). The MRQ assesses eleven different dimensions of reading motivation within three broad categories: self-efficacy dimensions; goal-oriented scales such as competition and working for grades; and social dimensions such as compliance. The results revealed that approximately one third of students scored at a high level consistently across all dimensions. Around 15% of students scored at a low level consistently across all dimensions but the remainder, just over half the participants, scored high in some dimensions and low in others. These results demonstrate that motivation to read is a complex process.

There is evidence that student perceptions of self-efficacy as a reader form from as early as two months after starting primary school (Chapman, Tunmer and Prochnow, 2000), and have a measurable effect on motivation to read. A study of first-grade students examined the effects of reading progress on motivation. The students were divided into three groups: skilled readers who demonstrated high intrinsic motivation to read; low-skilled readers with poor intrinsic motivation; and low-skilled readers with poor motivation but who received tutoring to improve their reading skills. Reading skills, competency beliefs, task orientation and motivation of all three groups were tested over several months. The key finding from this study was that even when the third group had improved their reading skills through the tutoring sessions, their motivation to read remained poor (Morgan et al., 2008). The research could have been strengthened by the use of standardised measures of motivation, as students' intrinsic motivation was measured only by teacher reporting, but this study supports other research findings that feelings of failure in relation to reading persist over time (McGeown, Duncan, Griffiths, & Stothard, 2015; Wolters, Denton, York, & Francis, 2014). So even in first grade, struggling readers would appear to lose motivation to read. As stated in the Matthew Effect, this is likely to lead to avoidance of reading and the initiation of the cycle of failure.

Students with high self-efficacy in reading not only read more, but also read more challenging texts and perform better in reading tests than students with low self-efficacy (McKenna, Kear, & Ellsworth, 1995; Mucherah & Yoder, 2008). Wide independent reading is a major way in which vocabulary develops, and the broader world knowledge that supports reading comprehension more generally, is obtained (NICHD, 2000). McKenna et al. also postulate that motivation to reading is likely to decline as students get older and other pursuits compete for their leisure time. This decline is faster in students with lower reading ability.

The negative *Matthew Effect* results in more than poor reading outcomes. It is accompanied by a corresponding affective component as a student's sense of self-efficacy as a reader is continually undermined. Compared to children in their first years of schooling, adolescents with reading difficulties have lived with a sense of failure for many years. It is not surprising, therefore, that diminished self-esteem, poor motivation, a low sense of self-efficacy and a reduced sense of personal empowerment are all complicating factors when trying to remediate reading difficulties. According to Chapman, Tunmer and Prochnow (2000), students from an early age become aware of their poor performance in reading compared to that of their peers, and from that point, approach reading tasks with an expectation of failure. By secondary school, reading tasks would be approached with a deeply entrenched negative attitude.

Margolis and McCabe (2004) state that, as struggling readers anticipate failure, it is not surprising that their motivation to read is very low. Reduced motivation means that students are less likely to persist with reading tasks that they find challenging and are less likely to employ strategies for word identification and comprehension of extended text. Their sense of their own ability to successfully engage with reading tasks, in other words, their self-efficacy, is too low for success to occur. Students do not persist in activities they believe will lead to negative outcomes (Kamhi, 1991).

These students must nevertheless persist until the end of compulsory schooling. Baker and Wigfield (1999) reported that many simply drop all pretence of trying to engage with their schoolwork, become serial avoiders of work and can often be a highly disruptive influence in the classroom. A great deal of time and effort, and

significant resources are dedicated to controlling disruptive behaviour within secondary schools. In contrast, relatively little effort is expended on diagnosing reading problems and formulating remedial programs. The reason for this may be that the disruptive students are considered too disengaged from their academic studies to benefit from any intervention (Rowe & Rowe, 1999; Kelly, 2013). This has further implications for the need to intervene early, as the secondary effects of reading difficulties cause additional problems that can impact on fellow students.

Paterson and Elliott (2006) argue that for teachers to improve reading outcomes, they must first address negative attitudes and beliefs. In reality, however, it is rare in mainstream secondary classes, where reading instruction is not a focus, for teachers to differentiate curriculum for individual students (Strutt & Konza, 2014), and therefore attempt to reverse these attitudes by increasing students' chances of success. It is generally assumed by teachers that secondary students possess a sufficient level of literacy to cope with the demands of a particular course. If achievement does not meet expectations, it is often attributed to factors such as laziness and lack of motivation (Butler, 1994; Graham, 1991; Weiner, 1985).

### **Gender differences in reading**

Just as motivation can help explain differences in students' approaches to, and success in reading tasks, gender has also been implicated in both motivation to read, and reading achievement. Results from longitudinal research such as NAPLAN and PISA, along with numerous other studies, consistently show that girls outperform boys in reading. Using NAPLAN data, a recent Australian study was able to quantify this trend. Struggling readers were defined as those not meeting the minimum benchmark in the reading test. The ratio of male to female struggling readers was 1.44:1 at Year 3, 1.32:1 at Year 5, 1.47:1 at Year 7 and 1.30:1 at Year 9 (Limbrick, Wheldall, & Madelaine, 2010). Whilst there is some variation in these ratios, there is a consistent trend showing a greater number of struggling readers among boys than girls.

According to the Canadian Council of Learning (2009), differences in reading behaviours in boys and girls go beyond performance differences on large-scale assessments. Girls tend to do more non-assigned reading, reading for enjoyment, and reading for general interest than boys. Girls enjoy reading more than boys do, and

more girls than boys rate themselves as confident readers. Girls also report more sharing and discussion of reading materials and more time doing homework than boys. Boys, on the other hand, report that they prefer watching television or movies to reading. Boys spend less time reading than girls, are less motivated to pick up a book, do not value reading as an activity, are less confident readers and see themselves as having lower reading skills than girls. These findings have been supported by a number of studies (McGeown, Goodwin, Henderson, & Wright, 2012; Wolters et al., 2014)

Using PISA results from 2009, a 2013 study examined the gender differences in online reading with students from Hong Kong and Korea. Although girls read more than boys, the difference was less when compared to traditional print reading. The authors suggest that online reading is more likely to be considered a leisure activity compared to print reading by boys, who are therefore more likely than girls to participate in online reading activities (Cheung, Mak, & Sit, 2013).

A recent British study examined how closely children's reading skill correlated with their intrinsic and extrinsic motivation and competency beliefs and investigated whether gender made a difference. Nearly 500 students aged 7-11 years completed a reading comprehension test and completed questionnaires about intrinsic and extrinsic motivation and competency beliefs relating to reading and schoolwork in general. The results showed the boys' competency beliefs in reading and intrinsic motivation for reading and schoolwork were significantly more closely associated with their level of reading skill, when compared with the girls. This could be interpreted in at least two ways. Firstly, boys' motivation and beliefs in their ability may be more dependent on their success in reading. Alternatively, boys' motivation and competency beliefs may play a more significant role in the effort they put into reading (Logan & Medford, 2011). In either case, it would appear that girls are more likely to maintain motivation to read even when experiencing difficulties with reading.

McGeown et al. (2012) also examined motivation, gender and reading comprehension in children of a similar age by having them complete a reading comprehension test and questionnaires on reading motivation and gender role. The purpose of this study was to look beyond biological sex as a factor in reading

motivation and examine the role of gender identification in motivation. Whilst there were no differences among the participants in reading skill and extrinsic motivation, girls appeared to have a higher intrinsic motivation. The authors concluded that this difference was better explained by examining masculine or feminine traits rather than biological sex. The notion of masculine and feminine traits was measured by the Children's Sex Role Inventory (CSRI). The CSRI evaluates gender orientation by asking students to respond on a Likert scale to questions such as: "When I play games, I like to win: (masculine) and: "I care what happens to others" (feminine). Feminine traits correlated more closely with certain aspects of reading motivation such as curiosity, efficacy, involvement and the prospect of better grades than masculine traits did. This would suggest that students with a higher level of what are considered to be female traits, regardless of biological sex, are likely to experience high intrinsic motivation to read. This adds a further dimension to previous studies that have looked at biological sex differences only in reading motivation

### **Locus of Control and its effect on reading motivation and achievement**

In addition to a poor sense of self-efficacy, student achievement may also be influenced by their *locus of control*, which taps into related beliefs and expectations (Lefcourt, 2000). Locus of control refers to individuals' beliefs about their control over life events. Some feel personally responsible for the things that happen to them. These individuals are considered to have an internal locus of control and are labelled *internals*. Others feel that their outcomes in life are determined by forces beyond their control. They therefore have an external locus of control and are labelled *externals* (Lawrence, 1999, p. 49). In the school setting, *internals* believe that their success or failure is largely determined by their own ability, actions and efforts. Conversely, *externals* believe their success or failure is determined by factors beyond their control, such as whether the teacher likes them or not, or whether an examination was easy or difficult. These, of course, represent the extremes of a spectrum and all students fall somewhere on that spectrum (Rotter, 1954; You, Hong, & Ho, 2011).

Research cited above would suggest that students with an internal locus of control have a strong sense that their circumstances, including academic achievement, are under their personal control, and not the control of external people or factors. This would suggest that, if these students find something unsatisfactory in



their situation, they believe that they can change it through their own efforts. A strong internal locus of control would thus appear to empower students, and reduce the likelihood of them attaching a negative label to themselves if they have a bad experience. These students would then be more likely to take responsibility for their learning and to achieve academic success as a result. Students with a strong internal locus of control would then demonstrate more resilience to failure because they believe they can change their circumstances by changing their behaviour or their strategy, whereas those with an external locus of control do not believe they can do anything to affect an outcome, and are therefore unlikely to change their behaviour. It is important to note that internality and externality do not apply equally over all domains of effort by individuals. It is possible to be an internal in one area, such as sport, and an external in another, such as academic achievement

Internality has been further analysed to determine whether individuals assume responsibility for successful events in their lives (I+) and also for unpleasant or unsuccessful events (I-). A study by Brown, Engin, and Wallbrown (1979) explored the relationship between locus of control and attitudes to reading with 431 elementary school students. The researchers found that there was a strong correlation between students with high (I-) scores and reading anxiety. The researchers interpreted this as high (I-) students, anticipating unsuccessful experiences with reading, would attribute that to their limited ability .

The studies referred to in this section were conducted several decades ago. Locus of control as a research subject reached its zenith in the 1970s but has re-emerged to some extent more recently in studies of the relationship between locus of control and the academic achievement of school students (Binder, 2014; Chang & Ho, 2009; Wickline, Nowicki, Kincheloe, & Osborn, 2011). There is very little recent research linking locus of control and reading ability; however, one study from the last decade is detailed below.

Reading difficulties, according to Galbraith and Alexander (2005), may occur for many reasons and it is likely that one of the reasons that these difficulties persist is because the poor reader views reading as a negative influence on their self-concept. The child who fails initially to achieve reading skills will soon develop a lack of confidence in his or her ability to succeed. S/he will avoid potentially humiliating

situations and will be disinclined to take risks for fear of failure. The consequent negative self-belief may impinge upon opportunities to acquire and refine the skills that are characteristic of proficient learners. Students with literacy difficulties who have negative school experiences frequently remain external in their locus of control, believing that their efforts will have little impact on their progress.

Galbraith and Alexander conducted case studies of six students with literacy difficulties, including three boys with special education needs. Self-esteem and locus of control were tested and a program for improvement was implemented in both the whole class and one-to-one contexts. As part of the normal classroom program, each child in the target group was exposed to an eclectic approach to literacy. The children selected for special educational support followed an additional highly structured program, guided by the needs of the individual children and with targets specified on their Individual Education Plans (IEPs). In the class as a whole, the girls showed more internality (that is, reliance on self-effort) than the boys did. This bears out the findings of Findley and Cooper (1983) that locus of control is affected by gender. Overall, reading scores improved alongside improved self-esteem and greater internality of locus of control. The children with the poorest reading scores were not the most external in terms of locus of control. This would suggest that whilst children with an external locus of control may believe no amount of effort on their part will make them better readers, some children with an internal locus of control blame themselves for their poor reading yet do not necessarily increase their efforts to improve. This reflects the findings in a study by Brown, et al. (1979) which reported that if reading difficulties are combined with an internal locus of control, students blame themselves for their poor reading and greater anxiety results. A possible implication for this finding is that literacy instruction needs to include an affective component including encouragement by teachers, making the conditions of success more explicit, and continually pointing out to students the progress they are making.

Overall, the studies tend to indicate that greater internality of locus of control leads to better reading performance. However, the studies also reveal that this correlation is not straightforward. Locus of control, like self-efficacy, is not constant across all areas of achievement. Students may perform strongly in areas other than reading and this may affect the overall *internality* or *externality* of locus of control

(Marks, 1998; Wang & Su, 2013). This highlights the complexity of addressing locus of control, in much the same way as gender differences and motivation in general complicate the reading process.

### **Effects of parental involvement on reading motivation**

According to Hart and Risley (1995), parents who, for different reasons, do not engage in frequent and elaborated verbal interactions with their children, or do not expose them to printed material in the years before school, are likely to disadvantage their child's academic potential. The effect of parental activity continues into the school-age years. There is evidence that parents who are more involved in their child's schoolwork have a positive effect on performance (Jeynes, 2005). This involvement includes parental expectations about and attitudes toward education (Anguiano, 2004), motivational behaviours such as setting expectations and providing support and cognitive behaviours such as helping the student to understand set tasks and teaching school routines (Weems, 2005). It would appear from this research that parents have a powerful effect on their children's academic progress.

Different studies have, however, arrived at inconsistent conclusions about the precise effect of parental involvement on academic outcomes of students. One potential reason for this is the many definitions that are used for *parental involvement*. A meta-analysis conducted by Fan and Chen attempted to make sense of the many definitions and methodologies and concluded that, despite inconsistencies in defining parental involvement and measurements of academic success, that parents' aspirations and expectations for their children had a strong effect on academic performance compared to other aspects of parental involvement such as supervision of school work and study in the home (Fan & Chen, 2001).

Research into the effects of parental involvement on academic achievement has generally focused on primary school students (Hill & Taylor, 2004; Jones & White, 2000). A relatively recent study, however, supports the view that adolescents also benefit academically from greater parental involvement at home. Home-based parental involvement pertains to a supportive relationship at home, whereas school-based parental involvement focuses on a relationship with the school system that reflects parents' judgement that they need the school to help their children (Kaplan

Toren, 2013). An earlier study also concluded that parental support could have a positive impact on academic performance even at the tertiary level (Cutrona, Cole, Colangelo, Assouline, & Russell, 1994).

### **The role of the secondary teacher**

A decade ago, the Australian National Inquiry into the Teaching of Literacy (2005) found that in most teacher preparation institutions, less than 10% of time in compulsory units was devoted to teaching pre-service primary and secondary teachers how to teach essential literacy skills, including reading, to students. In half the institutions, less than 5% of time in compulsory units was devoted to this task (Rowe, 2005). In a survey of Australian pre-service teachers, Loudén found that most felt under-prepared to teach literacy skills, especially to a diverse range of students. Pre-service secondary teachers felt less confident about teaching literacy than pre-service primary teachers did. Most secondary teachers felt substantially unprepared to teach specific skills like phonics and literacy strategies to students with literacy problems (Louden & Rohl, 2006).

Catone and Brady (2005) examined the use of IEPs for students with literacy difficulties in primary and secondary schools. They found that IEPs in secondary schools were not targeted appropriately to address specific reading deficits even when those deficits were obvious. A number of reasons were cited for this discrepancy. Many secondary teachers assumed such learners would be resistant to the teaching of basic skills because they would perceive it to be demeaning. Emphasis was instead placed on learning vocabulary from content areas. The main reason given, however, was that secondary teachers lacked the knowledge to teach specific literacy skills to poor readers and this reflected the paucity of literacy training in pre-service teacher training courses.

Secondary teachers are not typically trained in or focused on reading remediation (Catone & Brady, 2005; Lyon, Vaassen, & Toomey, 1989; Moats, 1995). Reading instruction is often neglected at the secondary level because teachers in high schools do not view themselves as being responsible for teaching basic literacy skills (Gillespie & Rasinski, 1989; Strutt & Konza, 2014; Valleley & Shriver, 2003). In this Researcher's experience, unless secondary English teachers undertake post-graduate studies in a specialist literacy course, they cannot expect more than a few hours a year

of professional development in improving literacy, in particular reading. Most English teachers in Australian secondary schools are under-prepared to meet the challenge of remediating poor reading skills (Harper & Rennie, 2009). Practical strategies are needed and this study attempts to meet that need by providing such a strategy to improve reading fluency.

Current research has shown that nearly all students can be taught to read regardless of their background if they have access to well-structured, evidence-based teaching (Buckingham, Wheldall, & Beaman-Wheldall, 2013a). Unfortunately, as reported previously, many teachers have neither the background nor training to access and implement research-based instructional methods in reading instruction. Furthermore, instead of relying on the evidence of a wide body of research, some teachers persist with methodologies of doubtful value simply because it is the way they have always done things (Spear-Swerling & Sternberg, 2001).

Many secondary students experiencing reading difficulties have a specific problem with reading fluency. Poor reading fluency results in slow, laboured, disconnected reading. The effort required to access the actual words severely limits the attention available for reading comprehension. Struggling readers in secondary schools are likely to have a poor general vocabulary and are less likely to develop the subject-specific vocabulary taught in learning areas, which further impedes their fluency, and as a consequence, their comprehension (Hairrell, Rupley & Simmons, 2011; Nagy & Townsend, 2012). This has a significant impact on their ability to successfully navigate the secondary curriculum, and therefore on many of their future options. It is for this reason, that the current study specifically targeted students with poor reading fluency.

### **The Importance of Reading Fluency**

A major reason for focusing on reading fluency is the theoretical connection between fluency and comprehension. Fluent reading allows the reader to focus on the meaning of the text rather than the mechanics of reading. Lack of fluency can also adversely affect a reader's motivation to engage in reading (Meyer & Felton, 1999). Although the high correlation between reading fluency and comprehension does not prove causation, it would seem that to improve reading comprehension, improving

reading fluency in poor readers is a worthwhile activity (T. Rasinski et al., 2005). As mentioned earlier in this chapter, comprehension also requires the reader to have an adequate vocabulary and the relevant background knowledge to understand what is being read (Noordman, Vonk, Cozijn, & Frank, 2015; Oakhill, Cain, & McCarthy, 2015; Van den Broek, Beker, & Oudega, 2015).

Fluency is the focus of this research because many students in secondary school who have experienced reading problems have had specific problems with reading fluency. Given the link between fluency and reading comprehension, and given that much of secondary education depends on reading comprehension, it is important that the problem is resolved (Whithear, 2011). Students entering secondary school with an inadequate level of reading fluency struggle to cope with the increased volume and complexity of reading required in their subjects. This study seeks to test and evaluate a method of improving reading fluency for secondary students to improve their ability to cope with age appropriate curriculum reading.

### **The Use of Repeated Readings to Improve Reading Fluency**

Since the 1970s, a common approach to improving fluency has been the use of *repeated readings*. Pioneered by S. Jay Samuels at the University of Minnesota and Carol Chomsky at Harvard University, this strategy involves the reading of a short, meaningful passage several times until a satisfactory level of fluency is achieved (Samuels, 1997).

Students need to read material at their independent level to build fluency, as fluency is a function of rapid word recognition. If the reading material is too difficult for the reader, too much time will be spent decoding or struggling to recognise words, to allow fluency to develop. Samuels' procedure was to match short passages of less than 200 words to the reading age (as opposed to the chronological age) of students experiencing fluency problems. As the students read the passages, errors were recorded, as was the rate of words per minute read. Students continued to read the passage until the rate of 85 words per minute was reached. The students then moved on to another passage. It was demonstrated that as the students' reading rate improved, the number of errors decreased. With subsequent passages, the initial reading rate was higher and it took fewer readings to reach 85 words per minute.

Samuels (1997) emphasised speed over accuracy because insisting on 100% accuracy would actually reduce reading speed.

Repeated readings have been the subject of hundreds of studies and, as a general rule, have shown significant improvements in fluency in a number of meta-analyses (Chard, Vaughn, & Tyler, 2002; Kuhn & Stahl, 2003; NICHD, 2000; Therrien, 2004). Variations to the original procedure have included initial modelling of the reading, whereby a competent reader models the correct reading of the passage before the student reads the passage; and corrective feedback, which involves correcting mistakes during the reading of the passage (Therrien, 2004). Progress is improved if there is an overlap of words from passage to passage (Rashotte & Torgesen, 1985). It is also considered important that students read aloud with prosody: the correct pitch, tone and rhythm. This is best achieved through reading rehearsal of fictional and poetic texts as these allow greater variance in prosody than non-fiction texts (Kuhn, 2004; Rasinski, 2006).

Repeated readings have been found to be an effective way to develop fluency in students with and without learning difficulties (Rashotte & Torgesen, 1985; Weinstein & Cooke, 1992). The National Reading Panel Report (NICHD, 2000) conducted a meta-analysis of 364 studies on repeated reading (or guided oral reading) and concluded guided oral reading procedures had a consistent and positive impact on word recognition, fluency, and comprehension as measured by a variety of test instruments, and at a range of grade levels. Effect sizes (reported as Cohen's *d*) ranged from 0.55 for reading accuracy, 0.44 for reading fluency and 0.35 for reading comprehension. Overall, the meta-analysis found a weighted effect size average of 0.41, suggesting that guided oral reading has a moderate impact upon reading achievement.

Technology has helped verify the efficacy of repeated reading programs (Foster, Ardoin, & Binder, 2013). A recent study examined changes in eye movements in students undertaking repeated reading activities. Primary school students read a passage four times whilst measurements were taken of the duration of the first fixation on a word, regardless of the number of fixations made on the word; the sum of all fixations made on a word prior to movement to another word; the sum of all fixations, including those following regressions on a word; total number of

regressions between words; and the total number of fixations divided by number of words of interest. The study found that the students spent significantly less time actively fixating on words, made significantly fewer fixations per word, and revisited previously fixated material significantly fewer times after four consecutive readings of the same passage (Foster et al., 2013).

Most studies of repeated readings have been conducted with primary school students. This is understandable because the first shift from *learning to read* to *reading to learn*, where fluency is a vital precursor to comprehension, occurs for most children in primary school. At younger ages, the initial focus of reading is to learn how to decode. As children advance through the grades, the focus of reading instruction shifts to comprehension. It has been argued that secondary students with reading difficulties are rarely provided with the opportunity to correct any deficits in the prerequisite skills of reading because of a lack of direct and intensive instruction in these skills at this level, and therefore, they are less likely to achieve the requisite levels in fluency and comprehension to succeed at the curriculum (Espin & Tindal, 1998).

In recent years, recommendations emanating from research regarding the implementation of repeated readings in secondary schools have appeared (T. Rasinski & Padak, 2005; Sample, 2005; Worthy & Broaddus, 2001; Worthy & Prater, 2002). Most studies, however, tend to involve students with emotional and behavioural problems or learning disabilities (LD), as elaborated on in the following paragraphs.

A small study conducted on four middle school students exhibiting behaviour problems found that repeated readings resulted in an increased reading rate for three of the four students, a reduction in reading errors for all four and improved literal and inferential comprehension for the four students (Alber-Morgan, Ramp, Anderson, & Martin, 2007). This study also included an informal survey of the students' opinion of the intervention, to which they all responded positively and claimed to recognise an improvement in their reading. However, this particular study was conducted in a special facility and data were collected by an experienced researcher and two doctoral students, resources that are unlikely to be found in most secondary schools.



A similar study was conducted in 2004 with students with emotional and behavioural disorders. An intervention consisting of repeated readings showed an increase in reading fluency and comprehension in four of the six participants. However, as in the Alber-Morgan et al. study, the intervention was only given to a small group in a specialised setting and was implemented by an outside specialist, in this case a research assistant (Strong, Wehby, Falk, & Lane, 2004).

Other studies have been conducted with secondary or upper primary students in special classes with the interventions conducted by specialists with students identified as having learning disabilities (Chard, et al., 2002; Freeland, Skinner, Jackson, McDaniel, & Smith, 2000; Herman, 1985; Mercer, Campbell, Miller, Mercer, & Lane, 2000) or emotional or behavioural disorders (T. M. Scott & Shearer-Lingo, 2002). None of these studies involved mainstream students experiencing fluency problems. These studies demonstrated that students with emotional and behavioural disorders and/or learning disabilities did improve their reading fluency with repeated readings. It has also been shown that students with reading fluency deficits in mainstream secondary classes could also improve their reading fluency through repeated readings (Therrien, 2004). What distinguishes the current study is that it does not rely on specialist settings or professionals to conduct the intervention. It has been designed for implementation by mainstream teachers for mainstream students.

Only one meta-analysis of research into repeated reading as an intervention for secondary students with fluency problems was located in this review of the literature (Wexler, Vaughn, Edmonds, & Reutebuch, 2007). The meta-analysis examined nineteen studies conducted between 1980 and 2005, and drew the conclusion that repeated reading did improve fluency among secondary students, especially if there was an audiotape or adult model to preview the reading. It was inconclusive as to whether there were gains in comprehension and it was suggested that specific strategies in comprehension be taught as well. With older students, there were also gains in fluency when non-repetitive reading was undertaken. Only five of the studies within the meta-analysis involved students with specific reading difficulties: the remaining studies involved students with diagnosed learning

disabilities or behavioural disorders; and all involved students in remedial rather than mainstream classes (Wexler et al., 2007).

Wexler, et al. (2007) also acknowledged that although increases in reading rate and accuracy could be achieved, motivating students to increase their amount of reading was problematic. Other limitations were that the passages used were predominantly from narrative texts, despite the emphasis on expository texts in the secondary setting. In addition, all studies involved a teacher or researcher having to physically be with the students to listen to them read, a limitation addressed in this study.

In one of the few studies of repeated readings with secondary students with substantial reading delays, Valleley and Shriver (2003) investigated their use with four Year 9 students whose reading fluency was below Fourth Grade level. They were given three, twenty-minute reading sessions a week for ten weeks: a total of ten hours of intervention. The students read each passage, starting at fourth grade level, until there were three consecutive improvements on words correct per minute. When this was achieved, they moved on to the next passage. They were also given passages from their Year 9 level English and social studies textbooks to practise. The results of this study indicated that repeated reading was an effective intervention for increasing these students' fluency as compared to their pre-test performance and that of a comparison group of average readers. Fluency gains were demonstrated with intervention materials from the fourth and fifth grade levels, with materials from the ninth grade level, and with passages from the participants' curriculum. These gains were accomplished with only ten hours' participation in the repeated readings intervention. Comprehension, however, did not markedly improve when reading fluency increased. The authors suggested that this might have occurred because reading fluency may have increased without existing deficits in background knowledge and vocabulary having improved, and these are critical component of comprehension. It may also be that a ten-hour repeated reading intervention might not have been sufficiently long to result in tangible effects on comprehension.

The challenge is how to implement a program of repeated readings in a mainstream secondary classroom. There are significant time constraints and many students feel stigmatized by being singled out for a remedial program (Ortlieb,

Grandstaff-Beckers, & Cheek, 2011; Reinking & Bridwell-Bowles, 1996). A common suggestion to overcome these problems is to implement a program of *Readers Theatre* (Rasinski, 2006; Worthy & Prater, 2002), a whole-class activity where students rehearse and then perform readings of poems, song lyrics or narratives. Worthy and Broadus (2001) suggest Readers Theatre as one of several performance-based interventions that can provide students with poor fluency the opportunity to practise their reading through rehearsal. By matching passages with student interest and ability and providing ongoing feedback, fluency is improved without any individual being singled out. They suggest that students can plan, practise and perform new texts as often as every week. Despite Worthy and Broadus' support for this intervention, it is a very time-consuming activity in an already crowded syllabus and the students with fluency problems still need to be closely monitored and tested.

Other methods similar to repeated reading have been suggested by Nichols, Rupley and Rasinski (2009) to improve literacy, including paired repeated reading, where pairs of students of similar reading ability read to each other. Assisted reading is another method whereby a student reads to a more proficient reader, either another student or a parent. Several other methods are also mentioned but all are essentially variations on repeated readings or Readers Theatre and are consequently time and teacher intensive. These represent real limitations for the teacher of any secondary subject with a syllabus to teach within a specified period of time.

It has been established that reading fluency is an area of reading difficulty for many students, especially at the secondary level of schooling. Most secondary English teachers, however, while familiar with the term *fluency*, would not be aware of the research evidence linking fluency and comprehension, nor of the various strategies that can be used to improve fluency, as these are not addressed in their pre-service teacher education programs (Love, 2010). Even if the links between fluency and comprehension were understood, and strategies such as repeated readings were known, implementing any repeated reading program in mainstream secondary English classrooms is highly problematic due to the time required to implement such a program, and the potential stigma felt by participating students. Thus secondary

English teachers have little capacity or opportunity to address this problem (Deshler, Hock, & Catts, 2006; Leko & Mundy, 2012).

For the purposes of this research, the following elements of fluency instruction will be integrated into the reading fluency intervention for both the treatment and comparison groups:

(a) Fluency practice on a daily basis. Both groups are required to spend several minutes a day practising their reading,

(b) Repeated oral reading of passages. Passages are read between five to ten times in a week for both groups.

(c) Controlled text difficulty. Participants from both groups will receive passages commensurate with their increasing reading ability.

(d) Provision of corrective feedback. This aspect is limited due to the positive influence feedback can have on performance. The treatment group receive an elementary form of feedback from the VRS as they read their passage. The comparison group receive some peer feedback because they read to each other.

(e) Teacher-modelled text reading. The comparison group will have their teacher model the reading passage. The home-based group will have a recording of each passage being read by the Researcher.

(f) Specified performance criterion levels of fluency; namely, 97% reading accuracy, a minimum rate of 100 words per minute and acceptable prosody before moving to a harder passage (Chard et al., 2002; Kuhn and Stahl, 2003; NICHD, 2000).

In addition, this research was designed to investigate the potential of computer technology to overcome the barriers to improving students' reading fluency that exist in the secondary setting. The following section of this review tracks the use of early computer technology to assist students with reading difficulties, before exploring how more recent developments in this field have been used to support secondary students with reading difficulties, and their teachers.

## **Computer Technology in Reading Assistance and Remediation**

### **Early developments**

In 1963, while at Stanford, Patrick Suppes and Richard Atkinson established a program of research and development on computer-assisted instruction in mathematics and reading (Suppes, 1966). They sought to free students from the lock-step process of group-paced instruction and developed individualized, instructional strategies that allowed the learner to correct responses through rapid feedback. The self-paced programs allowed a student to take an active role in the learning process. Mastery was obtained through drill-and-practice. Suppes and Atkinson were the first researchers to publish a report on the use of computers in the teaching of reading (NICHHD, 2000).

Very little research was conducted through the 1960s and 1970s due to the limited access to computers, with early experiments confined to specialised studies in universities. In the late 1960s in the United States, in order to make access to computers widely available, the National Science Foundation (NSF) supported the development of 30 regional computing networks, which included 300 institutions of higher education and some secondary schools. In 1963, only 1% of American secondary schools used computers for instructional purposes. By 1975, 55% of the schools had access and 23% were using computers primarily for instruction; however, they were mainly used for teaching the elementary principles of computing and some programming languages such as BASIC. Despite the large numbers of students involved in this early computer education, much of it was conducted through time-share arrangements with universities (Chua & McCallum, 1984; Lidtke & Moursund, 1993).

This changed to some degree in the 1980s with the development of microcomputers, which became available to schools. As time progressed, computers became cheaper and more powerful which sparked an interest in using the machines to overcome reading difficulties experienced by students (Lidtke & Moursund, 1993). There were, however, a number of reasons why computers did not play a large part in reading instruction until the late 1990s. Computers did not have many of the capabilities that were needed to implement a complete program of reading instruction. In particular, there was an inability to comprehend oral reading and judge

its accuracy. Another difficulty was the inability of computers to accept open responses to comprehension questions, leading to a sole reliance on recognition tests like multiple choice formats (NICHHD, 2000).

Despite the ready availability of computers through the 80s and 90s, relatively few studies were conducted on their use in reading. When the National Reading Panel prepared their report in 2000, they were only able to include 21 studies in their chapter on computer technology and reading instruction.

### **Assistive and Remedial Technologies**

Technology has been used either in an *assistive* way, or for *remedial* purposes. Technology that *assists* is designed to accommodate a learner experiencing difficulties and thus reduce the difficulties in a particular learning context. On the other hand, technology that *remediates* addresses the actual problem the learner is experiencing. For example, a text to speech converter provides access to text for a person who is visually impaired. This will accommodate their difficulties accessing the print, but will not remediate their impairment. On the other hand, drill and practice software is designed to remediate problems with phonics, word recognition and reading fluency (Edyburn, 2001).

*Accommodating* a learning difficulty can be considered to be at one end of a spectrum and *remediation* of a problem at the other. This review is more concerned with technology that remediates reading difficulties. In terms of promoting reading fluency, different forms of computer software can both read text to students (text to speech) in order to model the spoken version of written text, and convert speech to text (voice recognition). The most sophisticated of the text to speech software programs available at the time of data collection for this research was the Kurzweil 3000 version 13 (Green & Thormann, 2009). The software scans written text and then reads it back in a human-sounding voice. Text is displayed on the screen in any size the user chooses and text is highlighted as it is read (Laga, Steere, & Cavaiuolo, 2006).

In a study conducted to improve reading fluency in four students with cerebral palsy, the Kurzweil 3000 was used in a repeated reading program to model the correct reading of a passage (M. B. Coleman & Heller, 2010). The students read the passage

three times while the Kurzweil software modelled the reading twice in each session. The students completed between 12 and 16 sessions. The results showed that there were gains in fluency whilst reading the passages and that those gains were transferred when reading unseen, unpractised passages. Despite the use of this technology, however, the intervention still required a researcher to be present each time one of the participants read the required passage so that rate and accuracy could be recorded and corrective feedback given. Since the researcher was present as students read, the relevance of the software comes into question. The researcher could have modelled the passages instead of the software although the authors suggest use of the technology provided a motivational effect on the students (M. B. Coleman & Heller, 2010).

### **Using computer technology to remediate reading difficulties**

The Kurzweil 3000, like other text to speech software, is generally considered to be assistive technology. Voice recognition software, or speech to text, however, can be used for a more remedial function (Higgins & Raskind, 2004). The majority of recent work in this area has emanated from the Frostig Centre in California in the work of Eleanor Higgins and Marshall Raskind.

At the Frostig Centre, speech recognition-based programs (SRBP) and an automaticity program (AP) were given to 28 students aged between 8 and 18 years who had learning disabilities that included reading and spelling difficulties. They participated in the programs for 17 weeks and their progress was compared with that of a group who did not have exposure to the programs. The SRBP program used text to speech software by offering students five spoken options for missing words in sentences. As students selected the correct words, sentences formed to complete a story. The authors cite that the benefits of this program were that by hearing the words, students were able to more quickly establish phoneme-grapheme relationships. Previous studies by the authors concluded that voice recognition helped students improve word recognition, reading comprehension, spelling and phonological processing. They also claimed that there were problems generally associated with using voice recognition, such as the requirement for a quiet environment and inaccuracies with the software that were exacerbated by its difficulty in recognising children's speech. They claimed that the Kurzweil 3000

overcame these difficulties. However, the program they described appeared to incorporate a text to speech function rather than voice recognition, as the Kurzweil 3000 is capable of both functions. At the end of the program all students in the treatment group had made significant increases in reading ability although there was no improvement in spelling (Higgins & Raskind, 2004).

The Automaticity Program used in that research consisted of three parts and was delivered in three 50-minute sessions per week. The first part, *Reading Patterns*, was designed to develop rapid automatic recognition of predictable phonological/orthographical patterns. This was followed by *Sight-word Workouts* that promoted rapid automatic recognition of unpredictable phonological /orthographical patterns. *Repeated Readings* to encourage speed and fluency in reading connected text concluded the program. The program was not done entirely on computer but divided among teacher-supported and peer-supported activities. Kurzweil 3000 read the passages to the students, who then read the passage, trying to maintain pace as the software highlighted the text. Again, this program was based on converting text to speech rather than voice recognition.

In an earlier study, the same authors (Raskind & Higgins, 1999) examined students with unspecified learning difficulties that resulted in them having a reading age two to three years below their chronological age. In their experiment, 19 students used VRS for 50 minutes a week to compose narratives over a sixteen-week period. The authors believed that using VRS to compose writing would have a secondary effect on reading. The process of composing required the students to read as well in order to check accuracy. Compared to a control group, the students showed greater improvement in word recognition and reading comprehension. Pre- and post-testing showed that the real growth compared to the control group was in improved phonological processing. The authors suggested a number of reasons for reading improvement through the use of VRS. The technology required constant monitoring (reading) of the screen to ensure that the right words were being written. When there was doubt, a list of alternative words was provided, again requiring more reading. In effect, the technology provided multiple additional opportunities to practise reading. Another possible contributor to the improved reading outcomes, according to the authors, was the bimodal nature of the process: saying the words and then seeing



them appear immediately on the computer screen consolidated phonemic-graphemic relationships through paired association learning. Finally, there was the motivational factor associated with using technology that may have resulted in greater application to the task.

The authors followed up this study when a newer version of VRS became available (Higgins & Raskind, 2000). The original version required word-by-word (discrete) dictation whereas the newer version allowed for continuous speech; that is, whole sentences could be spoken while appearing on the screen. Another group of 17 students, also with learning difficulties, was created to compare with the original control group and the group using discrete word recognition. Again, the students spent 50 minutes, three times a week for sixteen weeks composing stories. Pre- and post-testing revealed that both groups using VRS performed better than the control group in word recognition and reading comprehension. The discrete group showed the greatest improvement in spelling. The authors suggest that continuous voice recognition was not as effective as discrete voice recognition because students missed out on the very direct phoneme-grapheme correlation whilst dictating (Higgins & Raskind, 2000).

*Read Naturally* was a program designed to improve reading fluency using a combination of books, audiotapes, and computer software. It included three main strategies: repeated reading of English text for oral reading fluency development, teacher modelling of story reading, and systematic monitoring of student progress by teachers. The program provided three audio models that increased in rate by approximately 10% with each subsequent recording. Following a 32-week intervention, researchers found average gains of approximately 51-54 correct words read per minute for second and third-grade students in a remedial reading program (Hasbrouck, Ihnot, & Rogers, 1999).

A more recent study (Denton, Fletcher, Anthony, & Francis, 2006) examined the use of *Read Naturally* as one component within an intensive reading intervention for upper elementary students who failed to respond to previous intervention attempts. Denton et al. found small to moderate effect sizes for reading fluency following an eight-week intervention using *Read Naturally*; however, *Read Naturally* yielded no significant effect on the students' decoding, spelling, or comprehension.

In both cases, the intervention required substantial teacher involvement and interaction with the students.

A British study (Lange, McPhillips, Mulhern, & Wylie, 2006) assessed the compensatory effectiveness of four assistive software tools (speech synthesis, spellchecker, homophone tool, and dictionary) on literacy. A total of 93 secondary students with reading difficulties completed computer-based tests of literacy skills. Students were divided into three groups: the Assistive Software group, the Microsoft Word® Control group and the Full Control group. Training on their respective software followed for those assigned to the Assistive Software and the Microsoft Word® Control groups. Post-tests revealed an improvement for the Assistive Software group on reading comprehension, homophone error detection, spelling error detection, and word meanings. The Microsoft Word® Control group also improved on spelling error detection and word meanings, but performed worse on homophone error detection. The Full Control group showed no significant improvements on any of the measures. Overall, results of the study indicated a significant assistive value associated with the four software tools (Read and Write Gold, 2002) across several domains of literacy. Speech synthesis was used to read passages aloud for reading comprehension exercises. The Assistive Software group improved their reading comprehension by a mean of eight per cent on pre-testing whilst the two control groups recorded no improvement. The study supported previous research by Raskind and Higgins (1999) that the technology particularly benefits students with reading difficulties, and foregrounded the potential impact that technology could have on supporting development of this critical skill.

A meta-analysis of Computer Assisted Instruction (CAI) for reading examined how CAI was used to improve reading ability in 17 students with learning disabilities (Hall, Hughes, & Filbert, 2000). Three main elements of CAI were identified: drill and practice, strategy and simulation. The elements they targeted were pre-reading, word recognition, vocabulary/language and comprehension /higher order thinking skills. Although 13 of the 17 studies showed improvements in reading following intervention through CAI, all subjects had broader learning disabilities as opposed to specific reading difficulties. The real strengths of CAI, particularly software designed for drill and practice, were that it enabled students to practise

without the teacher, it provided instant feedback, and students were able to work at an individual pace. However, the study's authors cautioned against using technology to replace teacher instruction. A significant conclusion from this meta-analysis was that CAI is a useful tool to allow students to practise skills but a teacher must provide instruction prior to practice and monitor student progress in order to make adjustments. Teachers were not being replaced by technology, but were being supported by it.

A commercial program that has used VRS to improve reading fluency, *Soliloquy Reading Assistant* (SRA), requires students to read e-books into a computer using a standard headset and microphone. Through SRA's voice-recognition technology, the program was able to "listen" and recognise when readers stumbled or made mistakes on specific words. When a student struggled, the program assisted or corrected him/her by reading the word clearly, whilst making records in the background for teacher review. The 60 students involved in the study began using the program in October 2006 after they undertook a Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment, a set of standardised, individually administered measures of early literacy development. The participating students' initial DIBELS results revealed that they were at the lowest level of literacy, defined as the Intensive level. In order to raise their fluency level, SRA was used each day for fifteen minutes, four days a week in a computer lab. The program was used in addition to the students' daily 90-minute reading block. After two months of usage, the majority of the students reached the next level of literacy, the Strategic level, based on a follow-up DIBELS assessment (Speech recognition improves reading fluency at school, 2007).

These results provided some evidence of the potential of VRS to support struggling readers, but most of the information relating to this software is available from commercial sources. One doctoral dissertation was located that provided an independent evaluation of the software. It was used with 45 second-grade students identified as struggling readers over a three-month period. Results from the study showed that the students had improved their reading fluency; however, the author concluded that the most important factor for student improvement was consistent, quality literacy instruction (Albert Devine, 2009).

In 2007, *Soliloquy Reading Assistant* was acquired by the Scientific Learning Corporation, owners of another successful commercial computer-based reading program, *Fast Forward*, which has had significant independent peer-reviewed research. One study conducted in 2001 investigated the progress of 11 participants, aged 7-12 with reading difficulties, who undertook *Fast Forward* (FFW) treatment for approximately two hours each week day for two months. They completed five computer-based reading activities daily that took approximately 20 minutes each for a total of 100 minutes with two 10-minute breaks. Treatment continued until the student had reached the criterion, which was successful completion of the five activities at a level of 90% or better, or until an obvious plateau had been reached. Children varied in completion time from 22 to 44 days, depending on individual performances. The progress of the 11 children were compared with a similar group who undertook Orton Gillingham (OG) training treatment, which involved one hour a day of one-on-one remediation five days a week. The OG teaching method is a multi-sensory structured language approach that incorporates the following principles of teaching: emphasis on the alphabetic code, systematic and explicit presentation of concepts, consistent review of previously presented material, and emphasis on rule acquisition and application.

Analysis of outcomes showed that both treatment groups (FFW and OG) made gains in phonemic awareness immediately after treatment, but only the OG group made gains in word attack. Neither group made gains in word identification. In the area of word attack, the increased gains made by the children in the OG treatment group were consistent with evidence that combining phonemic awareness training with direct instruction in the alphabetic code (how letters map onto sounds) was more successful in increasing reading skills than training in phonemic awareness alone (Hook, Macaruso, & Jones, 2001). There was a lack of progress by either group in word identification, which could have reflected the short time period over which the study was conducted (only 5-8 weeks).

*Fast Forward* improved phonemic awareness immediately after treatment but no more than a less intensive OG program, and the OG group made greater improvement in word attack. Both groups of participants were then tested one and two years after the intervention. Over a two-year period, FFW did not appear to

provide benefits in the rate of acquisition of word identification, word attack, or passage comprehension skills in children with reading disabilities who were receiving appropriate multi-sensory structured language intervention. Therefore, the intensive amount of time needed to complete the FFW activities and the expense involved did not seem warranted (Hook et al., 2001).

Despite the popularity of *Fast Forward*, first released in 1996, no published, peer-reviewed research has supported its claims to remediate reading difficulties. Only two small studies, written by designers of the program, report that the program benefits struggling readers (Gillam et al., 2008; Olson, 2011). The program is available in Australia but is a relatively expensive option for most schools, and based on the evidence available, does not represent an effective option to remediate reading difficulties.

As speech/voice recognition has improved in recent years, it has also been used to assess student reading. *Fluent Oral Reading Assessment* (FLORA) is an accessible computer program that uses speech recognition to provide an accurate measure of children's oral reading ability. It presents grade-level text passages to children who read the passages aloud, and computes the number of words correct per minute (WCPM), a standard measure of oral reading fluency. In a comparison of the results of FLORA with human scoring on 783 recordings of grade level text passages by 313 students in Years 1 to 4 across schools, the FLORA WCPM scores were highly correlated with the human scoring. Across all recordings, the mean difference between FLORA and the averaged human scores was 3.62 words, while the mean difference between human scores was 1.28 words. In the study, the human scorers were two former elementary school teachers, each of whom had more than a decade of experience administering reading assessments to elementary school children (Bolanos, Cole, Ward, Borts, & Svirsky, 2011). This is an example of VRS being used in relation to fluency, but only for diagnosis, not remediation, but does offer some hope that technology will be able to automate some of the processes of diagnosis and remediation of reading difficulties.

In 2012, Balogh and her colleagues analysed large-scale adult literacy assessment data collected by the United States government using a system called *VersaReader*. This software used automatic speech recognition and speech

processing technologies to score oral reading fluency. In the initial part of the experiment, human researchers rated oral reading performances to establish a criterion measure for comparisons with the machine scores. The goal was to measure the reliability of ratings from humans, and to determine whether or not the humans biased their ratings in favour of, or against, three groups of readers: Spanish speakers, African Americans, and all other native English speakers. The results demonstrated that ratings from skilled humans were extremely reliable and free from bias. The second part of the experiment was designed to compare the criterion human ratings with scores generated by *VersaReader*. Correlations between *VersaReader* scores and human ratings approached unity, revealing that the machine scores were almost identical to the human scores, and that the *VersaReader* results were also free from bias (Balogh et al., 2012). This provides further support for the view that technology would be extremely useful in supporting secondary teachers in the assessment of students' reading fluency.

Some research into CAI has included investigation of the motivational effects associated with using computer technology because of the novelty factor. It has been considered a factor in encouraging students to participate more readily in literacy tasks such as writing (Goldberg, Russell, & Cook, 2003). By 2008, however, some researchers believe that, due to the ubiquitous nature of computer technology, the novelty effect had largely disappeared (Huett, Moller, Young, Bray, & Huett, 2008). The ever-increasing variation in the programs available since then, however, and the variety of ways in which computer technology can engage and motivate the user, suggest that the motivation factor cannot be discounted, and that the conclusions of Huett, et al. need further testing.

### **The rise of portable devices**

Huett may have been correct about the ubiquitous nature of computer technology, but as he was making this observation the first iPhone was released in 2007 with Android-powered smartphones following shortly after. In 2010, the Apple Corporation launched the iPad. The introduction of these new portable technologies opened up new opportunities for literacy instruction; and it was argued that the novelty factor had returned (Winters & Cheesman, 2013).

In 2006, the *iREAD* (I Record Educational Audio Digitally) project started as a pilot program in California, with six teachers of English language learners working with low-performing readers, content experts, and IT staff (Chen, 2010). The initial project had expanded four years later to more than 100 K-8 classrooms. Students used the iPods with external microphones to record their reading practice and assessments. The iPod Touch, with its larger screen, Internet access, and applications, enabled students to download audiobooks and songs and read along with the text of stories and lyrics. Student and teacher recordings were uploaded to iTunes, where teachers created playlists for each student. Students, teachers, and parents could then review progress.

Recording their voices using the iPod provided instant feedback, as students could easily record their fluency practice and listen immediately to the voice recording. Struggling readers are usually concentrating to such an extent on the act of reading, that they have little perception of what they actually sound like. The iPod provided a means for the student to receive feedback by listening to his or her own recordings. Anecdotal evidence gathered in the school district involved in the study showed fluency gains of 10-64 correct words per minute following a six-week intervention involving repeated reading and voice recording with iPod mobile devices (Chen, 2010).

A smaller study in 2013 that utilised technology in a repeated reading program involved five primary-aged students from a rural, Midwestern school in Grades Two to Four who were categorised as having specific learning disabilities (Carlson, 2014). Their oral reading fluency scores fell below grade-level benchmarks on the DIBELS Next Oral Reading Fluency subtest. Over the course of 14 weeks, the students participated in two repeated reading interventions: in the first, they reread passages until a pre-determined criterion had been reached; and in the second, they listened to audio recordings of a fluent reader reading a passage before engaging in repeated reading of the same passage. Each participant's formative performance was measured using one-minute, repeated-reading probes. The researcher measured summative performance through examination of overall performance change and the participants' benchmark and progress monitoring scores on the DIBELS Next Oral Reading Fluency subtest. All five participants showed improvements in oral reading

rate and accuracy after participating in the repeated reading interventions. The addition of audio modelling by a fluent reader resulted in a greater decrease in error rates and slightly greater rates of growth in oral reading rate when compared to repeated reading procedures alone (Carlson, 2014). It appears that portable technologies could have an important role to play in reading remediation.

Another small research project examined the impact of the iPad on the rate of fluency gain on struggling sixth-grade readers when used in conjunction with other reading intervention strategies (Swanson, 2013). Students used the iPad to record themselves reading along with pre-recorded stories. In addition, and of particular relevance to this study, the research project examined the use of the iPad and its influence on the students' self-perception as readers. The study took place for 10 weeks in a rural school district during the 2012-2013 year. Eight students participated in the study, and were surveyed both before and after the study. Data from the surveys and rates of fluency gain were charted.

The students were ranked and placed by matched pairs into two groups. The study took place in the sixth-grade reading classroom for 30 minutes each day and was divided into two phases, each of 23 days' duration. Using *Read Naturally* stories, students' initial unpractised reading fluency scores were charted during both phases of the study. Only one group was able to use the iPad during the first phase to record themselves and to practise their reading passages. During the second phase, the other group was allowed use of the iPads for the same purpose. The findings of the study revealed that all of the students liked using the iPad, but no conclusive evidence was found to suggest that iPad use increased the rate of fluency gain. Notably, students still had to read the passages to an adult who timed the reading and measured the accuracy. Results from the Reader Self-Perception Scale (RSPS) showed a slight improvement in their self-perception as readers as a result of participating in the intervention (Swanson, 2013). It is possible that the school setting and adult involvement created a perception among students that this was another task controlled by the school. This research aims to reduce that impact by allowing students to conduct the intervention in their homes.

Reading comprehension was examined in a randomized control trial in four Grade 6 classes, two of which received a digital literacy intervention and two of



which did not. The six-week intervention consisted of independent reading of an age-appropriate text on an iPad along with instruction on how to use the technologies associated with the digital text, with the non-intervention group reading the same text in standard print format. All students participated in pre- and post-tests that used the Qualitative Reading Inventory (QRI) to measure comprehension proficiency and the Adolescent Motivation to Read Profile (Pitcher et al., 2007) to measure the motivation to read. When analysis of variance techniques were used to compare the groups, results revealed that students who received the digital intervention improved significantly more in both comprehension and motivation than those who read the printed text. In addition, regression analysis revealed that neither race, gender, standardized state test scores, nor changes in motivation were significant predictors of the change in reading comprehension: the only significant predictor was whether or not the student received the digital intervention. Taken together, the findings from this small sample study suggest that motivation and comprehension proficiency improved after students read a narrative text on an iPad (Bauman, 2014). The use of novel technology appeared to be a key component.

In summary, employing computer technology to assist reading instruction has been in place since the early 1980s (Lidtke & Moursund, 1993). Many of the studies have involved students with broader learning disabilities as opposed to struggling readers. The use of voice recognition technology has been very limited. Most applications of this technology have been to assist students with learning disabilities to write more effectively. Alternatively, it has been used as one of several reading interventions applied concurrently, so it is difficult to gauge its particular effectiveness in developing reading fluency. The vast majority of studies that incorporate VRS involve participants from early primary school settings or secondary students with significant learning and/or intellectual disabilities. There is a paucity of studies that examine the role that VRS can play in improving reading outcomes for mainstream secondary students (Blanchard & Farstrup, 2011; Slavin, Cheung, Groff, & Lake, 2008). One reason for this could be the considerable time it has taken for VRS to become sufficiently accurate and inexpensive to be used widely in schools. Thus, while the technology is not new, it has only recently developed to the point where it can be used effectively within a school setting. It is therefore not surprising that there have been few studies involving VRS in the remediation of literacy

problems. At approximately the same time that VRS has achieved useful levels of accuracy, much of the attention has been shifted away from traditional computing to the newer portable devices such as the iPad.

The popularity of portable devices including the iPad, iPhone and iPod, and the thousands of *apps*, or applications, which have been, and continue to be, developed, has opened a new domain for research into fluency remediation. As yet, however, relatively little published research has emerged on how such devices can remediate reading fluency. With this new shift in technology, the development of software has also changed. Where once large software companies produced a narrow range of software, now any member of the public can produce an app. As a consequence, there are hundreds of thousands of these apps now in existence (Lynch & Redpath, 2014). The effect of this development is that research has struggled to keep up with the development of this type of technology in the form of peer-reviewed studies. The published studies and a number of post-graduate theses, have had very small sample groups. As a result of these two factors—the abandonment of VRS on traditional computers just as it was becoming useful, and the inability of researchers to keep up to date with the explosion of apps—there is relatively little published research that could be included in the section of the literature review.

## **Chapter summary**

This chapter is summarised by the conceptual framework presented in Figure 7. (Words in bold refer to headings within the conceptual framework.) Reading difficulties affect a significant proportion of students in secondary schools, perhaps as many as 10-20% and it is the experience of these students that form the broad **context** of this study.

Laboured, dysfluent reading is one of the most common reading problems experienced by secondary students; problems that would have had their origins in the early years of primary school. As a result of the Matthew Effect, students' early reading difficulties would have impeded **the reading process**, and been exacerbated by the increasing length and difficulty of secondary texts, and the growing complexity of the tasks required at secondary school. Disruption to the reading

process has been shown to have a damaging effect on reading **fluency, which is of critical importance** for successful participation in the secondary curriculum.

Poor fluency has a significant **impact** on these students. This impact affects their ability to participate in the curriculum and erodes motivation and increases the likelihood of school failure and dropout. This in turn can lead to unemployment, poverty, health issues and even incarceration.

For secondary students feeling the impact of reading difficulties, specifically poor reading fluency, **repeated readings can improve reading fluency**; however, the constraints of secondary classrooms make their application very difficult. When implemented in the classroom, this strategy is time-intensive and publicly singles out students with reading difficulties.

Whilst a large number of studies over the years have proposed **using computer technology to assist with literacy learning, including reading**, far fewer have explored ways in which computers can specifically remediate reading beyond the early acquisition stage (Ketterlin-Geller & Tindal, 2007; Zhao, 2007). Most of the studies have involved students in primary schools or with broader learning difficulties. Very few of the studies involving computer technology in reading have exclusively employed VRS. This area still has extensive scope for research and was the focus of this study. Specifically, could VRS be employed to expedite the delivery of a home-based repeated reading program to improve reading fluency in adolescents? In addition, the study sought to determine whether reading comprehension and self-perceptions as a reader would show improvement as a consequence of improved reading fluency.

As a result, this research focused on secondary school students with reading difficulties but without a particular diagnosis. It examined how poor reading may be remediated through the use of VRS. Unlike many previous studies, the technology employed a *speech to text* rather than *text to speech* function. The intervention, detailed in the next chapter, arose as a result of the literature review, and was designed to assess whether **a home-based repeated reading program incorporating VRS would improve reading fluency** and comprehension, as well as improve perceptions of themselves as readers.

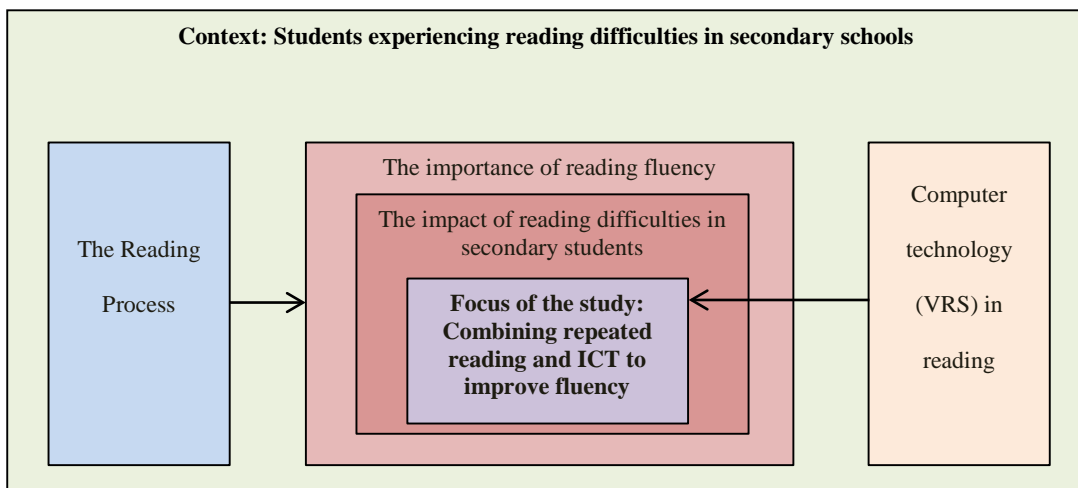


Figure 7. Conceptual framework of the study

Chapter Three describes the methodology employed for this research. It provides a rationale for the chosen methodology and research design. It also describes the assessment instruments used, and the data collection and analysis procedures.

## Chapter Three: Research Methodology and Design

### Overview

Chapter Two examined the literature relevant to this study, with a specific focus on the reading process, including reading fluency, and the use of *repeated readings* to improve reading fluency. It also examined how ICTs have been employed to assist with reading fluency. It concluded that there has been very limited work involving the use of ICTs to remediate reading fluency problems among adolescents in mainstream educational environments. This research addresses this gap in the literature by examining whether ICTs, specifically VRS, can improve the reading fluency of junior secondary students who have been identified as having poor reading fluency.

This chapter describes the rationale behind the methodological approach, descriptions of the instruments, the research site, selection of participants and how they were allocated to groups. It then describes the data collection and analysis procedures, as outlined in Figure 8.

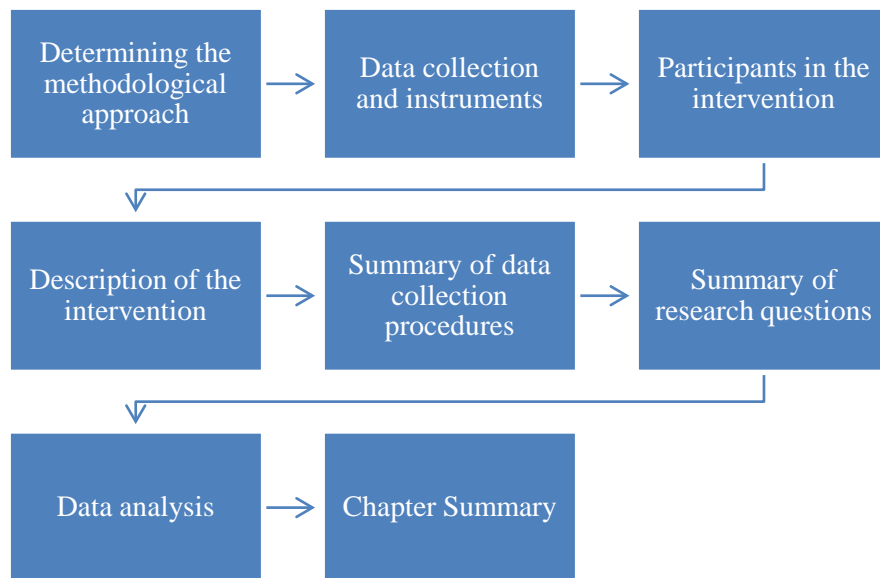


Figure 8. Structure of the research methodology and design chapter

### Restatement of the Purpose of the Study

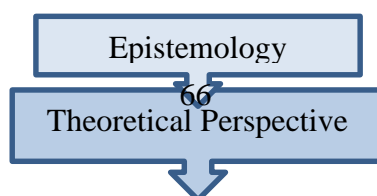
The purpose of the study was to examine whether the use of repeated readings delivered via a home-based program employing VRS could improve the reading fluency and self-perception as readers of adolescent students experiencing reading

difficulties. The intervention was designed to overcome the problems associated with delivering a repeated reading program within a secondary English classroom. These problems relate to the amount of time required to conduct a repeated reading program within the constraints of the existing curriculum; and the reluctance of students to participate in such a program as it draws attention to their reading difficulties. Within this context, three specific research questions were developed:

1. What impact does a home-based repeated reading program using VRS have on the reading fluency of adolescents with reading difficulties, relative to a traditional repeated reading program?
2. What impact does a home-based repeated reading program using VRS have on the reading comprehension of adolescents with reading difficulties, relative to a traditional repeated reading program?
3. What impact does a home-based repeated reading program using VRS have on the self-perception as readers of adolescents with reading difficulties, relative to a traditional repeated reading program?

### **Determining the methodological approach**

A researcher's goal is to extend the body of human knowledge, which requires an understanding of the nature of this somewhat abstract construct. *Epistemology* is the study of knowledge and justified belief (Renaud, 2006), and is therefore central to research endeavour. In the context of research, Crotty (1998) defines epistemology as one's perceptions of reality and understandings about human knowledge. He argues that a researcher's epistemological assumptions will influence the *theoretical perspective* (sometimes referred to as the research paradigm) the researcher will choose. The theoretical perspective will then guide the *methodology*: the strategy or plan of action for the research. In turn, the methodology determines the precise *methods* employed: the techniques or procedures used to collect and analyse the data related to the research question. Crotty's model demonstrating this process is presented in Figure 9 and the way in which it informed the current study is expanded upon in the subsequent sections.



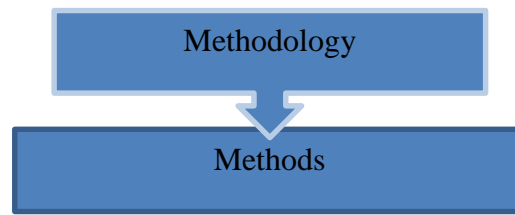


Figure 9. Crotty's four elements of the research process (Crotty, 1998)

### **Epistemology**

For decades a researcher's choice was essentially between the *objectivist paradigm* with its quantitative assumptions of controlled settings and precise measurements; and the *constructivist paradigm* with its qualitative endeavours to deepen understanding through exploration of individual contexts and different perspectives (Mackenzie & Knipe, 2006). More recently, these two broad approaches have come to be viewed as the extreme ends of a spectrum and researchers have employed both qualitative and quantitative methods to investigate issues and phenomena (Burke Johnson & Onwuegbuzie, 2004).

Unlike Cohen, Manion and Morrison (2011), who subscribe to the two main approaches to studying the social sciences briefly described above, Crotty (1998) describes several key epistemologies. He includes *objectivism*, which holds that meaning is separate from our consciousness and is not open to individual interpretation. This approach is based on the notion that through the observation and measurement of human behaviour, universal rules can be deduced. The objectivist epistemology lends itself to a *positivist* theoretical perspective, which is the dominant ideology of quantitative researchers.

Crotty's second epistemological approach is *constructionism* [which could be perceived as a development of *constructivism*] and holds that meaning is not 'discovered' but *constructed within the mind*; hence, different people can construct different meanings from the same phenomenon. Constructionist researchers acknowledge the influence their own experience and backgrounds may have on their research. Unlike objectivist researchers, they do not necessarily begin with a theory but may generate theory or a pattern of meanings as their research unfolds. Constructionism is the dominant ideology of qualitative researchers, although

quantitative methods may also be used to support or provide more depth to qualitative data (Mackenzie & Knipe, 2006).

Crotty (1998) describes a third major epistemological approach: that of *subjectivism*. There is an important difference between constructionism and subjectivism: in constructionism, meaning is constructed during the interplay between subject and object; whereas within subjectivism *meaning is imposed on the object by the subject*. The latter is the epistemological approach favoured by those with a structuralist, post-structuralist or post-modernist perspective on seeking understanding. Subjectivism gained popularity in the 1980s in response to the recognition that social theory behind the dominant approaches up to that time had been largely based on a white male perspective (Mertens, 2005, p. 17).

Initially, this research was to be conducted within an objectivist paradigm with a predominantly quantitative approach to methodology. The reduction in participant numbers, explained more fully at a later point, meant that a strictly quantitative approach was not appropriate. It was decided that a *constructionist* approach would be more appropriate, because it better represented the individual nature of reading difficulties and facilitated inclusion of the students' experiences in the study. As Crotty (1998) states, in constructionist epistemology meaning is not discovered but constructed (p. 41). Whilst the phenomenon of reading difficulties has been widely researched and the causes and consequences described, the experience of reading difficulties is different for each individual. An investigation into the experiences of individuals who have reading difficulties would necessarily have to explore the experiences for each individual.

### **Theoretical perspective**

Assumptions about epistemology influence a researcher's theoretical perspective. While epistemology refers to a researcher's assumptions about the *nature* of knowledge, the theoretical perspective describes the researcher's assumptions of *how knowledge applies to the human world* and how it applies to the specific aims of a study, the research questions and the anticipated outcomes (Mills, Bonner, & Francis, 2006).



Positivist perspectives are generally aligned with an objectivist epistemology, and therefore focus on constructs such as objective measurement and clearly defined answers. The term *positivist* was made popular by the French philosopher, Auguste Comte (1798-1857), who held the view that all genuine knowledge is based on what is observable and can only be advanced by means of observation and experiment. In addition, the end product of positivist research in the social sciences is expressed, as it is in the natural sciences, in terms of laws or law-like generalisations (Cohen et al., 2011).

In contrast to the single objective reality assumed by the positivist approach, the *interpretivist* perspective assumes that more than one reality can exist, and incorporates within the research the participants' views, including those of the researcher, with the acknowledgement that the researcher's background and experience will influence the outcome (Mackenzie & Knipe, 2006). Indeed, the interpretivist view is that incorporating all views is the *only way* to access truth (Myers, 2009). The goal of interpretivist research is *to understand* a phenomenon, and therefore research endeavour focuses on what is specific and unique rather than on what is general and representative. The knowledge generated by this type of research is not *absolute* but *relative*, depending on time, context, culture and the values of those involved (Pizam & Mansfeld, 1999).

*Pragmatism* describes a theoretical perspective that differs from both the positivist and interpretivist views (Ormerod, 2005). It emerged in America in the 1870s and is largely attributed to the American mathematician and philosopher, Charles Sanders Peirce. It caused controversy in the United States and Europe in the late nineteenth and early twentieth centuries, but had relatively little impact. Pragmatism received renewed attention after Quine and Sellars used a revised pragmatism to criticise logical positivism in the 1960s (as cited in Kemp, 2006). The pragmatic perspective *places the central focus on the research problem* rather than on a particular theoretical orientation, and therefore the research is conducted using whatever methods are most suited to answering the research question, whether they be qualitative or quantitative (Mackenzie & Knipe, 2006; Morgan, 2014). This means that the researcher must resist fixed principles and absolutes, and deal only with facts as they relate to the problem at hand. The goal is resolution of the problem. This does

not mean that logic and rigour are discarded, but that strict adherence to a particular theoretical perspective may in fact hinder movement toward understanding and the expansion of knowledge (Florczak, 2014).

The proponents of pragmatism argue that, rather than drawing from conflicting and incompatible approaches, pragmatism draws on the strengths of each of the traditional perspectives whilst offsetting their weaknesses. A combination of quantitative and qualitative methods can in some cases provide a better understanding of research questions than either approach alone (Symonds & Gorard, 2008). This approach is consistent with the notion of *triangulation*: the use of data sets of different types and from different sources to either confirm or question apparent findings.

Pragmatism was selected as the theoretical perspective for this study because the research questions could not be answered through the exclusive use of either a quantitative or a qualitative approach. For example, reading progress can be measured quantitatively, but understanding self-perception as a reader is best achieved through the use of both quantitative and qualitative methods.

### **Methodology**

The theoretical orientation provides the rationale for the methodology: the plan of action designed to answer the research question(s). The pragmatic theoretical perspective leads, almost by definition, to a mix of methodologies and in recent years, the use of *mixed methods* has become a popular approach to social research (Burke Johnson & Onwuegbuzie, 2004; Creswell, 2003; Gorard, 2004). Mixed methods integrate both qualitative and quantitative procedures and can respond to the research questions more comprehensively than each can independently (Johnson, Onwuegbuzie, & Turner, 2007).

In this study, different instruments were used to measure the reading ability of participants; but measurements alone could not explain why one student might perform better than another, or why progress of individuals during an intervention might be rapid or slow. Exploring these questions required more holistic thinking, which led to consideration of a case study approach (Burke Johnson & Onwuegbuzie, 2004; Cameron, 2011).

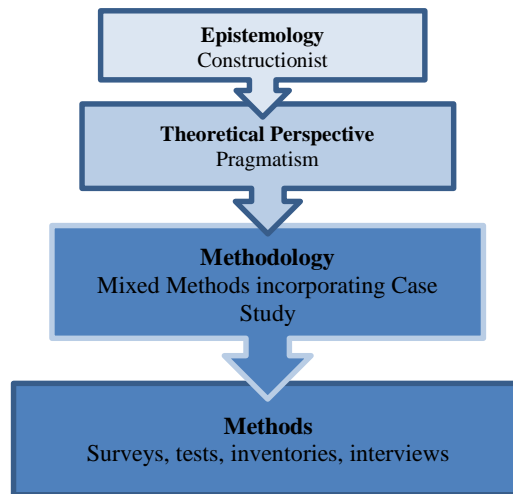
Case studies can penetrate situations in ways that are not always susceptible to numerical analysis. They aim for analytic rather than statistical generalisation by developing theory that can help researchers understand similar cases, phenomena or situations (Gillham, 2010; Woodside, 2010). Another benefit of case studies is that they can explore cause and effect: indeed one of their strengths is that they observe effects in real contexts, recognising that context is a powerful determinant of both causes and effects (Cohen et al., 2011; Robson, 2002). Thus case studies constitute an empirical inquiry that uses evidence from multiple sources to investigate phenomena within their real-life context, and when there are more variables present than data points (Yin, 2009).

Thus, the methodology selected for this study was mixed methods incorporating elements of case study design. This facilitated exploration of the students' stories and experiences in ways that the quantitative data could not accommodate, allowing a more complete picture to emerge than numbers alone could construct.

## **Methods**

Methods are essentially the means by which the researcher gathers and analyses the relevant data. This research employed a range of quantitative instruments for measuring reading accuracy, rate and comprehension; reading prosody; and the self-perceptions of participants as readers. These sources of data were supported by qualitative interviews to explore the stories behind the numbers.

Figure 9 presents an overview of the epistemology, theoretical perspective, methodology and methods used in this study. It demonstrates how the broad epistemological approach of constructionism and the pragmatic theoretical perspective led to a mixed methods approach incorporating case study elements, and the use of different data collection methods to answer the specific research questions. An explanation of the data collection instruments follows Figure 10.



*Figure 10.* The research elements informing this study using Crotty's (1998) four elements of the research process

### **Data Collection**

Data collection for this research was designed to achieve a number of outcomes. For the program to have some potential benefit, participants needed to have the ability to decode words but not at a sufficient level of automaticity to maintain age-appropriate reading rate, accuracy or comprehension. The Names Test (Duffelmeyer, Kruse, Merkley, & Fyfe, 1994) was used to determine whether participants could decode adequately. The Neale Analysis of Reading Ability (NARA) (Neale, 1999) measured rate, accuracy and comprehension. Once participants were selected, pre-testing was conducted using the NARA and the Reader Self-Perception Scale (RSPS) (Henk & Melnick, 1995), which measured self-perception as a reader.

During the intervention, participants were tested weekly with the Informal Prose Inventory (IPI) (Ayrey, 1999) which measured reading rate and accuracy. They were also tested weekly with the Prosody Matrix (Zutell & Rasinski, 1991) which measured prosody. Post-testing was conducted with the NARA to gauge progress in reading rate, accuracy and comprehension. The RSPS was also administered to determine whether any changes to reader self-perception had changed. A detailed description of these instruments follows.

## **Instruments**

### **Neale Analysis of Reading Ability (Neale, 1999)**

The Neale Analysis of Reading Ability was designed to measure the accuracy, comprehension and rate of reading, to monitor reading progress and to obtain diagnostic observations of reading behaviour. It contains assessments of oral reading and comprehension, discrimination of initial and final sounds, names and sounds of the alphabet, graded spelling, auditory discrimination and blending and word lists. For this study, however, only the tests of accuracy, rate and comprehension were used for pre-, mid-point and post-intervention testing.

Participants were tested three times with the NARA to measure their reading rate, accuracy and comprehension. The first time was during pre-testing, then mid-way through the intervention at the ten-week mark. Finally, the NARA was used in post-testing to calculate the gains made in rate, accuracy and comprehension.

The NARA was designed to assess the reading of students between the ages of 6 and 13. It consists of six passages of increasing difficulty, each of which is accompanied by a simple line drawing. The child reads each passage aloud in turn and the test administrator records reading errors, responses to standard comprehension questions, and time taken. The test is complete when the child either has read all six passages, or finds it too difficult to continue (determined by the number of reading errors made). There are two parallel versions of the test, which permit the same child to be re-tested within a relatively short period of time without the *practice effect*, that is, the student remembering the passage and thereby affecting the score. The student's scores are converted into separate reading ages for accuracy, comprehension and rate. The NARA has been used frequently in studies since it originally appeared in 1958 and has been evaluated as an effective instrument for assessing word reading accuracy and comprehension (Cain & Oakhill, 2006). Results for the NARA are standardised up to the seventh year of schooling. Participants in this intervention were in their eighth, ninth or tenth year of schooling, but all participants were at least two years below their chronological age on rate, accuracy or comprehension based on the seventh year of schooling standardised results. Used consistently across the intervention, this scale could still demonstrate whether improvements had occurred.

Table 3 displays the results of the internal consistency coefficients of rate, accuracy and comprehension. Results reveal high levels of internal consistency at all year levels for both Forms. While more current standardised assessments of reading are now available, at the time of planning this research, the NARA was considered the best available.

*Table 3.* Internal consistency reliability coefficients for rate, accuracy and comprehension raw scores by year of schooling (Neale, 1999, p.72).

Years of schooling	N	Rate		Accuracy		Comprehension	
		Form One Reliability	Form Two Reliability	Form One Reliability	Form Two Reliability	Form One Reliability	Form Two Reliability
1	118	.95	.95	.95	.95	.71	.81
2	141	.95	.95	.96	.95	.87	.85
3	153	.94	.93	.95	.96	.88	.88
4	143	.94	.93	.95	.96	.85	.88
5	145	.95	.95	.96	.96	.96	.87
8	149	.94	.95	.96	.91	.88	.90
7	116	.96	.95	.96	.96	.89	.89

In this study, the standardised Form One was used for pre-testing and standardised Form Two was used for the mid-intervention test. Post-testing occurred twenty weeks after pre-testing and to avoid influencing the results through the practice effect (Kulik, Kulik, & Bangert, 1984), another equivalent test was required. Diagnostic Form A, which had not been standardised, is included in the NARA package and is presented in a similar format; that is, passages of increasing difficulty across six levels from reading ages six to twelve. The possibility of using this form led to an assessment of its equivalence with Forms One and Two.

Equivalence was determined by comparing the readability of Passages 3 to 6 from Diagnostic Form A with the equivalent passages from Forms One and Two on three readability scales accessed online. Readability scores have been used for decades to judge the suitability of text for different age groups, most often for students in junior primary years (Fry, 1969). Readability scales use formulae that in most cases measure characters or syllables per word and words per sentence. Online tools have simplified this process greatly. Sample passages are inserted into the relevant online tool, and results, expressed in United States grade levels, are available

immediately. The readability scales used in this case were the Gunning-Fog Score (Gunning, 1969), the Coleman-Liau Index of Readability (Coleman & Liau, 1975) and the SMOG Index of Readability (McLaughlin, 1969), all of which have been assessed as being suitable for education contexts (Scott, 2012). The results are presented in Table 4.

Table 4  
*Readability scores for NARA passages used in testing*

	Gunning-Fog Score	Coleman-Liau Index of Readability	SMOG Index of Readability	<b>Average Grade Level</b>
<hr/> Passage 3				
Form One	6.4	10.8	4.9	<b>6.2</b>
Form Two	4.8	12.9	3.8	<b>6.2</b>
Form A	6.3	8.9	3.8	<b>5.6</b>
<hr/> Passage 4				
Form One	10.6	14	7.8	<b>10.8</b>
Form Two	8.1	14.1	6	<b>9.4</b>
Form A	8.4	14	6.2	<b>9.5</b>
<hr/> Passage 5				
Form One	13.3	12	9.7	<b>11.7</b>
Form Two	12.8	14	9.1	<b>12</b>
Form A	13.3	15	9.7	<b>12.7</b>
<hr/> Passage 6				
Form One	15.3	15	11.6	<b>14.0</b>
Form Two	15.9	13	11.6	<b>13.4</b>
Form A	15.4	16	10.3	<b>13.9</b>

The average grade level shows that there is significant variation across all three forms, but that no one form contained passages that were consistently more or less difficult than the other two. Diagnostic Form A results across the three scales were, in all but four of the 36 individual ratings, identical or between the ratings of Forms One and Two. On this basis, Diagnostic Form A was considered to be equivalent to the other two forms, and acceptable to use as the post-intervention test.

### **The Names Test (Duffelmeyer et al., 1994)**

The Revised Names Test is a collection of 35 first and family names (see Appendix A). It was originally devised by Cunningham (1990) and consisted of only 25 names. The test was revised and augmented by Duffelmeyer, et al., to improve reliability and usability of the scoring instrument.

The purpose of the test is to assess a subject's letter-sound, or phonic, knowledge, and his or her ability to use this knowledge in reading new words. In the context of this study, it was necessary to establish that participants had at least basic knowledge of the alphabetic code that underpins English in its written form. If they did not, their reading ability would not improve from this intervention because fluency cannot develop if the ability to decode has not reached a minimum level of proficiency.

Relatively unusual names are used in the test to avoid the possibility of participants recognising a word on sight rather than having to apply their knowledge of letter-sound correspondences. Names were chosen for this test based on the fact that as participants interact with peers and adults, and watch films and television, many names are added to their listening vocabulary that they probably have not seen in print. Reading and then correctly pronouncing a name provides a positive reinforcement that is not obtained by using nonsense words, the usual method for testing letter-sound knowledge.

The names represent a sample of the eight most common phonics elements: initial consonants, initial consonant blends, consonant digraphs, short vowels, long vowels, vowel digraphs, controlled vowels and representations of the schwa. Among the 70 names in the test, each of these categories has between 15 and 37 instances to ensure sufficient category validity (Duffelmeyer, et al, 1994).



The Names Test was chosen to ensure that participants in this study had sufficient letter-sound knowledge to decode words, and would therefore be in a position to improve aspects of fluency such as rate and intonation. Those students with adequate decoding skills were then assessed on the NARA. Participants were selected for participation in the study if they could pass the Names Test, but demonstrated at least a two-year delay in either accuracy, rate or comprehension as measured by the NARA.

### **Informal Prose Inventory (Ayrey, 1999)**

The Informal Prose Inventory is a set of reading passages designed to provide a systematic approach to diagnosing and monitoring decoding skills, and literal and inferential comprehension of both narrative and information text types. It tracks reading achievement over time as participants demonstrate mastery of the graded passages in three areas: accuracy (decoding), retelling, and comprehension.

The inventories consist of graded reading passages of 150-200 words on average. Although designed to measure accuracy and comprehension, *they were used in this study to provide the passages for the repeated reading program.* The IPI is not normally used for recording reading rate and the marking keys do not mention reading rate. Nevertheless, each passage states how many words it contains, which facilitates the measurement of reading rate. An example of a reading passage and scoring sheet is provided as Appendix B. In this study, the IPI passages were used to record accuracy and rate, but not comprehension, which was measured every ten weeks using the NARA. Pre-testing with the NARA determined the year level of the IPI from which each participant started.

The IPI consists of three booklets. Each booklet contains two passages at specified reading levels. These enabled participants up to six opportunities to master a reading level before moving to the next level. In terms of reading accuracy, the IPI states that a score of 94% suggests that the passage is too difficult for the reader. If the score is above 97%, it is likely that the reader can move to a passage at the next level of difficulty. The latter was the criterion used in this study for progressing to the next reading level.

### **Prosody Matrix (Zutell & Rasinski, 1991)**

Prosody has often been considered an *outcome* of fluent reading; however, it is now considered to be a *contributing factor* and, like speed and accuracy, needs to be measured (Benjamin & Schwanenflugel, 2010). Whilst quantifying speed and accuracy is relatively straightforward, prosody has been more difficult to measure. In response to this problem, Zutell and Rasinski (1991) developed a three dimensional scale that measures phrasing, smoothness and pace, each of which has four discriminators:

#### ***A. Phrasing***

1. Monotonic with little sense of phrase boundaries, frequent word-by-word reading.
2. Frequent two and three-word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark ends of sentences and clauses.
3. Mixture of run-ons, mid-sentence pauses for breath, and possibly some choppiness; reasonable stress/intonation.
4. Generally well-phrased, mostly in clause and sentence units, with adequate attention to expression.

#### ***B. Smoothness***

1. Frequent extended hesitations, false starts, sound-outs, repetitions, and/or multiple attempts.
2. Several "rough spots" in text where extended pauses, hesitations, etc., are more frequent and disruptive.
3. Occasional breaks in smoothness caused by difficulties with specific words and/or structures.
4. Generally smooth reading with some breaks, but word and structure difficulties are resolved quickly, usually through self-correction.

#### ***C. Pace***

1. Slow and laborious.

2. Moderately slow.
3. Uneven mixture of fast and slow reading.
4. Consistently conversational.

This scale was used to evaluate the prosody of each instance of the participants' oral reading, resulting in an annotation for each component, such as A2B3C2. Over time it was possible to see changes in the dimensions of phrasing, smoothness and pace as the numbers between one and four changed. Due to the increasing difficulty of the passages, small improvements in each of the dimensions, or even no change in the dimensions, meant that fluency was improving.

When all readings had been assessed by the Researcher, an experienced literacy researcher also rated 12% of the readings from each of the participants on each of the dimensions on Zutell and Rasinski's prosody scale. The agreement percentages achieved were 84% for phrasing, 79% for smoothness, and 89% for pace, indicating a very high level of concordance. A criticism of percentages of agreement is that they do not allow sufficiently for agreements that could occur by chance and therefore overestimate the level of agreement (Jakobsson & Westergren, 2005). However, in this case, because the readings were rated by two experienced literacy educators (the Researcher and an academic with expertise in literacy development and instruction), it was deemed that agreement by chance was far less likely than actual agreement.

### **Reader Self Perception Scale (Henk & Melnick, 1995)**

The Reader Self-Perception Scale provides an assessment of how children view themselves as readers and some insight into their motivation to read. The scale was used with participants before and after the intervention. The first item, separate from the four dimensions included in the scale, asks participants to rate their overall perception of themselves as readers.

The scale consists of 33 items that evaluate four dimensions of self-efficacy:

- Progress - participants assess whether their reading has improved recently;
- Observational Comparison - participants compare their progress in reading with that of their peers;

- Social Feedback - participants evaluate feedback they have received from teachers, parents or others about their reading;
- Physiological States - participants rate how they physically feel when they are reading.

Participants are asked to indicate how strongly they agree or disagree with each statement along a 5-point scale (1=Strongly Disagree, 5=Strongly Agree). Scoring the RSPS requires multiplying the score on each of the four scales by the number of statements for that scale. For example, the Physiological States scale has nine statements. Using the five-point scale, the maximum score achievable is 45 (9 x 5). A score somewhere in the middle (22-23) would suggest the participant has a relatively indifferent perception of him or herself in that area. Each dimension has a different possible highest score. The RSPS survey and marking sheet are included as Appendix C.

The scale also provides descriptive statistics by grade level for each scale. The raw score of a group or individual can be compared to that of the norming data for each grade level to determine whether individual scores are above or below an established mean. Because these statistics are only provided for Grades 4, 5 and 6 (Henk & Melnick, 1995), they were not applied in this study. The scale was used to determine any changes in the individuals' self-perceptions as readers.

### **Interviews**

Participants in the intervention was interviewed prior to and at the completion of the intervention. Pre-intervention questions were designed to gauge participants' interest in and enjoyment of reading in general. The post-intervention questions were concerned with the participants' perception of the intervention, specifically any problems had they encountered and whether they felt the process had improved their reading ability or enjoyment.

The interviews were conducted with individual participants immediately after the pre-testing and post-testing using the NARA. The responses were recorded as field notes, which were examined a number of times to look for common themes or trends. The questions asked post-intervention were particularly important. Responses were compared to determine whether there were specific problems or obstacles

experienced in the conduct of the intervention, particularly for the treatment group. This was to ascertain whether modifications needed to be made to the intervention should it be implemented in a school at a future time. The post-intervention responses were also examined to compare the experiences of the treatment and comparison groups. Where responses were considered relevant to the findings, they have been included in the next chapter, Findings and Discussion. The questions can be found in Appendix D.

In addition to these interviews, there were occasions when the Researcher had incidental communications with the participants and some of the parents. This was through email exchanges or casual contact within the school. There was no planned interview process with parents and these informal contacts occurred on only a few occasions. Information from these informal encounters was recorded as field notes, and individual comments that corroborated findings were included in the Findings and Discussion.

### **Dragon Naturally Speaking® Voice Recognition Software**

Dragon Naturally Speaking® VRS (VRS software was first developed in 1996 with the primary purpose of assisting people with disabilities to use computers. It originally employed discrete word recognition; that is, word-by-word speech rather than continuous speech, which was introduced a year later. Over the next several years, the software became more sophisticated and computers became considerably more powerful (Frankenberger, 2016). By version 10, which was used in this study, the software was very rapid and accurate. Different editions are available: this study used the Home edition, the most basic version, because it was adequate for use in the intervention. Version 10 was an improvement on previous versions because it had an improved capacity to recognise the voices of children, an acknowledged weakness of previous versions (Frankenberger, 2016).

In this study, VRS was able to provide immediate feedback to participants as they read their passages. If the right words appeared in the right order, this could be construed by the participant that the passage was being read correctly.

## **Participants in the intervention**

The participants were volunteer students from lower ability Year 8 and 9 classes from a metropolitan government secondary school (Years 8-12) in one Australian state. Whilst data were not available to the Researcher on the socio-economic status of individual participants, the school had an Index of Community Socio-Educational Advantage (ICSEA) of 1004. The average for all schools across Australia is 1000, meaning that the school population in general was slightly above average in terms of socio-educational advantage.

Participants had listened to an explanation of the intervention and returned consent forms signed by them and their parents. The Names Test was administered to ensure that all participants had sufficient letter-sound knowledge to decode words, and therefore had the accuracy required for reading fluency to develop. On this basis, two of the initial volunteers were excluded. The NARA was then used to establish the basal scores for reading accuracy, rate and comprehension in terms of reading ages for each of those elements. Participants with a reading age at least two years below chronological age in one or more of those areas were targeted for inclusion in the intervention.

A sample group of twenty participants was selected from a group of approximately thirty volunteers based on their reading age according to testing and their willingness to participate in the intervention. Initial assessment revealed a number of volunteers had reading ages that were higher than the minimum deemed appropriate for the intervention so they were eliminated. In addition, some decided not to participate, despite their initial desire to volunteer. The remaining participants had a reading age at least two years below chronological age, though none had special education status. They all came from homes where English was the first language with the exception of one participant whose family often spoke Afrikaans at home. Of the participants who eventually completed the intervention, two were from Year 8 and twelve from Year 9.

## **Procedures for Gaining Consent**

Consent was gained to conduct the research from the Western Australian Department of Education (see Appendix E) and from the principal of the school (see Appendix F).

Descriptions of the intervention and its aims were presented to potential participants. Parents of the volunteers were sent an outline of the proposed study (see Appendix G) with an attached consent form, and invited to an information session that detailed the purpose of, and procedures involved in, the intervention.

To minimise attrition during the intervention, participants and their parents were informally interviewed during the information session. The interview determined, as much as possible, that parents and students understood, and agreed to the requirements of the intervention; that there would be no scheduled absences during the intervention; and that there was sufficient desire to participate.

Parents who had returned consent forms (see Appendix H) but had not been able to attend the information session were contacted by telephone to confirm that they understood the aims of the study and were willing to support their child. Students were also required to give consent to participate in the experiment (see Appendix I). Both parents and students were informed of their right to withdraw from the study at any time.

## **Formation of the treatment and control groups**

In total, six of the initial twenty participants withdrew. Two did not commence, revealing that, despite their parents giving consent, they decided they did not want their computers to be “tied-up” with the project. Individual students withdrew at two, three and four weeks respectively. One withdrew at the ten-week mark. The main reason for withdrawing could be broadly categorised as a loss of interest, with reasons such as “Just don’t want to anymore” and “...haven’t got time” being offered. Data collected from participants who withdrew were not used in the study.

The remaining fourteen participants were those whose NARA assessments demonstrated they were reading at least two years below chronological age in one or

more of the elements of accuracy, rate or comprehension. These participants were provided with VRS. In order for the intervention to be implemented, each participant required access to a computer that could:

- Receive emails (short written passage and audio recording of that passage being read as attachments);
- Install, train and operate Dragon Naturally Speaking® VRS;
- Record the participant reading the passage using a software recording package;
- Send email with attachments of the recorded passages to the Researcher.

After being issued with Dragon Naturally Speaking® Version 10 VRS, participants received training in the use of the software, and how to ‘teach’ the software to match their speech. Training the software to an individual voice is necessary for its effective use. The process of installation and training, however, proved a major stumbling block for a number of participants, who were unable to achieve one or more of the technical steps required for the intervention to progress as planned. The training process took approximately 30 minutes of continuous reading, and consisted of reading passages aloud until the software was able to recognise the speaker’s pronunciation sufficiently well to accurately transcribe the words of the speaker.

A number of participants found this task too daunting and were unable to train the software to the stage where it could be successfully used in the intervention. VRS has progressed significantly in recent years and is now more capable of recognising speech from younger speakers. The other major reason participants were unable to utilise the software was the age of some home computers, many of which could not meet the system requirements of the software. In many cases, the processing speed of the computers was too slow; and in others, computers lacked the necessary hardware to plug in a microphone.

Participants were also given the free-licence software *Easy Hi-Q Recorder* (Roemer, 2010), that enabled them to record their passage reading as an MP3 file, which could be emailed to the Researcher for analysis. Participants used the free



version, which recorded in mono rather than stereo, as this was considered adequate for the intervention.

Of the 14 participants, only six had both the computer capacity, and the ability to complete the technical steps necessary to train the software. This group became the *treatment group*. Seven of the remaining eight participants were in the same class for students at educational risk. This class group stayed together for most subjects, and were taught by the same teacher. With the cooperation of the teacher, a *comparison group* was formed and completed the repeated reading program at school without the VRS technology. Thus two groups were formed: the treatment group that performed the program at home utilising VRS; and the comparison group that participated in a repeated reading program at school. Seven of the eight participants in the comparison group were in the same class of low ability students. Their teacher, a young woman in her second year of teaching, took the students for most of their lessons. She was cooperative and keen for her students to participate in the intervention. The participation of the eighth student, who did not belong to the at-risk class, was managed differently, as explained at a later point. All 14 participants completed the full twenty-week intervention, except one student in the treatment group who did not send recordings for three weeks when her computer was being repaired.

### **Description of the Intervention**

Participants underwent a twenty-week intervention of repeated reading. After the initial pre-testing, both groups commenced the first ten weeks of the intervention, which consisted of a weekly repeated reading program using passages from the IPI. The initial starting passage of the IPI for each participant was determined by his or her NARA scores.

At the beginning of each week, participants in the treatment group were emailed a passage from the IPI. Each short written passage of approximately 200 words was accompanied by a sound file of the Researcher reading the passage to allow the participant to hear correct pronunciation and expressive reading of the passage.

Participants then listened to the sound file at home and were instructed to practise reading the passage aloud once or twice each day through a microphone into the VRS that transposed the words into print. On the first one or two occasions on which this process was followed, the participants may have needed to adjust the VRS manually by adding words from the IPI passage such as names; however, this was intended to increase the participants' engagement with the text. The VRS provided both instant feedback to the participant and a degree of novelty that most participants found motivating. The other advantage of using VRS was the multisensory experience it provided whereby participants read, spoke and listened to the relevant passages. It was not necessary for the transposed reading to exactly match the passage being read in terms of all punctuation and formatting being identical. As long as the correct words appeared in the correct order, some feedback was provided to the participant.

At the end of each week, and usually after five or six readings of the IPI passage, the participant recorded his or her final reading on a sound file that was emailed to the Researcher to analyse for rate and accuracy. Whilst the IPI also tests comprehension, this was not assessed on a weekly basis. As they reached the minimum level of reading competence (97% accuracy and 100 wpm) they were given a passage from the next grade level. However, if sufficient progress had not been made in prosody (the criterion being scores of 3 or 4 on at least two of the three dimensions), they remained on the same grade level even if reading accuracy and rate suggested they should move to the next level. The next passage was then recorded and emailed and the process continued, as shown in Figure 11.

To enable the process to be manageable, only one IPI passage per week was given. This allowed time to monitor each participant's recording for accuracy, reading rate and prosody.

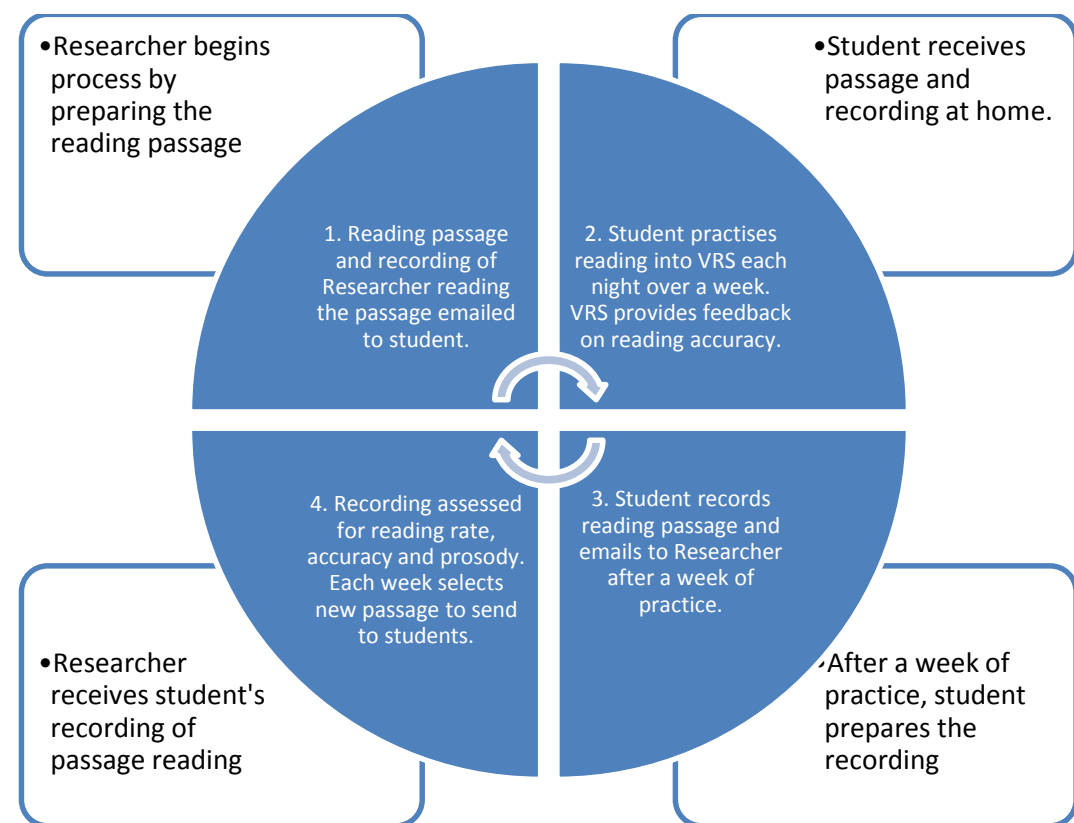


Figure 11. The cyclical nature of the intervention for the treatment group

Participants assigned to the comparison group received a passage each week and were given time in class to practise their reading, with the intervention of seven of the students managed by their teacher. Each Monday, the teacher would distribute the passages to the participants, read the relevant passage to each student, and provide them with opportunities to read each day in self-selected pairs. There were occasional variations to the daily routine depending on what other activities were planned. This was not considered problematic because members of the treatment group also varied in the number of times they practised their reading during each week. At the end of each week, students used a digital recorder to record their reading, which was delivered to the Researcher for analysis. As with the treatment group, a determination was made each week as to whether students remained on the same reading level or progressed to the next level.

The same process was conducted separately by the Researcher with the participant (James) who did not belong to that class. As he was not able to operate the software successfully at home, he became a member of the comparison group. He would practise reading the passages to his mother during the week and each Friday,

the Researcher would record his final reading for analysis. It was decided to include his results with the comparison group because his circumstances were more closely aligned with those participating in a more traditional repeated reading program that did not employ technology. Because his conditions were unique, however, his participation is also discussed in a case study in the next chapter.

The comparison group completed the same testing regime as the treatment group. Unlike participants in the treatment group, who had a recorded version for reference if necessary, the comparison group heard the teacher read the text only once. This placed them at a disadvantage, as they had less opportunity to have the correct reading of the passage modelled to them. Based on discussions with the participants in the experimental group, it appears that they too only listened to the recording once, consequently the disadvantage could be considered to be slight, but it does raise a point of potential difference that could have affected the results. This limitation is further discussed in the final chapter.

The Researcher did not provide formal or informal feedback on how each participant was progressing with their reading at any stage of the intervention with either group. This was designed to negate the effects that positive or negative feedback may have had on participant motivation and effort (Hattie & Timperley, 2007).

### **Summary of Data Collection Procedures**

The Neale Analysis of Reading Ability (NARA) (Neale, 1999) provided pre-, mid and post-intervention measures of accuracy, reading rate and comprehension. During the intervention, the Informal Prose Inventory (IPI) (Ayrey, 1999) was used in the repeated reading program to measure progress on rate and accuracy. A prosody matrix developed by Zutell and Rasinski (1991) measured phrasing, smoothness and pace. Another data set was comprised of the pre- and post-test results that measured self-perception as a reader. This was measured using the Reader Self Perception Scale [RSPS] (Henk & Melnick, 1995). As mentioned previously, data were also collected in the form of informal interviews with the participants during post-testing with the NARA and RSPS, and even more informally when interacting on other occasions.

Twelve months after the intervention was complete, the opportunity arose to retest a number of participants for their reading rate, accuracy and comprehension using Form 1 of the NARA. The purpose of this retesting was to determine what, if any, progress had been made by participants twelve months after the reading intervention. This retesting was not possible for all participants because some students had left the school and three students were reluctant to participate in the retesting. The data collection process is summarised in Table 5.

Table 5  
*Data collection timeline*

Phase	Event	Assessment Instruments
Pre-intervention (Term 1)	Potential group of participants identified	
	Potential participants tested	Names Test, NARA, RSPS, informal interviews
	Allocation to treatment group or comparison group	
Intervention (Terms 2 and 3)	Weeks 1-10	IPI (weekly via email)
	Mid-intervention testing	NARA, informal interviews
	Weeks 11-20	IPI (weekly via email)
Post-testing (Term 4)	Week 21	NARA, RSPS, informal interviews
	12 Month follow-up test	NARA, Interviews (available participants)

### **Summary of research questions and data collection procedures**

The research questions are restated below along with the specific sources of data designed to answer them:

- 1. What impact does a home-based repeated reading program using VRS have on the reading fluency of adolescents with reading difficulties, relative to a traditional repeated reading program?***

This was determined by measuring the reading fluency of students in the treatment and comparison groups before and after the intervention, as measured by a standardised test of reading ability (NARA), and monitoring their progress on a weekly basis throughout the 20-week duration of the intervention using passages

from the IPI to measure rate, accuracy and prosody. By comparing gains from pre-testing to post-testing for both groups, it was possible to compare changes in fluency.

***2. What impact does a home-based repeated reading program using VRS have on the reading comprehension of adolescents with reading difficulties, relative to a traditional repeated reading program?***

Participants from both the treatment and comparison groups were tested for reading comprehension using a standardised test of reading ability (NARA) before and after the intervention, and at the ten-week (mid) point of the intervention.

***3. What impact does a home-based repeated reading program using VRS have on the self-perception as readers of adolescents with reading difficulties, relative to a traditional repeated reading program?***

Participants from the treatment and comparison groups completed a survey of their self-perception as readers (RSPS) as part of pre- and post-testing to determine if there were changes in reading self-perceptions throughout the duration of the intervention. This was supplemented by data gained from the informal interviews held throughout.

## **Data Analysis**

Descriptive statistics were used to determine average gains in reading rate, accuracy and comprehension over the course of the intervention for both individuals and groups. Prosody and self-perception as readers were also analysed using descriptive statistics. The results of a number of individual students were explored to ascertain not only individual progress in reading rate, accuracy, comprehension and prosody, but also to examine the students' experience of the intervention in a qualitative manner.

### **Analysis of reading rate, accuracy, prosody and comprehension**

Each individual was assessed to determine any changes in rate, accuracy and comprehension from pre-testing, at the ten-week mark, and after twenty weeks (post-testing) using the NARA. In addition, means were calculated for the treatment and comparison groups at these intervals.

As each participant progressed through the intervention, reading rate and accuracy were assessed weekly as they read passages from the IPI. These results were used to determine whether participants should progress to a more difficult passage or stay at the same level. The IPI results were not analysed to determine overall progress of the participants as this was ascertained by assessment using the NARA.

Effect sizes (Cohen's *d*) were calculated for both groups for the average gain in reading age in months for reading rate, accuracy and comprehension. Effect size is a simple way of quantifying the difference between two groups that has many advantages over the use of tests of statistical significance alone: it emphasises the size of the difference rather than confounding this with sample size, and is particularly valuable for quantifying the effectiveness of a particular intervention, relative to some comparison (Coe, 2002).

Hattie (2009) concludes that in large longitudinal databases such as PIRLS, PISA and NAPLAN, a year of typical student progress equates to an effect size of 0.4. He also states that for educational outcomes, "a small effect size is 0.2, a moderate effect size is 0.4 and a large effect size is 0.6" (p.9). These criteria were used in determining level of progress in this study.

Individual effect sizes for rate, accuracy and comprehension were also included in the case studies. Hattie (2009) provides a formula for calculating effect sizes for individuals:

$$\text{Effect size} = \frac{\text{Individual score (post-test)} - \text{Individual score (pre-test)}}{\text{Spread (standard deviation [sd]) for the group}}$$

While effect sizes need to be interpreted cautiously when used with an individual, they were calculated on certain individuals' results in rate, accuracy and comprehension and compared with those of the treatment group as a whole.

Prosody was also assessed weekly using Zutell and Rasinski's Prosody Matrix. Individual scores were recorded to show progress over the duration of the intervention. Means were also calculated for the treatment and comparison groups so that comparisons between the two groups could be made.

### **Analysis of reader self-perception data**

Individuals completed the reading self-perception scale before and after the intervention to determine any changes that might have occurred throughout the intervention. Means were also calculated for the treatment and comparison groups to allow a comparison.

### **Qualitative data**

Each individual was informally interviewed before and after the intervention. Issues such as general reading habits, specific areas of reading difficulty and the experience of the intervention were explored, partially to determine whether participants followed the intervention as instructed, and also what factors, such as level of parental support, affected their participation in the intervention. In addition, there were incidental exchanges by email or at the school with the Researcher. Field notes were recorded to capture these various interactions.

### **Validity**

Studies or experiments are said to possess internal validity if a causal relationship between two variables, an independent and a dependent, is properly demonstrated (Brewer, 2000). A number of potential threats to the internal validity of this research are described below, accompanied by an explanation of how these were mitigated in this study.

*History* effects refer to the measurement of behaviour at different points in time that could result in differences occurring as a result of cultural change, such as changes to national curriculum, teacher training or educational policies, over which the experimenter has no control. History is a threat to conclusions drawn from longitudinal studies. The greater the period of time between measurements, the more the risk of a history effect (Huitt, Hummel, & Kaeck, 1999). In this study, both the treatment and control groups participated for twenty weeks, which is approximately half a school year. No significant changes occurred at the broader level, nor were any reported from any individuals. It is considered unlikely that history effects had any impact on internal validity.

*Maturation* alone may produce changes across time which can produce behavioural changes unrelated to an experimental variable (Huitt et al., 1999).



However, twenty weeks is not sufficient time for adolescent participants to experience enough physiological change to affect the outcomes of the intervention.

The *selection* threat exists when the treatment and comparison groups differ in variables other than the intervention that could result in post-test differences (Huitt et al., 1999). This threat was minimised because participants were selected from a relatively homogenous sample, they were approximately the same age, and all were reading at least two years below their chronological age in rate, accuracy or comprehension.

*Testing* effects occur as a result of practice or learning from exposure to repeated testing. Longitudinal studies which require participants to take certain tests on a number of occasions are subject to this threat (Huitt et al., 1999). Students were not given the same test twice with the exception of the RSPS conducted during pre- and post-testing. This measured self-perception as a reader and therefore did not affect reading ability. Testing for reading ability was conducted with three separate forms of the NARA and each week participants practised with a new IPI passage. These measures should have eliminated the testing threat.

*Instrumentation* problems are a concern in longitudinal studies where over significant periods of time researchers may leave and be replaced and testing instruments may become invalid due to changes over time (tests are typically revised every ten years). Change in researchers may result in different observers or techniques, which could alter the continuity of measurement (Huitt et al., 1999). This intervention did not extend over a long period (20 weeks). The researcher did not change, nor did the instruments or procedures, so this was not deemed to be a likely threat to validity.

*Mortality* or *attrition* of subjects can be a significant threat in longitudinal studies because the characteristics of the sample group will change over time and may not be comparable to the starting sample. (Huitt et al., 1999). Again, this was not a lengthy longitudinal study. The participants who did withdraw did so at the beginning of the intervention. Their data were not used in the results. Therefore, the sample group remained stable over the duration of the intervention.

If treatment effects spread from treatment groups to control groups, a lack of differences between experimental and control groups may be observed. This is called *diffusion*. This does not mean, however, that the independent variable has no effect or that there is no relationship between dependent and independent variable. It does make it more difficult to determine the extent of the effect of the independent variable (Huitt et al., 1999). In this study the key independent variable was the use of VRS. Only the treatment group used VRS so there was no diffusion.

*Compensatory rivalry/resentful demoralisation* occurs when comparison groups behave in one of two ways during an intervention. They may act competitively with the treatment group; or conversely, they may feel disadvantaged and resentful towards the treatment group and essentially 'give up'. This does not mean that the independent variable produced no effect or that there is no relationship between dependent and independent variable. However, if the comparison group does feel demoralised and resentful, this can exaggerate the effects of the intervention (Trochim, 2006). It is unlikely that this was a threat because the comparison group was largely unaware of the existence of the treatment group. They did not know who had been selected for the treatment group or how their participation differed from the comparison group. As far as the comparison group was concerned, they were participating in a repeated reading program at school.

*Experimenter bias* occurs when the individuals who are conducting an experiment inadvertently affect the outcome by non-consciously behaving in different ways to members of control and experimental groups. It is possible to eliminate the possibility of experimenter bias through the use of double blind study designs, in which the experimenter is not aware of the condition to which a participant belongs (Rosenthal & Rosnow, 1969). In this study, measuring rate and accuracy could be completed in an objective, quantitative manner. The analysis of prosody was more subjective, so to reduce the likelihood of experimenter bias, an experienced literacy researcher rated 12% of the recordings using Zutell and Rasinski's (1991) prosody scale, as described in the description of instruments section earlier in this chapter. These procedures reduced the threat of experimenter bias.

Another potential threat to internal validity was the use of positive feedback which has the effect of improving student motivation and time on task (Hattie &

Timperley, 2007). As explained previously, feedback from the researcher was not provided to participants during the intervention as this could confound the results.

External validity is concerned with the degree that the results of a study can be generalised to other situations (Aronson, Wilson, Akert, & Fehr, 2007). All instruments, resources and software used in this research are commercially available and were not specifically created for use in this study. In addition, the procedures followed were clearly explained and the technique of repeated reading has been extensively researched. All these factors contribute to the external validity of this research.

### **Chapter summary**

This chapter has outlined the methodology used in the study to determine whether reading fluency among adolescents could be improved using VRS; and if so, whether it was more effective than a traditional repeated reading program. It described the rationale behind the methodological approach, the instruments used, the research site, participants, and a description of the data collection and analysis procedures. It also addressed potential threats to internal and external validity, and ways in which they were addressed

The chapter concludes with the Research Framework as shown in Figure 12. (Words in bold in the following description refer to headings within the Figure.) It incorporates the conceptual framework that provided the literature base for the focus of the study: whether a home-based repeated reading intervention using VRS could improve the fluency of struggling adolescent readers. A **treatment group**, comprising Year 8 and 9 students who would undertake the intervention for 20 weeks was formed. Another group who were also chosen to participate but, for various reasons, could not engage the technology at home completed a repeated reading program at school and became the **comparison group**.

For both groups, **data were collected** at various points in the intervention to measure their oral reading performance using a number of instruments. In addition, pre- and post-testing of self-perception as a reader was conducted to examine whether improvements to self-perception as a reader were evident. An expanded version of the research framework is included in Chapter Four where the results are added.

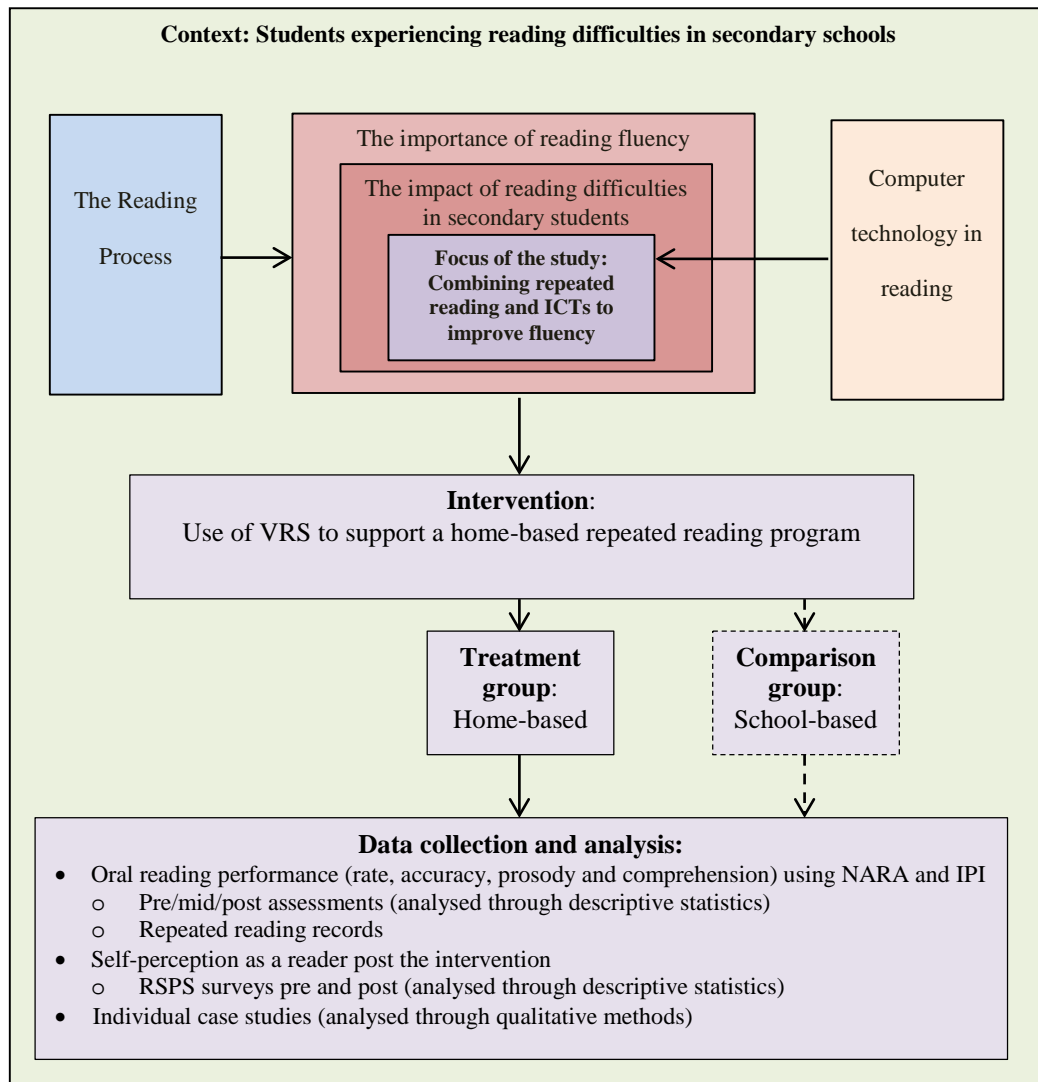


Figure 12. The research framework for the intervention research

## Chapter Four: Findings and Discussion

### Overview

Chapter Three outlined the intervention used in this research, and the methodological procedures used to investigate the research questions. Data were collected to measure performance in reading rate, accuracy, comprehension, prosody and changes in reader self-perception. This chapter initially summarises results of the intervention for the combined treatment and comparison groups before discussion of individual results. Case studies of some participants explore their experiences from a qualitative perspective. Throughout the chapter, results are synthesised into ten key findings.

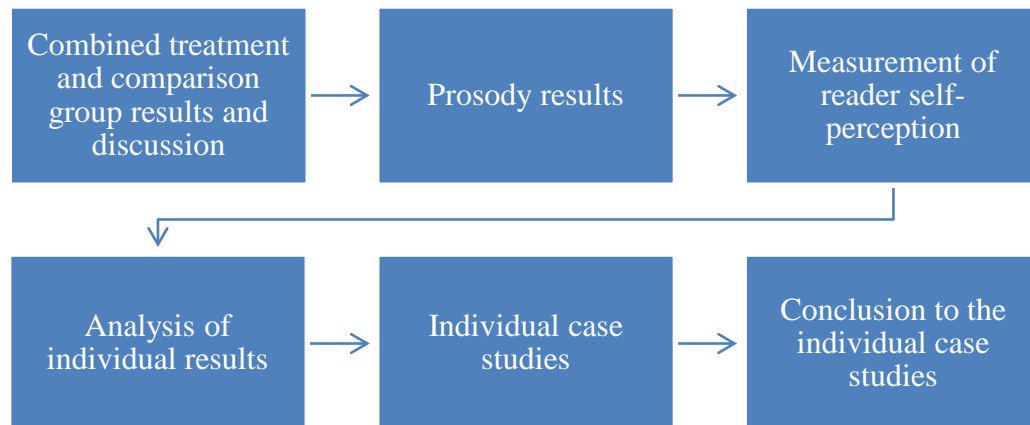


Figure 13. Structure of the findings and discussion chapter

### Testing for pre-existing differences

A Mann-Whitney test was conducted on initial NARA results for reading rate, reading accuracy and reading comprehension to determine whether there were significant differences between the treatment and comparison groups prior to the intervention. The non-parametric equivalent of the independent samples t-test was used since the data violated the assumption of normality. The results of the Mann-Whitney tests indicated there were no significant differences between the two groups for reading rate (Mdns: treatment = 6.33, comparison = 8.38;  $U = 17$ ,  $p = 0.414$ ), reading accuracy (Mdns: treatment = 6.17; comparison = 8.5;  $U = 16$ ,  $p = 0.344$ ) or

reading comprehension (Mdns: treatment = 8.5; comparison = 6.75;  $U = 18$ ,  $p = 0.484$ ).

### **Combined treatment and comparison group results and discussion**

Results for the *treatment* group are shown in Figure 14, which presents each individual's reading age (in years and months) for rate, accuracy and comprehension at the pre-intervention, mid-intervention and post-intervention stages as measured by the NARA.

In summary, gains were made in reading rate, accuracy and comprehension by all six students in the 20 weeks from pre-testing to post-testing, with some students making gains of over 12 months in one or more areas. Of particular note were Kath, who gained over two years in accuracy; Julie, who gained nearly four years in comprehension; and John, who made a gain of over three years in reading rate. Two students achieved the maximum possible result in either reading rate, accuracy or comprehension relatively early in the intervention. Because the NARA only norms scores up to the age of 13, it was not possible to determine progress beyond that reading age.

The comprehension scores of two students, Peter and Richard, dropped at the ten-week mark, before making gains of more than a year in the second half of the intervention. John's accuracy score dropped slightly at the ten-week point, but improved with gains of almost a year at the conclusion of the ten weeks. In addition, some post-testing results were not as high as results from testing conducted midway through the intervention. These results are explored further in the discussion of individual student progress.

**Key Finding 1.** All students in the treatment group made gains from pre-testing to post-testing except for those participants who achieved the maximum score at pre-testing.

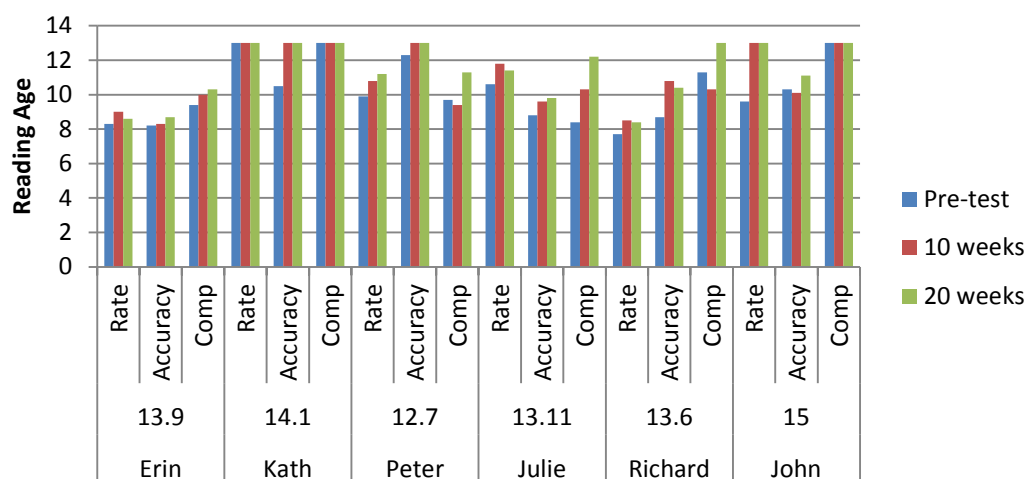


Figure 14. Individual NARA results for the treatment group

The individual results for the *comparison* group are presented in Figure 15. Whilst the graph reveals growth in reading ability from pre-testing to post-testing for most students, this growth was not consistent. The scores of a number of students dropped at the mid-intervention point, particularly in comprehension. Jarrad recorded decreases in rate and accuracy scores over the period of the intervention, results which are explored at a later point. For most participants, however, there were gains, some of which were quite substantial. Jack, for example, gained nearly four years in reading accuracy. Jarrad, despite declining performance in reading rate and accuracy, gained nearly three years in comprehension; and Kristy gained nearly three years in accuracy.

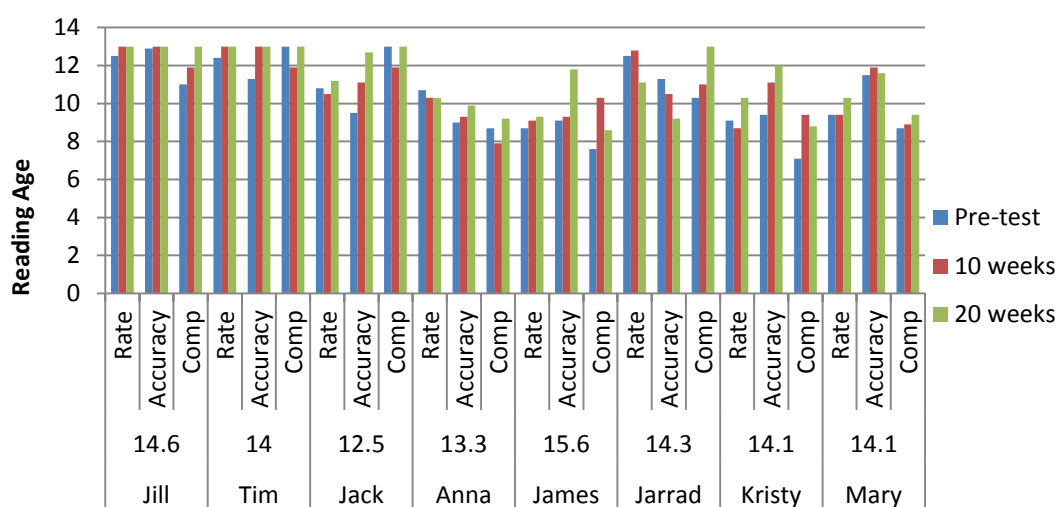


Figure 15. Individual NARA results for the comparison group

Figure 16 directly compares the *group average increases* in reading rate, accuracy and comprehension for the treatment and comparison groups over the five months of the intervention. The Y axis represents the increase in reading age (in months), and the X axis shows the three reading skills measured by the NARA. The graph shows that the treatment group, on average, improved in reading rate by 16 months over the five-month intervention whereas the comparison group improved by an average of three months.

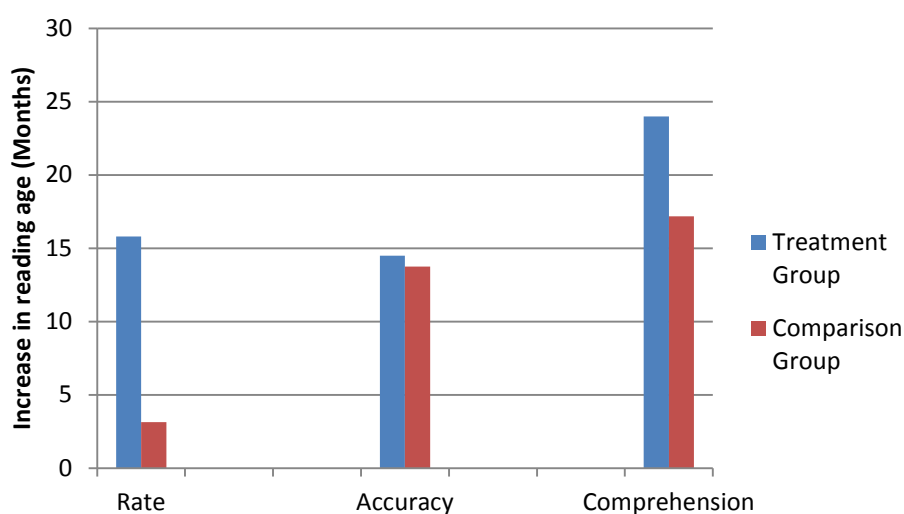


Figure 16. Average increases in reading rate, accuracy and comprehension as scored by the NARA for both groups over the course of the intervention

The average gain of 16 months in the treatment group's reading rate reflected an accelerated period of growth in the aspect of reading targeted by the intervention. Conversely, the gain of three months achieved by the comparison group on average over the same five-month period was minimal. Overall, therefore, the home-based intervention can be regarded as successful in developing this component of reading, particularly when one considers that this growth occurred with texts of increasing difficulty over the intervention period. If this improvement were to be transferred to reading of content material, it would represent a very positive outcome for these students, as the volume of reading required at secondary school is overwhelming for students with reading difficulties (Whithear, 2008). Not being able to manage the required reading has further effects on student motivation to engage in learning at the secondary level, thus any improvement in reading rate could have a positive effect on student motivation and willingness to engage in set tasks.



Average results for reading accuracy did not reflect this stark contrast between the groups, with the treatment group improving by an average of 14.5 months and the comparison group by 13.75 months. Substantial growth in accuracy would not have been expected, because this element of reading needs to be quite secure in order for any level of fluency to be in place (Kuhn, Schwanenflugel, & Meisinger, 2010), and both groups had been screened to ensure their ability to apply knowledge of letter-sound correspondences was in place. The fact that some students did improve quite dramatically in this area is explored further in individual case studies, but in general, it would appear that their level of automaticity had improved. They were accurate but slow before: the practice had improved their ability to retrieve known words and decoding information quickly. They had become more automatic, which improved rate and therefore fluency.

The most profound results, however, relate to the progress in reading comprehension for both groups, with an average increase of two years for the treatment group, and 17 months for the comparison group. As reported in the literature review, the link between fluency and comprehension has been well established (NICHD, 2000; Pikulski & Chard, 2005), and these results further support the use of this simple fluency strategy to build comprehension. The results also attest to the greater impact of the home-based program. An increase in reading comprehension of two years could have a considerable impact on a student's academic progress: a greater proportion of text material would be accessible, thus teachers would have a greater repertoire of curriculum materials from which to draw. This would facilitate both teaching and learning.

**Key Finding 2.** Both groups made progress on average, however, the treatment group made greater progress in the areas of rate and comprehension.

**Key Finding 3.** The strongest gains for both groups were made in the area of comprehension, with the treatment group gaining 24 months, and the comparison group gaining over 17 months.

Effect sizes (Cohen's *d*) were calculated for the average gain in reading age in months for reading rate, accuracy and comprehension for both groups, as shown

in Table 6. Whilst the standard deviations are large, indicating a wide variation in scores, it can be seen that there was a large effect size for reading rate, a moderate effect size for comprehension, and a small effect size for accuracy. The small effect size for accuracy reflects the similarity in gains made by both groups in that area. In reading rate particularly, but also in comprehension, the larger gains made by the treatment group relative to gains made by the comparison group are reflected in the effect sizes.

Table 6  
*Effect sizes for treatment and comparison groups' average gain in reading age in months for reading rate, accuracy and comprehension*

	Treatment Group		Comparison Group		Effect Size
	Mean	SD	Mean	SD	Cohen's <i>d</i>
Rate	15.8	14.62	3.25	9.81	1.06
Accuracy	14.5	9.46	13.75	21.06	0.04
Comprehension	24	14.63	17.17	9.93	0.59

Effect sizes (Cohen's *d*) were also calculated using the pre- and post-intervention results for each group, as shown in Table 7. Cohen's *d* was calculated using the NARA results for rate, accuracy and comprehension using the averages of the participants' reading ages in the pre- and post-intervention scores.

In this study, the largest effect size was for gains in comprehension of the treatment group at 0.87. The intervention had a moderate to large effect size of 0.55 for reading rate for the treatment group compared with the much smaller effect size of 0.20 for the classroom-based repeated reading program used by the comparison group. Both groups made similar substantial gains in accuracy although the effect size for the comparison group is a little higher than that of the treatment group. This may be as a result of the smaller average standard deviation of the comparison group results.

Whilst the comparison group had a large effect size for accuracy and a moderate effect size for comprehension, the effect size for rate was small. The treatment group achieved stronger results in all three areas. In addition, the 20-week

intervention appeared to be long enough to enable most participants to demonstrate substantial gains in reading ability. This was not consistent across all participants, some of whom reached a peak after 10 weeks and then did not perform as well at the end of the intervention period.

**Key Finding 4.** The greater gains in rate and comprehension by the treatment group were confirmed by calculation of effect sizes.

**Key Finding 5.** The intervention period of 20 weeks was sufficient to enable participants in both groups to achieve substantial gains in reading age. Some participants made large gains after 10 weeks then regressed, while others continued to improve after the 10 week point.

Table 7  
*Effect sizes for treatment and comparison groups' pre- and post-intervention scores for reading rate, accuracy and comprehension*

Rate	Treatment		Comparison	
	Pre	Post	Pre	Post
Average	9.85	10.93	10.76	11.06
SD	1.87	2.03	1.59	1.33
Avg SD	1.95		1.46	
<b>ES</b>	<b>0.55</b>		<b>0.21</b>	
<hr/>				
Accuracy	Pre	Post	Pre	Post
Average	9.8	11	10.5	11.65
SD	1.53	1.74	1.44	1.41
Avg SD	1.64		1.42	
<b>ES</b>	<b>0.73</b>		<b>0.8</b>	
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Comprehension	Pre	Post	Pre	Post
Average	10.8	12.13	9.93	11
SD	1.94	1.12	2.29	2.15
Avg SD	1.53		2.22	
<b>ES</b>	<b>0.87</b>		<b>0.48</b>	

Interviews and informal exchanges with the participants suggested that for the most part, the treatment group demonstrated greater intrinsic motivation to complete the reading program than the comparison group. In particular, the participants in the treatment group felt more comfortable with the intervention because it was conducted in the privacy of their own homes. "I really liked that nobody knew I was doing this,"

stated one member of the treatment group (Peter, 28/11/2010), in response to a passing question about how he was finding the program. “I hate reading in class, at least this way nobody could see me reading,” said another (Richard, 26/11/2010). Their peers, and in most cases even their teachers, were unaware of their participation in the program. The students also appeared to appreciate the responsibility and independence they were given by completing the intervention at home and in their own time. This was borne out in responses in informal exchanges. In some way, the reading task was viewed as separate from their school work. “I liked using the software and seeing my words come up on the screen. We don’t do stuff like that at school” (Erin, 26/09/2010).

Conversely, interviews with the comparison group suggested that the intervention was regarded as simply another classroom activity in which the teacher controlled the timing and duration of the reading activities. “I didn’t like Friday afternoons... that’s when we taped each other....it’s embarrassing if you don’t read it properly” stated a member of the comparison group (Kristy, 22/10/2010). Reading activities were conducted according to a routine, and non-compliance by participants in the comparison group, although uncommon, resulted in negative consequences. This may have resulted in members of the comparison group experiencing less motivation to participate in the intervention at full capacity. As Mary stated (26/11/2010): “I got lunchtime detention because I didn’t do my reading. I felt like quitting the whole thing then.”

**Key Finding 6.** The greater privacy enjoyed by the treatment group appeared to be a motivating factor that was likely to have contributed to greater gains compared to the comparison group.

The question of motivation becomes increasingly important for secondary students as the effects of many years’ struggle take their toll. As reported in the literature review, the impacts of long term reading problems, such as decreased motivation and lowered self esteem, exacerbate the potential debilitating impact of these difficulties (Kamhi, 1991; Margolis & McCabe, 2004). Adolescents would be aware that most students have mastered this skill well before secondary school. The lack of motivation contributes to the negative Matthew Effect (Stanovich, 1986), whereby poor progress leads to reduced incentive to continue practising, which in

turn leads to fewer opportunities to learn, and a further widening of the gap between the achievement of students with reading difficulties and their peers. The public aspect of the repeated reading activity conducted by the comparison group in this research appeared to be contributing to the cycle of negativity for some of the students. In addition, the teacher who taught seven of the eight participants in the comparison group did, on occasion, apply negative consequences to those she considered not working hard enough at their reading. It is possible that her approach would have contributed to the negative comments some of those in the comparison group expressed.

The negative Matthew Effect is particularly problematic as students move into adolescence, which is often a period of increased sensitivity and vulnerability. After eight or nine years of schooling, the adverse effects of reading failure are likely to increase for students with difficulties as their peers progress and the gap in achievement across multiple content areas widens (Paterson & Elliott, 2006). At secondary school, ability streaming is common and, despite attempts at creative labelling, students can usually identify the 'bottom class'. Whilst reading aloud in class was once a common part of English lessons in secondary schools, it is now considered a questionable strategy due to the potential to diminish struggling students' self-esteem even further (Whithear, 2008). For a number of the comparison group participants, involvement in this intervention resulted in their reading aloud to others for the first time in many years, and the overt demonstration of their difficulties would have been an unwelcome part of their day.

### **Prosody Results**

Figures 16, 17 and 18 show the average prosody scores of both the treatment and comparison groups throughout the duration of the intervention. These graphs *do not reflect* the increasing difficulty of the reading passages as the intervention progressed. At a later point in this chapter, graphs of individual performances include this added dimension.

The reading smoothness measures are presented in Figure 16 for both comparison and treatment groups throughout the intervention. Zutell and Rasinski's (1991) four-point scale for reading smoothness included in the methodology section is repeated below for convenience:

1. Frequent extended hesitations, false starts, sound-outs, repetitions, and/or multiple attempts.
2. Several "rough spots" in text where extended pauses, hesitations, etc., are more frequent and disruptive.
3. Occasional breaks in smoothness caused by difficulties with specific words and/or structures.
4. Generally smooth reading with some breaks, but word and structure difficulties are resolved quickly, usually through self-correction.

Figure 17 reveals that, on average, both groups began at the same point, and so were evenly matched on this dimension at the beginning of the intervention. The results of the treatment group reflected some variability throughout the intervention, but improved results were evident in the final two weeks of the intervention. The average score in the final week was approaching the generally smooth reading of proficient readers. Recording their own oral reading would have allowed the students to hear their level of improvement, and one could conclude that this added to their motivation. The privacy of the activity perhaps facilitated greater persistence and therefore greater progress over time. Achievement of the comparison group appeared to be relatively flat throughout, and unlike the treatment group, was on a downward trajectory in the concluding weeks. The comparison group's average score in the final week was in fact below the starting score. This could have reflected some level of disengagement with the repeated reading program, as the public nature of the activity may not encourage persistence with the task. This interpretation is supported by Kristy's comment about being embarrassed when reading in front of others (see p.105).

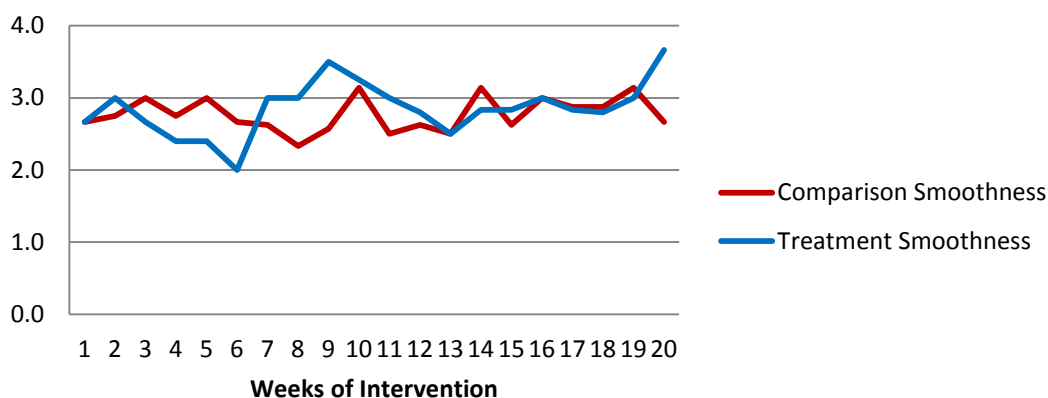


Figure 17. Average changes in reading smoothness for both groups

The measurement of reading phrasing for both treatment and comparison groups over the intervention is shown in Figure 18. Zutell and Rasinski's (1991) four-point scale for reading phrasing is repeated below:

1. Monotonic with little sense of phrase boundaries, frequent word-by-word reading.
2. Frequent two and three-word phrases giving the impression of choppy reading; improper stress and intonation that fails to mark ends of sentences and clauses.
3. Mixture of run-ons, mid-sentence pauses for breath, and possibly some chopiness; reasonable stress/intonation.
4. Generally well-phrased, mostly in clause and sentence units, with adequate attention to expression.

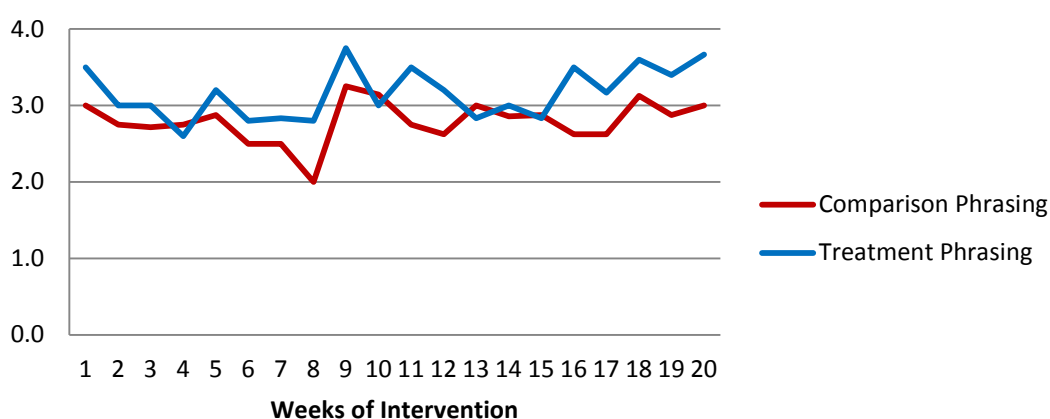


Figure 18. Average changes in reading phrasing for both groups

In order to determine if there were any significant differences between the treatment and comparison groups prior to the intervention, a Mann-Whitney test was conducted on initial phrasing results for students in both groups. The non-parametric

equivalent of the independent samples t-test was used since the small sample size was unlikely to result in a normal distribution of results. The test indicated there were no significant differences between the two groups for phrasing (Mdns: treatment = 7.83, comparison = 7.25;  $U = 22$ ,  $p = 0.8431$ ).

Both groups were reading more difficult texts as the intervention progressed. The average score for the treatment group was fractionally higher in the final week than in the first week, whereas the average score of the comparison group was exactly the same. Appropriate phrasing usually reflects comprehension, as without understanding the material being read, correct phrasing would be more difficult (Torgesen & Hudson, 2006). Minimal progress over a 20-week period in this element of reading is therefore a disappointing result, however, the lack of oral reading practice in secondary schools may be the cause of students' phrasing not improving.

The measurement of reading pace for both comparison and treatment groups is displayed in Figure 19. Zutell and Rasinski's (1991) four-point scale for reading pace is repeated below:

1. Slow and laborious.
2. Moderately slow.
3. Uneven mixture of fast and slow reading.
4. Consistently conversational.

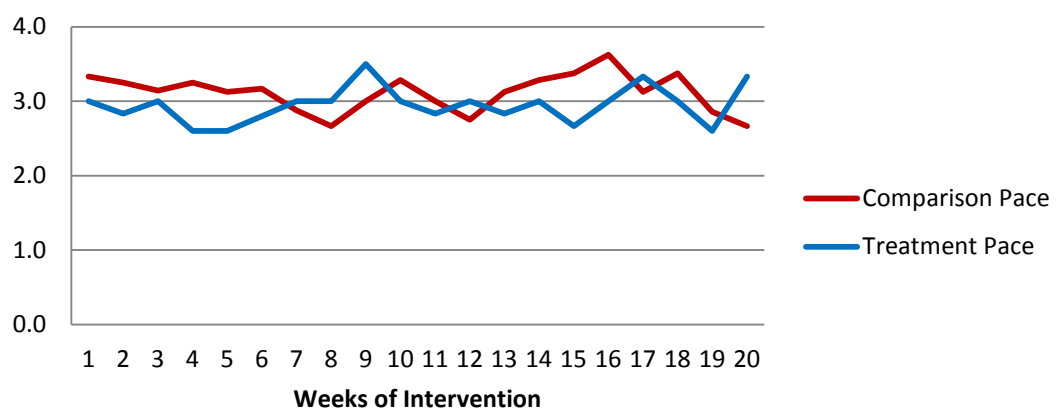


Figure 19. Average changes in reading pace for both groups



A Mann-Whitney test was also conducted on the initial pace results to determine whether or not there were any significant differences between the treatment and comparison groups prior to the intervention. The non-parametric equivalent of the independent samples t-test was again used because a normal distribution of results could not be assumed. The results indicated that there were no significant differences between the two groups for pace (Mdns: treatment = 6.33, comparison = 8.38;  $U = 14$ ,  $p = 0.4009$ ).

The uneven results for reading pace could again reflect the progressive increases in difficulty of the text passages. Figure 18 reveals that there was little to distinguish between both groups throughout most weeks of the intervention, although once again, the treatment group was on an upward trajectory at the 20-week mark, whereas the comparison group was on a downward trajectory at that point. It is, however, difficult to compare the results directly, as increasing the text difficulty did not occur uniformly for both groups, based as it was on individual student achievement on a weekly basis.

Consistent with performance in the other two areas of prosody is the treatment group's average improvement in the final weeks of the intervention, resulting in a small overall improvement in this component by the end of the intervention. The scores of the comparison group, however, were declining in the final weeks of the intervention, and although this group started at a slightly higher point, there was an overall drop in performance from pre-test to post-test. This could relate to the decreasing motivation reported by some students in the comparison group.

In summary, in two of the three components of prosody, students in the comparison group were scoring more poorly at the end of the intervention than they were at the beginning, whereas those in the treatment group had made gains in each. Most students began reading passages designed for a reading age of 9 to 10 years, but were reading passages with a reading age of 13 to 15 years at the conclusion of the intervention. This indicates that, while the treatment group outperformed the comparison group, the prosody of all participants improved to some extent over the five-month period during which the intervention took place. These results demonstrate the value of a repeated reading program for improving the reading

fluency of struggling readers. Furthermore, if the program is conducted in the home environment, this value of the program appears to be increased.

**Key Finding 7.** Both treatment and comparison groups had relatively stable prosody scores over the intervention; however, the difficulty of the passages increased significantly over that time suggesting a relative improvement in prosody.

### Measurement of Reader Self Perception

All participants in the intervention completed the Reader Self-Perception Scale (RSPS) before and after the intervention. As mentioned in the Methodology chapter, the scale consists of 33 items. Each item is a statement and participants indicate on a scale of one to five how strongly they agree or disagree with the statement. A score of one indicates the participant strongly disagrees with the statement, a score of five indicates strong agreement.

The scale measures reader self-perception across five categories or dimensions. The first is *general self-perception* and consists of one statement. The second dimension, *progress*, requires participants to assess whether their reading has improved recently. The next is *observational comparison* whereby participants compare their progress with that of their peers. This is followed by *social feedback* and asks participants to evaluate any feedback they have received from teachers, parents or others. The final dimension is referred to as *physiological state* and involves participants considering how they physically feel when they are reading. Table 8 summarises the number of items and the maximum score for each domain.

Table 8  
*Items and maximum scores in the RSPS*

Scale	Number of Items	Maximum Score
General Self-Perception	1	5
Progress	9	45
Observational Comparison	6	30
Social Feedback	9	45
Physiological State	8	40

As presented in Table 9, the average results revealed little difference between pre- and post-testing for either group, with self-perception remaining relatively constant over the course of the intervention. There were, however, slightly lower

post-results in the domains of *progress*, *social feedback* and *physiological states* for the comparison group. The treatment group showed a slightly lower post-result for *observational comparison*. Some average scores did not change at all.

Table 9  
*Descriptive statistics for the reader self-perception scale results*

	Treatment Group			Comparison Group		
	Min	Max	Mean (SD)	Min	Max	Mean (SD)
General Perception Pre-	1	5	3.17 (1.472)	2	4	3.00 (.535)
General Perception Post	2	4	3.17 (.753)	2	4	3.13 (.641)
Progress Pre-	24	43	33.67 (6.861)	26	42	34.88 (5.540)
Progress Post	30	39	35.00 (2.966)	25	43	33.75 (5.230)
Observational Comparison Pre-	9	25	17.00 (6.000)	9	22	17.13 (5.055)
Observational Comparison Post	11	26	16.17 (5.419)	11	26	18.75 (5.392)
Social Feedback Pre-	21	31	26.50 (3.728)	21	41	28.88 (7.200)
Social Feedback Post	23	29	26.50 (2.811)	21	36	26.50 (6.256)
Physical States Pre-	21	36	27.00 (5.727)	14	33	24.00 (6.279)
Physical States Post	19	34	27.00 (4.817)	10	37	23.63 (9.117)

The standard deviations were very large given the sample size of both the comparison and treatment groups, reflecting a wide range in participant responses. This supported the decision to investigate the results through individual case studies. Analysis of trends in the group averages over the five dimensions of the RSPS follows. Because the dimensions have different potential maximum scores, they have been graphed separately. Results for both treatment and comparison groups are presented on the same graph, along with separate results for females and males. The treatment group consisted of three females and three males and the comparison group consisted of four females and four males. Each participant completed the RSPS twice with a gap of over five months between testing.

It is conceivable that some anomalies in responses may have occurred because the RSPS measures perceptions, and perceptions can be influenced by many factors including having a bad day. Any such anomalies would also have been exacerbated by the small sample size. For these reasons, it is difficult to draw firm conclusions in this area.

Figure 20 displays pre- and post-testing results for both groups in the area of *general perception*. The combined scores over the course of the intervention remained relatively stable. The treatment group had a very small initial lead over the comparison group in their perception of themselves as readers, which did not change post-intervention; however, the comparison group scored the same result as the treatment group at the post-intervention mark.

Analysis at the gender level showed greater variation. Females in the treatment group displayed a small increase, as did males in the comparison group. Females in the comparison group displayed a small decrease, as did males in the treatment group. A possible reason for this difference is that the females in the treatment group made greater gains in pre- and post-intervention results using the NARA, compared to the females in the comparison group. The NARA results for males were less conclusive with the treatment group males performing slightly better. Although the treatment group males regressed in their self-perception whilst the comparison group males improved, the treatment group males scored more highly in the domain over the course of the intervention. Both treatment and comparison males were scoring higher than both female groups by the end of the intervention. It is difficult to explain this result other than, perhaps, male confidence.

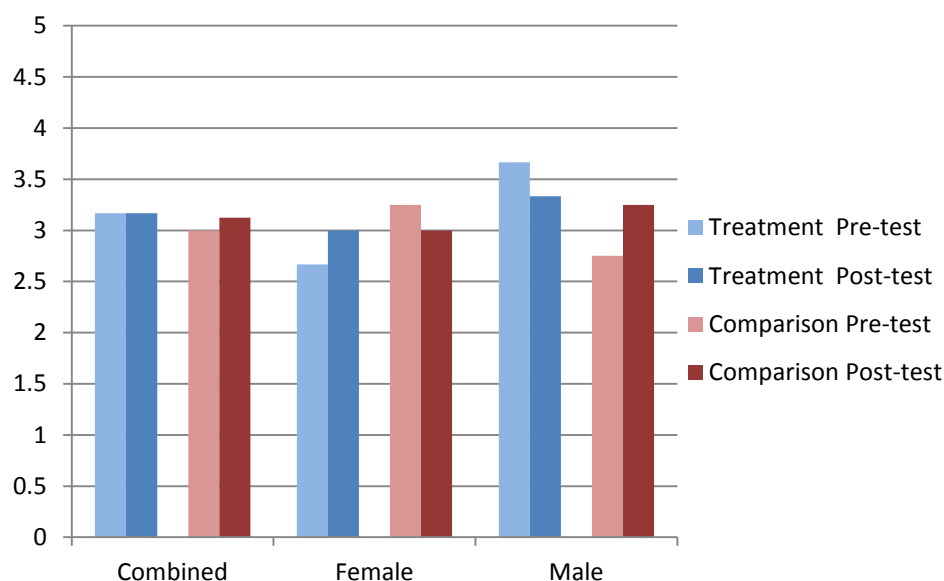


Figure 20. Results for treatment and comparison groups' *general perception* as a reader

As with *general perception*, the results for *progress* showed that both groups were quite similar in their perceptions of the progress they were making pre-intervention. Figure 21, however, reveals that the treatment group's scores improved in personal perceptions of their progress over the course of the intervention, albeit slightly, whereas there was a small decline in the scores of the comparison group's perception of progress after the intervention. The same pattern was revealed when analysed at the female and male levels, although it was more marked in the female cohorts. Of all the domains measured by the RSPS, this one attracted the highest scores from the participants. This would suggest that by undertaking the intervention, they were conscious that they were improving their reading skills.

The decline in the comparison group's scores is interesting in view of the fact that the NARA results reflected improvement in accuracy, rate and particularly in comprehension. Why could the students not recognise this improvement? It may be due in some part to their discomfort when reading in front of their peers – their embarrassment was such that it clouded recognition of progress. If this interpretation is correct, it has important implications for interventions such as this being conducted in class, and may also explain their lack of progress in the different dimensions of prosody, which can only be measured from oral reading. This highlights the need to consider the role of motivation in persisting with an intervention if it is to have any

impact, particularly in the adolescent population. It also adds support for an intervention such as the home-based one investigated in this research, whereby the public element was eliminated.

Nevertheless, despite removal of the public element for the treatment group, the improvement in their self-perception of progress was quite small. One would assume their sense of progress would improve substantially to reflect their improved results in fluency and comprehension. However, the participants were not given their NARA results at the different stages of the intervention; nor was feedback provided on a weekly basis as they completed each reading passage. Without concrete evidence of progress, it seems likely they maintained their original self-perceptions to a large extent, confirming the persistence of academic self-perception as reported in the literature review (McGeown et al., 2015; Wolters et al., 2014).

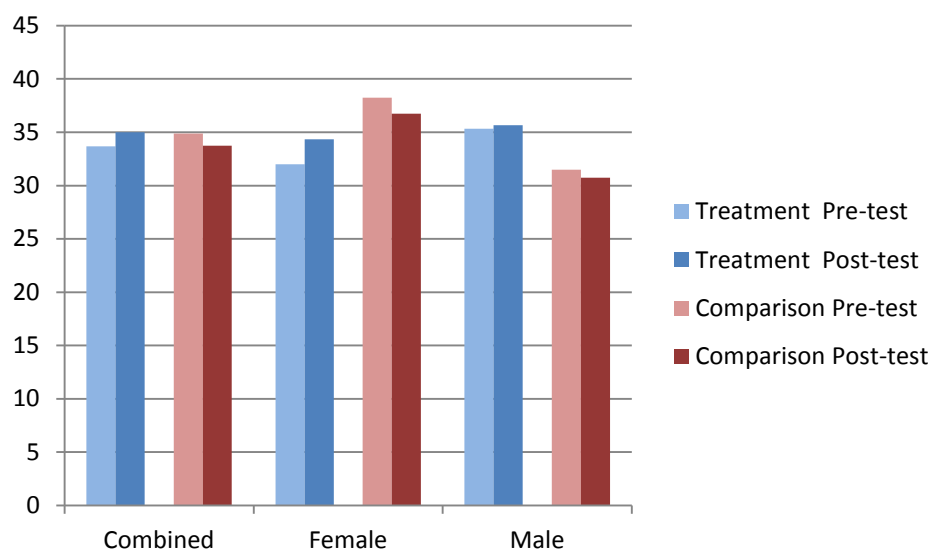


Figure 21. Results for treatment and comparison groups' perceptions of their reading progress

The *observational comparison* domain (see Figure 22) examined how the participants believed their reading compared to that of their peers. Examination of the combined results revealed that while both groups began at the same starting point, the treatment group's average scores declined, whereas the comparison group's scores improved, although movement in both cases was slight. This could be explained by the fact that the intervention did not require treatment group participants to read in front of peers, as they engaged in the intervention alone in their homes, and so direct comparison of their reading with other students did not occur. Moreover, it

is now relatively rare in secondary schools for students to read aloud in class, so they would have had little opportunity to compare their oral reading with that of their peers (Warner, Crolla, Goodwyn, Hyder, & Richards, 2016). The comparison group members paired up to read and to record each other's final reading attempt each week, so comparison group students had the opportunity to hear other students read.

Nevertheless, most participants, except for females in the treatment group, felt that their reading had improved slightly in comparison to their peers over the course of the intervention. The decline in the scores of treatment group females was quite marked, yet in the combined scores this decline was masked to some degree. This effect led to the decision to analyse the male and female results separately, as in several domains there were marked differences between males and females that were not reflected in the combined results. Analysis at this level also revealed that the scores for male participants in both groups were quite low in this domain. Overall, male students appeared to believe that their reading compared less favourably with that of their peers than did the female students. This may be due to the greater natural reticence of adolescent males to engage in reading generally, and in public specifically. It may also reflect the lower intrinsic motivation for reading that males can demonstrate (Logan & Medford, 2011; McGeown et al., 2012).

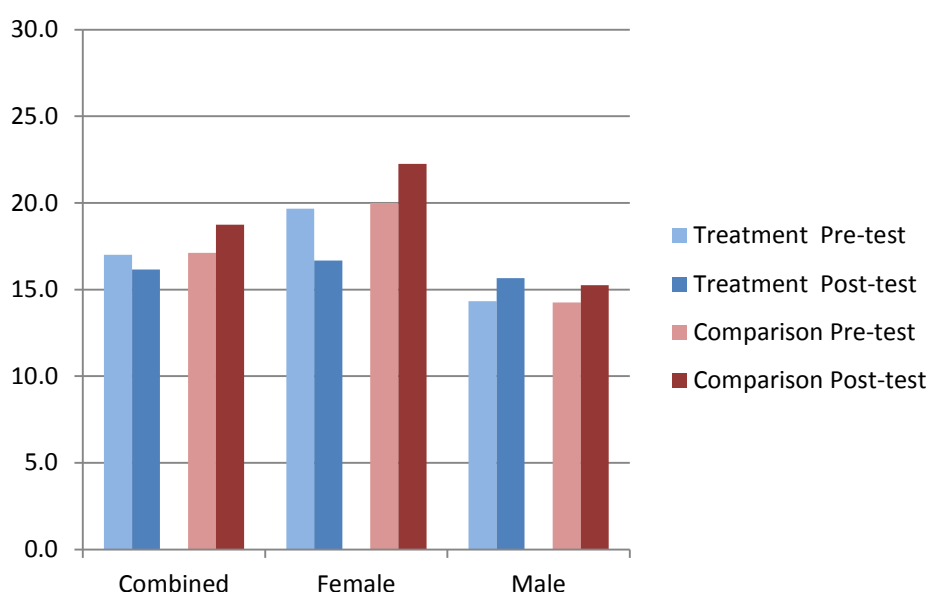


Figure 22. Results for treatment and comparison groups' *observational comparison*

Figure 23 presents the results for *social feedback*, which is how participants perceived feedback from teachers, parents or peers. Again, scores were relatively low apart from comparison group females. Males in the treatment group believed feedback was slightly *more* positive at post-intervention testing than before, the only group to perceive this. Females in the comparison group had a more favourable self-perception than the treatment males overall but recorded a decrease in scores in the post-intervention results. As with the results in the *observational comparison* domain, the overall low scores may be explained by the limited opportunity to read aloud in front of others, which therefore limited the opportunity to receive feedback. Students may not have realised that class assignments also reflected their capacity to read, and thus not viewed improvements in those (if they occurred) as a reflection of improved reading. The results gained in this domain could also be a consequence of the Researcher's deliberate decision to withhold feedback of any kind of performance in the repeated reading tasks lest it influence performance and motivation.

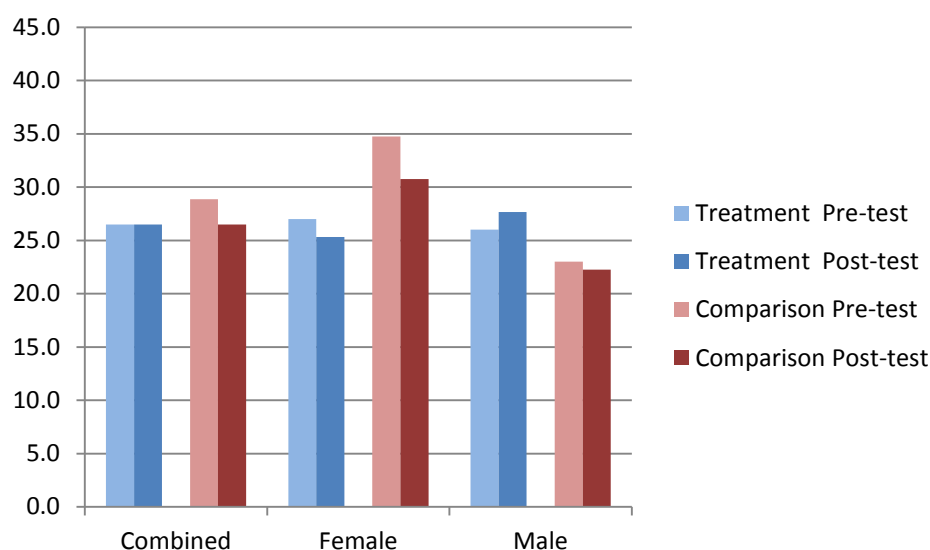


Figure 23. Results for social feedback for both groups and by gender

Figure 24 presents results for the domain of *physiological states*, which refers to the degree of physical comfort (or discomfort) participants felt while reading. Combined results revealed no differences pre- and post the intervention for the treatment group and some reduction for the comparison group, although from a higher starting point. The latter results are consistent with the comments made by Jack and Jarrad, which reflected some disenchantment with the class program as it progressed. It is possible that the treatment group felt more at ease because they were



reading in the privacy of their homes rather than at the school. The treatment group scores for females and males were relatively similar, although females decreased slightly and males increased slightly over the period of the intervention. There was a substantial difference between comparison group females and males, with the females feeling far more comfortable about reading than the males although both sets of scores decreased by the end of the intervention.

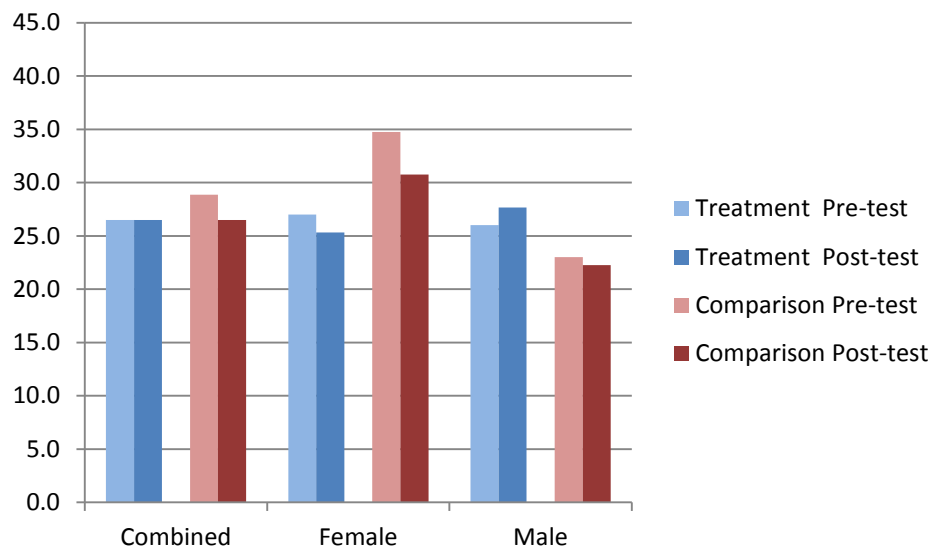


Figure 24. Results for physiological states for both groups and by gender

### ***Summary of results of the Reader Self Perception Scale***

The combined results across the five domains show minor differences between the treatment and comparison groups in the various domains of self-perception. However, when genders are separated, the comparison group females scored substantially higher than all the other participants in all domains except *general perception*. A possible explanation for this is that the four females of the comparison group were notable for their high level of self-confidence and extroversion. Whilst they were realistic about their limitations as readers, this did not appear to have a substantial effect on their self-concept. Two of the girls were highly accomplished netballers who had been selected for a state-wide netball program and had represented the school many times. Having received significant acknowledgement in this field, their sense of self-worth was perhaps not so strongly dependent on their reading skills. Global self-worth is comprised of many domains, academic self-concept being one of them. Marsh and Hattie (1996) contend that

individuals place greater emphasis on domains that are considered more important to them. It seems likely that these girls received greater validation from their sporting abilities than their academic performance and their perceived self-worth reflected this.

The comparison group males, on the other hand, were much more representative of students in a low-ability class, with the negative impact on self-concept that placement in those classes often entails. As discussed in Chapter Two, boys tend to have lower intrinsic motivation to read than girls. Furthermore, their self-concept as readers tends to be more closely linked to their reading ability, which could explain the relatively low scores of this group compared to the female participants.

Most forms of feedback have a positive effect on student academic performance (Hattie & Timperley, 2007; Siewert, 2010). Feedback and encouragement were variables that may have affected performance, and could well have affected RSPS results. The lack of feedback was considered important in ensuring that the results were a clear reflection of the effects of the repeated reading intervention only.

Over the course of the intervention most participants showed improvement in some aspect of their reading ability: rate, accuracy or comprehension, or a combination of these. Despite this, the RSPS data suggests that the participants did not perceive an improvement in their reading ability. It is possible that participation in the intervention reinforced in participants the notion that they were poor readers. Due to the lack of feedback in the intervention, the participants were unable themselves to determine whether progress was being made.

The other likely explanation for such minimal changes in reader self perception is that by adolescence, personal perception of reading ability has already been strongly formed in the minds of the participants. Since gains in their reading ability were achieved incrementally over an extended period, participants were unlikely to have noticed sufficient change to alter the perception of themselves as readers.

As reported in the literature review, there is some evidence that academic self-perception is formed within the first year of schooling and that even when poor academic progress is remediated, poor self-perception remains (Chapman et al., 2000; Morgan et al., 2008). Given that the participants were in their eighth, ninth or tenth year of schooling, perceptions of themselves as readers were well established in their minds. These perceptions were reinforced by their enrolment in low ability classes. This interpretation highlights the need to intervene as soon as possible, as a persistent view of themselves as poor readers could affect their motivation, and almost inevitably their performance, across the academic subjects.

**Key Finding 8.** Reader self-perception remained relatively stable despite significant gains by both groups, supporting research stating that self-perception remains relatively fixed from the early years of schooling.

### **Analysis of Individual Results**

As stated previously, the small sample sizes of both treatment and comparison groups meant that statistical analysis was not appropriate. The use of case studies of selected participants was used to elaborate on the descriptive statistics used. While examination of the differences between the scores of males and females revealed some interesting differences, exploring the individual results allowed even closer analysis of this diverse group of students. (The results of individual members of both groups are presented in Appendix J.)

#### **Individual Case Studies**

The following seven case studies include four students from the treatment group, and three from the comparison group. Case study analysis allowed a more fine-grained approach, and for more of the students' personal stories to be incorporated.

##### ***Julie***

Julie was 13 years and eleven months and in Year 8 when she began the intervention. She lived with her South African parents and occasionally spoke Afrikaans at home. She is the oldest of three children and has a brother and sister.

Julie was part of the treatment group. Although usually reliable in submitting her recordings, there was a period of three weeks midway through the intervention during which computer problems prevented Julie's participation in the intervention. Overall, she was positive about participating and felt it had contributed to an improvement in her reading ability and enjoyment. She also intimated that her parents were supportive, and encouraged her during the intervention. "Mum usually reminded about my reading, except when it [the computer] was being fixed. I sort of got into the habit after a while – maybe 'cause she nagged so much from the start" (10/11/2010).

Results for Julie using the NARA before, during and after the intervention are shown in Figure 25. Improvements at each stage of the intervention across the three domains were recorded. In reading rate and accuracy, gains of approximately twelve months were evident. The greatest improvement was in the area of comprehension where an increase of nearly four years in reading age was recorded over the five-month period of intervention.

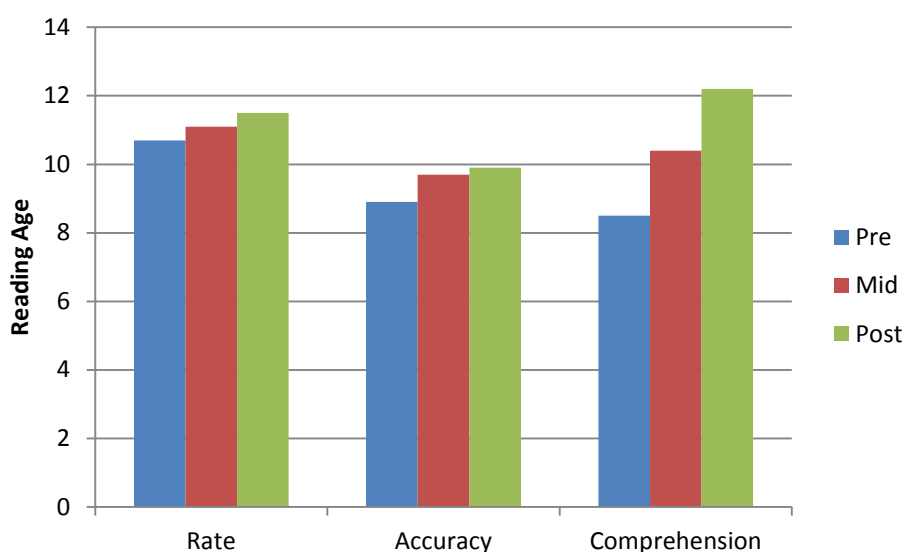


Figure 25. Julie's results according to the NARA

Julie was one of the participants re-tested twelve months after the intervention using Form 1 of the NARA. Figure 26 presents Julie's results pre-intervention, immediately after the intervention, and then twelve months later.

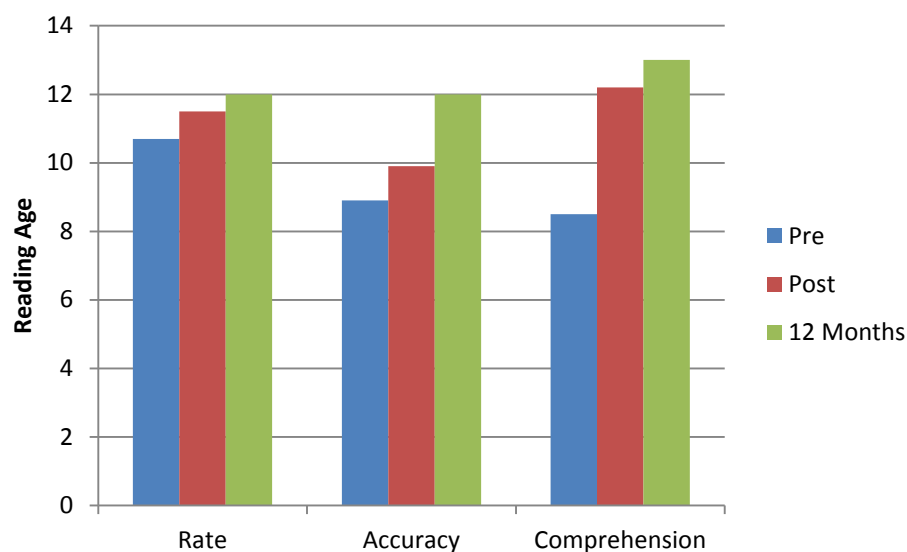


Figure 26. Julie's progress from pre-testing until 12 months after the intervention

Julie continued to make progress throughout the year following the intervention, showing approximately twelve months' improvement over post-testing and, in the case of reading accuracy, over two years' improvement. The overall growth in comprehension from the beginning of the intervention was approaching five years. By this stage, she had been transferred from a low-ability English class to a mainstream English class and was performing satisfactorily. "I feel like I'm doing better," she said. "Reading doesn't seem so hard. I feel like I'm keeping up in the new class even when they're all smarter than me" (30/10/2011). The latter part of the quote shows the intractability of her self-perception as a reader. Despite her considerable improvement across all areas of reading, and the fact that she was managing the work in a mainstream class, she still saw herself as less capable than her peers.

Effect sizes were calculated on Julie's results in rate, accuracy and comprehension and compared with those of the treatment group as a whole. Table 10 displays the effect sizes calculated for pre and post-intervention results. Whilst effect sizes in rate and accuracy were not as great as the average of the treatment group, they still indicated that the intervention improved results beyond normal expectations for growth during that period. Paradoxically, despite relatively smaller gains in rate and accuracy, Julie gained 45 months in reading age for comprehension over the five-month intervention, resulting in an effect size of 2.48. This is considerably larger than the average of the treatment group. Whilst it could be considered an outlier or

anomalous result given the small sample size, her comprehension results continued to improve at each testing phase, including twelve months after the intervention, suggesting that her progress in this area was genuine.

Table 10  
Julie's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing

	Gain in months	SD	Effect size	Treatment group effect size
Rate	10	1.95	0.41	0.55
Accuracy	12	1.64	0.61	0.73
Comprehension	45	1.53	2.48	0.87

Julie's results for prosody indicate a steady improvement in phrasing, smoothness and pace, despite the increasing difficulty of the reading passages. Her prosody results are presented in Figure 27 for the 18 weeks in which she participated in the intervention. The left vertical axis shows the four-point scale on which phrasing, smoothness and pace were measured. The right-hand vertical axis reflects the reading age in years of the reading passages that Julie used over the course of the intervention.

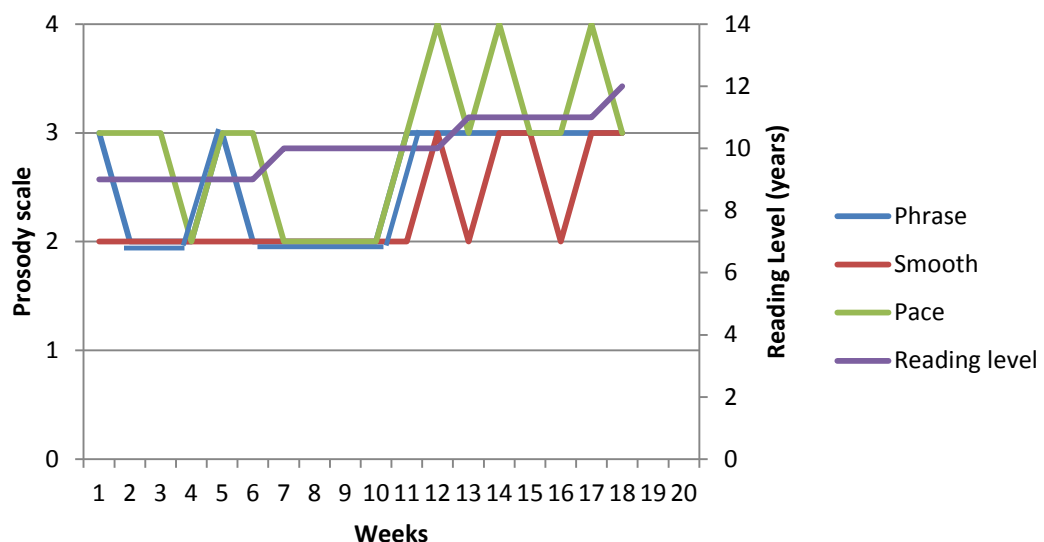


Figure 27. Julie's prosody scores compared with the reading level of the passages

Figure 27 shows that Julie's reading phrasing and pace and, to a lesser extent, her smoothness improved over time. This is despite the reading level of the passages she read increasing from a reading age of 9 years to 12 years over the 20-week intervention. There is no variation in the graph between weeks seven and ten, the period during which Julie was without a computer and unable to complete her reading. Julie stated that she had not thought to read to a parent during this period because it was approaching the school holidays and she was preoccupied with other matters. Despite this break, her performance continued to improve in the weeks following, particularly in pace and phrasing.

Figure 28 displays Julie's pre- and post-test results on the Reader Self-Perception Scale. The results indicate that there was little change in Julie's general perception of her reading ability, but there was some improvement in her perceived level of progress and her physical state whilst reading. Nevertheless, there was a drop in her rating for observational comparison, and also in social feedback, meaning that she felt she was not making as much progress as her peers. This is consistent with her statement that although she was keeping up in her new class, she did not believe she was as 'smart' as her peers were.

Overall, Julie's self-perception as a reader did not markedly improve despite her good results in the intervention, especially in the area of reading comprehension. The improvement shown in progress reflects comments she made in which she stated that she felt the reading was improving as a result of the extra practice involved in the intervention. "I tried hard [with the program] ... I thought I was going better but it was hard to tell. I sort of lost track of where I started from" (10/11/2010). This could indicate that Julie had a relatively internal locus of control (Findley & Cooper, 1983; You et al., 2011) and believed that the effort she expended affected her performance. This suggests that students with an internal locus of control may be more successful with this intervention. Actively pointing out to students the positive outcomes of their efforts, and thereby gradually changing their locus of control, may be an important way in which teachers can build the personal efficacy of their students, in addition to their academic outcomes.

There were significant changes in responses to individual items in Julie's pre- and post-test engagement with the RSPS. In her first attempt, almost all responses

were in the *undecided* column, with a few *agrees* and *disagrees*. The post-test results, however, revealed strong changes in some items. For example, her responses to item 25, "I feel comfortable when I read," and item 26, "I think reading is relaxing," changed from *undecided* to *strongly agree*. These changes indicate that Julie had become more confident about her ability to read. Conversely, her response to item 9, "My classmates think that I read pretty well," changed from *undecided* to *strongly disagree*, possibly reflecting her move from a remedial class to a mainstream class and Julie's awareness of the different levels of ability in that class. Her response to item 10, "When I read, I don't have to try as hard as I used to," also changed from *undecided* to *strongly disagree*. This appears to contradict other responses that refer to being more comfortable and relaxed when reading, and also her statement that "reading doesn't seem so hard". It could reflect a lack of understanding of the item, which was phrased in the negative, or an acknowledgement of the extra effort she had expended on improving her reading. Of note was her response to item 32, "I enjoy reading," which had changed from *undecided* to *agree*. Increased enjoyment is likely to lead to increased reading, which would lead to further improvement, a demonstration of the positive Matthew Effect (Stanovich, 1986).

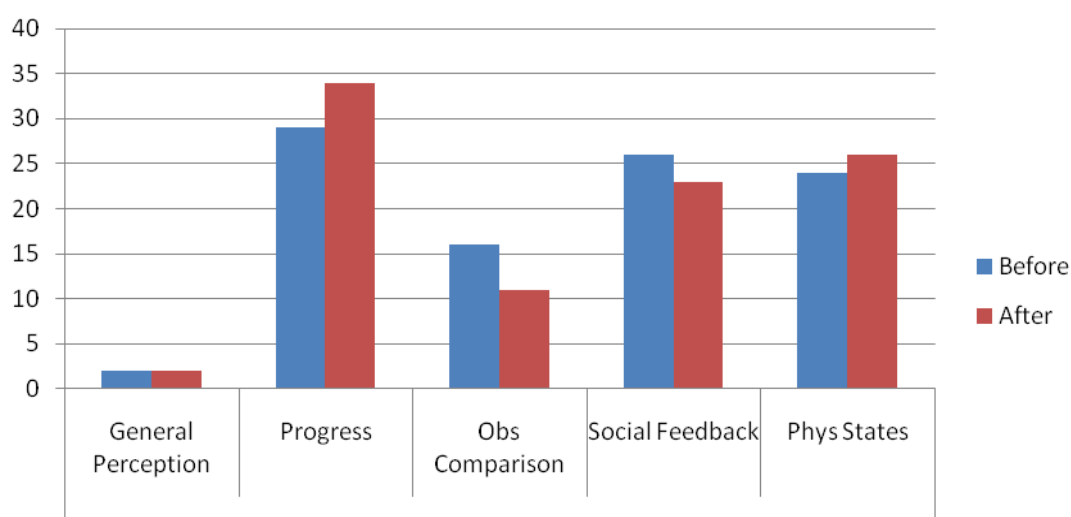


Figure 28. Julie's scores on the RSPS

Julie's experience with the intervention was positive according to both objective and subjective measures. She made substantial gains in reading accuracy and fluency, and growth of over four years in comprehension, resulting in her transfer from low ability to mainstream classes in English and social studies. As a consequence of her improved reading ability, Julie was able to access a far greater



range of curriculum materials, materials that were more consistent with her grade level, and which should have transferred into improved academic performance across the curriculum.

Julie also enjoyed using the software. It was both intrinsically motivating in that it involved technology (“It was kinda cool seeing the words come up when I spoke” 26/10/2010) and motivating in that it provided the means by which she could improve her reading without any public display. Whilst continuing to believe that she was a poor reader, Julie’s confidence as a reader and her academic performance both improved. These are major outcomes of the intervention and suggest that VRS has considerable potential to support secondary students in the area of reading fluency in a way that acknowledges both the academic and social-emotional needs of adolescents.

Importantly, Julie also received support from her family in undertaking the intervention at home. Her mother maintained email contact with the Researcher to ask questions and seek advice on how to help Julie. Over the course of the intervention, email contact was initiated by her mother on five occasions. Opening up another avenue for communication with families, particularly the families of students who are struggling at school, was an unexpected but important outcome of the research. This suggests that a home-based program to support reading fluency utilising VRS could be an important addition to the repertoire of strategies available to teachers of secondary students with reading difficulties, and could also facilitate communication with families.

### ***Peter***

Peter was aged 12 years and seven months at the beginning of the intervention, and enrolled in Year 8. He was the younger of two brothers and lived with both his parents. Peter completed the intervention at home as part of the treatment group and was very reliable in submitting his recordings each week.

Peter’s parents were very supportive of his participation although he went to great lengths to keep his involvement in the intervention away from their scrutiny. He only practised his reading in his bedroom and would not tolerate interruptions from family members. “They’d try to see how I was going every now and then but

I'd just tell them to get out of my room.” (26/11/2010) When asked why he was so secretive he explained that he knew his reading was a problem and he did not want anyone, including his family, to see the extent of that problem. “I just wanted to see if I could get better before I showed anyone, even them [my family]” (26/11/2010).

Peter was a relatively accurate reader: his reading was methodical, but generally slow and laborious. He appeared willing to sacrifice speed for accuracy and would often pause at a word until he was sure he knew what it was. Over the course of the intervention his reading rate improved by approximately twelve months in reading age. Whilst still slow for his grade level, it was a substantial improvement.

Peter's NARA results completed before, during and after the intervention are shown in Figure 29. The results show his improvement in reading rate, with the greatest gain made in the second half of the intervention. His accuracy score reached the ceiling level of 13 years by the mid-point of the intervention, and remained there. After a fall in the comprehension score at the midpoint of the intervention, there was considerable growth in the latter half of the intervention. “I wasn’t sure if I was getting better ... it was hard to tell,” he said. “After a couple of months it seemed to get easier” (26/11/2010).

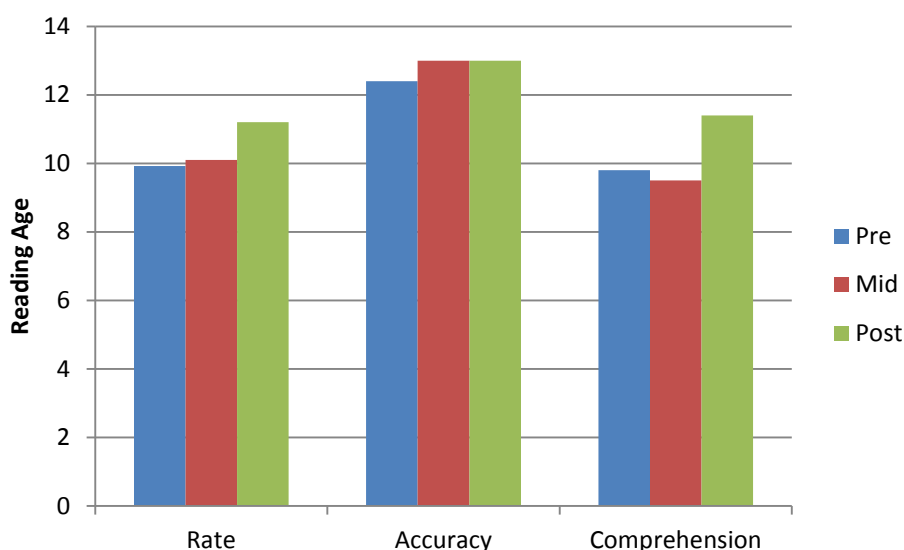


Figure 29. Peter's results according to the NARA

Peter was one of the participants re-tested twelve months after the intervention using Form 1 of the NARA. Figure 30 displays Peter's results from pre-testing to post-testing and then re-testing twelve months later.

In a little under two years, Peter's reading rate had improved from an ability level of less than ten years to one of over thirteen years. His reading accuracy had always been relatively high and stayed so. Comprehension improved by a little over two years. Like Julie, these substantial gains in fluency and comprehension had enabled Peter to access curriculum materials appropriate to his grade level and contributed to his move to a mainstream English class.

Peter reported that, twelve months after the intervention, he was reading more for pleasure although he would not classify himself as a regular reader. Like Julie, he was keeping up in the mainstream class. He reported that he was better able to cope with the reading at school. He could get through it quicker and understand more of it, but remained cautious about what his progress meant long-term. As he stated twelve months after the intervention, "I still don't feel like I should be in this [English] class. I keep waiting to be kicked out (laughs)" (28/11/2011).

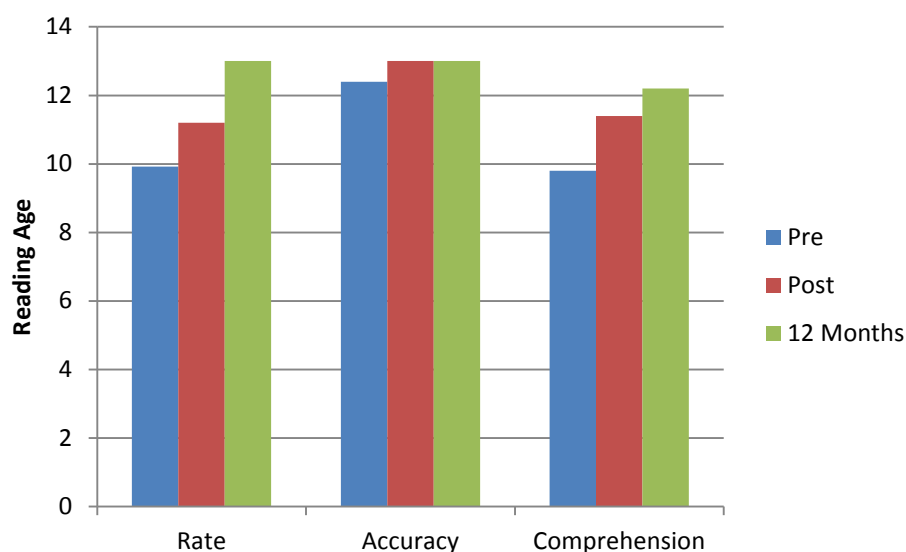


Figure 30. Peter's progress from pre-testing until 12 months after the intervention

When Peter's individual effect sizes were calculated, as shown in Table 11, they generally reflected greater gains than the rest of the treatment group. The exception to this was in accuracy, where Peter had an effect size of 0.43 compared to the group effect size of 0.73. This can be explained by the fact that Peter achieved the maximum possible score for accuracy on the NARA during mid-intervention testing, effectively preventing the measurement of further progress in this area. This still

equated to a gain of eight months in reading age over a ten-week period, a more substantial gain than the effect size suggests.

Table 11

*Peter's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing*

	Gain in months	SD	Effect size	Treatment group effect size
Rate	15	1.95	0.67	0.55
Accuracy	8	1.64	0.43	0.73
Comprehension	20	1.53	1.05	0.87

Figure 31 shows Peter's progress in prosody over the course of the intervention. Whilst smoothness did not improve greatly, there were considerable gains in pace and phrasing despite the reading level of the passages increasing by four years over the 20-week intervention. The lack of smoothness reflects Peter's tendency to hesitate at difficult words until he was sure of the correct pronunciation rather than trying to approximate the word. Phrasing and pace showed a large improvement in the final weeks of the intervention. The increased pace reflected the improvements in reading rate that Peter made; however, the lack of progress in smoothness demonstrates Peter's habit of hesitating. The improved pace revealed that the hesitations became shorter.

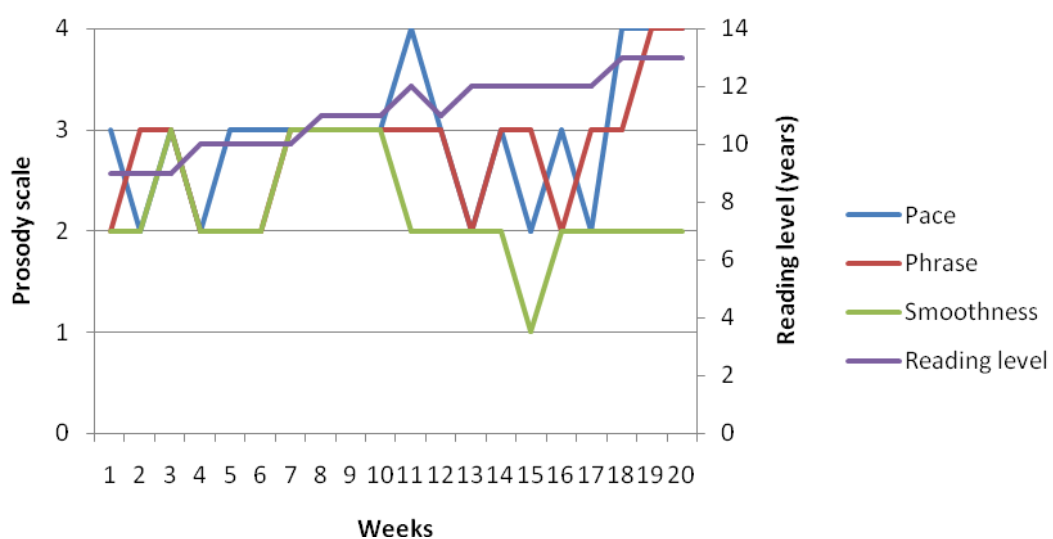


Figure 31. Peter's prosody scores compared with the reading level of the passages

Peter's results on the Reader Self-Perception Scale are presented in Figure 32. The results show that there was no change in Peter's general perception of his reading ability over the course of the intervention, although improvement was recorded in his perception of his *progress* and his *observational comparison* with peers. His perception of receiving positive feedback from parents, teachers or peers (*social feedback*) appeared to diminish slightly over the intervention as did his comfort level (*physiological states*) whilst reading.

Responses to most individual items remained stable in Peter's pre- and post-testing on the RSPS. Exceptions include item 10, "When I read, I don't have to try as hard as I used to," and item 11, "I seem to know more words than other kids when I read," both shifted from *disagree* to *agree*, as did item 14, "I understand what I read as well as other kids do." To some extent, these changed responses help to explain Peter's increased scores for *progress* and *observational comparison*.

Peter did not transfer to a mainstream English class until the school year after the intervention. When asked at the conclusion of the intervention if he thought he was reading better when compared to his peers he stated, "Sometimes the teacher gets us to read out a bit of our writing. I just noticed that I seemed to read better than some kids I thought were better than me" (26/11/2010).

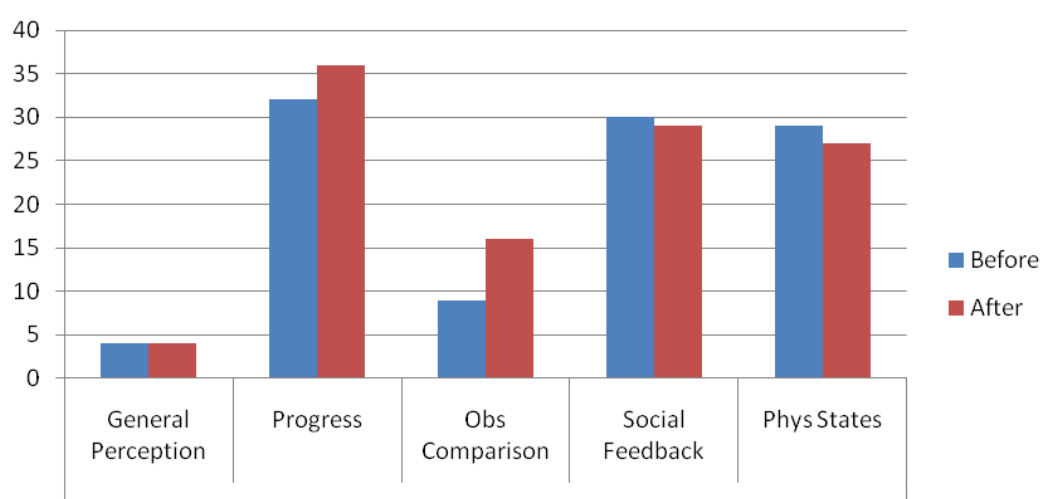


Figure 32. Peter's scores on the RSPS

### *Erin*

Erin, a Year 8 student, was aged 13 years and nine months at the beginning of the intervention. She lived with her mother and stepfather and was the oldest of three sisters. Erin was part of the treatment group and was diligent about completing her readings each week, but she lacked self-confidence and was pessimistic about her progress throughout the intervention. Her stepfather stated to the Researcher: "...don't expect too much from her, she's not very bright," (22/06/2010) which reflected low expectations in at least some quarter of the home environment.

Figure 33 shows Erin's progress in reading rate, accuracy and comprehension over the course of the intervention. Although Erin made improvements, they were quite small, in most cases reflecting less than twelve months in reading age. Unusually, her reading rate declined in the latter half of the intervention, reversing what had been a substantial gain in the first half of the intervention. Accuracy and comprehension improved as the intervention progressed although these improvements were not large: six months for accuracy and eleven months for comprehension over the five-month intervention. On the day of the post-intervention testing, Erin appeared particularly pessimistic about her progress and somewhat despondent.

Unfortunately, Erin left the school shortly after the intervention so there was no opportunity to retest her twelve months after the intervention.

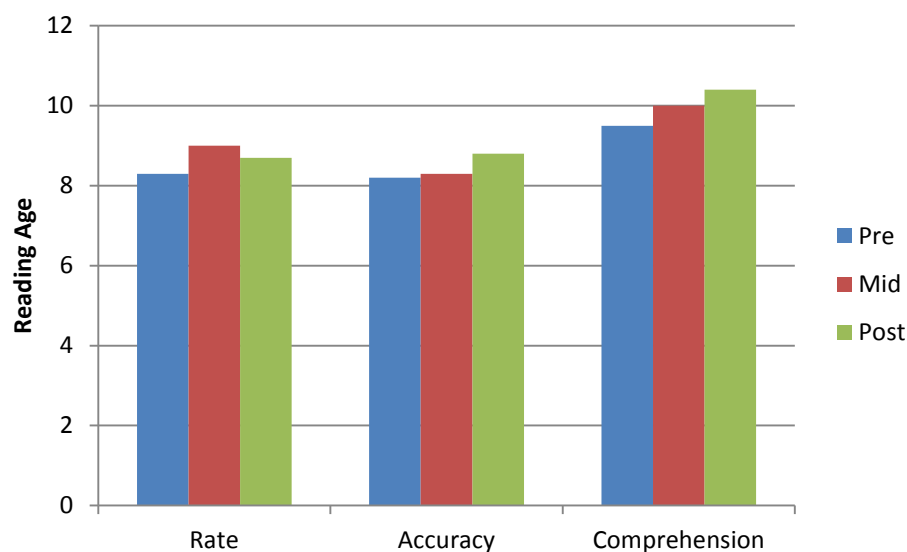


Figure 33. Erin's results according to the NARA

Table 12 displays Erin's individual effect sizes compared to the rest of the treatment group. Effect sizes for rate and accuracy fell below 0.4 suggesting that the intervention had little effect on these components. Her score of 0.67 for comprehension, whilst lower than the group average of 0.87, indicated greater than expected growth in reading comprehension, which could be cautiously attributed to the intervention.

Table 12

*Erin's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing*

	Gain in months	SD	Effect size	Treatment group effect size
Rate	4	1.95	0.15	0.55
Accuracy	6	1.64	0.30	0.73
Comprehension	11	1.53	0.67	0.87

Despite only small gains in rate, accuracy and comprehension, Erin's prosody scores improved more substantially as shown by Figure 34. Her pace and smoothness improved over the course of the intervention. Phrasing remained relatively constant, despite the fact that the reading level of the texts increased by four years over the course of the intervention. Her final reading showed a drop in phrasing and

smoothness that contradicted performance to that point. It is possible that this final reading was rushed, as shortly after the intervention concluded, Erin left the school as a result of her stepfather's posting to a new location interstate. Her strong gains in pace contradict her NARA results and the sudden drop in phrasing, smoothness and pace in the final week of the intervention could have been related to her relatively lacklustre post-intervention results on the NARA. It is possible that Erin had received news of her family's relocation in the final week of the intervention, and this had affected her performance.

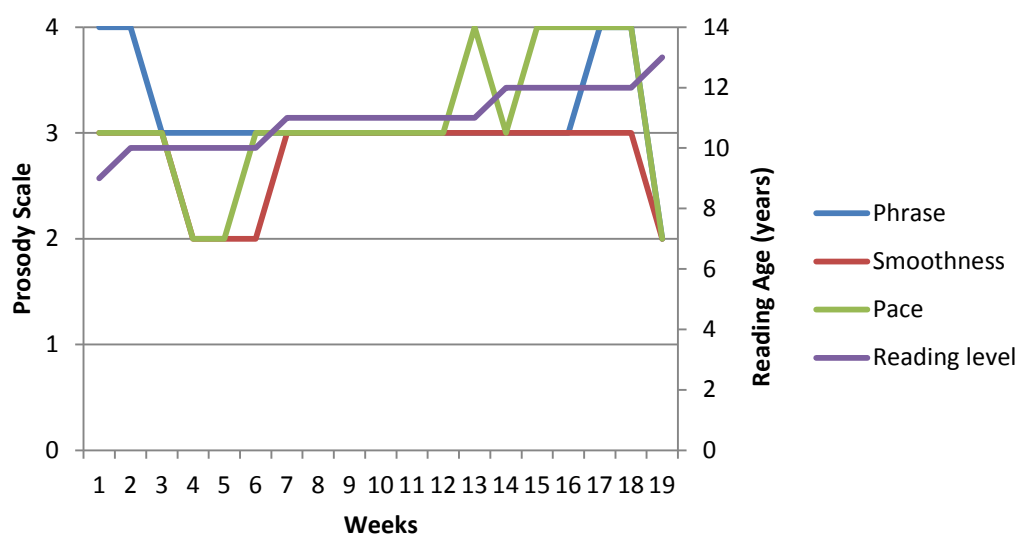


Figure 34. Erin's prosody scores compared with the reading level of the passages

As with her prosody, Figure 35 shows that Erin's perception of herself as a reader had improved. Specifically, her *general perception*, her perception of her *progress* and how she physically felt whilst reading all showed a marked improvement by the end of the intervention. These are unusual results given Erin's general pessimism and lack of confidence in her ability as a reader. The relatively large improvements in her general perception of herself as a reader and her perception of progress are at odds with the many comments she made to the researcher. "I'm no good at this, am I?" and, "Am I failing?" (27/09/2010). It was necessary to explain often that the intervention was not a school assessment that she could fail. Her perception of positive feedback from parents, teachers and peers remained unchanged [indicating that she did not appear to notice her stepfather's pessimism about her ability], however, personal perception of her reading ability compared to that of her peers declined.



Individual responses from pre- to post-testing revealed substantial improvement in items relating to *progress* and her *physiological states* while reading. Responses to item 8, for example, "I feel good inside when I read," shifted from disagree to agree, as did her responses to item 19, "I read faster than I could before," and item 28, "When I read, I recognise more words than I used to." Perhaps Erin's largest gain was in her general perception of herself as a reader which was captured in her response to item 1, "I think I am a good reader," which changed from *strongly disagree* to *undecided*. While certainly not a resounding endorsement of newfound confidence, her post-intervention response did move some way along the continuum. These increases in general perception, progress and physical states were particularly pleasing in light of her stepfather's pessimism about her ability and potential.

Erin's responses to statements regarding *observational comparison* were lower in post-testing. As a member of the treatment group, Erin had limited opportunity to hear her peers read. Despite her perception of improved progress and feeling more physically comfortable whilst reading, it would appear that her lack of self-confidence affected personal perception of her ability compared with that of her peers.

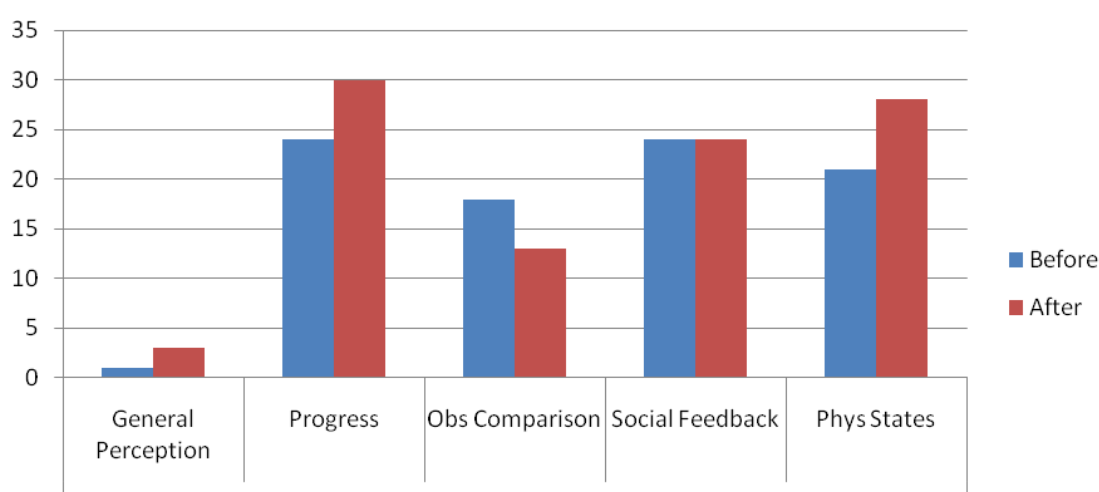


Figure 35. Erin's scores on the RSPS.

Whilst Erin's gains according to the NARA were not large, her week by week reading showed that her pace improved along with the smoothness and that generally, her perception of herself as a reader improved markedly. She was reticent in interviews but towards the intervention stated: "I think I'm getting better... it seems a bit easier than before," (13/11/2010). It should be stated that her general perception of herself as a reader started from a very low point, reflecting her lack of confidence in her reading ability. Her performance and results in the NARA, the last week of the reading and her final RSPS results show inconsistencies with the rest of the results in the intervention. It is possible to conclude that some emotional turmoil in the final week of the intervention, as mentioned previously, created these discrepancies.

### ***Richard***

Richard was aged 13 and six months and in Year 9 when he began the intervention as part of the treatment group. Richard lived with both parents and was the middle of three brothers. He completed the intervention at home and was very diligent about completing each week's recording. There was strong parental support. Initial testing with the NARA showed that his reading rate and accuracy were very low.

Despite his poor reading skills, Richard was in a mainstream English class. In many respects, he was a model student: well behaved, cooperative and possessing a strong desire to do well at school. He was keen to volunteer for the intervention and hoped it would boost his academic performance. Of note, however, was Richard's self-acknowledged indifference to reading. He simply did not enjoy it and avoided it where he could. "When we do stuff in class I understand it all but if we have to read anything, like a text book, it just takes too long and I don't really get it," (11/06/2010).

Figure 36 reveals that Richard's reading rate changed little, remaining slow and laborious over the course of the intervention. Reading accuracy and comprehension improved considerably more, though not consistently. Accuracy dropped slightly from mid- to post-intervention, and comprehension dropped from pre-testing to the mid-point of the program, but clear progress was evident at post-intervention testing. Whilst his comprehension level was age appropriate by the end of the intervention, his reading rate and accuracy were still very low and below the

standard required for full participation in secondary school subjects where reading was a key component of the curriculum.

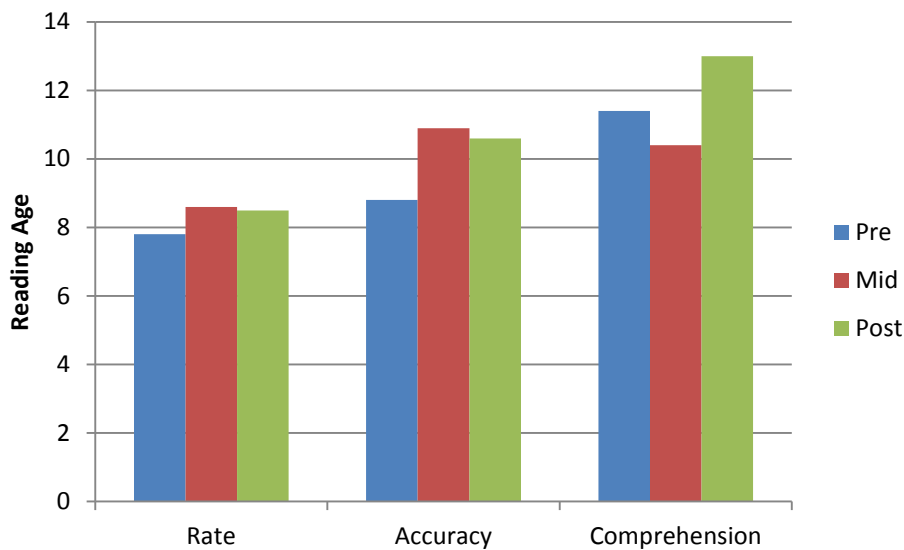


Figure 36. Richard's results according to the NARA

Richard was one of the participants re-tested twelve months after the intervention using Form 1 of the NARA. Figure 37 presents Richard's results from pre-testing to post-testing and subsequent re-testing twelve months later.

It can be seen that despite a large improvement in reading rate, he regressed in accuracy and comprehension. When queried about this discrepancy, Richard claimed to have done no voluntary reading since the intervention. He was still unable to find any enjoyment in reading and actively avoided it. "...just can't be bothered, no point in it," (15/09/2011) he stated when re-tested twelve months after the intervention.

A gain of three years in reading rate in less than two years seems remarkable when Richard claimed to have done very little reading practice over the intervening period. A possible explanation is that he had actually read quite substantially across the different content areas, but had not recognised this as constituting 'reading practice'. His substantial improvement in reading rate was also inconsistent with his lack of progress in accuracy and comprehension, both of which appeared to regress. It is possible that in the testing twelve months after the intervention, he raced through the reading passages to finish quickly with a deleterious effect on accuracy and comprehension.

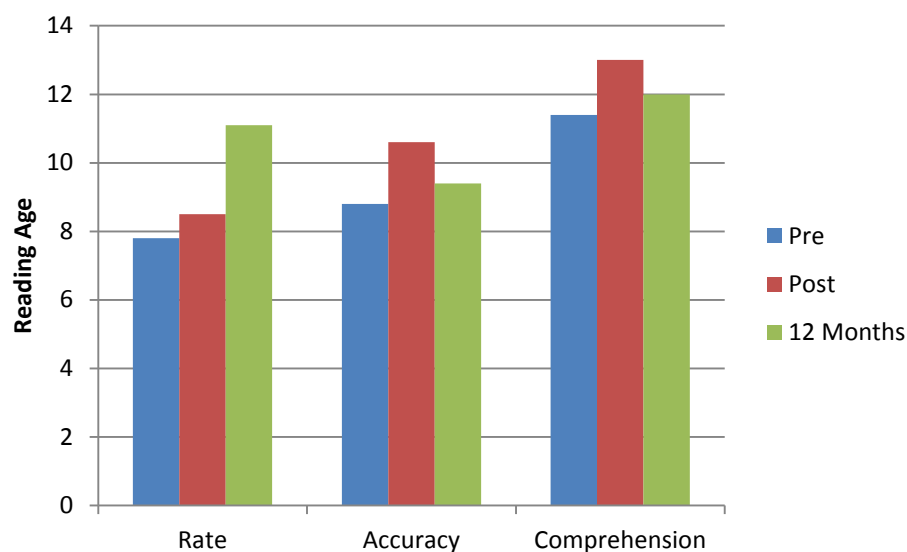


Figure 37. Richard's progress from pre-testing until 12 months after the intervention

When Richard's individual effect sizes were calculated, as shown in Table 13, they revealed that Richard was below the group average in rate but exceeded the group average for accuracy and comprehension. During the intervention, Richard's rate did not improve greatly although it did twelve months after the intervention. Unfortunately, this gain could not be reflected in an effect size. The gains over the period of the intervention in accuracy and comprehension were substantial, however, and the effect sizes demonstrated the impact of the intervention on Richard's reading performance.

Table 13

*Richard's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing*

	Gain in months	SD	Effect size	Treatment group effect size
Rate	9	1.95	0.34	0.55
Accuracy	22	1.64	1.04	0.73
Comprehension	20	1.53	1.11	0.87

Figure 38 shows Richard's prosody results, which are quite erratic. Apart from maintaining pace with increasingly difficult text, no strong trends appeared to emerge. It is possible to conclude that phrasing and smoothness declined somewhat

as the reading passages became more difficult. Despite this, however, his reading became more rapid. Phrasing and smoothness appear to decline each time the reading level of the passages increased in difficulty.

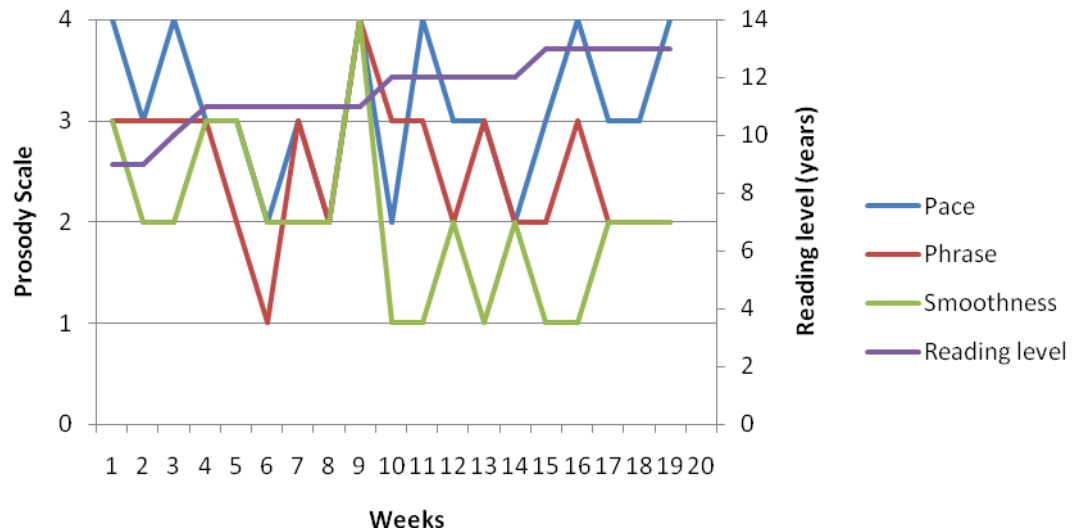


Figure 38. Richard's prosody scores compared against the reading level of the passages

Richard's results according to the Reader Self-Perception Scale conducted before and after the intervention are shown in Figure 39. Whilst Richard's *general perception* did not change, there were minor improvements in perceptions of his *observational comparison* and *social feedback*. However, perception of his *progress* in reading and his *physical states* whilst reading became more pessimistic.

Looking at the responses to individual items in the pre-testing and post-testing, Richard's responses were almost identical. Changes occurred in responses to item 23, "I understand what I read better than I could before," and item 24, "I can figure out words better than I could before." Both items shifted from *undecided* to *agree*. Also, responses to item 31, "People in my family think I read pretty well," and item 32, "I enjoy reading," both shifted from *strongly disagree* to *disagree*.

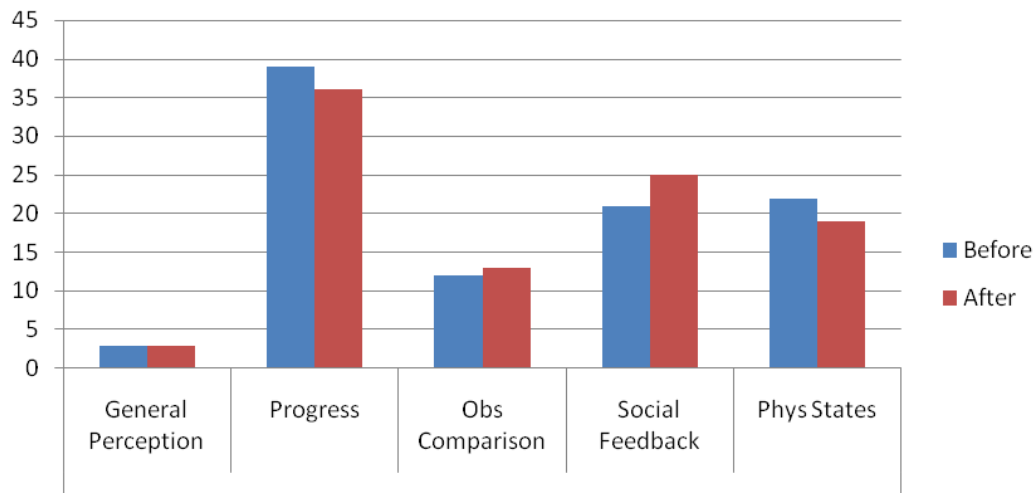


Figure 39. Richard's perception of himself as a reader before and after the intervention

"I just don't like reading...it's the last thing I'd pick," (12/11/2010) he said at one point. Despite this stated attitude to reading, he had volunteered to participate in the intervention and had shown improvement.

### ***Jarrad***

Jarrad was 14 years and three months at the beginning of the intervention and in Year 9. Jarrad was unable to complete the technical steps necessary for the VRS to operate effectively at his home, which meant that he participated in the more conventional repeated reading program in his class as part of the comparison group.

Each Monday, Jarrad received his written passage from his teacher who read it once to model the pronunciation. Over the week, he was given opportunities to practise his reading and each Friday he read the passage for a final time and it was recorded.

The recording of the final reading was not always supervised by the teacher. Over the course of the intervention, particularly towards the end, Jarrad sometimes missed sentences or sections of the reading passage. On occasion, he also mumbled incoherently during sections of his reading. It appeared that his limited engagement in the intervention diminished even further as it progressed.

When asked why he did this, Jarrad claimed to be unaware that there had been any problems with his reading. He denied that he was disinterested or unmotivated in

participating in the intervention. It was explained to Jarrad that his participation in the intervention was quite separate from his schoolwork and that he was not being graded or assessed in any way that would reflect on his school performance.

Figure 40 shows Jarrad's results for reading rate, accuracy and comprehension before, at the midway point, and after the intervention according to the NARA. They reveal that he dropped nearly a year in reading age for his reading rate, and nearly two years for his reading accuracy. In reading comprehension, however, he gained nearly three years and reading age. These trends support the notion that Jarrad took little interest in the recordings despite being able to read and comprehend quite well.

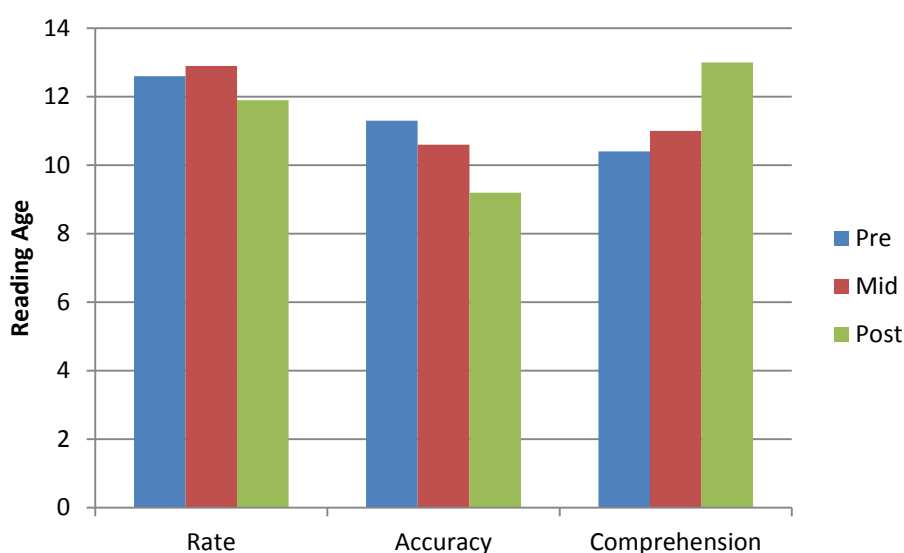


Figure 40. Jarrad's results according to the NARA

Jarrad was also one of the participants re-tested twelve months after the intervention using Form 1 of the NARA. Figure 41 compares Jarrad's results from pre-testing to post-testing and then re-testing twelve months later.

Twelve months after the intervention, he had managed to regain some of the losses made between pre-testing and post-testing in reading rate and accuracy. Comprehension had fallen away but was still higher than pre-testing.

Jarrad's reluctance to read had not diminished over the twelve months after the intervention. He remained in a class for students at-risk academically. This

placement appeared to have been made due to Jarrad's attitude to academic subjects rather than his ability. His teacher claimed he was far more capable than he was prepared to demonstrate. He had a history of disengagement that may have developed from poor reading skills in the early primary years.

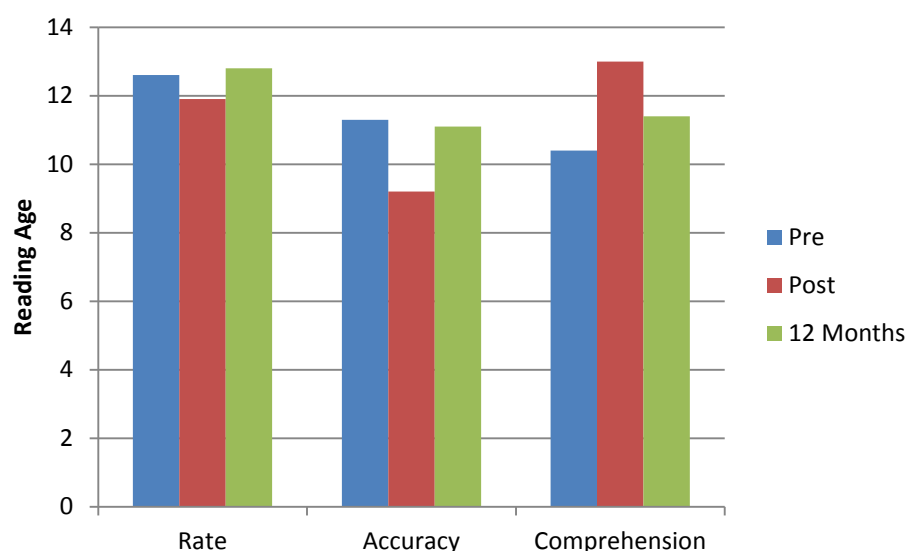


Figure 41. Jarrad's progress from pre-testing until 12 months after the intervention

Jarrad's apparent lack of interest in the intervention is reflected in his individual effect sizes as displayed in Table 14. He was the only participant in the intervention to score negative effect sizes. The fact that his comprehension result was significantly higher than the rest of the comparison group suggests broader motivation issues regarding his engagement at school that were not addressed by this intervention.

Table 14  
Jarrad's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing

	Gain in months	SD	Effect size	Comparison group effect size
Rate	-17	1.46	-0.96	0.21
Accuracy	-25	1.42	-1.48	0.80



Figure 42 shows Jarrad's prosody scores over the course of the intervention. Although it was not possible to record Jarrad's reading rate and accuracy in some of the later passages, it was still possible to evaluate his prosody. As Figure 41 shows, Jarrad's pace, phrasing and smoothness all improved over the course of the intervention. When he was not mumbling or missing passages in the later stages of the intervention, his reading sounded quite prosodic and advanced.

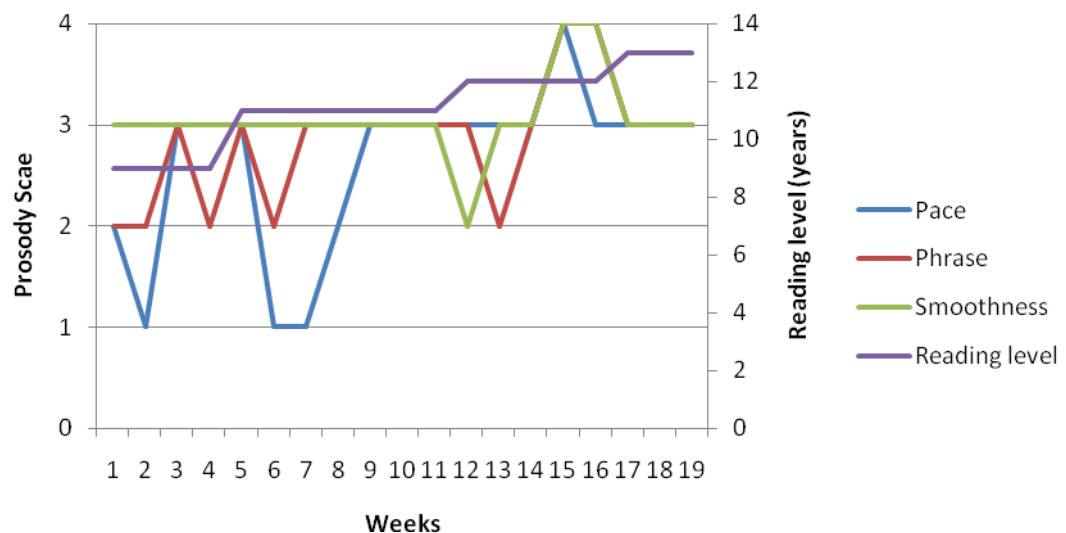


Figure 42. Jarrad's prosody scores compared against the reading level of the passages

Jarrad's results on the Reader Self-Perception Scale before and after the intervention are shown in Figure 43. Jarrad's general perception of his reading ability did not change, however he felt his progress as a reader had reduced and feedback from parents, teachers and peers did not seem as positive to him. His perception of his reading ability compared to that of his peers and his physical state whilst reading, however, improved.

Despite the small overall changes in the results of the RSPS from pre-testing to post-testing, responses to individual items did change significantly. His response to item 13, "I am getting better at reading," changed from *undecided* to *strongly agree* and his response to item 14, "I understand what I read as well as other kids do,"

changed from *disagree* to *strongly agree*. Conversely, his response to item 18, “Reading is easier for me than it used to be,” changed from *strongly agree* to *disagree*. Likewise, item 19, “I read faster than I could before,” changed from *strongly agree* to *undecided*. The changes in items 18 and 19 may be a reflection of the increased difficulty of the reading passages as the intervention progressed.

Also of interest was Jarrad’s responses to item 29, “Reading makes me feel good,” and item 32, “I enjoy reading,” both of which showed improvement from pre-testing to post-testing. Item 29 changed from *disagree* to *agree* and item 32 changed from *strongly disagree* to *undecided*.

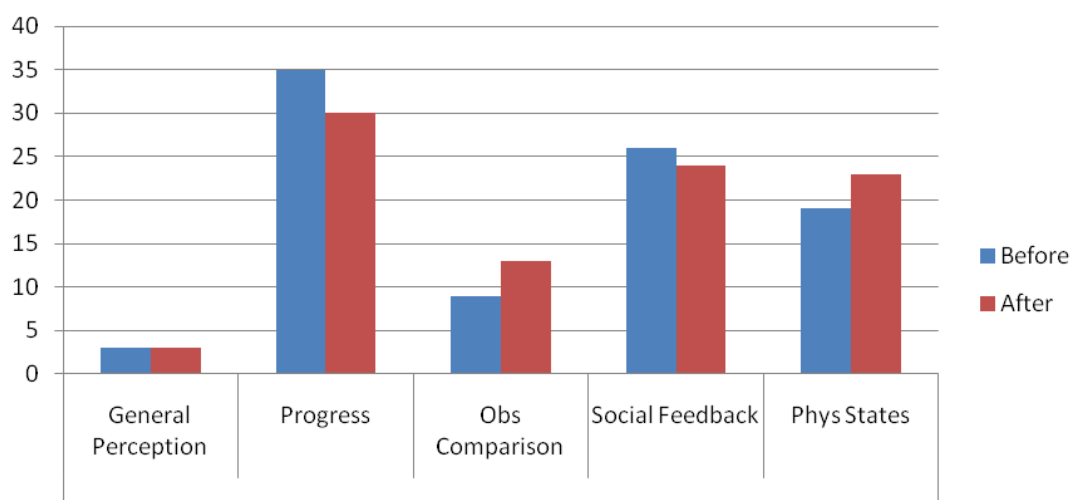


Figure 43. Jarrad’s perception of himself as a reader before and after the intervention

The inconsistency in Jarrad’s results was perplexing. Some recordings revealed that he was quite a competent reader, capable of good rate and accuracy. Despite his protestations to the contrary, it appeared that he was deliberately undermining his own performance. Although technically a volunteer for the intervention, his teacher had applied considerable pressure on him to participate. The most plausible explanation for this is that his motivation to succeed was very low. Jarrad was at risk of further disengagement and possibly leaving school before graduation, thereby limiting many of his future opportunities and potentially facing some or all of the negative outcomes discussed in Chapter Two. Jarrad’s results provide further support for intervention as early as possible.

### *Kristy*

Kristy was 14 years and one month at the beginning of the intervention and was in Year 9. Kristy was unable to make the VRS operate effectively at her home; therefore, she participated in the conventional repeated reading program as part of the comparison group.

Like Jarrad, Kristy received her written passage from her teacher each Monday who read it once to model the pronunciation. Over the week, she practised her reading of the passage and each Friday she read the passage for a final time whilst it was recorded.

Kristy's twin sister, Mary, was also a member of the comparison group and they practised their reading together and recorded each other's final readings each week. This was significant because Kristy did not report any discomfort about reading aloud the way some others in the comparison group did.

Figure 44 presents Kristy's results for reading rate, accuracy and comprehension before, halfway through, and after the intervention according to the NARA. Kristy's results show a modest gain in reading rate and a substantial gain in accuracy but a smaller increase in comprehension, which actually fell from the middle of the intervention to post-testing. Reading rate improved by a little over 12 months and accuracy improved by over two years over the five months of the intervention. Comprehension remained a major challenge for Kristy. Even when she was reading relatively fluently, she found it very difficult to answer comprehension questions. Nevertheless, there was a gain of approximately two years in comprehension throughout the intervention. Unfortunately, Kristy was unavailable for retesting 12 months after the intervention.

Comprehension can be affected by poor background knowledge, limited vocabulary and problems with both short- and long-term memory. It is not unusual for readers to have automaticity and fluency, but limited comprehension. This highlights the complex relationship between fluency and comprehension (Applegate, et al., 2009).

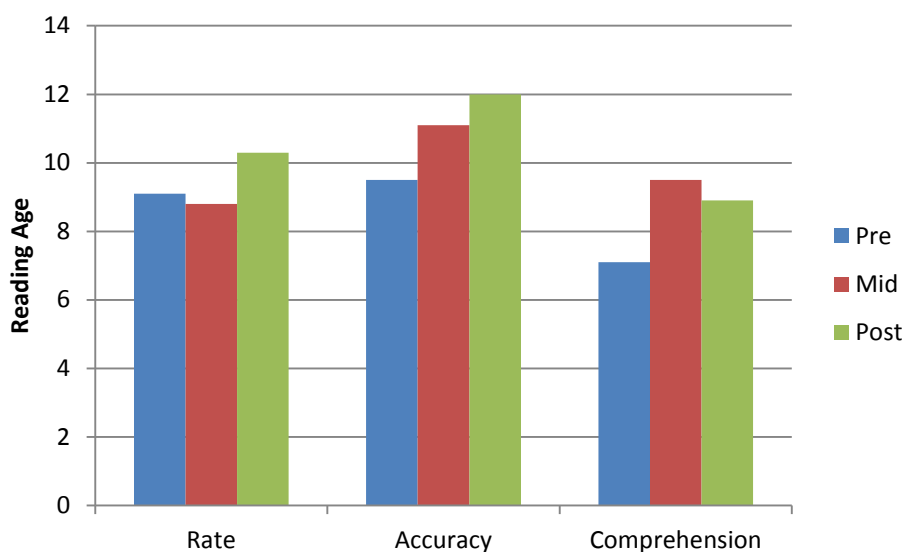


Figure 44. Kristy's results according to the NARA

Table 15 shows that Kristy exceeded the comparison group average in rate, accuracy and comprehension. Whilst these represent significant gains, Kristy started from a low base. Despite her gain of nearly two years in comprehension, her final result was only equivalent to that of a nine-year-old. This essentially precluded her from participating successfully in a mainstream secondary curriculum.

Table 15  
Kristy's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing

	Gain in months	SD	Effect size	Comparison group effect size
Rate	13	1.46	0.82	0.21
Accuracy	31	1.42	1.83	0.80
Comprehension	20	2.22	0.77	0.48

Figure 45 shows Kristy's prosody scores over the course of the intervention. Overall, Kristy made steady progress in fluency and progressed to the more difficult passages of the IPI quite quickly. There was a clear discrepancy in rate during Kristy's reading of the IPI passages and her performance during testing with the NARA. It is possible that when given the opportunity to practise passages a number of times her reading rate progressed rapidly, in contrast to the NARA testing, during which she was only able to read each passage once. A key aspect of a repeated reading

program is the requirement for systematic rehearsal and practice over time to develop fluent reading of a passage. This is consistent with research evidence that it may take some time for the transfer of improved reading fluency of practice passages to be reflected in improved general reading in the class and in standardised tests (Therrien, 2004; Therrien & Kubina, 2006).

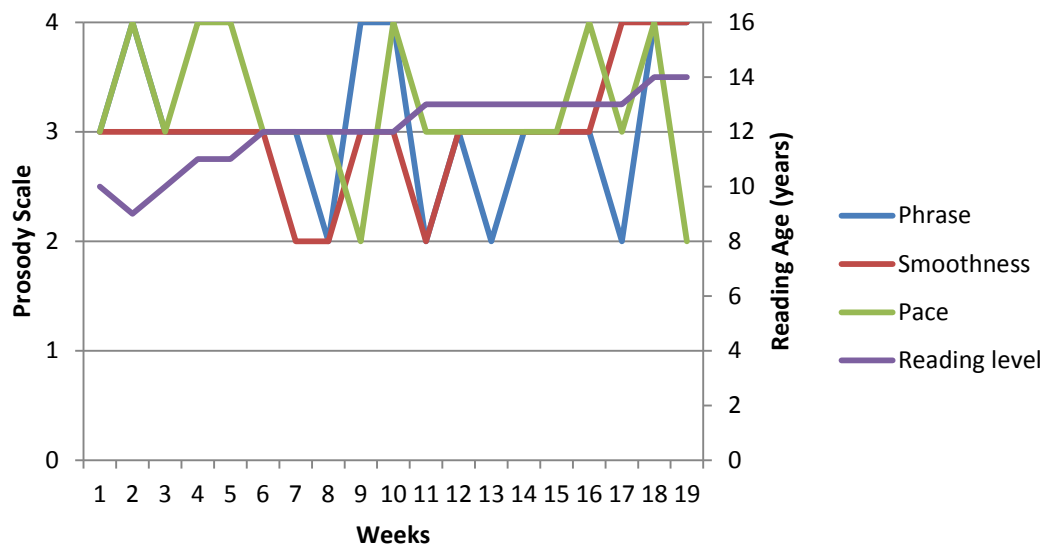


Figure 45. Kristy's prosody scores compared with the reading level of the passages

Figure 46 shows Kristy's results on the Reader Self-Perception Scale before and after the intervention. Unlike most participants, Kristy showed a very clear difference between pre- and post-testing in her perceptions of herself as a reader. Unfortunately, this movement was in a negative direction. As the intervention progressed, especially when she was tested with the NARA, Kristy became more critical of herself, especially during the comprehension tests.

The most profound changes occurred in the domain of *social feedback*. For example, responses to item 2, "I can tell that the teacher likes to listen to me read," changed from *agree* to *disagree*. Also, her response to item 12, "People in my family think I am a good reader," changed from *agree* to *disagree*. Her response to item 17, "My teacher thinks I am a good reader," changed from *undecided* to *disagree*. It is possible that at some point throughout the intervention Kristy received or perceived

some negative feedback about her reading or it may have been a result of the vagaries of an adolescent mood on the day of testing.

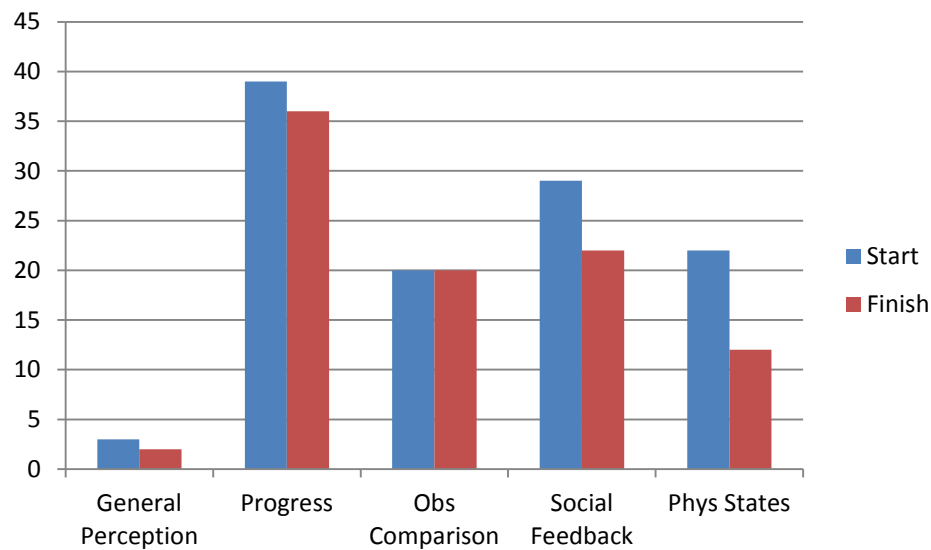


Figure 46. Kristy's perception of herself as a reader before and after the intervention

In the school year following the intervention, Kristy was placed in a mainstream English class but reported discomfort about being in that class because she felt she was not as capable as the other students were. “They’re much smarter than me,” she said. “They read everything real well.” (14/06/2010) Kristy’s results from the NARA suggest that her reading rate and comprehension were insufficient for her to manage secondary-level texts. Perhaps not surprisingly, Kristy dropped out of school shortly after beginning Year 11.

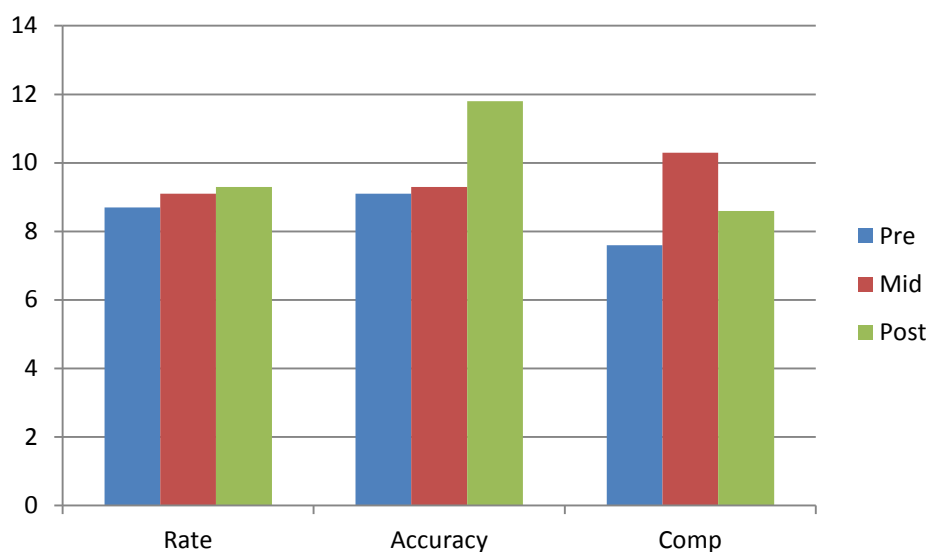
As discussed in Chapter Two, studies have shown a close correlation between poor reading skills and drop-out rates in secondary school (Daniel et al., 2006; House Kogut, 2004). It can be considered part of the trajectory that often begins with frustrations and difficulties at school and which can potentially result in long-term negative outcomes across a range of economic, health and social domains. Despite making relatively strong progress over the course of the intervention, post-intervention results suggest that Kristy was unlikely to have been able to cope with the reading demands of her various subjects. Had intervention occurred earlier, preferably in primary school, the outcome for Kristy may have been different.

### *James*

James was 15 years and six months at the beginning of the intervention and was in Year 9. He initially appeared to be an enthusiastic participant and volunteered to participate in the intervention. Unfortunately, he was unable to make the VRS operate effectively at his home; but he did not belong to the same class as all other members of the comparison group. As he was keen to participate, a special arrangement was made with him and his mother. James would read the passages each night to his mother, who provided corrective feedback, and James would have his reading recorded by the Researcher each Friday at school.

This created a quandary because, like the treatment group, he participated in a home-based repeated reading program; however, like the comparison group, his was a traditional repeated reading program conducted without the benefit of technology. Although his overall results have been included with the comparison group, his unique involvement warranted an individual case study.

Figure 47 shows James's results for reading rate, accuracy and comprehension before, halfway through, and after the intervention according to the NARA. James's results show a small incremental gain in reading rate and a more substantial gain in accuracy. Reading rate improved by approximately seven months and accuracy improved by two years and eight months over the five months of the intervention. Comprehension remained a major challenge for James. His reading rate and accuracy showed improvement despite remaining below his chronological age, but he found comprehension very difficult. Despite an increase in this aspect of over two years at the mid-point testing, his post-test result was only 12 months greater than his pre-test result. Unfortunately, James was unavailable for retesting 12 months after the intervention.



*Figure 47. James's results according to the NARA*

Table 16 shows that James exceeded the comparison group effect size average in rate and accuracy but not comprehension. Whilst these represent significant gains, James, like Kristy, started from a low base. Despite his gain of nearly two years in comprehension mid-intervention, his final result had regressed considerably. Whilst a gain of twelve months in comprehension over a five-month period is commendable, he was still well below the level that would allow him to participate successfully in a mainstream secondary curriculum. Since comprehension is the result of many complex processes, and increasingly dependent on knowledge of subject-specific vocabulary at the secondary level, it is clear that despite James's gains in accuracy and rate, this would be insufficient for him to cope with the demands of curriculum reading material at the Year 9 level. With a reading comprehension age of a little over eight years of age, James would most likely have lacked the vocabulary and background knowledge (largely acquired through reading) to comprehend the texts he would have encountered in most subjects.



Table 16  
*James's individual effect sizes for rate, accuracy and comprehension from pre- to post-testing*

	Gain in months	SD	Effect size	Comparison group effect size
Rate	7	1.46	0.41	0.21
Accuracy	32	1.42	1.88	0.80
Comprehension	12	2.22	0.45	0.48

Figure 48 shows James's prosody scores over the course of the intervention. Compared to other participants, James did not advance through the reading passages as quickly. He started on passages appropriate for a reading age of nine to ten years of age and progressed to passages appropriate for a twelve-year-old.

There was considerable volatility in his scores for phrasing, smoothness and pace, despite the relative stability of the reading age of the passages. In most of the participants, this volatility occurred when a new text level was introduced; however, within a week or two most students had adapted their phrasing, smoothness and pace to the new level of difficulty. The figure shows that when James reached a new level of difficulty, his prosody declined, but did not recover to the same extent as that of his peers. James's performance was haphazard and inconsistent.

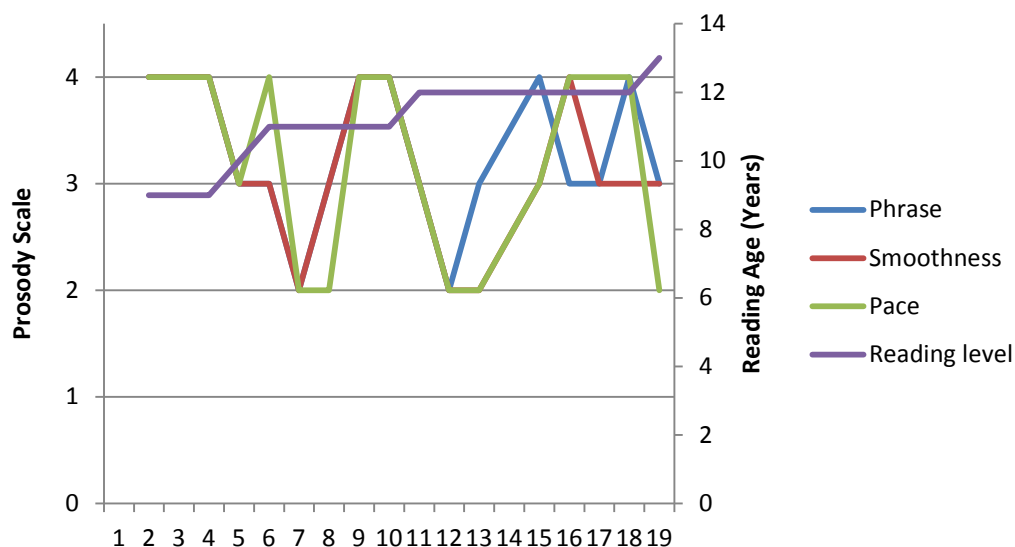


Figure 48. James's prosody scores compared with the reading level of the passages

Figure 49 shows James's results on the Reader Self-Perception Scale before and after the intervention. Like Kristy, James showed quite a clear difference between pre-testing and post-testing in his perceptions of himself as a reader. Like Kristy, this movement was in a negative direction by the end of the intervention. James's perceptions of himself remained unchanged in the areas *general perception* and *observational comparison* and declined in the areas of *progress*, *social feedback* and *physical states*.

The most profound changes occurred in the domain of *physical states*. For example, responses to item 8, "I feel good inside when I read," changed from *disagree* to *strongly disagree*. In addition, his response to item 16, "Reading makes me feel happy inside," also changed and *disagree* to *strongly disagree*. All his responses to the *physical states* items were *strongly disagree* with the exception of item 21, "I feel calm inside," which remained unchanged at *undecided*. Despite the progress he had made with his reading, his perception of himself remained poor and, in particular, reading remained an unenjoyable activity for James.

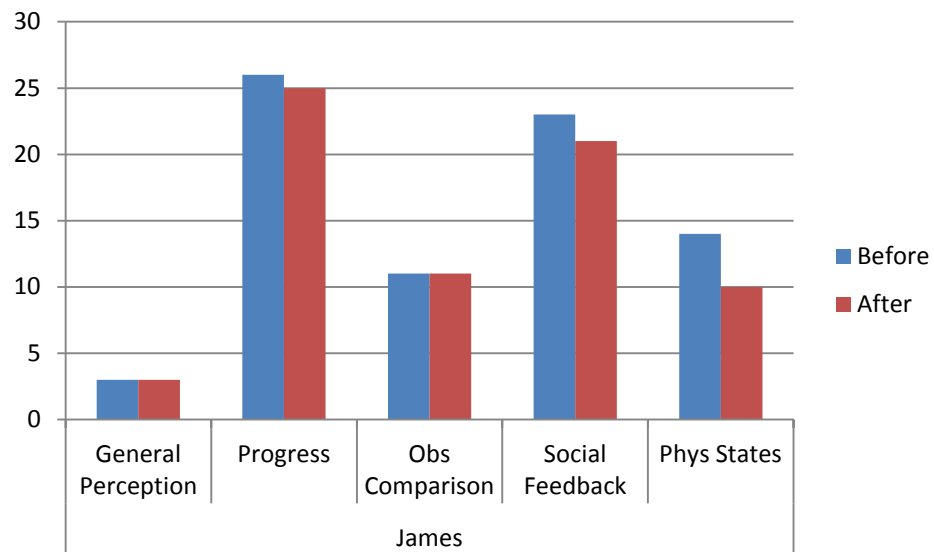


Figure 49. James's perception of herself as a reader before and after the intervention

James's results are interesting because he occupied a grey area between the treatment group and the comparison group. On one hand, he participated in a repeated reading program at home with parental support, free from the stigma of public demonstration of his reading difficulties. On the other hand, he did not have the benefit of novel technology and the independence to read at a time of his choosing and communicate with the Researcher in privacy. His results are clearly inferior to those members of the treatment group, and many from the comparison group. To some extent, this may be explained not by the mode in which he participated, but rather by other factors. Perhaps his initial enthusiasm was related to his anticipation of using the technology, and when that failed to materialise, he viewed the reading program as a chore, not dissimilar to regular schoolwork. Alternatively, perhaps as the oldest participant, he had lived with his reading difficulties longer, and was therefore more experienced in terms of discouragement and poor self-esteem as it related to his academic progress. Although the topic did not arise in informal discussions, it is possible that difficulties arose through his mother's involvement. Tensions can easily arise when parents help their adolescent children, and while these may not have been reported by the mother or by James himself, it could contribute to an explanation of his poor progress.

To some extent, Richard, Kristy and James shared some similarities in their attitudes towards reading as a worthwhile activity. Despite the gains they accomplished, there was a pervasive negativity towards reading and their perception of themselves as readers. This could be explained in terms of the negative Matthew Effect (Stanovich, 1986).

**Key Finding 9.** The use of VRS was novel and appeared to have a motivating effect on members of the treatment group.

**Key Finding 10.** For some of the treatment group participants, the involvement and encouragement of parents improved their engagement with the intervention. Unless the involvement was positive and encouraging, it did not appear to improve engagement with the intervention.

### Conclusion to the individual case studies

During the informal interviews and other discussions with participants throughout the period of the study, it appeared clear that those in the treatment group generally responded more favourably to the intervention than participants in the comparison group. This conclusion was based on their responses, many of which have been included in the individual case studies. These findings have been added to the research framework presented in Figure 50. (Words in bold refer to headings within the research framework.) Components of the treatment group strategy, such as the use of technology and conducting the intervention at home, either separately or in combination, appeared to have a greater **positive impact on the results**, particularly in developing the important element of comprehension. Participation at home provided students with **privacy**, the ability to work at the time and for the duration of their own choosing and an opportunity to use what was at that time relatively sophisticated, **engaging and novel technology**. Some within the treatment group also reported a positive influence from **parental involvement** and encouragement.

Conversely, there is some evidence that the comparison group viewed the intervention as just another school task, based on their responses throughout the

study. The timing and duration of participation was set by the teacher. Practice sessions and recording of final reading attempts were conducted without the privacy afforded by their home environment. Whilst parental involvement, specifically encouragement, appeared to be a motivating factor for some in the treatment group, direct involvement of a parent in the intervention, as with James, may have contributed to a negative attitude towards the intervention. These differences appeared to have a significant impact on their level of engagement in the tasks, their enjoyment, and ultimately their progress.

Both groups improved in reading fluency, with some in the comparison group making similar gains to those in the treatment group, but overall, the treatment group demonstrated a clear advantage. Both groups remained relatively static in terms of their **perceptions of self as readers**. The treatment group, however, appeared to enjoy the intervention more and to be more motivated to participate regardless of whether they perceived any improvement in their reading ability. From the Researcher's perspective, the home-based reading intervention was far more efficient to administer to than the school-based intervention. This was because students recorded their own readings and sent these by email. In addition, involvement in the intervention allowed the Researcher to communicate regularly and efficiently with parents of the participants of the home-based program.

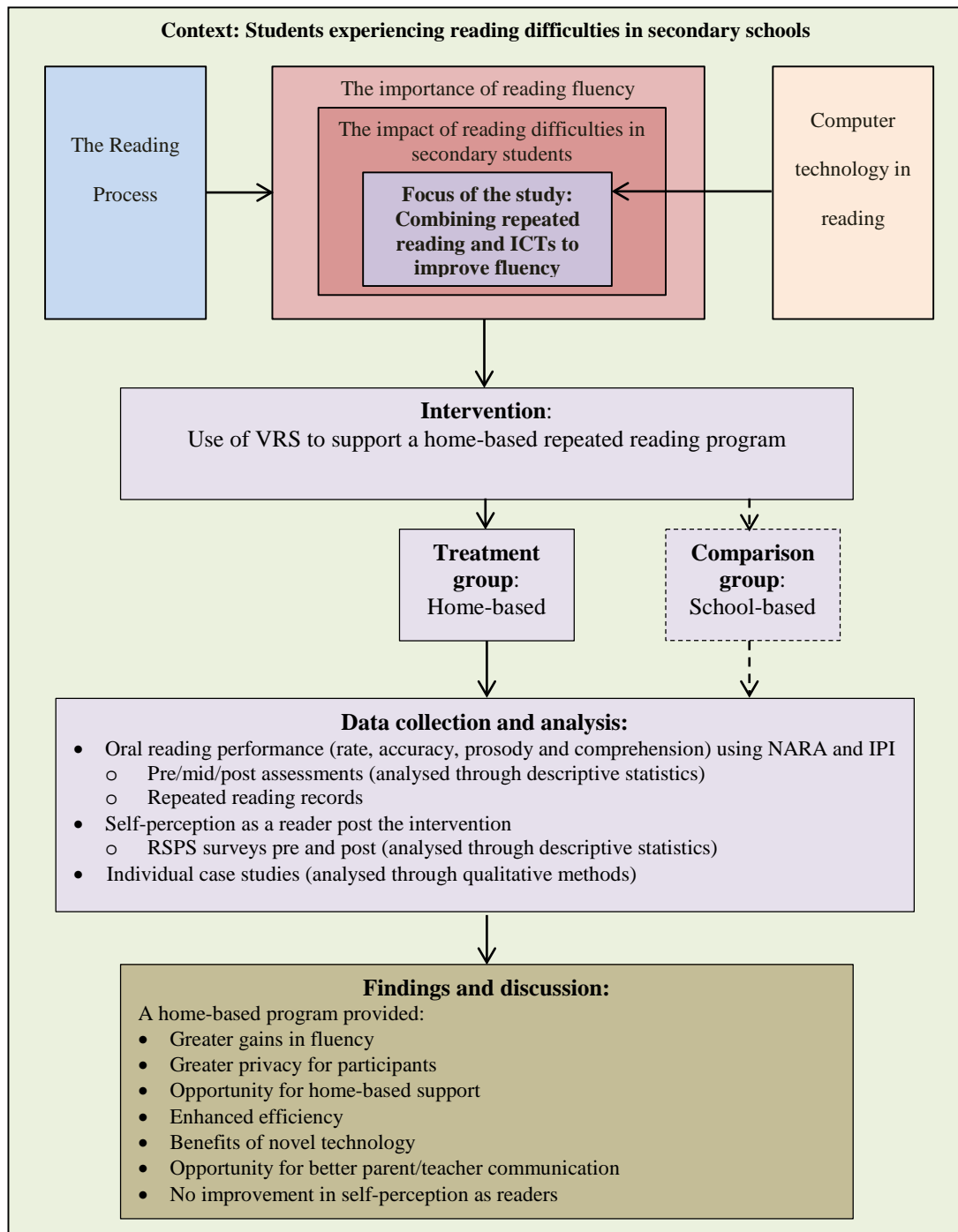


Figure 50. The research framework including the discussion of findings

## Chapter Five: Conclusions and Recommendations

After an overview of the study's broad outcomes, this chapter presents the conclusions as responses to each of the research questions, and the implications that may be drawn from them. It also demonstrates how this research has contributed to our understanding of the reading difficulties of secondary students, and to a response that has the potential to be both effective and time efficient. Discussion of the study's limitations, and how these could be mitigated in future research, is included. Finally, it presents recommendations for teacher practice, pre-service teacher education and future research, as outlined in Figure 51.

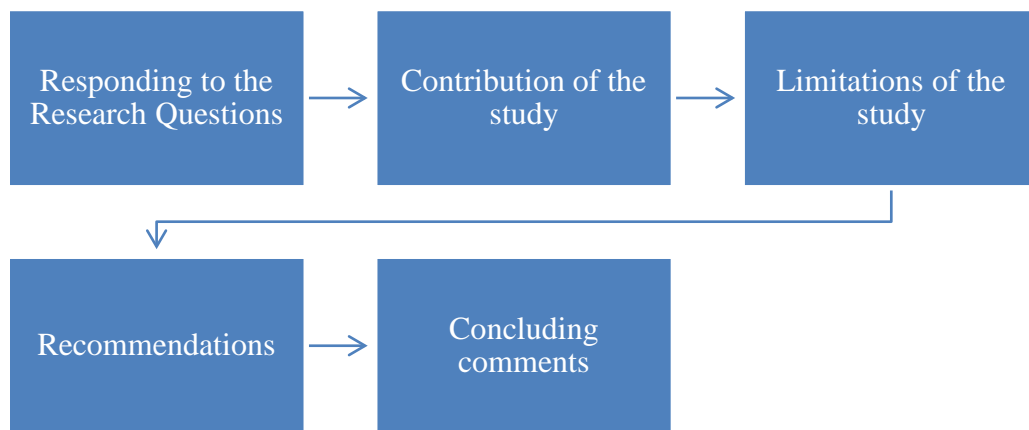


Figure 51. Structure of the Conclusions and Recommendations chapter

### Overview

Figure 52 provides an overview of the outcomes of the study for the two groups. Improvements in fluency and comprehension were achieved by both the treatment and comparison groups, but no improvements were evident in either group in self-perception as a reader. The level of progress was, however, greater in the home-based program, which also resulted in a number of other positive outcomes.

One of these positive outcomes was the elimination of the stigmatizing effect of public reading. Participating in the intervention at home removed this burden from the participants, increasing their confidence to participate. This contrasted with the experience of the comparison group who read aloud to others in a more public setting.

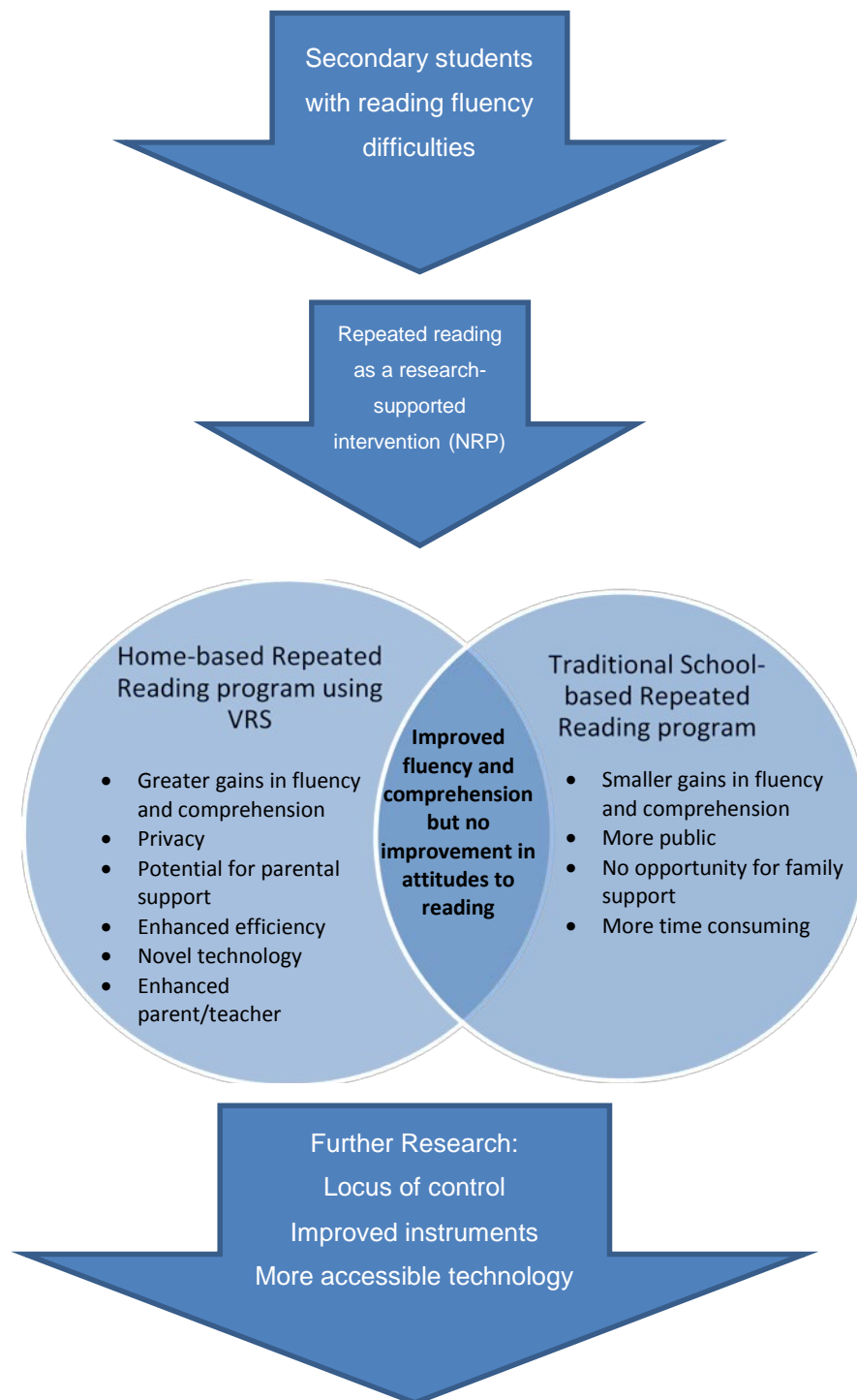


Figure 52. Relative outcomes of interventions for treatment and comparison groups

A further positive outcome for the home-based participants was the scope for parental support. Having parents' support and encouragement appeared to be a motivating influence. The home-based program also opened up opportunities for greater communication between the parents and the Researcher through the use of email. The *direct support of James's mother in the actual intervention*, however, appeared not to have been a positive factor. On reflection, the potential for tensions



to arise in this arrangement should have been apparent, considering the longevity of his reading difficulty, the vulnerability of adolescent self-esteem, and the many other factors than can affect relationships between adolescents and their parents.

The intervention was very time efficient. Participants were only required to spend a few minutes each night reading. The use of voice recording software meant the Researcher could analyse the participants' reading at the time and place of his choosing, and readings during school time did not have to be scheduled.

The use of VRS was novel for all of the participants in the treatment group and appeared to have a motivating effect. Whilst all participants were frequent users of computers, none had used VRS before and all reported enjoying this experience.

The list of key findings is summarised below:

1. All students in the treatment group made gains from pre-testing to post-testing except for those participants who achieved the maximum score at pre-testing.
2. Both groups made progress on average, however, the treatment group made greater progress in the areas of rate and comprehension.
3. The strongest gains for both groups were made in the area of comprehension, with the treatment group gaining 24 months, and the comparison group gaining over 17 months.
4. The greater gains in rate and comprehension by the treatment group were confirmed by calculation of effect sizes.
5. The intervention period of 20 weeks was sufficient to enable participants in both groups to achieve substantial gains in reading age. Some participants made large gains after 10 weeks then regressed, while others continued to improve after the 10 week point.
6. The greater privacy enjoyed by the treatment group appeared to be a motivating factor that was likely to have contributed to greater gains compared to the comparison group.

7. Both treatment and comparison groups had relatively stable prosody scores over the intervention; however, the difficulty of the passages increased significantly over that time suggesting a relative improvement in prosody.
8. Reader self-perception remained relatively stable despite significant gains by both groups, supporting research stating that self-perception remains relatively fixed from the early years of schooling.
9. The use of VRS was novel and appeared to have a motivating effect on members of the treatment group.
10. For some of the treatment group participants, the involvement and encouragement of parents improved their engagement with the intervention. Unless the involvement was positive and encouraging, it did not appear to improve engagement with the intervention.

### **Responding to the Research Questions**

The overall purpose of this research was to determine whether VRS could be used to deliver a repeated reading program to improve the reading fluency of struggling adolescent readers. Within this context, there were three specific research questions:

**Research question 1:** *What impact does a home-based repeated reading program using VRS have on the reading fluency of adolescents with reading difficulties, relative to a traditional repeated reading program?*

The home-based repeated reading program improved the reading fluency of adolescents with poor reading skills as encapsulated in Key Finding 1, and was more effective than the school-based repeated reading program, as stated in Key Finding 2. The degree of improvement varied among the individual participants, but each member of the treatment group improved his or her reading fluency.

In terms of reading rate, the treatment group made an average gain of 15.8 months in reading age compared to 3.25 months for the comparison group. It was more difficult to quantify gains made in prosody. Examination of changes in the prosody matrix supported the view that both groups maintained relatively stable prosody scores over the duration of the intervention. However, because the difficulty

of the reading passages increased from a reading age of 9 years to 15 years over the 20-week intervention, this would suggest that both groups made strong relative gains in prosody, as summarised in Key Finding 7.

The home-based intervention demonstrated its greater effectiveness over the school-based intervention in more ways than the figures quoted above. Participants in the treatment group were generally more positive about the intervention than the comparison group and demonstrated higher levels of motivation. One explanation for this is that the treatment group saw some benefit from participating in the intervention away from the school environment and in the privacy of their own homes. This ensured there was no stigma attached to participating in the intervention because no one from the school was aware of their involvement. Conversely, the comparison group conducted their reading program within school and, by participant accounts, viewed the intervention as a process whereby their weakness in reading was exposed and scrutinised on a weekly basis. It appeared that the greater sense of independence and privacy afforded by the home-based intervention contributed to the more positive experience of those students who participated in the home-based intervention, as reflected in Key Finding 6.

An additional reason that may explain the superior performance of the treatment group, and related to the last reason, was that motivation may have been increased because students were working at home using what was, at the time, innovative technology, as summarised in Key Finding 9. Interviews with the six participants in the treatment group suggest that the use of VRS was a new experience for them and maintained their interest in the intervention to varying degrees.

When participants in the treatment group used the VRS, they were also, in effect, receiving feedback. This was rudimentary: words appearing on a computer screen; nonetheless, if the correct words appeared in the correct order, participants received the message that they were reading correctly. This basic form of feedback was a result of the technology and was not available to the comparison group.

The members of the treatment group participated in the intervention at home. Many reported that they were encouraged and cajoled into completing their reading practice by parents keen to see them improve. Conversations with several parents

revealed a strong desire for their child to participate and use the intervention as an opportunity to improve their child's reading ability in order to improve general academic results at school. As a result, they were active in supporting the child's reading practice during the intervention.

It seems likely that this parental support was missing for most of the comparison group. Although participants were encouraged to practise their reading at home, it was not necessary since they could practise during school time, and not likely, considering that reading would not have been a preferred activity. During informal discussions with members of the comparison group, most stated that they did not discuss their participation in the intervention with their parents. This behaviour is not unusual in students of their age, particularly among a group of poor readers, thus it would appear that most, if not all, participants in the comparison group did not experience the positive effects of parental support and encouragement.

Whilst all parents provided consent for the students to participate in the intervention, parents of the treatment group had potential opportunities to observe the reading practice and offer encouragement. This opportunity was effectively denied to the parents of the comparison group participants. A number of studies have detailed the importance of parental support to improved academic outcomes. Parental support is as effective for adolescents as it is for younger children and can be demonstrated as expectation or encouragement rather than tangible help with work (Cutrona et al., 1994; Fan & Chen, 2001; Kaplan Toren, 2013). The beneficial effects of both the novel use of technology and parental support for the treatment group were expressed in Key Finding 10.

In addition to not benefitting from the novelty of technology and parental support, participants in the comparison group were also disadvantaged by a lack of privacy, which resulted in a relatively public acknowledgement of their own struggles with reading. In informal discussions after the intervention, most of the comparison group stated that they did not like reading at school, citing the lack of privacy as a major concern. Since they already considered themselves to be poor readers, these relatively public reading sessions appeared to contribute to a poor perception of themselves as readers. Nevertheless, results from the RSPS show that the comparison group, unlike the treatment group, improved their self-perceptions in the area of

*observational comparison*. They had greater opportunity to compare their reading progress to that of others, something that members of the treatment group were not able to do. This would appear to be the only beneficial effect.

As mentioned in Chapter Three, seven of the eight participants in the comparison group were in the same class of low ability students. It became apparent from interviews with participants, and from accidental sound recordings, that the teacher could be, at times, quite forceful in insisting that the participants practise and read to the best of their ability. It is likely that the teacher's response encouraged the view that the intervention was just another school task, and while it was not possible to quantify this effect, it could have influenced the perceptions and progress of the comparison group.

Comparison group participants also had very little control over when and where they practised their reading. This relates to the issue of locus of control, in that comparison group participants were likely to have perceived greater external influence on the performance of their reading. The external individual will attribute to other factors their relative success or otherwise at a task; in this case, the teacher. A feeling of disempowerment would be the likely result. If students can see their own role in the educational process as significant, they may be encouraged to persevere in the face of difficulty. It has been suggested that to encourage students to become more 'internal', work practices should change from a teacher-centred approach where the teacher sets the task and its parameters, to one that incorporates a more student-centred pedagogy where students plan, carry out, then reflect on their work (Galbraith & Alexander, 2005). This would appear to be even more consistent with an effective learning environment for adolescents, who see themselves, or want to see themselves, as becoming increasingly independent and in control of their own destinies.

**Research question 2:** *What impact does a home-based repeated reading program using VRS have on the reading comprehension of adolescents with reading difficulties, relative to a traditional repeated reading program?*

As summarised in Key Finding 3, reading comprehension improved for both groups over the 20-week intervention period, and again the progress of the treatment group, with an average gain of 24 months, was greater than that of the comparison

group's 17 months. In fact, it was in the area of comprehension that both groups made the strongest gains, and achieved the highest effect sizes (see Key Finding 4). Furthermore, as encapsulated in Key Finding 5, an intervention length between 10 and 20 weeks was sufficient to make substantial improvements to comprehension, as well as rate and in some cases, accuracy.

Whilst this study was designed to test a practical and time-efficient method of improving fluency, the ultimate aim of reading is comprehension, thus these findings are highly encouraging, and support the strong link between fluency and comprehension. Considering that comprehension is also dependent on many other individual factors such as vocabulary, memory capacity and background knowledge—none of which were addressed in this intervention—the potential for a relatively straightforward fluency intervention to improve comprehension augurs well for its successful application in schools.

The home-based element of the program also meant that class time was not spent on the intervention, although it would require the teacher to listen to students' recorded readings, assess when they needed a higher text level, and record passages for modelling purposes. This, however, may only be necessary for one or a very small number of students in any one class, and therefore should not be too burdensome.

**Research question 3:** *What impact does a home-based repeated reading program using VRS have on the self-perception as readers of adolescents with reading difficulties, relative to a traditional repeated reading program?*

As summarised in Key Finding 8, perceptions of themselves as readers, did not improve for students in either group. Even students who made very substantial gains in their reading ability still perceived themselves as poor readers as measured by the Reader Self-Perception Scale. Some individuals did report more positive attitudes to reading in interviews but these attitudes were not substantially reflected in their RSPS responses.

These results highlight the imperative of early intervention. The role of functional reading is critical to life in a literate society, and a secure concept of oneself as a competent reader facilitates the confident navigation of the many daily functions that require reading. It is disappointing that despite significant growth in

reading comprehension, resulting in transfer from a lower-ability class to a mainstream class in at least three cases, that students' perceptions of themselves as readers did not change.

### **Contribution of the study**

This study contributed to the body of knowledge in a number of ways. *It confirmed that a repeated reading program can improve reading fluency and comprehension in secondary students.* Much of the research in this area has examined the efficacy of repeated reading programs for primary school children. Relatively few studies have examined the impact of repeated reading on secondary students, especially in mainstream classes, despite reading being such an important component of secondary schooling.

More importantly, the study *comprehensively demonstrated that a repeated reading program can be effectively delivered in a student's home in a time-efficient manner whilst ensuring privacy.* Secondary teachers would probably regard repeated reading programs as far too time consuming to employ effectively in the school setting because of the limited time available to teachers to listen to and provide feedback on students' reading. Students selected for such a program may also feel stigmatised. This study has shown that VRS can provide the necessary feedback in a student's home with just a few minutes of practice each day while their peers remain unaware of their participation.

The study thus highlighted the emotional impact of reading difficulties that persist into adolescence, and therefore the significance of using strategies that are responsive to the particular needs of young people who see themselves as inadequate, if not failures, in a skill that has lifelong relevance. The findings from this study could provide a practical solution for the teachers of both primary and secondary students experiencing reading fluency difficulties. The procedures outlined offer teachers a simple and effective method for improving reading fluency in struggling readers who are motivated to improve.

Furthermore, technology, a key component of this intervention, is becoming more accessible, less expensive, and easier to use. Many schools, including primary schools, are issuing students with portable tablets such as the iPad. *Nuance*, the

company that produced Dragon Naturally Speaking<sup>®</sup>, has now produced a free *app* called *Dragon Dictation*, which provides effective voice recognition. This free piece of software, in conjunction with an iPad, would solve many of the technical problems experienced by many of the study's participants, preventing them from taking part in the home-based repeated reading intervention. Nor would students necessarily be required to practise their reading at home. The opportunity would exist for them to practise during breaks at school, on the way to or from school or during quiet times in English classes where they could step outside the classroom and practise quietly for a few minutes.

Whilst a home-based repeated reading program utilising VRS was never intended to be a panacea for all students experiencing reading difficulties, this study has demonstrated that *the application of an old technique enhanced with new technology can make substantial improvements in the reading of sufficiently motivated individuals*. Improvements in technology, in terms of capability and cost, will continue to expand opportunities to address reading difficulties experienced by students.

## **Limitations of the study**

### **Availability of technology in students' homes**

This intervention was originally planned to include twenty participants to operate VRS in their homes. Of the original twenty participants, only six were able to satisfactorily install and operate VRS, use voice recording software and communicate by e-mail. The remaining fourteen, of whom six eventually withdrew from the intervention, cited a number of reasons for their inability to satisfactorily operate the technology.

The most common reason given was that the computer hardware and operating system at home was not sufficiently powerful to operate the VRS. In addition, a number of participants did not have a computer with the capacity to support the use of a microphone or headphones/speakers. One participant did not have internet access at home. A number of participants stated that, despite parental approval to participate being given, parents decided that they did not want the participants to use the computer at home.



Whilst none of these problems were insurmountable, and attempts were made to overcome them, time constraints on the data collection phase precluded these students from participating as part of the treatment group. Had time not been such a constraint, these problems could have been overcome with the school supplying the participants with a computer. The school at which the comparison group participated in the research, like many other secondary schools, constantly replaced computers as they aged and there was a stock of spare computers awaiting disposal. These machines would have been capable of running the VRS and supporting microphones and headphones. A lack of internet access at home could have been overcome by exchanging voice recordings on a USB drive.

Twelve months after the data collection phase, all students at the school were issued with a laptop capable of running the latest version of the VRS. This would have overcome all the problems experienced by the participants with the exception of access to internet at home. This would be insignificant because the transfer of reading passages and voice recordings between participant and Researcher could be conducted over the school's internal wireless network.

Such technical problems are likely to be less prevalent over time as more and more students gain access to more powerful computers as prices decrease and schools increase access to computers for their students. Additionally, the intervention could be conducted with an iPad and the free *Dragon Dictation* app. This would make the technology available relatively cheaply.

### **Lack of monitoring to ensure fidelity of implementation**

A key methodological problem associated with the intervention was that it was not possible to monitor whether the treatment group was actually conducting the intervention as instructed. Participants in the treatment group were reluctant to admit that they had missed reading practice sessions yet it was apparent, judging by fluctuations in weekly reading performance, that some reading passages had not been practised as thoroughly as others had.

An essential element of the intervention was the privacy afforded to participants by being able to conduct their reading practice at home; therefore, there was no practical way of overcoming this problem. However, since participation was

voluntary, a degree of intrinsic motivation to comply with the requirements of the intervention could be assumed. In addition, parents of participants were encouraged to support their child in the daily reading practice. Informal discussions with a number of the participants revealed that this had a positive effect on their motivation to complete their daily practice. The duration of the daily reading practice was no more than a few minutes so, provided the participants could establish this as a habit, the lack of supervision from a researcher should not be problematic.

### **Limitations of instruments and testing**

The Neale Analysis of Reading Ability (NARA) has been a popular instrument for measuring reading rate, accuracy and comprehension (Cahill, Russell, Theodoros, & Waite, 2010; Cain & Oakhill, 2006); however, it was designed primarily for testing primary school aged children and results are not standardised beyond 13 years of age. Whilst the tests can be used for older students and even adults, once subjects achieve a reading age of 13 it is not possible to accurately track improvement in reading.

The participants in the study had reading ages below their chronological ages and, in many cases, had not achieved a reading age of 13 by the end of the intervention. A number of the participants, however, made substantial progress and reached the maximum score half way through the intervention. The limitations of the testing instrument meant that it was not possible to measure the exact progress that had been made by these students over the full length of the intervention. At the time when decisions regarding instrumentation were made, the NARA appeared to be a good choice for the study. By the time the potential limitation of the instrument became apparent, the data collection was under way.

The argument could be made that achieving a reading age of 13 was sufficient for participants in Year 8 and 9 to then participate more fully in the curriculum that was age appropriate for them. Given that the rationale of this research, as described in Chapter One, was to help struggling readers to engage with the appropriate reading material in order to achieve academic success, once these students reach a reading age of 13, the likelihood of this outcome is greatly increased. Nonetheless, a test that covered ages above 13 would have provided more specific data to inform this research. An alternative would be the *Diagnostic Reading Analysis* (Crumpler &

McCarty, 2008). This assesses reading accuracy (standardised score and reading age), reading rate and reading comprehension. Two parallel forms A and B allow for re-testing, and can additionally be used to assess short-term progress. Importantly, the tests are standardised for students aged 7 to 16.

Another possible assessment is the *York Assessment of Reading for Comprehension (YARC) Passage Reading Secondary* (Stothard, Hulme, Clarke, Barmby, & Snowling, 2010) which is comprised of a series of prose passages – both fiction and non-fiction – that enables the assessment of a student's reading comprehension and fluency in a systematic way across the secondary school years. It contains passages for students from age 12 to 16 to read silently and also includes passages developed for students with a reading age of 8 to 9 years, which are read aloud and include a miscue analysis. Comprehension questions tap vocabulary knowledge and different types of inference. It is considered ideal as an assessment before and after a specific intervention programme and provides standard scores, age equivalent scores and percentile ranks (Stothard et al., 2010). It was originally standardised for students in the United Kingdom in 2009 but recently an Australian edition has been released. The skills assessed by the *YARC-Australian Edition* have also been mapped to the Australian Curriculum: English Content Descriptions.

### **No measures of locus of control**

During analysis of results, the question arose as to whether participants in the treatment group had a naturally higher locus of control than the control group, or whether the intervention itself may have had an effect on the treatment group. Due to late changes in the methodology, the concept of locus of control was not considered prior to the intervention and consequently was not measured. If the intervention were to be conducted again, participants would be tested in order to measure their locus of control before and after the intervention to gauge whether this had an impact on reading progress. The Intellectual Achievement Responsibility Questionnaire (Crandall, Katkovsky, & Crandall, 1965) could have been used as it assesses children's beliefs about their control and responsibility for success and failure experiences in the intellectual achievement area. The questionnaire consists of 34 questions and can successfully be used with secondary school students.

Alternatively, the Nowicki-Strickland Locus of Control Scale for Children (Nowicki, 1973) could have been used. The scale, however, is quite general and very few of its 40 questions deal specifically with academic achievement. The Duttweiler Internal Control Index (Duttweiler, 1984), although designed for adults, could also be suitable for adolescents.

### **Hawthorne Effect**

The Hawthorne Effect refers to the manner in which “variables can be unwittingly confounded in the experiment because of some aspect of the experiment itself” (Parsons, 1974, p. 922). For example, participants may perform at a higher level simply because they are being observed, or are aware of their participation in research. This effect was noticed during experiments to improve efficiency and productivity at the Hawthorne electrical goods factory in the 1920s. Productivity seemed to improve with whatever intervention the researchers tried. Mayo, one of the researchers, generalised this effect in 1933 by stating that the Hawthorne effect occurred when people who are singled out for a study of any kind may improve their performance or behaviour not because of any specific condition being tested, but simply because of all the attention they receive (Rice, 1982). Mayo’s interpretation of the effect has gone largely unquestioned over the decades but his stance has been questioned by a few who reviewed the original research. Parsons (1974) found that much of the improvement in worker productivity could be attributed to better work practices that were triggered by the research but not measured. Macefield (2007) proposes that if the Hawthorne effect is real, it should effect both treatment and control groups, as was found in the original Hawthorne studies.

It is acknowledged that participants in this study were singled out due to their reading difficulties and received considerable attention in the process of the intervention. However, this attention was provided to both the treatment and comparison groups. Since this is the case, the effect essentially cancels itself out and the superior performance of the treatment group over the comparison group in this study must be for reasons other than the Hawthorne effect.

## **Recommendations**

### **Recommendation for Teacher Practice**

*1. A repeated reading program using VRS is recommended as a viable and cost-effective approach to improving the reading fluency of secondary students.*

English teachers are relatively adept at identifying struggling students. A quick reading test where the identified student reads aloud easily confirms a reading fluency problem. It is unlikely, as discussed in previous chapters, that a typical secondary English teacher will have a repertoire of strategies to remediate the fluency problem. This intervention is a cost-effective strategy that can be easily taught to teachers and allows them to improve reading fluency in their students in a time-efficient manner that preserves students' privacy. This would be practical, as only a small number of students in most classes would require such an intervention.

### **Recommendations for pre-service teacher education**

*2. Teacher education programs for all secondary teachers should include some information about the development of reading.*

The reasons behind reading difficulties that persist into the secondary years, the potential long-term effects of such difficulties, and some strategies to address them that are practical within the secondary system should also be included. Many students enter secondary school with reading difficulties that affect their progress across all areas of the curriculum.

Pre-service courses for secondary English teachers should include some strategies to remediate these problems. One of the major causes of reading difficulties in adolescents is poor reading fluency. The use of a repeated reading program such as that described in this study could be included as one strategy to address fluency problems.

## **Recommendations for further research**

### **3. *Investigate use of repeated reading in VRS in larger-scale study.***

Including students from a number of schools could determine whether or not the trends apparent in this study were supported. Such a study would provide the opportunity to explore questions that arose in this study, such as:

- the most effective time period for such an intervention; or whether it should continue until a certain level of achievement was reached;
- teachers' views on the viability of a repeated reading program in terms of time and effectiveness;
- parents' views regarding the program's effectiveness, intrusiveness into the family home, and whether or not the process simply added to family tensions about the secondary student's progress.

### **4. Explore the efficacy of a home-based intervention using VRS with students from non-English speaking background (NESB).**

Students from non-English speaking backgrounds were excluded from this study to limit the likely causes of poor reading fluency among the participants. A program of repeated reading using VRS could have potential with this group of students because many have great motivation to work hard at their academic studies and are generally supported by parents who are keen for their children to succeed (Riley, 2015).

### **5. Explore the role of locus of control on the impact of reading interventions for secondary students.**

Future research in this area could also examine the impact of participants' locus of control on the intervention and its implications for reading performance. In addition to testing for locus of control, participants could be given training in self-management skills as part of the study. Students who are encouraged to plan, carry out and then reflect on their own work ('Plan-Do-Review') may increase their self-management skills and internality of locus of control. When combined with teaching on how to approach tasks, 'attributional retraining' is possible and may prevent children using

avoidance strategies by reducing anxiety and helping them to change their perceptions of the causes of their successes and failures (Thomson et al., 2012).

#### **6. Utilise recent assessment instruments.**

If secondary students are the subjects of further research, instruments that discriminate reading performance to ages above 13 should be used. Ideally, an instrument such as the York Assessment of Reading for Comprehension – Australian edition, could provide greater discrimination of results.

#### **7. *Incorporate new technology.***

With VRS becoming available on smartphones and tablets, future research could incorporate these in order to alleviate many of the technical problems encountered in this study. Greater availability and lower cost of the relevant technologies provides the potential to alleviate the reading difficulties of many students who would otherwise have little opportunity for remediation.

#### **Concluding comments**

Figure 53 completes the research framework begun in Figure 11 by adding the findings and recommendations.

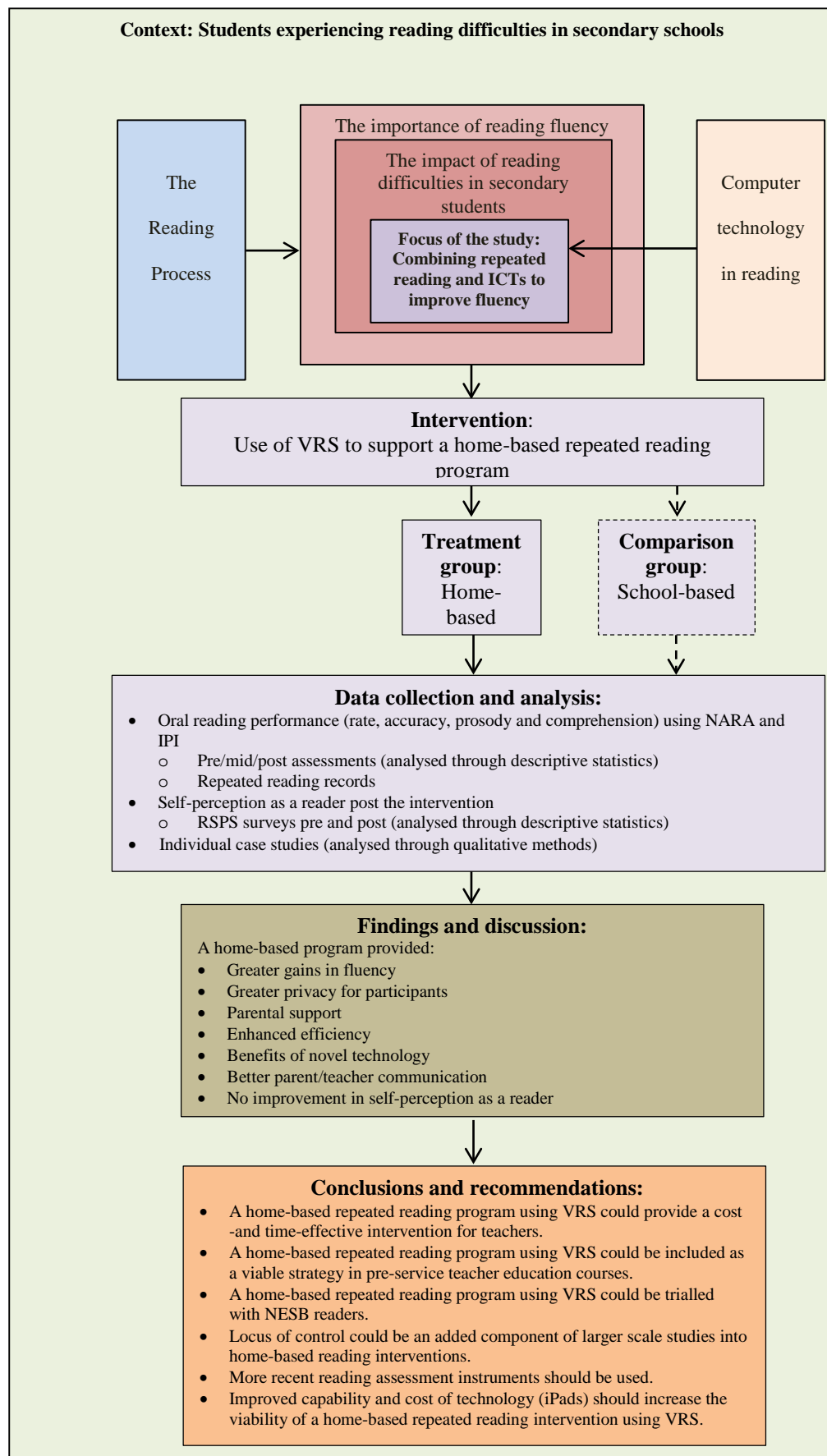


Figure 53. The research framework for the intervention research including findings and recommendations



In the conduct of this study, one of the key issues that became apparent was the importance of secondary school teachers being able to support students with reading difficulties through the use of appropriate intervention strategies. There is a general presumption that students entering secondary schools possess the requisite literacy skills to cope with the demands of the curriculum. Decades of evidence to the contrary has done little to alter this presumption. Many of the affected students present with behavioural problems and are managed as discipline problems. Those without behavioural issues are often left to slip between the cracks and many exit their schooling early.

Until all students leave primary schools with adequate literacy skills, secondary English teachers must take greater steps to understand the literacy issues some of their students face and take steps to alleviate them. This study focused on secondary students with fluency problems. There is no reason, however, that the intervention outlined in this study could not be conducted in primary schools for students struggling to make the transition from learning to read to reading to learn. The sooner reading fluency problems are remediated, the greater the likelihood that affected students will achieve the levels of reading comprehension required to keep pace with their peers.

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## Appendices

### Appendix A

#### The Revised Names Test (Duffelmeyer, et al, 1994)

Original version (25 pairs of first and last names)

Jay Conway	Cindy Sampson	Flo Thornton
Tim Cornell	Chester Wright	Dee Skidmore
Chuck Hoke	Ginger Yale	Grace Brewster
Yolanda Clark	Patrick Tweed	Ned Westmoreland
Kimberly Blake	Stanley Shaw	Ron Smitherman
Roberta Slade	Wendy Swain	Troy Whitlock
Homer Preston	Glen Spencer	Vance Middleton
Gus Quincy	Fred Sherwood	Zane Anderson
		Bernard Pendergraph

Augmented version (35 pairs of first and last names)\*

Jay Conway	Stanley Shaw	Bernard Pendergraph
Tim Cornell	Wendy Swain	<i>Shane Fletcher</i>
Chuck Hoke	Glen Spencer	<i>Floyd Sheldon</i>
Yolanda Clark	Fred Sherwood	<i>Dean Bateman</i>
Kimberly Blake	Flo Thornton	<i>Austin Shepherd</i>
Roberta Slade	Dee Skidmore	<i>Bertha Dale</i>
Homer Preston	Grace Brewster	<i>Neal Wade</i>
Gus Quincy	Ned Westmoreland	<i>Jake Murphy</i>
Cindy Sampson	Ron Smitherman	<i>Joan Brooks</i>
Chester Wright	Troy Whitlock	<i>Gene Loomis</i>
Ginger Yale	Vance Middleton	<i>Thelma Rinehart</i>
Patrick Tweed	Zane Anderson	

Added names are in italics.

## Appendix B

### Example of a passage from the Informal Prose Inventory (Ayrey, 1999)

#### Tama's Birthday Watch

by Alan Bagnall

Last year, my little brother Tama got a watch for his birthday. Mum and Dad gave it to him – a Japanese watch with a black nylon strap and a big shiny silver face. It was the sort you could wear underwater.

Tama wore it all the time when we went to stay with Nanna for the Christmas holidays. We had heaps of fun at Nanna's. A TV crew was making a film about the day when a famous missionary landed, and there was this old-time sailing ship anchored in the bay.

They had built a Maori village, and three big canoes lay on the beach. Tama and I played around the set every day, watching them make the film. Nanna and all her neighbours were in it.

One day, the director asked Nanna if we could be "extras" too – just olden-day kids, splashing about in the water as the famous missionary landed.

"But no togs!" the director demanded. "This film has got to look like a real day in 1820."

That upset Nanna. (Nanna wore a feather cloak for her part.)

It didn't worry us.

"We'll stay in the water up to our middles, Nanna."

We made Nanna give in.

After a whole morning of learning what we had to do, the final shooting began.

Name :		Date :	Age :			
Title : Tama's Birthday Watch		Running words : 218	Reading Age : 9 - 10    Level 4			
<p>Last year, my little brother Tama got a watch for his birthday. Mum and Dad gave it to him – a Japanese watch with a black nylon strap and a big shiny silver face. It was the sort you could wear under water.</p> <p>Tama wore it all the time when we went to stay with Nanna for the Christmas holidays. We had heaps of fun at Nanna's. A TV crew was making a film about the day when a famous missionary landed, and there was this old-time sailing ship anchored in the bay.</p> <p>They had built a Maori village, and three big canoes lay on the beach. Tama and I played around the set every day, watching them make the film. Nanna and all her neighbours were in it.</p> <p>One day, the director asked Nanna if we could be "extras" too – just olden-day kids, splashing about in the water as the famous missionary landed.</p> <p>"But no togs!" the director demanded. "This film has got to look like a real day in 1820."</p> <p>That upset Nanna. (Nanna wore a feather cloak for her part.)</p> <p>It didn't worry us. "We'll stay in the water up to our middles, Nanna."</p> <p>We made Nanna give in.</p> <p>After a whole morning of learning what we had to do, the final shooting began.</p>		<b>Analysis of uncorrected reading miscues</b> Circle cues used during miscue				
		1.	M	V	S	
		2.	M	V	S	
		3.	M	V	S	
		4.	M	V	S	
		5.	M	V	S	
		97%	6.	M	V	S
		Instructional Level	7.	M	V	S
			8.	M	V	S
			9.	M	V	S
			10.	M	V	S
			11.	M	V	S
			12.	M	V	S
			13.	M	V	S
		94%	14.	M	V	S
		15.	M	V	S	
		16.	M	V	S	
		17.	M	V	S	
		18.	M	V	S	
		19.	M	V	S	
20.	M	V	S			
<b>Analysis of self corrections</b> Circle cues used during miscue      self correction						
1.	M	V	S	M	V	S
2.	M	V	S	M	V	S
3.	M	V	S	M	V	S
4.	M	V	S	M	V	S
5.	M	V	S	M	V	S
6.	M	V	S	M	V	S
7.	M	V	S	M	V	S
8.	M	V	S	M	V	S
9.	M	V	S	M	V	S
10.	M	V	S	M	V	S
Accuracy Pass 97%		Comments about reading behaviour :				
Retelling Pass 50%						
Comprehension Pass 75%						
		Recommended Instructional Reading Age :				

## Appendix C

### The Reader Self-Perception Scale (Henk & Melnick, 1995)

Listed below are statements about reading. Please read each statement carefully. Then circle the letters that show how much you agree or disagree with the statement. Use the following:

SA = Strongly Agree  
A = Agree  
U = Undecided  
D = Disagree  
SD = Strongly Disagree

Example: I think pizza with pepperoni is the best. SA A U D SD

If you are really positive that pepperoni pizza is best, circle SA (Strongly Agree).

If you think that is good but maybe not great, circle A (Agree).

If you can't decide whether or not it is best, circle U (undecided).

If you think that pepperoni pizza is not all that good, circle D (Disagree).

If you are really positive that pepperoni pizza is not very good, circle SD (Strongly Disagree).

1. I think I am a good reader. SA A U D SD

[SF] 2. I can tell that my teacher likes to listen to me read. SA A U D SD

[SF] 3. My teacher thinks that my reading is fine. SA A U D SD

[OC] 4. I read faster than other kids. SA A U D SD

[PS] 5. I like to read aloud. SA A U D SD

[OC] 6. When I read, I can figure out words better than other kids. SA A U D SD

[SF] 7. My classmates like to listen to me read. SA A U D SD

[PS] 8. I feel good inside when I read. SA A U D SD

[SF] 9. My classmates think that I read pretty well. SA A U D SD

[PR] 10. When I read, I don't have to try as hard as I used to. SA A U D SD

[OC] 11. I seem to know more words than other kids when I read. SA A U D SD

[SF] 12. People in my family think I am a good reader. SA A U D SD

[PR] 13. I am getting better at reading. SA A U D SD

[OC] 14. I understand what I read as well as other kids do. SA A U D SD

[PR] 15. When I read, I need less help than I used to. SA A U D SD

[PS] 16. Reading makes me feel happy inside. SA A U D SD

[SF] 17. My teacher thinks I am a good reader. SA A U D SD

[PR] 18. Reading is easier for me than it used to be. SA A U D SD

[PR] 19. I read faster than I could before. SA A U D SD

[OC] 20. I read better than other kids in my class. SA A U D SD

[PS]21. I feel calm when I read. SA A U D SD

[OC]22. I read more than other kids. SA A U D SD

[PR] 23. I understand what I read better than I could before. SA A U D SD

[PR]24. I can figure out words better than I could before. SA A U D SD

[PS]25. I feel comfortable when I read. SA A U D SD

[PS]26. I think reading is relaxing. SA A U D SD

[PR]27. I read better now than I could before. SA A U D SD

[PR]28. When I read, I recognize more words than I used to. SA A U D SD

[PS]29. Reading makes me feel good. SA A U D SD

[SF]30. Other kids think I'm a good reader. SA A U D SD

[SF]31. People in my family think I read pretty well. SA A U D SD

[PS]32. I enjoy reading. SA A U D SD

[SF]33. People in my family like to listen to me read. SA A U D SD



### The Reader Self-Perception Scale scoring sheet

Student name \_\_\_\_\_

Teacher \_\_\_\_\_

Grade \_\_\_\_\_ Date \_\_\_\_\_

Scoring key: 5= Strongly Agree (SA)

4= Agree (A)

3= Undecided (U)

2= Disagree (D)

1= Strongly Disagree (SD)

#### Scales

General Perception	Progress	Observational Comparison	Social Feedback	Physiological States
1.	10.	4.	2.	5.
	13.	6.	3.	8.
	15.	11.	7.	16.
	18.	14.	9.	21.
	19.	20.	12.	25.
	23.	22.	17.	26.
	24.		30.	29.
	27.		31.	32.
	28.		33.	

Raw score	___ of 45	___ of 30	___ of 45	___ of 40
-----------	-----------	-----------	-----------	-----------

#### Score interpretation

High	44+	26+	38+	37+
Average	39	21	33	31
Low	34	16	27	25

## **Appendix D**

### **Student Questions – Pre-Intervention**

How much do you normally read?

What sort of things do you read?

Do you like reading? Why?

Do you dislike reading? Why?

Do you think it is important to be able to read well?

### **Post Intervention Questions**

Did you experience any problems with the weekly process?

Did you find the software helped you to read more accurately?

Is there anything you'd like to change about the process?

Do you feel you are a better reader?

Do you enjoy reading more than you did before the project?

## Appendix E

### Consent provided from Department of Education (WA)



Government of Western Australia  
Department of Education and Training

Your ref :  
Our ref : D09/0641428  
Enquiries :

Mr Peter Count  
19A North Lake Road  
ALFRED COVE WA 6154

Dear Mr Count

Thank you for your completed application received 5 November 2009 to conduct research on Department of Education and Training sites.

The focus and outcomes of your research project, *Reading Intervention Using Voice Recognition Software*, are of interest to the Department. I give permission for you to approach site managers to invite their participation. It is a condition of approval, however, that upon conclusion the results of this study are forwarded to the Department at the email address below.

Consistent with Department policy, participation in your research project will be the decision of the school invited to participate, the children in the school and their parents. Researchers are responsible for providing site managers with a copy of this letter as well as a current Working with Children Check.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The Department will require a copy of a letter confirming that you have received ethical approval of your research protocol from the Edith Cowan University Human Research Ethics Committee as soon as it becomes available as well as a signed declaration from Dr Jeremy Pagram when he returns from overseas.

Any proposed changes to the research project will need to be submitted for Department approval prior to implementation.

Please contact Ms Liz Harrison, Policy and Planning Officer, on 9264 5168 or [researchandpolicy@det.wa.edu.au](mailto:researchandpolicy@det.wa.edu.au) if you have further enquiries.

Very best wishes for the successful completion of your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. Dodson'.

ALAN DODSON  
DIRECTOR  
EVALUATION AND ACCOUNTABILITY

6 November 2009

## **Appendix F**

### **Consent Form for the Site Manager**

Dear Mr

#### **Reading Intervention Utilising Voice Recognition Software**

My name is Peter Count and I am writing to you on behalf of Edith Cowan University. I am conducting a research project that aims to improve reading fluency and comprehension among students experiencing reading difficulties. The project is being conducted meet the requirements for the award of a PhD at Edith Cowan University.

I would like to invite XXXX SHS to take part in the project. XXXX SHS is the only school in Western Australia approached for their participation.

#### **What does participation in the research project involve?**

I seek access to approximately 20-25 Year 8 and 9 students experiencing reading difficulties.

Students will be invited to participate in initial testing for the project. The initial testing will involve assessing students' reading rate (words per minute), accuracy and comprehension to determine if reading age is two or more years below actual age and that reading fluency is a problem. Students who do not meet these criteria will have no further requirement to participate.

Students who do meet the criteria will be trained to use Dragon Naturally Speaking® voice recognition software. This process takes approximately 30 minutes. This software will be loaded onto their home computer. Each Monday for twenty weeks I will send students (either by email or USB drive) a short written passage of about 200 words along with a sound recording of me reading the passage. Each night, for about five to ten minutes students will read the passage into a microphone and the software will convert it into written text. For the first few readings, students will have to make corrections to the software so that it records the words accurately. By each Thursday or Friday, students should be able to read the passage and have the words recorded accurately. In the final reading, students will make a voice recording which is sent to me (via email or USB drive). I will spend the weekend assessing the reading and issue a new passage on the following Monday. Although the project lasts for twenty weeks, students should only have to participate for no more than ten minutes each weekday.

The students will be divided into two groups, an experimental group and a control group. Due to the design of the study, the control group will undergo the intervention ten weeks after the experimental group. This ensures that all students participate in, and potentially benefit from, the intervention.

I will keep XXXX SHS's involvement in the administration of the research procedures to a minimum. However, it will be necessary for me to conduct the following activities that may impact the school:

- Liaise with SAER and English teachers for the initial identification of potential participants.

- Conduct an information session for parents of participants in the Staff Room or a classroom one day after school.
  - Conduct diagnostic reading tests on participants. I will endeavour to complete this during students' English lessons. This testing will occur prior to the intervention and once it is complete.
  - Train participants on the use of voice recognition software (one period required).
- Teaching and administrative staff at XXXX SHS will not be asked to contribute their time to this research.

**To what extent is participation voluntary, and what are the implications of withdrawing that participation?**

Participation in this research project is entirely voluntary.

If any member of a participant group decides to participate and then later changes their mind, they are able to withdraw their participation at any time. Participants may also request that their data be withdrawn from the study at any time.

There will be no consequences relating to any decision by an individual or the XXXX SHS regarding participation, other than those already described in this letter. Decisions made will not affect the relationship with the research team or Edith Cowan University.

**What will happen to the information collected, and is privacy and confidentiality assured?**

Information that identifies anyone will be removed from the data collected. The data is then stored securely in a locked filing cabinet at my residence and can only be accessed by me. The data will be stored for a minimum period of 5 years, after which it will be destroyed. This will be achieved by microwaving the CD-ROMs the data will be stored on.

The identity of participants and the school will not be disclosed at any time, except in circumstances that require reporting under the Department of Education and Training *Child Protection* policy, or where the research team is legally required to disclose that information.

Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.

The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from participants.

Consistent with Department of Education and Training policy, a summary of the research findings will be made available to the participating site(s) and the Department. You can expect this to be available in 2011. Should the intervention prove successful I am willing to in-service interested teachers at XXXX SHS in the methodology.

**Is this research approved?**

The research has been approved by the Ethics Committee of Edith Cowan University, and has met the policy requirements of the Department of Education and Training as indicated in the attached letter.

**“Do all members of the research team who will be having contact with children have their Working with Children Check?”**

Yes. Under the Working with Children (Criminal Record Checking) Act 2004, people undertaking work in Western Australia that involves contact with children must undergo a Working with Children Check. I will be the only member of the research team that will have any contact with students and a copy of my WWC card is kept at XXXX SHS.

**Who do I contact if I wish to discuss the project further?**

If you would like to discuss any aspect of this study with a member of the research team, please contact me on the number provided below. If you wish to speak with an independent person about the conduct of the project, please contact:

Kim Gifkins

Research Ethics Officer at Edith Cowan University:

**Tel: (+61 8) 6304 2170**

**Fax: (+61 8) 6304 2661**

**Email:** [research.ethics@ecu.edu.au](mailto:research.ethics@ecu.edu.au)

You can also contact my supervisors at Edith Cowan University:

Associate Professor Deslea Konza

**Tel: (+61 8) 6304 5797**

**Email:** [d.konza@ecu.edu.au](mailto:d.konza@ecu.edu.au)

Dr Jeremy Pagram

**Tel: (+61 8) 9370 6331**

**Email:** [j.pagram@ecu.edu.au](mailto:j.pagram@ecu.edu.au)

**How do I indicate my willingness for the school to be involved?**

If you have had all questions about the project answered to your satisfaction, and are willing for XXXX SHS to participate, please complete the **Consent Form** on the following page.

This information letter is for you to keep.

Peter Count

Teacher – English Learning Area

XXXX SHS

## Consent Form for Department of Education and Training Site Managers

### Consent Form

- I have read this document and understand the aims, procedures, and risks of this project, as described within it.
- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.
- I am willing for XXXX SHS to become involved in the research project, as described.
- I understand that participation in the project is entirely voluntarily.
- I understand that XXXX SHS is free to withdraw its participation at any time, without affecting the relationship with the research team or Edith Cowan University.
- Should it be deemed necessary, data may be withdrawn from the study at any point.
- I understand that this research may be published in a doctoral thesis or academic journal, provided that the participants or the school are not identified in any way.
- I understand that XXXX SHS will be provided with a copy of the findings from this research upon its completion.

Name of Site Manager  
(printed):

Signature:

\_\_\_\_\_

\_\_\_\_\_

Date:     /     /

## **Appendix G**

### **Information Letter for Parents – Child Participation**

Dear Parent/Carer

#### **READING INTERVENTION UTILISING VOICE RECOGNITION SOFTWARE**

My name is Peter Count and I am an English teacher at XXXX SHS but I am writing to you on behalf of Edith Cowan University where I am undertaking post-graduate studies. I am conducting a research project that aims to improve the reading fluency and comprehension of students experiencing reading difficulties. The project is being conducted as part of my PhD studies at Edith Cowan University.

I would like to invite your child to take part in the project. This is because I am trying to identify students with a reading age at least two years below actual age and there is a possibility that your child may fit this category. I will be approaching approximately twenty families at XXXX SHS to participate in this project.

#### **What does participation in the research project involve?**

Your child is invited to participate in initial testing for the project. The initial testing will involve assessing your child's reading rate (words per minute), accuracy and comprehension to determine if reading age is two or more years below actual age and that reading fluency is a problem. If your child does not meet these criteria there is no further requirement to participate.

If your child does meet the criteria, he/she will be trained to use Dragon Naturally Speaking® voice recognition software. This process takes approximately 30 minutes. This software will be loaded onto your home computer (if you don't have a computer at home I will arrange to lend you one). Each Monday for twenty weeks I will send your child (either by email or USB drive) a short written passage of about 200 words along with a sound recording of me reading the passage. Each night, for about five to ten minutes, your child will read the passage into a microphone and the software will convert it into written text. For the first few readings, your child will have to make corrections to the software so that it records the words accurately. By Thursday or Friday, your child should be able to read the passage and have the words recorded accurately. In the final reading, your child will make a voice recording which is sent to me (via email or USB drive). I will spend the weekend assessing the reading and issue a new passage on the following Monday. Although the project lasts for twenty weeks, your child should only have to participate for no more than ten minutes each weekday.

#### **Rationale**



The process I have described above is called *repeated readings* and is a long established method of improving reading fluency. By reading the same passage 6-7 times the student builds up his/her store of sight words. Over time more and more words become stored which means the student can read more automatically (fluently) and spend more time thinking about what the sentences mean rather than trying to decode the words. The only problem with repeated readings is that they are very time-consuming to do in a class of thirty students and, naturally, students in high school don't like to be singled out. The main aim of this study is to see whether using the software can automate much of the process while allowing the student to participate in the program without his/her peers knowing.

The participating students will be placed into two groups –an experimental group and a control group. After ten weeks of this process, the experimental group will be tested against the control group to see how much progress has been made. To ensure all students get to participate, the control group will also go through the process but will start later than the experimental group.

At the end of the process, students will be tested to see what gains have been made in reading rate, fluency and comprehension. I will also be testing to see whether attitudes to reading have improved and conducting some focus group interviews to see what the students thought about the process.

If the project is successful, it will provide an effective method for schools to use to improve the reading abilities of the 10-20% of secondary students who experience reading difficulties.

**Does my child have to take part?**

No. Participation in this research project is entirely voluntary. This decision should always be made completely freely. All decisions made will be respected by members of the research team without question.

Your child has also been provided with a letter from me that I encourage you to discuss with him/her.

**What if either of us was to change our mind?**

If a decision is made to participate, it will need to be made by 1<sup>st</sup> March 2010 for your child to be included in the project.

Once a decision is made to participate, either you or your child can change your mind at any time.

You may request that data collected on your child be withdrawn from the project at any time.

There will be no consequences relating to any decision by you and your child regarding participation, other than those already described in this letter. These decisions will not affect your family's relationship with your child's teacher(s) or the school.

**What will happen to the information collected, and is privacy and confidentiality assured?**

Information that identifies anyone will be removed from the data collected. The data is then stored securely at my home in a locked filing cabinet and can only be accessed by me. The data will be stored for a minimum period of 5 years, after which it will be destroyed. This will be achieved by destroying the CD-ROMs on which the data is stored.

Participant privacy, and the confidentiality of information disclosed by participants, is assured at all times, except in circumstances that require reporting under the Department of Education and Training Child Protection policy, or where the research team is legally required to disclose that information.

The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from you and your child.

It is intended that the findings of this study will be contained within an unpublished Doctoral thesis prepared by me. A summary of the research findings may be requested on completion of the project. You can access this by contacting me by email or phone and expect it to become available in June 2011.

**Is this research approved?**

The research has been approved by the Ethics Committee of Edith Cowan University, and has met the policy requirements of the Department of Education and Training.

**How do I know that the people involved in this research have all the appropriate documentation to be working with children?**

I will be the only person undertaking this research and the only person who will have contact with your child. As a Department of Education and Training teacher, I am registered with the Western Australian College of Teaching and hold a current Working With Children card. This can be verified by [REDACTED], Principal of [REDACTED] SHS.

**Who do I contact if I wish to discuss the project further?**

If you would like to discuss any aspect of this study with a member of the research team, please contact me on the number provided below. If you wish to speak with an independent person about how the project is being conducted or was conducted, please contact

Kim Gifkins - Research Ethics Officer at Edith Cowan University:

Tel: (+61 8) 6304 2170

Fax: (+61 8) 6304 2661

Email: [research.ethics@ecu.edu.au](mailto:research.ethics@ecu.edu.au)

You can also contact my supervisors at Edith Cowan University:

Associate Professor Deslea Konza

**Tel: (+61 8) 6304 5797**  
**Email: [d.konza@ecu.edu.au](mailto:d.konza@ecu.edu.au)**

Dr Jeremy Pagram  
**Tel: (+61 8) 9370 6331**  
**Email: [j.pagram@ecu.edu.au](mailto:j.pagram@ecu.edu.au)**

**How does my child become involved?**

Please ensure that you:

- discuss what it means to take part in the project with your child before you both make a decision; and
- take up my invitation to ask any questions you may have about the project.

Once all questions have been answered to your satisfaction, and you and your child are both willing for him/her to become involved, please complete the **Consent Form** on the following page. (Your child is also asked to complete the Consent Form attached to his/her letter.)

This project information letter is for you to keep.

Peter Count  
English Teacher  
XXXX SHS  
9330 0300  
[Peter.Count@det.wa.edu.au](mailto:Peter.Count@det.wa.edu.au)

**Appendix H**  
**Consent Form for Parents – Child Participation**

**Consent Form**

- I have read this document, or have had this document explained to me in a language I understand. I understand the aims, procedures, and any identified risks of this project, as described within it.
- I have taken up the invitation to ask any questions I may have had and am satisfied with the answers I received.
- I understand that participation in the project is entirely voluntarily.
- I am willing for my child to become involved in the project, as described.
- I have discussed with my child what it means to participate in this project. He/she has explicitly indicated a willingness to take part, as indicated by his/her completion of the child consent form.
- I understand that both my child and I are free to withdraw that participation at any time without affecting the family's relationship with my child's teacher(s) or my child's school.
- I understand that I can request that data collected on my child can be withdrawn from the project at any stage.
- I give permission for the contribution that my child makes to this research to be included in a doctoral thesis prepared by Peter Count provided that my child or the school is not identified in any way.
- I understand that I can request a summary of findings after the research has been completed.

Name of Child (printed):

Name of Parent/Carer  
(printed):

Signature of Parent:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Date:     /     /

**Appendix I**  
**Student Consent Form**

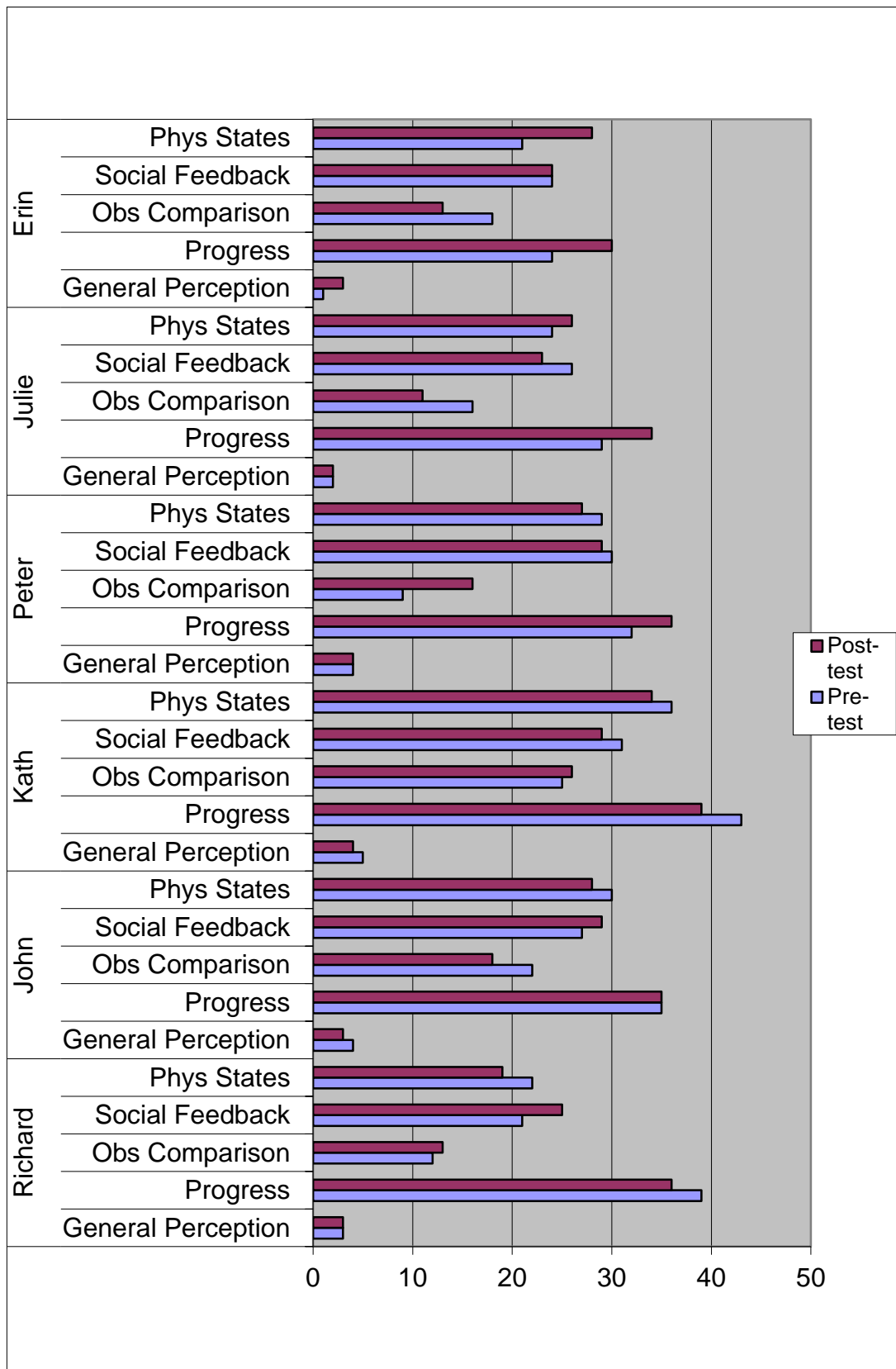
- I know that I don't have to be involved in this project, but I would like to.
- I know that I will be doing reading short passages into a computer and making an audio file of the reading. This file will then be assessed to check my reading ability as part of the project. I understand that this process will last for twenty weeks.
- I understand I am free to stop and withdraw from the project at any time
- I understand that should I choose to withdraw from the study I can also request that any of my data collected not be used in the study.
- I understand that participating in this project will not affect my grades, my relationship with my teacher(s) or my school.
- I understand that I need to write my name in the space below, before I can be a part of the project.

Your name: \_\_\_\_\_

Today's Date:     /     /

## Appendix J

### Pre and post-test RSPS results for members of the treatment group



## Appendix K

### Pre and post-test RSPS results for members of the comparison group

