

The effects of a specialist reading intervention on children's literacy and behaviour.

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Abstract

Early reading skills are the foundation of children's academic success (Lonigan et al., 1999). Unfortunately reading difficulties are highly prevalent in school children (National Center for Education Statistics, 2007) and can have significant and long-lasting negative impacts on academic, social, and vocational achievement (Sylva & Hurry, 1996). A link between difficulties in reading and behaviour problems has also been widely noted in the literature. Few studies have, however, examined the impact of reading interventions on both reading and behaviour skills for children, particularly for children with mild to moderate behavioural issues. This is an important area of research in determining the effects of literacy intervention, and disentangling the complex relationship between reading and behavioural difficulties. Accordingly, the current study aimed to monitor the effectiveness of a specialist reading intervention on children's literacy skills and behaviour.

The research employed a multiple case study design, and was separated into three phases (a pre-testing phase, intervention phase, and post-test phase). Participants consisted of 11 students from two Christchurch Primary schools who had difficulties in reading, as well as five teachers, two literacy teachers, and one teacher aide. Four participants, who exhibited more severe behaviour (as identified by their teacher on the Strengths and Difficulties Questionnaire) at pre-test, were selected as case study participants. Case study participants' literacy teachers provided additional information regarding the students' behaviour. All participants completed pre- and post-literacy (reading and spelling) and phonological awareness assessments and students were observed in the classroom setting. Teachers also completed surveys in regards to the students' classroom behaviour over the course of the intervention.

The Agility with Sound intervention primarily targets phonological awareness and application of phonological decoding strategies in reading. The intervention also focuses on

vocabulary development and reading comprehension. At School 1, participants attended four, 1 hour sessions each week as a small-group. At School 2, participants attended three sessions each week for 30 minutes. Differences in intervention scheduling and content across the two schools restricted the research design that could be employed to establish the effects of the specialist teaching.

Results showed that the majority of participants showed an increase in raw score for the Letter-word Identification (n=11), Word Attack (n=7), and Helen Arkell Spelling Test (n=9), indicating that the research intervention had a significant, positive impact on children's word identification, decoding, and spelling skills. No significant differences were found between pre- and post-test measures of behaviour, however, qualitative data from teachers indicated that for four participants, some change in classroom behaviour was evident following intervention.

Findings from case study students indicated that Participant 9 who had the most reported difficulties during literacy sessions (as reported by her literacy teacher), demonstrated the least progress in literacy; demonstrating decreases in spelling and reading raw scores following the intervention period. The remaining case study participants all demonstrated increases in reading, spelling, and phonological awareness (with the exception of Participant 3 who showed no change in phonological awareness). All participants (with the exception of Participant 11 whose teacher-report of classroom behaviour remained the same from pre- to post-test) also demonstrated decreased raw scores in observation of problem classroom behaviours and teacher-reports of problem classroom behaviours over the course of the intervention period. A correlation analysis did not show a significant association between change in literacy and change in classroom behaviour following the intervention period.

The current research supports the use of Agility with Sound for enhancing school children's literacy skills, and highlights the importance of combining literacy and behavioural intervention to enhance both literacy and classroom behaviour skills for children with co-morbid difficulties.

Table of Contents

Acknowledgements.....	ii
Abstract.....	iii
Table of Contents.....	vi
List of Figures.....	viii
List of Tables.....	ix
1. Introduction and Literature review.....	1
1.1 Typical reading and spelling development, the link, and the role of phonological awareness.....	3
1.1.1 Reading.....	3
1.1.2 Theoretical models of word reading development.....	6
1.1.2.1 Dual-route model.....	7
1.1.2.2 Connectionist model.....	9
1.1.3 Spelling.....	10
1.1.4 Importance of early reading success.....	12
1.1.5 Role of motivation and self-concept.....	13
1.2 Reading difficulties and the role of phonological awareness, language skills, and motivation:.....	15
1.2.1 Reading difficulties.....	15
1.2.2 Language skills.....	17
1.2.3 Motivation.....	18
1.3 Links between reading and behaviour.....	19
1.4 Effectiveness of reading intervention for early reading difficulty.....	22
1.5 Effectiveness of reading interventions on children's behaviour skills.....	29
1.6 Overall summary.....	31
1.7 Research questions and hypotheses.....	31
2. Method.....	33
2.1 Participants.....	33
2.2 Design.....	35
2.3 Rationale for research design.....	36
2.4 Setting.....	37
2.5 Procedure.....	37
2.5.1 Pre and post literacy assessment measures.....	37
2.5.1.1 The Woodcock-Johnson III Diagnostic Reading Battery (WJ III DRB).....	38

2.5.1.2 Queensland University Inventory of Literacy (QUIL)	40
2.5.1.3 The Helen Arkell Spelling Test (HAST) and the Experimental spelling test.	42
2.6 Pre and post behavioural and observational measures	44
2.6.1 The Novel Strengths and Difficulties Questionnaire (SDQ) – Informant-rated.....	45
2.6.2 Classroom Problem Behaviour Index (CPBI)	46
2.6.3 The Literacy Teacher Survey	46
2.7 Intervention	48
2.7.1 School 1 intervention sessions.....	51
2.7.2 School 2 intervention sessions.....	52
2.8 Reliability	53
3. Results.....	54
3.1 Individual Results.....	54
3.2 Group Results.....	101
3.2.1 Statistical Analyses:.....	101
3.2.2 WJ III DRB.....	101
3.2.3 QUIL.....	102
3.2.4 Spelling.....	102
3.2.5 Behaviour.....	103
3.2.6 Correlations	104
4. Discussion	106
4.2 Link between research findings and previous research.....	107
4.3 Limitations of the current research.....	113
4.4 Theoretical, clinical, and practical implications of the findings	114
4.5 Future Directions.....	118
4.6 Conclusion.....	119
5. References.....	121
Appendix A: Human Ethics Committee Approval Letter.....	135
Appendix B: Experimental Spelling Test	136
Appendix C: Literacy Teacher Survey	137
Appendix D: Teacher Instructions for Story Reading.....	138
Appendix E: Instructions for Using the Sliders.	140

List of Figures

<i>Figure 1:</i> Illustration of the dual-route theory of word recognition, adapted from Gillon, 2004, p.16).....	8
<i>Figure 2:</i> Research design for literacy, phonological awareness and behaviour assessment.	35
<i>Figure 3:</i> Example of accuracy of sound scoring system.....	44
<i>Figure 4:</i> Participant 1's total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.....	58
<i>Figure 5:</i> Participant 2's total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.....	62
<i>Figure 6:</i> Participant 3's total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.....	67
<i>Figure 7:</i> Participant 4's total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.....	71
<i>Figure 8:</i> Participant 5's total raw score for reading, spelling, and phonological awareness, at pre- and post-test.	74
<i>Figure 9:</i> Participant 6's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.....	78
<i>Figure 10:</i> Participant 7's total raw score for reading, spelling, phonological awareness, classroom and teacher reported behaviour at pre- and post-test.....	82
<i>Figure 11:</i> Participant 8's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.....	87
<i>Figure 12:</i> Participant 9's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.....	92
<i>Figure 13:</i> Participant 10's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.....	96
<i>Figure 14:</i> Participant 11's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.....	100

List of Tables

Table 1: Pre- and post-test levels of participants at School 2	53
Table 2: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 1.	55
Table 3: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 1.....	56
Table 4: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 1.....	57
Table 5: Raw scores for the Strengths and Difficulties Questionnaire for Participant 1.....	57
Table 6: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 2.....	59
Table 7: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 2.....	60
Table 8: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 2.....	61
Table 9: Raw scores for the Strengths and Difficulties Questionnaire for Participant 2.....	61
Table 10: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 3.....	63
Table 11: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 3.....	63
Table 12: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 3.....	64
Table 13: Raw scores for the Strengths and Difficulties Questionnaire for Participant 3.....	66
Table 14: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 4.....	68
Table 15: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 4.....	68
Table 16: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 4.....	69
Table 17: Raw scores for the Strengths and Difficulties Questionnaire for Participant 4.....	70
Table 18: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 5.....	72
Table 19: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 5.....	73
Table 20: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 5.....	74
Table 21: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 6.....	75
Table 22: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 6.....	76
Table 23: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 6.....	77
Table 24: Raw scores for the Strengths and Difficulties Questionnaire for Participant 6.....	77

Table 25: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 7.....	79
Table 26: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 7.....	80
Table 27: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 7.	81
Table 28: Raw scores for the Strengths and Difficulties Questionnaire for Participant 7.	81
Table 29: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 8.....	83
Table 30: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 8.....	84
Table 31: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 8.	85
Table 32: Raw scores for the Strengths and Difficulties Questionnaire for Participant 8.	86
Table 33: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 9.....	88
Table 34: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 9.....	88
Table 35: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 9.	89
Table 36: Raw scores for the Strengths and Difficulties Questionnaire for Participant 9.	91
Table 37: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 10.....	93
Table 38: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 10.....	93
Table 39: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 10.	94
Table 40: Raw scores for the Strengths and Difficulties Questionnaire for Participant 10.	95
Table 41: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 11.....	97
Table 42: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 11.....	97
Table 43: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 11.	98
Table 44: Raw scores for the Strengths and Difficulties Questionnaire for Participant 11.	99
Table 45: Paired samples t-tests for Woodcock-Johnson III DRB subtests.	101
Table 46: Paired samples t-tests for QUIL subtests.....	102
Table 47: Paired samples t-tests for spelling subtests and descriptive analyses.....	103
Table 48: Paired samples t-tests for behaviour subtests.	103

1. Introduction and Literature review

Early reading skills are the foundation of children's academic success (Lonigan et al., 1999). Reading difficulties in children are, however, relatively common (Pfof, Dorfler, & Artelt, 2012) and without early intervention these difficulties in reading can negatively affect various and multiple areas of a child's life (Sylva & Hurry, 1996). This point is supported by Garbrieli (2009) who noted that a first grade child with reading difficulties has a 90% chance of experiencing reading difficulties in fourth grade, and a 75% chance during high school. Reading difficulties also affect a child's ability to participate in class activities which can limit their progress not only in English but in other subjects as well (Sylva & Hurry, 1996).

The relationship between reading difficulties and behaviour problems is well documented (e.g., Carroll, Maughan, Goodman, & Meltzer, 2004; Fuerst, Fisk, & Rourke, 1989; Hinshaw, 1992). Several authors have noted a strong relationship between reading difficulties and aggressive, antisocial, and delinquent behaviour (Cornwall & Bawden, 1992). However, the direction of the relationship is still unclear and is debated in the literature (Kempe, Gustafson, & Samuelsson, 2011). One method of establishing whether reading difficulties play a causal role in the development of behavioural difficulties, is through intervention studies. That is, if enhancing literacy development alone has an impact on reducing negative behaviours, it gives evidence that poor literacy development may influence the development of behavioural problems in at least some cases. It is thus important to examine the impact of reading interventions not only on children's literacy skills, but also to observe any related changes to behaviour in response to such input. It has also been found that children who present with co-morbid reading and behaviour difficulties often make significantly less progress in reading than children with only one risk factor (reading or behaviour) or no risk factors (Kamps et al., 2003). It is thus important that intervention

studies begin to track the impact of literacy intervention on behaviour (and vice versa) to detail how we may improve children's responsiveness to literacy and behavioural interventions.

Surprisingly, very few studies have examined the impact of reading intervention on children's behaviour. The plethora of research noting a relationship between reading difficulties and behaviour, however, makes it clear that research that examines effective ways to intervene with children who exhibit both reading and behaviour problems is merited (Bruhn & Watt, 2012). Although only a limited number of studies have examined the impact of a reading intervention on both reading and behaviour skills (and none of these with children without a formal diagnosis of a reading disability or behaviour disorder), there is preliminary evidence to suggest that reading interventions may not only enhance literacy skills, but behavioural skills as well (Coie & Krehbiel, 1984; Cook et al., 2012). Further research is needed to replicate such findings across different literacy interventions, delivery methods, and with different participant profiles.

Agility with Sound (the research intervention studied in this thesis) is currently being implemented in approximately 12 Christchurch schools, and although the intervention includes its own pre and post test assessment, it has not been previously evaluated by an independent researcher.

The aim of this thesis is to examine the effects of the research intervention (focused on phonological awareness, reading, and spelling) on school children's classroom behaviour and literacy skills. The following literature review begins with a discussion of typical development of reading and spelling, and the role that phonological awareness plays in this process. It is important to understand the processes that underlie successful reading and spelling development when examining the effectiveness of word level literacy interventions.

Secondly, difficulties in reading and spelling are explained in regards to the role of several contributing factors, including:

- 1) Phonological awareness
- 2) Language skills, and
- 3) Motivation.

Next, the link between reading and behaviour is discussed to highlight the importance of considering behaviour in literacy intervention research. The effectiveness of current reading interventions for early reading difficulty is then discussed to highlight the need for multi-dimensional intervention that considers phonological awareness in addition to other literacy skills. Finally, the effectiveness of reading interventions on children's behaviour skills is discussed to demonstrate the impact of literacy interventions on reading and behaviour, and emphasise the lack of research in this area.

1.1 Typical reading and spelling development, the link, and the role of phonological awareness.

1.1.1 Reading

Successful reading development is extremely important to individuals in many areas of their life, as it supports academic achievement, education, employment, as well as social, emotional, and behavioural outcomes (Reynolds, Elksnin, & Brown, 1996).

Typical reading development is dependent on instructional, ecological, and cognitive elements (Goswami, 2008). Orthographies are written codes for speech that convey meaning. Therefore, reading is basically the process of understanding written speech, suggesting that factors affecting language development (such as phonological awareness) will also affect

reading development (Goswami, 2008). Researchers agree that word recognition is crucial when learning to read (Foorman, 1994). Indeed, if an individual is unable to read the print on the page, then reading comprehension is not possible.

The Simple View of Reading is consistent with this idea, as it posits that reading comprehension is reliant on the components of word recognition and language comprehension (Stuart, Stainthorp, & Snowling, 2008). From the perspective of the Simple View of Reading, an individual's word recognition abilities transform the printed words into language, and their language comprehension abilities draw meaning from the translated print (Catts, Adlof, & Weismer, 2006). In this way, the Simple View of Reading forwards that the development of word recognition and text comprehension processes are not the same, and as a result, it is important to develop an individual's language comprehension skills alongside their word recognition skills (Stuart et al., 2008).

Arguably one of the most well-researched, and critical phenomena required for the development of word recognition, is phonological processing; cognitive operations that depend on the phonological structure of language (Troia, 2006). Phonological processing encompasses phonological awareness (the awareness of the sound structure of a spoken word) as well as coding phonological information into working memory and retrieving phonological information from long-term memory (Gillon, 2004). Phonological awareness encompasses three levels; the syllable level which requires an individual to understand that words can be broken into syllables (e.g. understanding that hotel is divided into ho-tel), the onset-rime level which is the understanding that words and syllables can be divided into onsets (e.g. st in start) and rime units (e.g. art in start), and the phoneme level (the most complex level) which is the understanding that words can be broken into individual sounds (e.g. free into /f/ /r/ /i/); (Gillon, 2004). Phonological awareness is an important process in learning to read and spell (Cassady, Smith, & Putman, 2008), and typically begins to emerge

when children are three to four years old (Neuman, 2004). Phonological awareness is thought to underlie successful development of decoding, hence impacting reading comprehension via word recognition as described in the Simple View of Reading above. The National Reading Panel (NRP, 2000) review notes that phonological awareness along with letter knowledge is the best predictor of school entry performance of reading over the first two years. For example, Deacon (2012) researched the contributions of phonological awareness, morphological awareness, and orthographic processing on early word reading. Participants consisted of 202 students (between 6 and 9 years old) from seven rural Canadian schools. Participants completed phonological and morphological awareness tasks, as well as an orthographic processing, vocabulary, and real and pseudo reading accuracy task. Findings showed that phonological awareness had the largest independent contribution (7-17%) to both real and pseudo word reading when compared with orthographic processing (5-10%) and morphological awareness (1-2%).

Children's acquisition of phonological awareness may be demonstrated through various means (e.g., rhyming and breaking long words into syllables). After children begin to become aware of sounds through avenues such as song and games, they next become to adjust to phonemic awareness; they understand that spoken words can be broken into single sounds known as phonemes.

While the importance of phonological skills for typical reading development is widely accepted, debate remains around which type of phonological skills (rime, syllable, or phoneme) are of most importance for reading development. Hulme, Hatcher, Nation, Brown, Adams, and Stuart (2002) conducted a longitudinal study with five and six year olds (N=72) in which each participant was asked to complete three tasks at the phoneme and rime level (deletion, oddity, and detection) at pre-assessment and post-assessment. Results from the

study showed that measures of phoneme awareness, rather than rhyme awareness were the best concurrent and longitudinal predictors of reading development.

Similarly, Høien, Lundberg, Stanovich, and Bjaalid (1995) examined the components of phonological awareness in two studies. In their first study, Høien et al. (1995) tested 128 Norwegian preschool children (aged six years old) with a battery of tasks that tapped various aspects of phonological awareness (rhyme recognition, initial-phoneme matching and detection, syllable counting, and phoneme blending and counting). Through a principal component analysis, three basic components (a phoneme factor, syllable factor, and rhyme factor) were extracted. In their second study, Høien et al. (1995) replicated the structural relationships on a larger scale of 1509 participants (aged seven years old). Results from the study showed that the phoneme factor was the strongest predictor of reading variance. The rhyming factor, however, also had a small, independent effect on reading variance. These findings suggest that phonological awareness at the phoneme level is especially crucial when considering the development and implementation of reading intervention and instruction.

As has been shown in the literature, phonological awareness is a crucial aspect of successful literacy development. In particular, phoneme awareness has been shown to be the most important and complex aspect of phonological awareness. The research intervention examined in the current research focused primarily on instruction in phoneme awareness and word-level literacy as a key component of improving reading comprehension for struggling readers.

1.1.2 Theoretical models of word reading development

In order to understand where difficulties in reading lie, it is first necessary to understand the typical route to word recognition. Two influential and competing models of

word recognition that contribute to this debate include the dual-route and the connectionist model, which will be discussed in the following pages.

1.1.2.1 Dual-route model

The dual-route model of word recognition proposes two routes for reading from print to speech that differ depending on whether sequential or parallel processing is involved. A direct lexical (phonological) route or an indirect non-lexical (visual) route may be taken (Coltheart, 2006). The first route is the phonological route and requires a number of sub-skills to understand the meaning of a word. The skill that is used first in this route is graphemic parsing which involves grouping letters within the word to those that represent individual phonemes (i.e., graphemes). Next, graphemes are converted to phonemes after which the meaning of the word can be accessed. The second route (referred to as the visual route) is independent of the phonological route and permits individuals to develop a direct association between the printed word and the word's meaning from the individual's vocabulary store. It is understood that skilled readers are able to access both routes with relative ease (Gillon, 2004). A model of each route is presented below in Figure 1.

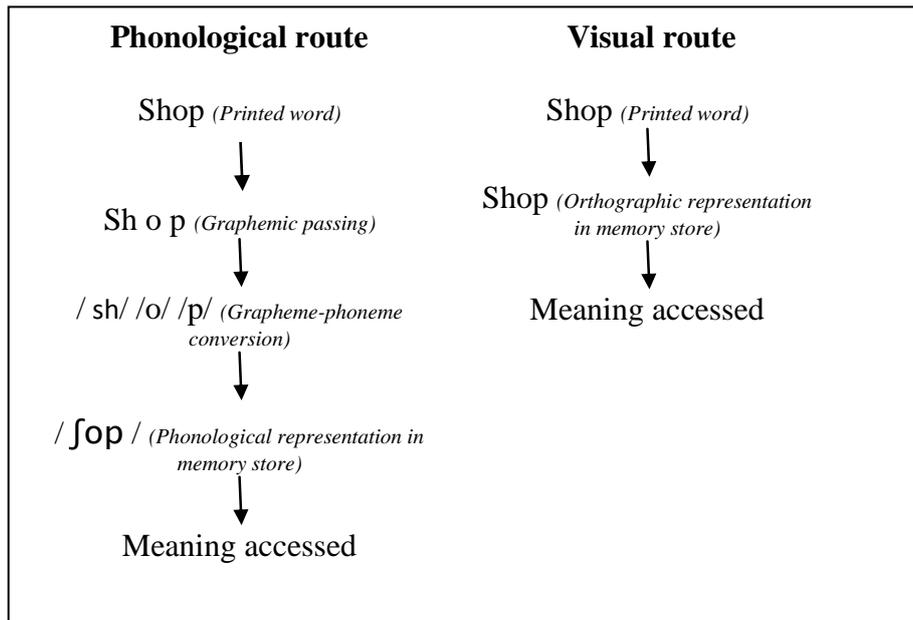


Figure 1: Illustration of the dual-route theory of word recognition, adapted from Gillon, 2004, p.16).

Cain (2010) explains that in the dual-route model, when an individual is processing a word, identifying the letters will activate both routes at the same time, and the fastest route decides the pronunciation. The visual route is generally faster for real, familiar words, whereas the phonological route is generally slower (due its assembly of sounds), and allows an individual to pronounce unknown and pseudo-words. However, familiarity with grapheme-phoneme connections must be built via the phonological route in early reading development before ‘sight’ recognition is possible across a large set of lexical items (e.g., Ehri, 1995; Share, 1999).The dual-route model thus places a large emphasis on phonological awareness skills in the development of word level reading within both the phonological and visual route. Providing explicit instruction in phonological awareness can enhance the use of the phonological route by enabling students to break words into smaller parts in preparation for grapheme-phoneme conversion (i.e., graphemic parsing, see Figure 1 above; Gillon, 2004). One limitation of the dual-route model, however, is that little has been said in the

literature about the process in which children learn this structure, something that is, however, explained in the connectionist model (Coltheart, 2006).

Ehri (1995) suggests that an individual's reading develops through phases. Ehri (1995) proposed four phases of learning to read. The first (pre-alphabetic) phase occurs before the child has alphabetic knowledge and instead connections are made between the word's visual cues and the word's pronunciation or semantic representation (e.g., identifying words of logos as a result of the surrounding context). The second (partial alphabetic) phase consists of individual's using a combination of letter reading and pronunciation in which the first and last letters of the word are generally vital. In this phase the process of combining visual cues with pronunciation helps store the word in the individual's memory. In the third (full alphabetic) phase, individuals are able to make grapheme-phoneme connections for words that are familiar to them (sight words). In the fourth, and final (consolidated alphabetic) phase, individuals are able (with practice) to consolidate recurring letter patterns, indicating that acquiring new words becomes easier. It is important to note that the model is flexible and acknowledges that individuals do not always strictly develop through the stages in sequence (Beech, 2005).

1.1.2.2 Connectionist model

The connectionist model, unlike the dual-route model, is a biologically-orientated model that emphasises a single mechanism for word processing, as well as a process of pattern recognition that is directed by constraints rather than rules (Foorman, 1994). The connectionist model maintains that both irregular and regular words are read through a connected system of phonological, orthographic, and semantic knowledge that has been acquired by an individual. In contrast to the dual-route model, the connectionist model

forwards that knowledge develops by way of a learning algorithm, which steadily, and over time, changes the strength of the connections so that each word becomes more accurate (Coltheart, 2006). For example, if an individual came across the word *chop*, the printed word (orthographic pattern) needs to produce the correct phonological representation which is accomplished through interactions between the phonological, orthographic, and semantic systems. In other words, connections need to be made between the letters in a word, the speech-sounds represented by the letters, and an individual's vocabulary knowledge. If an individual has limited phonological knowledge, the word *chop* may stimulate any phonological representation that starts with /k/ (e.g., cake or caught) When connections have been strengthened (through learning and exposure) between certain graphemes and phonemes, only the connections from the orthographic pattern that are close to phonological representations (such as chip and chap) will be stimulated. With further learning and contact with the full phonological representation of the word, the correct connections will be strengthened.

From a connectionist perspective, reading instruction should have a strong emphasis on phonological awareness, as it is maintained that the reader requires knowledge about the word's phonological structure, to read words accurately (Gillon, 2004). It is also believed that reading intervention should involve explicit instruction that links phonological, orthographic, morphological, and semantic processes during word recognition. Unfortunately, there are minimal intervention studies reported in the literature that have examined the effectiveness of this type of instructional approach (Wolf & Katzir-Cohen, 2001).

1.1.3 Spelling

In contrast to the breadth of knowledge on the development of reading, the development of spelling has gained much less attention in the literature (Caravolas, Hulme, & Snowling, 2001).

Spelling skills, however, are an important area of research, as difficulties in spelling are characteristic of individuals with dyslexia throughout their lifetime (Bruck, 1990) and many of the skills that underlie spelling development also underlie reading development (Conrad, 2008).

Caravolas, Hulme, and Snowling (2001) investigated the development of spelling skills in 154 British children, over the first three years of schooling. Participants completed measures of spelling, reading, and phonological awareness. Findings showed that letter-sound knowledge and phoneme segmentation were foundational skills of early phonological spelling, and that initial phonological spelling skills predicted later reading skills. Furthermore, early reading skills did not influence later phonological spelling skills. The study's findings have important implications for supporting phonological awareness instruction in the research intervention, to enhance children's spelling skills in addition to reading.

Spelling is learnt around the same time as reading but is more difficult, and develops slower than reading (Hulme & Joshi, 1998). In young children, spelling development is a linguistic task as opposed to something that is learned through memorisation. Individuals create the spelling of a word on the basis of their language (particularly phonology) and print knowledge (Treiman, 1998). Lennox and Siegel (1998) propose that from the start (and consistent with the dual-route model of reading as outlined in section 1.1.2.1) children rely on phonological and visual strategies for spelling, which interact in a reciprocal manner. Nation and Hulme (1998) further propose that spelling by analogy is closely connected to phoneme awareness and "young children are able to make analogies when spelling, not only between words sharing rime units but also to words that share a single phoneme-grapheme correspondence" (p.444). The researchers also note that even in the earliest phase of the development of spelling, children's abilities to make analogies when spelling is connected to their awareness at the phoneme level (Nation & Hulme, 1998).

The dual-route and connectionist models can also be applied to the intervention of spelling skills. Both models emphasise that phonological awareness is also implicated as an important skill underlying spelling development. From a dual-route perspective, the phonological route for spelling development can be taught by instructing children to listen for the first sound in the word (i.e., initial phoneme identification), to break the word into smaller parts (i.e., syllable awareness), as well as to sound out the word (i.e., phoneme segmentation). Instruction consistent with the visual route to spelling involves looking at the target word then covering up the word and visualising it before attempting to spell the word (Gillon, 2004). Similar to reading instruction, from a connectionist perspective, to spell increasingly more complex words accurately, spelling instruction requires knowledge about the word's phonological structure (Gillon, 2004).

Although there is more limited research regarding the development and intervention of spelling skills (when compared to reading), previous research has highlighted the connection between reading and spelling skills, and the importance of phonological awareness instruction. Consistent with the current study, these findings emphasise the importance of monitoring the impact of phonological awareness interventions on reading and spelling.

1.1.4 Importance of early reading success

Although the debate over the exact model of word recognition development continues, researchers widely agree that positive early literacy development (i.e., development at the word level) is important for later literacy development (Cassady et al., 2008). One concept that explains the importance of early reading success is the 'Matthew effect' (Walberg & Tsai, 1983). The 'Matthew effect' explains that inter-individual

differences in reading competence between individual's with and without reading difficulties become wider with age (Kempe, Eriksson-Gustavsson, & Samuelsson, 2011). In other words, the process is self-reinforcing, with advantages for good readers in that good readers will read more and thus improve their reading competence, influencing their reading behaviour and vice versa (Pfoest et al., 2012).

1.1.5 Role of motivation and self-concept

Early reading success is not only connected to later success in reading, but also to the development of positive self-perceptions related to reading. Chapman, Tunmer, and Prochnow (2002) examined academic self-concepts of 60 children soon after school entry, towards the end of their first and second years, and in the middle of their third year in schooling. Results indicated that children with positive self-concepts showed considerably higher phonological sensitivity skills and letter-name knowledge at the start of schooling than children with negative academic self-concepts. It was also found that reading related-skills strongly predicted positive or negative academic self-concepts. These findings have important implications for the current research in regards to the importance of examining behavioural factors (e.g., motivation, engagement) alongside literacy skills when identifying the effectiveness of literacy intervention for children with reading and spelling difficulties.

Morgan and Fuchs (2007) also emphasised the importance of success in reading by suggesting a bidirectional relationship between children's reading skills and their reading motivation. The authors reviewed 15 studies that addressed the relationship between children's reading and their competency beliefs or goal orientations. The authors concluded that children's reading skills and motivation showed a moderate correlation and supported a bidirectional relationship between reading skill and motivation. It must be noted, however,

that each study used different measures of motivation and not all of the researchers had established validity for the measures used. Similarly, Gottfried (1990) noted that children who experience early task mastery have higher perceptions of competence, and as a result higher motivation. Gottfried (1985) presented three studies in which children in Grades 4 to 8 (total n=567) were assessed for intrinsic motivation on math, reading, social studies, science, and general orientation to school, achievement on standardised school tests, and anxiety. Teachers' perceptions of participants' intrinsic motivation was also recorded. Results from the studies found that participants with greater academic motivation (intrinsic) showed significantly greater achievement in school, lower academic-related anxiety, and more positive perceptions of their academic competence. These findings support the current research in regards to the importance of enhancing children's literacy skills to reduce negative long-term literacy and motivation outcomes. The findings also add to the literature by providing an explanation for a possible link between reading and behaviour.

As previous research has shown, phonological awareness is important for the development of reading and spelling skills, and early success in reading and spelling has positive flow on effects for individual's motivation and self-concept as a reader. These findings promote the need for intervention incorporating phonological awareness instruction to promote reading and spelling skills, and highlight the potential for literacy interventions to enhance individual's motivation and self-concept. The next section turns to look at the difficulties in reading that arise when early successful reading development is not achieved, and the role that language, and motivation play in the development and maintenance of difficulties in reading.

1.2 Reading difficulties and the role of phonological awareness, language skills, and motivation:

1.2.1 Reading difficulties

The prevalence estimates of underachievement in school (and more specifically reading difficulties) vary widely. Data from the National Center for Education Statistics (2007) showed that, although a small increase has been made in reading comprehension since 1992, 26% of students are still reading below basic levels in the United States (i.e., they are unable to understand age-level text). It has also been noted that males typically present with a difficulty in reading at a higher rate than females (Hinshaw, 1992; Moffitt, Caspi, Rutter, & Silva, 2001). In international surveys of literacy achievement, New Zealand has consistently shown relatively high rates of variability in test scores (Tunmer, Chapman, & Prochnow, 2003). Indeed, the study of literacy achievement in 15 year olds that was conducted by the Organisation for Economic Cooperation and Development (OECD, 2001) found that New Zealand had the highest percentage of individuals performing at the highest but also the lowest levels for reading. This shows a large variation in New Zealand literacy achievement due to either being at the highest or lowest, which highlights the importance of researching literacy achievement and establishing effective literacy interventions in a New Zealand context.

For the purposes of this study, the source of reading difficulties are broadly categorised into three sources, consistent with the Simple View of Reading as outlined in section 2.1.1 (Gough & Tunmer, 1986). Individuals may struggle with literacy development due to phonological or decoding difficulties (sometimes deemed consistent with a profile of dyslexia), difficulties with aspect of language comprehension or difficulty with both decoding and linguistic comprehension

components. Another component that may negatively impact literacy development that is less frequently discussed in the literature, but is detailed here, is limited motivation for reading.

Dyslexia (also known as a specific learning disability) is an impairment in reading ability that is matched with a competency level that is below the expected level, with regards to the individual's intelligence level, existence of normal vision, and recognition of meaning of objects and pictures (Brooks & Weeks, 1999). The American Psychiatric Association (2000) defines dyslexia as reading accuracy or fluency difficulties that are inconsistent with an individual's educational opportunities, chronological age, or intellectual abilities. The term 'dyslexia' was first formally recognised by the New Zealand Ministry of Education in 2007, before which it had been opposed as it was thought that adopting such a policy would be conflicting with New Zealand's non categorical, needs-based system of special education (Tunmer & Greaney, 2010).

Dyslexia is considered by many to be the most common neurobehavioural disorder diagnosed in childhood (Shaywitz & Shaywitz, 2005). Lyon et al. (2001) note that prevalence estimates vary due to different classification processes that result in the misidentification or under-identification of individuals with dyslexia. However, depending on which definition is used, it is thought that dyslexia occurs in approximately 5% to 10% of individuals (Siegel, 2006). Current research has also noted a cultural and/or orthographic component in the prevalence of dyslexia in that, English speaking countries are especially prone to a diagnosis of dyslexia (Helmuth, 2001).

Characteristics of dyslexia include a deficit in phonological processing which is observed as the primary neuropsychological deficit in individuals with dyslexia. Many factors have been studied as possible causes of dyslexia, however, it is difficulties with phonological awareness that has been dominant in the literature (Gillon, 2004). It is also important to note that phonological processing difficulties are not only found in dyslexia, but may also be present in some other types of reading difficulties (Bishop & Snowling, 2004). A phonological processing deficit in children is

associated with difficulty in rhyming words, associating sounds with symbols, and naming letters (Macias & Twyman, 2011). As outlined in section 1.1 above, phonological awareness is important for both reading and spelling as it helps break down words into smaller units. It has also been demonstrated that for individuals in their early years of schooling, poor phonological awareness is highly linked to later poor reading (for review see Gillon, 2004).

1.2.2 Language skills

Another skill that is considered to be important for children to become skilled in reading is the ability to comprehend language. Children with specific reading comprehension difficulties are able to decode words (and sentences) at levels that are age-appropriate, however, they have extreme difficulties in understanding the text and making inferences while reading. Phonological awareness and reading comprehension are correlated skills but are also able to be separated and are reliant on different skills in cognition and linguistics. As reading comprehension takes time to develop, impairments are unable to be demonstrated before children are able to sufficiently read with accuracy and fluency (Nation, Cocksey, Taylor, & Bishop, 2010). Reading comprehension involves the processes of decoding text and understanding language. Initially, children's difficulties in comprehension are limited by individual differences in decoding, however, after decoding has become automatic, reading comprehension greatly depends on a child's language comprehension skills (Catts, Hogan, & Adlof, 2005). Surprisingly, the significant role of language skills in the acquisition of reading comprehension has not received the same level of attention as phonological processing difficulties in the literature (Hogan, Bridges, Justice, & Cain, 2011).

Hogan et al. (2011) demonstrated from their large overview of empirical evidence that language skills (including inferencing, use of text structure knowledge, and comprehension monitoring) are crucial for achieving comprehension. Catts, Fey, Zhang, and Tomblin (1999)

studied 604 good and poor readers, examining the contribution of phonological processing and of oral language skills to young children's reading. The researchers found that around 70% of children with poor reading in second Grade had a history of language deficits in kindergarten. Participants were assessed at kindergarten for phonological processing and oral language. Participants were assessed again at second Grade for written word recognition, reading comprehension, and intelligence. Similarly, Justice, Mashburn, and Petscher (2011) examined 62 children (from fifth Grade) with poor comprehension, poor decoding, or typical reading skills. A comprehensive battery of language measures were conducted at 15, 24, 36, and 54 months. The study found evidence that children with poor comprehension compared to children with either poor decoding or typical reading skills, had the lowest scores on language assessments at ages 15, 24, 36 and 54 months.

Language skills that facilitate reading comprehension are important as they are critical for success in language comprehension, which children need for understanding directions, stories and conversations (an idea central to the Simple View of Reading; Hogan et al., 2011). The current research intervention incorporates a variety of language skills including encouraging inference through reading of the stories which Hogan et al. (2011) note is a technique that is empirically validated for stimulating higher level language skills. The current study also included a measure of passage comprehension to assess participant's reading comprehension skills.

1.2.3 Motivation

Another contributing factor to reading difficulties, as outlined above, is motivation. A motivational issue for children with difficulties in reading is that very early on these children encounter fewer words than children without a difficulty in reading. For example, a child who is less motivated may, by their middle primary years, read only 100,000 words in a year,

whereas even an average reader may read 1,000,000 words (Sylva & Hurry, 1996). Promoting children's motivation to read is extremely important for reading interventions to be successful, as a lack of motivation can affect children's ability to increase their vocabulary skills and development of useful reading strategies (Mihandoost, Elias, Nor, & Mahmud, 2011). Previous findings emphasise the need to create an intervention that can motivate children to read and increase children's exposure to words (as is achieved through the current research intervention's use of take-home short stories).

1.3 Links between reading and behaviour

In the previous section, the contribution of low motivation to reading difficulties was discussed. The literature, however, indicates that the relationship between behaviour and reading difficulties goes much deeper and is more complex than simply difficulties with motivation.

Reading difficulties are highly co-morbid with psychological disorders including, but not limited to, attention deficit hyperactivity disorder (ADHD; Lonigan, Bloomfield, Anthony, Bacon, Phillips, and Samwel, 1999; Siegel, 2006), and obsessive compulsive disorder (Siegel, 2006). Consistent with this research, Hinshaw (1992) noted that co-morbidity of externalising behaviour and underachievement is present at levels that range widely between 10% to over 50%. Internalising and externalising behaviours have been reported as higher for children with dyslexia than those without the disorder (Dahle, Knivsberg, & Andreassen, 2011; Kempe, Gustafson, & Samuelsson, 2011). Fuerst et al. (1989), however, conducted a study with 132 children (aged six to twelve years) who had a learning disability. Each participant's primary caretaker completed the Personality Inventory for Children (Breen & Barkley, 1983). Results suggested that children's learning difficulties were more frequently accompanied by internalising rather than externalising behaviour problems.

A study conducted by Carroll et al. (2004) examined the relationship between specific literacy difficulties and psychiatric disorders in a large-scale national sample of children aged 9 to 15 years. Participants were assessed on measures of cognitive abilities, specific literacy difficulties, behavioural and emotional problems, and psychiatric disorder. Results showed a correlation between disabilities in literacy and conduct disorder as well as ADHD in both males and females. The study was limited, however, as it employed a cross-sectional design, limiting tests of whether inattention was the result of literacy difficulties or vice versa.

Similarly, Arnold et al. (2005) conducted research with 188 adolescents who along with their primary caregiver were repeatedly assessed (annually) on measures of single word reading ability, behavioural, emotional, and attention problems, attention deficit hyperactivity disorder, and socio-demographic variables. Findings from the study showed that parents reported more delinquent behaviour of those children with deficient single-word competencies in reading. This is supported by, Dahle et al. (2011) who examined 70 students with severe dyslexia as well as a control group without any reading problems. Parents, teachers, and the participants themselves provided information regarding the participant's behaviour through the Child Behavior Checklist (Achenbach, 1991). Results showed that participants with dyslexia showed greater aggressive and delinquent behaviour than was shown in the control group.

A distinct association between reading difficulties and ADHD has also been reported (Hinshaw, 1992). Lonigan et al. (1999) examined the overlap between reading disability and ADHD in preschool children from middle- and low-income backgrounds. Participants (N=85) were assessed on measures of nonverbal IQ, oral language, phonological processing, print knowledge, and behaviour. Results indicated that literacy skills and attention problems were uniquely and consistently associated; with effects being strongest for children from a middle-income background.

From their research of the associations between social skills and literacy achievement with a sample of low-income children (aged four to six years old), Miles and Stipek (2006) proposed that at kindergarten, an association between literacy skills and behaviour is weak or nonexistent, but that it gets stronger over time. Consistent with this idea, Jorm, Share, Matthews, and MacLean (1986) examined 453 Australian children over their first three years of schooling. During their first school term the participant's behaviour was assessed on the Child Behavior Checklist (Rutter, 1967). Participants were reassessed using this measure at the end of Grades 1 and 2. Participants' attentiveness was also assessed at the end of Grade 1. At the end of Grade 2 the participants completed the Neale Analysis of Reading Ability (Neale, 1966) to assess word recognition and reading comprehension. Results showed that at kindergarten there were no differences found in behaviour as a function of reading skills, however, by the end of first grade children with a reading difficulty had significantly higher rates of antisocial behaviour than peers with normal reading.

In contrast, there are studies that propose that reading difficulties do not contribute to externalising behaviour or vice versa. Kempe, Gustafson, and Samuelsson (2011) examined 360 six year old children in a kindergarten test battery to identify whether children were at risk for early reading difficulties. Participant's attention and hyperactivity were assessed from first to third grade. Findings revealed no significant differences between children at risk of a reading difficulty and those who were not, and suggested that reading difficulties and behaviour problems are independent. Likewise, Cornwall and Bawden (1992) in their review of the literature, noted that there was insufficient evidence to conclude that there was an association between reading disability and externalising behaviour. Additionally, in contrast to research supporting the co-morbidity of reading difficulties and behaviour, Richman, Stevenson, and Graham (1982) conducted a cross-sectional study of a random sample of 8 year old children (n=185) from London. Participants' behaviour and language was assessed using a behaviour screening questionnaire, a behaviour checklist, and three simple tests of language which included identifying

pictures that corresponded to a name word, naming specified items, and the researchers listening to participants' spontaneous speech to assess their level of syntactic development. The researchers reported that there was no significant association between reading disability and behaviour problems.

Given these conflicting findings in the literature, it is important that further research is conducted. In particular, studies that focus on literacy intervention and examine the impact on behaviour can be one method of examining the presence of a causal relationship between literacy and behaviour in at least some instances.

It is important to look at the behaviour of children with a reading difficulty in addition to their literacy skills as additional issues may be crucial in designing educational remediation (Knivsberg & Andreassen, 2008). The current research examines the initial reading difficulty and classroom behaviour of individual children, and examines the outcomes of the research intervention on both literacy skills and classroom behaviour. Although previous research has examined the link between reading difficulties and behaviour (e.g., Carroll & Snowling, 2004; Hogan et al., 2011; and Yeomans, 1999), the current study examines children in a New Zealand context who do not have a formal diagnosis of a behaviour disorder. This study thus allows examination of students' classroom behaviour in response to an intervention for reading skills in a cohort of children with less severe behavioural issues.

1.4 Effectiveness of reading intervention for early reading difficulty

Intervention for children with dyslexia or a reading difficulty is extremely important as children with difficulties in reading have been found to be at a significant risk of negative outcomes in adolescence and adulthood (Lyon, Fletcher, Fuchs, & Chhabra, 2006). Reading difficulties can create stress for the child and their parents, and as children advance through the schooling years these difficulties in reading can affect their abilities for classroom participation in

reading and other activities (Sylva & Hurry, 1996). Data from longitudinal studies has suggested that for individuals with dyslexia, academic and behavioural outcomes can be chronic and persistent. The disorder is described as stable and not a representation of a temporal, developmental lag. Without intervention, individuals tend to maintain a relative position on the spectrum of reading ability from childhood through adolescence into adulthood (Shaywitz & Shaywitz, 2010). Similarly, Goldberg, Higgins, Raskind, and Herman (2003) note that dyslexia exerts "critical influence across the entire lifespan" (p.222).

A study by Swanson (2008) investigated the literature from 1980 to 2005 and found that reading instruction that is aimed at children with a learning disability is low in quality and contains no explicit instruction for phonics or comprehension strategy. Another issue in regards to intervention for children with reading difficulties is that due to the New Zealand discrepancy-based assessment procedures, children with dyslexia are generally unidentified until after two to three years (often longer) of having been exposed to reading instruction, which is preventing the provision of early intervention (Tunmer & Greaney, 2010).

The effectiveness of phonological awareness interventions for children with reading difficulties has gained much attention in the literature (Gillon, 2002). As a result, many phonological awareness interventions have been developed and evaluated for children with and without a reading difficulty (Troia, 1999). Phonological awareness interventions generally involve activities that enhance knowledge of the sound structure of words and involve tasks that demand a clear understanding of the association between speech and print, for example repeating heard sounds, identifying initial and final sounds, and segmenting words into sounds (Gillon, 2002).

The reading intervention literature is consistent with the models of word recognition outlined in section 1.1.2 in that there is agreement that phonological awareness is essential to the teaching of reading and spelling in regards to converting words from print to speech and vice versa, and strengthening connections between phonological, orthographic, and semantic systems.

Intervention research and the dual-route theory of word recognition are also consistent in that they suggest that phonological awareness instruction can be involved in intervention and instruction in various ways.

Ryder, Tunmer, and Greaney (2007) have also demonstrated the effectiveness and long-term impact of phonological awareness intervention for children with early reading difficulties. To determine whether explicit instruction in phonemic awareness and decoding skills that are phonemically based would be effective for children with a difficulty in reading in a whole language instructional environment, 24 participants (aged six to seven years) were randomly assigned to either an intervention or control group. The intervention was delivered by a teacher aide over 24 weeks. Findings post-intervention showed that the intervention group performed better than controls on measures of phonemic awareness, pseudo word decoding, reading comprehension, and context free word recognition. Two-year follow-up data also indicated that effects had been maintained and generalised to word recognition accuracy in connected text.

Hatcher, Hulme, and Ellis (1994) also note the effectiveness of phonological training for children experiencing difficulties in reading, however, the researchers note that interventions aimed at enhancing phonological skills should be integrated with the teaching of reading to produce the maximal effect on improvement in literacy skills. Hatcher et al. (1994) examined a large sample of seven year olds with difficulties in reading. Participants were assigned to one of four groups (reading with phonology, reading alone, phonology alone, and a control group) and were assessed using a cognitive battery at both pre- and post-intervention. The researchers found that although children who experienced training in phonology alone showed the greatest improvement on phonological tasks, children who experienced reading and phonology showed the most reading progress (Hatcher et al., 1994). Similarly, Duff, Hayiou-Thomas, and Hulme (2011) evaluated 'Reading Intervention' which is a supplementary reading programme that emphasises the link between phonological awareness and reading. Twenty-nine six year olds with a reading

difficulty participated in the 10 week programme and were compared to a representative control group from the same class. Children in the intervention group progressed significantly more than the control group in early word reading, phoneme awareness, and phonetic spelling. At a six month follow-up the intervention group continued to show the positive gains of the intervention, however, it must be noted that post-intervention, children in the intervention group progressed significantly less than controls on single word reading, phoneme awareness, and phonetic spelling.

In contrast to the findings of long-term effectiveness of phonological awareness interventions, O'Conner, Arnott, McIntosh, and Dodd (2009) found differing results after the researchers examined the literacy outcomes of 57 students in Grade 2 who had come from socially disadvantaged backgrounds and had received specific whole-class intervention in phonological awareness and language in preschool. Although post-intervention effects were found for phonological awareness and language skills, by Grade 2 children who had received the intervention had similar performance to students who had received no intervention indicating that whole-class, teacher delivered, phonological awareness and language intervention may be effective in the short-term but may not lead to generalised enhancement of literacy skills.

Hurry and Sylva (2007) explored the long-term effectiveness of a reading recovery and a specific phonological training model of early intervention. Each of the 400 children were assigned to either 'Reading Recovery' (n=95), 'Phonological Training' (n=97), or a control group. Findings suggested that 'Reading Recovery' had a larger effect on aspects of children's reading. Both interventions significantly improved children's reading in the short and medium term, however, after three and a half years, no significant effects on overall reading were identified, suggesting that early intervention alone may be insufficient. In contrast, Wise, Ring, and Olson (1999) suggest from findings of very few significant differences between trained conditions in their study that "specific variations in good phonological training may be less important than once thought for most children with reading difficulties" (p.271). Wise et al. (1999) studied the effects of

phonological awareness training with and without explicit attention to articulation, and with and without manipulation of sounds. Participants consisted of 122 children (aged seven to eleven years old) with a difficulty in reading. Researchers found that after 40 hours of training, children in all treatment conditions performed better than controls in all tests with the exception of math.

Iversen and Tunmer (1993) examined the effectiveness of the 'Reading Recovery program' and the incorporation of phonological decoding skills. Participants included 102 children (with a mean age of six years two months) who had been identified as at-risk for a reading difficulty as well as two control groups of children with average reading abilities. Participants were assigned to the modified Reading Recovery (explicit instruction involving phonograms), the standard Reading Recovery, or a standard intervention group. Although children from both Reading Recovery groups were discontinued from the program due to reaching the required levels of reading performance, results indicated that children in the modified Reading Recovery group reached these levels of performance faster. However, as has been discussed above, short-term interventions may not be maintaining their effects, and as there was no follow-up, it is difficult to determine whether these improvements were maintained or if differences in length of maintenance were noted.

Similar effectiveness of literacy interventions has been reported in further studies, including Wanzek, Vaughn, Roberts, and Fletcher (2011) who conducted a year-long intervention for middle school children. Students with a learning disability were compared to a control group (who did not receive the intervention). Students with a learning disability took part in daily 50 minute literacy instruction. From the study, the researchers reported statistically significant differences between the treatment and control group, with the treatment group showing greater performance for sight word reading fluency and small effects for phonemic coding fluency. At four months follow-up the treatment group continued to significantly outperform the comparison group in regards to sight word fluency. Therefore, the research supports the notion that in the

majority of cases, improvements from phonological based interventions are being maintained at follow-up, which is important in maintaining reading gains and staying within age-expected levels.

While several studies have provided evidence that phonological awareness intervention is successful in enhancing children's reading and spelling skills, studies have contributed unique key principles that should be included in phonological awareness intervention. Brennan and Ireson (1997) noted that phonological awareness intervention should focus on developing skills at the phonemic level. The researchers evaluated the effects of a phonological awareness intervention on 38 kindergarten children in America. Participants were randomly assigned to the experimental or the control group. Participants in the experimental group received a training program of meta-linguistic games. Results from the study showed that participants in the experimental group had significantly higher increases in reading and spelling skills following the intervention. The experimental group also showed higher post-test scores on six of the metalinguistic tests, with the experimental group showing significantly higher increases in all tests of phoneme awareness than did the control group (Brennan & Ireson, 1997).

Hatcher et al. (1994; study outlined above) on the other hand, maintain that activities in phonological awareness should be integrated with training in letter-sound knowledge. Furthermore, Byrne, and Fielding-Barnsley (1995) suggest that either an intensive individual or small-group model of phonological awareness intervention may be necessary for children with severe reading difficulties. The researchers evaluated the effects of a phonemic awareness intervention for young children at two and three years follow-up. Participants consisted of 128 children (64 in the experimental group and 64 in the control group). Participants in the experimental group participated in a small group, 12 week, training programme which taught phonemes through jingles or poems, posters, and in the final week through card games. A supplementary experiment was also conducted in which 93 preschoolers completed the training

with their regular teacher. Results showed that in comparison to the control group, participants in the experimental group had higher scores in non-word reading at two and three years follow-up, and in reading comprehension at three years follow-up. The participants in the experimental group did not, however, show higher scores on measures of automaticity in reading. In addition, children trained by their teacher with the program showed more progress in aspects of phonemic awareness than participants in the control group from the main experiment. Participants did not, however, gain as much as participants in the more intensely trained experimental group (Byrne & Fielding-Barnsley, 1995).

It is also important to note that much of the phonological awareness intervention is focused on kindergarten and young children. As is evident in the research reviewed above, there is limited research aimed at the effects of phonological awareness intervention for older school children, which is important as phonological weakness remains a characteristic of many poor readers into middle childhood (Soltani & Roslan, 2013). Thus, the current study provides further examination of whether phonological awareness instruction can be effective for older students within a whole language environment.

One issue that is common in reading intervention research is that studies in this field are generally directed at children who have been diagnosed with specific reading difficulties, and children with general difficulties in reading encompass a neglected group in regards to intervention research (Hinshaw, 1992). The need to provide additional instruction in phonemic awareness and decoding, fluency in text processing and word recognition, spelling, vocabulary, and construction of meaning in small-group or one on one formats has also been noted in the literature (Foorman & Torgesen, 2001). The current research employs an intervention primarily focused on phonological awareness and includes participants who have been identified by their teacher as having low progress in reading and have not been diagnosed with a reading disability, providing further data on the effectiveness of a literacy intervention of children with a general

reading difficulty. The current study will also employ a small-group withdrawal format (that also includes homework), obtaining data in regards to instruction that is more explicit and comprehensive than classroom instruction for children from high and low decile schools.

1.5 Effectiveness of reading interventions on children's behaviour skills

Little research has examined the effects of reading interventions on children's behaviour skills and it has been proposed by some researchers that for a number of children with co-morbid reading and behaviour difficulties, receiving intervention in reading alone (without additional behavioural support) is insufficient (e.g., Bruhn & Watt, 2012; Lane et al., 2002). Possibly as a result, intervention studies are generally narrow in their focus of outcomes (focusing on either literacy or behaviour) and few have addressed children with co-morbid reading difficulty and externalising behaviour (Hinshaw, 1992). Cook et al. (2012), however, noted that if a reciprocal, transactional relationship between reading difficulties and problem behaviour is assumed, it is logical to predict that an intervention for reading would improve both reading and behavioural skills.

To test their hypothesis of a reciprocal, transactional, relationship, Cook et al. (2012) employed a single-case experimental design, recruiting six middle school students, who were nominated by their teacher as having poor performance in reading and disruptive classroom behaviour. Three children received a reading intervention (the Six-Minute Solution; Adams & Brown, 2006) followed by a behavioural intervention, with the remaining three children receiving the interventions in the opposite order. For four of the six students, findings indicated that the reading intervention provided a unique increase in behaviour skills. The two children who showed minimal to no improvements in behaviour skills were hypothesised to have attention-maintained (disruptive to gain attention) behaviour problems as opposed to escape-maintained (disruptive to

avoid difficult tasks) behaviour (Cook et al., 2012). The study had limitations in its small sample size, with only one female participant, and would benefit from replication.

Similarly, Coie, and Krehbiel (1984) studied 40 children from the fourth Grade at a North Carolina primary school who had co-morbid underachievement, and disruptive and social difficulties. Participants were randomly assigned to one of four groups (academic skills training in reading and math, social skills training, combined, or no treatment/controls) and participated in their assigned intervention over a six month period. The aim of their study was to examine whether change in one domain would lead to changes in the other area. Findings both immediately after the intervention and at one year follow-up showed that children who had received academic tutoring had significantly improved in academic achievement, but also in observations of classroom behaviour. The study has limitations in that, similar to Cook et al. (2012), the participants were predominantly male. The study also categorised classroom behaviour as on- or off-task, and only used quantitative measures of behaviour which is extended in the current study through more specific observations of classroom behaviour, as well as qualitative measures of classroom behaviour.

Hinshaw (1992) notes that training in academic skills is unlikely to succeed in reducing externalising behaviours in all children unless their motivation is increased through reinforcement incentives or response-cost procedures. However, evidence from some previous studies have indicated that for many children, direct instruction in academic skills can provide benefits for not only their reading skills but their behavioural skills as well (Coie & Krehbiel, 1984; Cook et al., 2012).

The current research intends to provide further data on the effects that reading intervention has on children's externalising behaviour in the classroom, and in addition to previous research, provide evidence from classroom observations of changes in classroom behaviour skills. A number of studies (as presented above) have examined the link between reading and behaviour.

The participants involved in these research studies, however, have been restricted to children with more severe levels of literacy and behaviour difficulties. The current study adds to previous research in that it examined the effects of a phonological awareness intervention on classroom behaviour of children who have not been diagnosed with a behaviour disorder.

1.6 Overall summary

The current study examined the effectiveness of a specialist reading intervention on children's literacy and behavioural skills, for primary school children with low progress in reading. In an effort to address existing gaps in the literature, the current research was conducted in a New Zealand context with children from two Christchurch schools who did not have a formal diagnosis of a reading or behaviour disorder. The research intervention examined in the current research taught multiple literacy skills including phonological awareness, comprehension, and spelling which as noted above have been identified in the research as key skills needed for success in reading. The current study also examined the effectiveness of the research intervention on behaviour skills in the classroom in addition to phonological awareness, reading, and spelling skills, which has been omitted from much of the literature. The current study also employed mixed methods data to assess changes in participants' classroom behaviour which incorporated both quantitative and qualitative measures of classroom behaviour to provide a more comprehensive picture of changes in behaviour following the research intervention.

1.7 Research questions and hypotheses

The current study addresses the following questions:

- a) Is the research intervention an effective intervention for enhancing school children's phonological awareness, reading, and spelling skills?
- b) Is the research intervention an effective intervention for enhancing school children's behavioural skills in the classroom context?

Based on the literature regarding reading intervention for literacy and behaviour skills, the hypotheses for the current study are:

- a) That the research intervention will enhance participants' phonological awareness, reading, and spelling skills.
- b) That the research intervention will enhance participants' classroom behaviour in the classroom context.

2. Method

2.1 Participants

Two Primary schools from Christchurch, New Zealand who were implementing Agility with Sound (Sewell, Unpublished) for their low progress readers, participated in the research. All students with regular attendance from each school who were undertaking the intervention were invited to participate in the study. In School 1 (Decile 2) six students were participating in the intervention and consent was obtained for three female students (Participant 1, Participant 2, and Participant 11, aged 9 years 2 months, 8 years 3 months, and 7 years 10 months respectively) to be included in the research. Participant 2 had an additional diagnosis of hearing problems and had grommets fitted which fell out during the intervention period. The remaining students did not have any additional cognitive or sensory difficulties. In School 1, students were selected for entry into the intervention from the school's Running Record data in which students with the lowest scores were selected. Students were ineligible for the research intervention at the school if they were involved in other specialist learning support (e.g., Resource Teacher of Learning and Behaviour), if they were identified by teachers as having severe behavioural problems, or students for whom English was their second language. The two teacher aides who implemented the intervention at School 1, and the two classroom teachers (whose students were participating in the intervention) also participated in the study by completing surveys regarding participants' behaviour during classroom and literacy sessions.

Participants from School 2 (Decile 5) consisted of eight students (Participant 3 to Participant 10, aged 12 years 2 months, 11 years 8 months, 10 years 3 months, 11 years 10 months, 12 years 7 months, 11 years 8 months, 10 years 3 months, and 11 years 3 months respectively, male n=4, female n=4) In School 2, eligibility for participation in the research

intervention was based on the classroom teacher identifying the student as having low progress in reading or whose performance on National Standards for reading was 'well below' the national standard (Ministry of Education, 2009). Participant 9 had an additional behaviour management plan introduced during the intervention period. The remaining students did not have any additional cognitive or sensory difficulties. One literacy teacher and three classroom teachers (whose students were participating in the intervention) also participated in the study. An English for Speakers of Other Languages (ESOL) student who was participating in the intervention programme was excluded from the current research as the school did not provide consent for the student's participation. One teacher from School 2 was also excluded from participation in the research as informed consent was not obtained.

From the cohort of 11 participants described above, four of these students were selected as case study participants to provide a further analysis on the relationship between change in behavioural and literacy measures over the course of the intervention. Case study participants were selected for further analysis if their initial Strengths and Difficulties Questionnaire (SDQ; normative measure of behaviour, see section 2.6.1 below for further details about this measure) showed an abnormal total difficulties score (Goodman, 1997). Three of the case study participants (Participants 3, 8, and 9) attended School 2 and the fourth case study participant (Participant 11) attended School 1. As noted above, case study Participant 9 was receiving an alternative behaviour management programme in addition to the literacy intervention.

All participants were given information letters detailing the aim and purpose of the study, what was required of them, and contact details for questions and concerns; as well as consent forms to take home and fill in if they wished to participate (student's parents/caregivers were also given an information letter and consent form). All participants returned signed consent forms prior to any data being collected. Students were excluded from

the research if they did not return a signed consent form from both themselves and their parent/caregiver. Confirmation of ethical approval for this project can be viewed in Appendix A.

2.2 Design

The current research employed a multiple case study design to evaluate the effectiveness of the research intervention in enhancing student’s literacy skills. The association between participation in the research intervention and classroom behavioural measures was also explored. The research design was separated into three phases (a pre-test phase, intervention phase, and post-test phase), which is represented in Figure 2. The intervention was already being implemented in both schools prior to the pre-test phase. Therefore, the intervention phase consisted of 12 weeks of intervention subsequent to pre-testing.

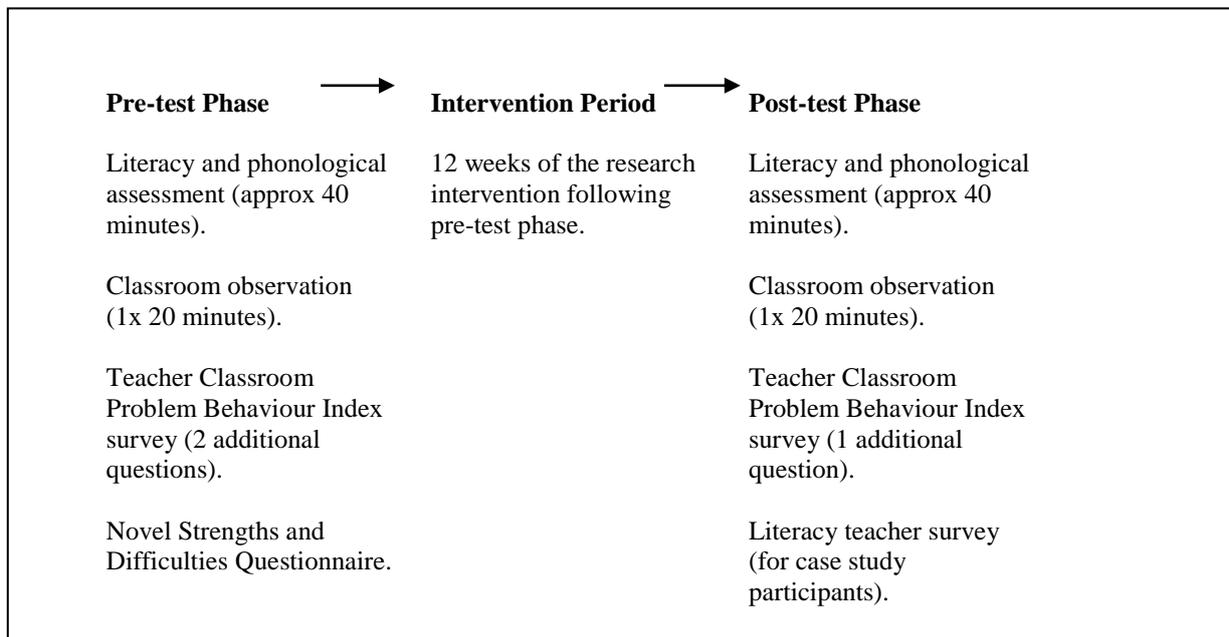


Figure 2: Research design for literacy, phonological awareness and behaviour assessment.

2.3 Rationale for research design

As there were large differences in the administration of the research intervention across schools, results could not be pooled across sites, therefore a multiple case-study design was employed to examine individual changes within participants. Although the research intervention (Agility with Sound) was meant to be identical across schools, there were scheduling differences due to logistical factors at both schools. Also, observation of the intervention sessions revealed broad differences in implementation of the content despite the same intervention being used.

The current study also had a relatively small sample size and a single-case study with repeated measures could not be employed due to time constraints and teacher availability. Multiple case study research has been noted in the literature to gain a more in-depth understanding of phenomena in a relatively small number of participants. If most of the cases in the study demonstrate similar results, there is considerable support for developing a preliminary theory to describe the phenomena (Zach, 2006). A multiple case study design was beneficial for the exploratory nature of the current study, using a descriptive research design to track associations between changes in literacy and behaviour on an individual basis.

While some researchers have argued that quantitative and qualitative methods should not be combined (Sale, Lohfeld, & Brazil, 2002), and have also cautioned the use of mixed-methods research for concern that attempting to do too much in a single study may lead to weakening of either design (Chwalisz, Shah, & Hand, 2008; Ponterotto & Grieger, 2007), others have noted that mixed methods research is gaining popularity amongst human service researchers (Ponterotto, Matthew, & Raughley, 2013) and that mixed methods research has many strengths that often result in superior research (Johnson & Onwuegbuzie, 2004). Johnson and Onwuegbuzie (2004) have defined mixed-methods research as “the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study” (p. 17). Ponterotto et al. (2013) note that due to the flexible nature of

mixed-methods studies, researchers have the possible benefit of a more accurate and holistic understanding of the target phenomena. A mixed-method research design was appropriate for the current study to gather classroom and literacy teacher's perspectives, of participants' changes in behaviour to support researcher observations and questionnaire data. The exploratory design was also suited to the logistical reality of detecting the impact of a research intervention that was implemented by teachers within a group and one-on-one setting.

2.4 Setting

At School 1, the intervention setting was a classroom that was used specifically for literacy teaching. All pre-test assessments were administered by the first author and were conducted individually in an empty classroom at the school. For one student's post-test assessment the classroom was unavailable and the school's library resource room was used.

At School 2, the intervention setting was a resource room that was used specifically for literacy teaching. The pre-test assessments were administered by the first author and were conducted in the school's boardroom. Post-test assessments were conducted in the school's literacy room. Both school settings for pre- and post-test assessments were well lit and sufficiently quiet.

All student observations at both schools were conducted in the student's classrooms.

2.5 Procedure

Ethical approval for the research was obtained from the University of Canterbury Educational Research Human Ethics Committee in May 2013.

2.5.1 Pre and post literacy assessment measures

The students participated in one, individual 40 minute assessment session at pre- and post-test to evaluate changes in student's phonological awareness, reading, and spelling skills

over the study. These sessions were conducted in a quiet, withdrawal setting in the student's school and were administered by the first author. A full description of each measure is provided in the following section.

2.5.1.1 The Woodcock-Johnson III Diagnostic Reading Battery (WJ III DRB).

The WJ III DRB (Woodcock, Mather, & Schrank, 2004) is an individually administered assessment that measures important dimensions of phonological awareness, phonics knowledge, fluency, vocabulary, and reading comprehension. It is appropriate for individuals aged 2 to 80+ years old and takes approximately five to ten minutes per subtest to administer (approximately 50 to 60 minutes in total). The WJ III DRB has been standardised on a U.S population (Woodcock et al., 2004).

Three of the subtests were administered in the current study; Letter-Word Identification, Passage Comprehension, and Word Attack. The Letter-Word Identification subtest is an assessment of word identification skills. The participant is required to firstly identify letters and then later read single words that get increasingly more difficult (e.g., is, keep, and together). The subtest is discontinued when six consecutive errors are made. A raw score (out of 76) and a standard score was collected for analysis. The Letter-word Identification subtest was used to measure the effectiveness of the intervention on student's word recognition skills as research has indicated that most poor readers in the early years of schooling have a deficit in word recognition, (Catts, Hogan, & Adlof, 2005) and that word identification is a basic process in reading which other complex reading tasks build upon (Yamashita, 2013). The research intervention had a strong focus on skills underlying successful word reading making it important to monitor this development over the course of the study.

The Passage Comprehension subtest is an assessment that primarily includes cloze tasks to examine reading comprehension. Firstly, the participant was required to match a pictographic representation of a word(s) with the object's picture. The participant then read a short paragraph and was required to fill in the missing word. The subtest was discontinued when six consecutive errors were made. A raw score (out of 47) and a standard score was collected for analysis. A measure of passage comprehension was used to measure the effectiveness of the intervention on student's reading comprehension skills. It was important to establish whether growth in phonological awareness and single word reading was transferred to improved reading comprehension performance. Reading comprehension was also specifically targeted within the research intervention.

The Word-Attack subtest is an assessment of decoding. The participant was required to use their knowledge of the alphabetic system to read pseudo-words (e.g., fim or distrum). The subtest was discontinued when six consecutive errors were made. A raw score (out of 32) and a standard score was collected for analysis. The word-attack measure was used to measure the effectiveness of the intervention on student's decoding skills, as decoding has been identified as a necessary (although not sufficient) part of reading, with decoding abilities being suggested to account for the most variance in children's early reading abilities (Gough & Wren, 1998). This phonological decoding strategy (underpinned by phonological awareness and letter-sound knowledge), was also specifically targeted in the research intervention.

For all subtests of the WJ III DRB, a standard score of 85 to 115 represented the expected performance for a student's age (compared to their same-age peers). Standard Error of Measures (SEMs) were also calculated for all subtests to determine whether changes in standard score on each subtest was clinically significant. SEMs is one method of ensuring

whether change in scores from pre to post is clinically significant when the research design lacks control (Apel, 2001).

2.5.1.2 Queensland University Inventory of Literacy (QUIL).

The QUIL consists of ten subtests that measure phonological awareness ability in school-aged children. The QUIL measures phonological awareness ability at three levels; syllabic level, onset-rime level, and phonemic level. Practice items are given for each subtest.

Four subtests focused at the phonemic level were administered; Phoneme Detection, Phoneme Segmentation, Phoneme deletion, and Spoonerisms. These subtests were chosen as phoneme awareness is considered to be the most complex level of phonological awareness and is also suggested to have the closest relationship with literacy development, making it an important aspect to monitor given the age range of participants in the study (Carroll & Snowling, 2004). The Phoneme Detection subtest required participants to identify the odd word out in a group of four words. The participant was told which part of the words would be the same (beginning, middle, or end) and all twelve items were completed regardless of any errors made. The Phoneme Segmentation subtest required participants to count up the individual sounds in the word that was spoken (e.g. knife = 3). The subtest was discontinued when three consecutive errors or no responses were given. A raw score was then obtained out of a possible 12. On the Phoneme Deletion subtest participants were required to repeat words back to the assessor without saying a specified sound in it (e.g. hill without saying /h/ would be ill). The subtest was discontinued when four consecutive errors or no responses were given. A raw score was then obtained out of a possible 10. The Spoonerism subtest required participants to mix the first sound of two words up to make two new words (e.g., sit and fun become fit and sun). The subtest was discontinued when three consecutive errors or no

responses were given on both elements. A raw score was then obtained out of a possible 20 (Dodd, Holm, Oerlemans, & McCormick, 1996).

Raw scores and standard scores were collected from these four subtests. A standard score of 7 to 13 represented the expected level of performance for the student's age (compared to their same aged peers). On the Phoneme Detection subtest, an item analysis of each participant's scores in regards to correct detection of first, end, last, and middle sounds were summed and collected for analysis. On the Phoneme Deletion subtest an item analysis of each participant's scores in regards to correct deletion of single phonemes or parts of a blend were also summed and collected for analysis. These analyses were conducted to provide a sensitive and developmental analysis of any change in phonological processing during the intervention period, given awareness of first and final sounds generally emerges before awareness of medial sounds (see Gillon, 2004 for review).

The QUIL was used to measure the effectiveness of the intervention on student's phonological awareness abilities as there is numerous research proposing that phonological awareness is essential for children to acquire skills in reading (Bruck, 1992; Ellis, 1990, Gillon, 2000; Hatcher et al., 1994; Wagner & Torgesen, 1987 etc.) and that difficulties in phonological awareness appear to underlie the majority of disabilities in reading (Adams 1990; Carroll & Snowling, 2004; Kim, Kim, & Lee, 2007 etc.). It was also important to measure aspects of phonological awareness as this was a specific focus of the research intervention which included activities directly involving phoneme detection, segmentation, and deletion, as well as spoonerism tasks.

2.5.1.3 The Helen Arkell Spelling Test (HAST) and the Experimental spelling test.

The HAST (Brooks & McLean, 1998) was developed by the Helen Arkell Dyslexia Centre. The HAST is a single word spelling test for children aged 5 to 19 years old. The test can be administered through group or individual assessment. The HAST includes high frequency (e.g. with) and low frequency (e.g. hyperbole) words and regular (e.g. am) as well as irregular words (e.g. was). The HAST assesses spelling ability and has been considered sensitively appropriate to reliably assess the literacy of children (Brooks & Weeks, 1999). The test is based on the normal development of spelling in individuals and school curricula, and has been standardised on a U.K. sample of 740 students (aged 5 to 20 years old; 50% male, 50% female). The task was administered by the examiner saying the word aloud, using the word in a sentence, and then saying the word in isolation again. Participants continued to spell the test words until they had made 10 errors.

A total raw score (out of 140) and a spelling age (calculated using the HAST total score and spelling age table) was collected for analysis. Further, the number of correct regular (out of a possible 70) and irregular words (out of a possible 70) at each assessment was calculated. This analysis was important given the intervention's focus on phonological encoding strategies and primary focus on phonetically regular words (particularly in the early levels of the programme). The HAST was used to measure the effectiveness of the intervention on student's spelling skills, as research has proposed that both spelling and reading skills share mental representations, which suggests that what is learned through spelling may benefit reading skills (Ehri 1997, 2005; Perfetti, 1997). Furthermore, Reed (2012) notes that phonological awareness and letter-sound knowledge (which are key aspects of the research intervention) underlie both reading and spelling development.

The Experimental spelling test (that matched the intervention's content) was constructed by the first author to provide a sensitive measure of the effects of the research

intervention. In the early stages of the intervention, the words included in decoding and passage reading tasks were comprised exclusively of short-vowel sounds. The experimental spelling test thus included twenty words that contained exclusively short vowel sounds. All twenty words were taken from the intervention itself, with words from all levels of Agility with Sound included. During administration of the task, the examiner said the word aloud, then used the word in a sentence, and then repeated the word. Participants were asked to spell all twenty words regardless of any errors made.

A total score (out of 20) was collected from all participants for analysis. Change in phonological encoding was also recorded by analysing the accuracy of phoneme-grapheme matches at each assessment point (with one point awarded for each match e.g. Rug = 3 points, Rg = 2 points). The same method as Gillon (2002) was used in which clear orthographic reversals were considered correct (e.g. lowercase s or g, and uppercase L or B), as were alternative graphemes for the written phoneme (e.g. k instead of c). A raw score for taught words (out of a possible 20), untaught words (out of a possible 20) was collected and calculated as a percentage from participants attending School 2. A score for taught and untaught words could not be collected from School 1 participants as all participants completed activities from changing levels of the research intervention, therefore words that had been taught or untaught could not be determined. An example of the scoring system is presented in Figure 3. The full list of items included in this measure can be viewed in Appendix B.

Word	Participant's spelling	Total number of graphemes in word	Number of graphemes correct
D/o/g	<i>Bog</i>	3	2
R/u/g	<i>Rag</i>	3	2
B/a/nn/ed	<i>bat</i>	4	2
H/a/pp/y	<i>happe</i>	4	3
M/i/dd/le	<i>midw</i>	4	2
T/r/u/ck	<i>thak</i>	4	1
S/p/l/a/sh	<i>Spash</i>	5	4
Total:		<u>27</u>	<u>16</u>

Figure 3: Example of accuracy of sound scoring system.

2.6 Pre and post behavioural and observational measures

After all pre-tests were completed, the participants' classroom teachers completed the novel SDQ (full description of this measure is included below) regarding the student(s)' classroom behaviour (since the start of the school year), as well as the Classroom Problem Behaviour Index teacher questionnaire (Sebti et al., 2000). The students were then observed to gather a baseline behaviour level using the Classroom Problem Behaviour Index (full description of this instrument is included below; Sebti et al., 2000). Students were observed by the first author during the week prior and the week following the twelve week intervention period in their classroom for exactly twenty minutes during the morning period before interval (at a time that was convenient for both the classroom teacher and student).

After the pre-test survey data was collected for each student, four students with abnormal total difficulties scores on the novel SDQ were identified as case study participants. The students' literacy teacher was then given a survey regarding the student's cooperation,

activity, confidence, carefulness, response to difficult tasks, overall behaviour, and any changes in behaviour during literacy sessions (See Appendix C).

Teachers were also given a post-test survey which consisted of the same questions from the Classroom Problem Behaviour Index teacher questionnaire. At post-test, however, they were asked to rate the recurrence of such incidents in the classroom at the current point in time. An additional question (“What changes (if any) have you noticed in the student’s behaviour over the course of the Agility with Sound intervention”) was also included.

2.6.1 The Novel Strengths and Difficulties Questionnaire (SDQ) – Informant-rated

The novel SDQ is a brief, behavioural screening questionnaire that assesses the psychological adjustment of children and youth, and covers behaviours, emotions, and relationships. The novel SDQ is appropriate for individuals aged 4 to 16 years old. The novel SDQ focuses on strengths in addition to difficulties, has a wide coverage of inattention, peer relationships, and prosocial behaviour, has only one form that is suitable for both parents and teachers, and is shorter in style to other SDQ formats (Goodman, 1997).

The questionnaire includes 25 items (statements) including both positive and negative attributes. To complete the novel SDQ, the informant read each statement and responded using a 3-point Likert scale (‘not true’, ‘somewhat true’, or ‘certainly true’) to indicate the amount to which each statement applied to the target student. The 25 items are divided into five scales (emotional symptoms, conduct problems, hyperactivity, peer problems, and pro-social behaviour). A total difficulties score was generated by summing the scores from all subscales (with the exception of the pro-social scale) with scores ranging from 0 to 40, and the total difficulties score being classified as normal (0 to 11), borderline (12 to 15), or abnormal (16 to 40; Goodman, 2001).

2.6.2 Classroom Problem Behaviour Index (CPBI)

The Classroom Problem Behaviour Index (used by the first author) is an observation schedule for use in measuring students' problem behaviours in the classroom setting. The schedule used in the current study was adapted from an existing behaviour schedule used in Kuwait (Sebti et al., 2000). The observation schedule consists of 15 events (such as "Student uses impolite language in the classroom" or "Does not follow the teacher's instructions"). The observer notes the frequency of each event on the observation schedule over a specified period of time. A total observation score was recorded by adding the occurrence of each event.

The observation schedule was accompanied by a teacher questionnaire that was given to the student's teacher to complete and return. The teacher questionnaire contained the same 15 events as the observation schedule and asked the teacher about the frequency of each event over the school year using a 3-point Likert scale (1=Often, 2=Sometimes, 3=Never). Two additional questions regarding the students' improper conducts in class that bother the teacher, and the student's manners were also included in the pre-test and one additional question regarding any changes noticed in the student's behaviour was included in the post-test. A raw score out of 2 (often =2, sometimes=1, never=0) for each event was collected to gain a total score out of 30, and qualitative data from the additional questions was collected for analysis.

2.6.3 The Literacy Teacher Survey

The Literacy Teacher Survey was developed by the first author to gather additional behavioural information on four case study students who were identified as having abnormal total difficulties scores on the novel SDQ as informed by their teachers.

The survey consisted of eight questions and was completed by the student's literacy teacher (i.e., the teacher who conducted the intervention sessions with the students). Six of the questions were adapted from the WJ III DRB observation checklist (which asked the literacy teacher about the students' cooperation, activity, confidence, carefulness, and response to difficult tasks) as well as two additional questions that asked the literacy teacher about the students' overall behaviour during literacy sessions and about any noticeable changes in the student's behaviour over the course of participation in the research intervention.

The first six questions asked the literacy teacher to respond by circling the letter for each question that they believed best applied to the student (For example, a) Appears confident and self-assured b) Appears at ease and comfortable (typical for age) c) Appears tense or worried at times or d) Appears overly anxious). Questions 7 and 8 were open-ended with a blank space left for responding (A copy of the literacy teacher survey is presented in Appendix C).

The novel SDQ, CPBI, and Literacy Teacher Survey were all used to examine changes in the student's behaviour over the intervention period. This was important given the well documented link between reading and behaviour within the literature (Hinshaw, 1992; Hirvonen, Georgiou, Lerkkanen, Aunola, & Nurmi, 2010; Knivsberg & Andreassen, 2008; Willcutt & Pennington, 2000 etc.) For example, Hirvonen et al. (2010) have demonstrated that task-focused behaviour is a significant predictor of later spelling and reading comprehension skills.

2.7 Intervention

The interventions that were utilised across the two schools were based on the Agility with Sound reading intervention, which was developed by Betsy Sewell as a complete reading programme for primary school children who have difficulties with reading and spelling. Given that the intervention content and delivery differed across the two school contexts (as discussed in section 2.3), it is important that the interventions utilised across schools are seen as distinct. A full description of the content and delivery of the research interventions across the two schools is provided later in this section. The reading content in the intervention is not based on common and/or high frequency words, but instead on common sounds and patterns found in English. The original intervention was written specifically for children who have had difficulty learning to read by the usual route (including children diagnosed with a specific learning disorder). The intervention covers phonological awareness with a specific focus on two components; analysing the sounds in words and blending those sounds. The intervention also targets vocabulary development and comprehension. There are eight levels of the intervention, each of which is highly structured and sequenced. Children are encouraged to participate in the intervention for 10 to 15 minutes, three times a week until they have reached a level appropriate for withdrawal from the intervention as determined by the teacher aide.

The intervention process begins with a simple diagnostic test which has been designed to establish the child's baseline reading level and intervention needs. The test thus pinpoints the student's starting point in the intervention and what aspects the programme needs to place particular emphasis on for the child.

Level 1: Firstly, at the most basic level of the intervention, children are taught to find the sounds in simple three letter words (two consonants and one vowel, such as cat or hot) using the grapheme tiles (small tiles printed with different graphemes which are colour-

coded, red for vowels and green for consonants). Next, the child is introduced to the common rime patterns of these words such as changing cat to bat. The child practices this skill at this level until they are able to complete the patterns presented to them with minimal error, and know how to read these words as competent readers would.

Level 2: As children progress, sounds and patterns are introduced one at a time. At level two of the intervention, th, sh, and ch are introduced (such as that, shot, and much), then the common suffixes ing, ed, er, and y which are attached to three letter words (such as running, ripped, funny, and copper).

Level 3: At the third level of intervention, the word endings, ay, ck, le, ll, en, and et are introduced and included in words (such as well and kitten).

Level 4: At the fourth level of the intervention, the initial blends ng, ar, ow, and y are introduced and included in words (such as try and star).

Level 5: At the fifth level of the intervention, final blends, r-controlled vowels, and triple initial blends (such as spr) are introduced.

It is important to note that (with the exception of the vowels listed above), all reading in levels 1 to 5 include words with short vowels only as well as 15 sight words (such as said and what).

Level 6: At the sixth level of the intervention, basic long-vowels using a silent pattern (such as ee and ea) are introduced and included in words (such as hear and seem).

Level 7: At the seventh level of intervention, all other common vowel structures and prefixes are introduced.

Level 8: At the final level of intervention, suffixes, and Latin and Greek consonants and vowels are introduced.

At all levels of Agility with Sound, stories are used to practice and consolidate the skills learned, as well as enhance the students' comprehension skills (See Appendix D). The

first stories in the intervention are predominantly made up of three letter words (employing the patterns children have already learnt). Blends are added in, then more complex structures which are followed by more complex vowel sounds, minor patterns (such as 'ea' making 'e' in bread), patterns of prefixes and suffixes and other patterns that 'typically' developing readers absorb comparatively easily, but in a step by step process with one pattern at a time. The stories are original, and are on themes and of a length that is age-appropriate. Some unfamiliar vocabulary may be included in the stories (such as 'dapper'). The stories in the intervention are suitable for children seven years or older. There are 77 stories in total as part of the intervention and stories are given to the children's teachers for use in the regular classroom. To aid the intervention process, every story is scripted with suggestions for comprehension prompts and modelling for the teacher or teacher aide.

In Agility with Sound, children read words to build a mental image (as opposed to the other way round). Each story is printed off on A4 paper in book fold format which becomes the child's own. Illustrations are incorporated only where they are necessary to understand the text, however, most books have no illustrations. To ensure children are using appropriate comprehension strategies, there are spaces for children to provide a specified illustration throughout the stories. Children must monitor their understanding, summarise, and make inferences of the text to illustrate the stories. Each book will generally include some vocabulary that is unfamiliar to the children but is incorporated in such a way so as to help children figure out the approximate meaning of the word. Some of the stories are incomplete and ask children to write an appropriate ending. Other exercises and games were also utilised at each level to support learning. These activities include onset-rime cards and 'sliders' (see Appendix E).

Agility with Sound was used and incorporated differently at each of the schools in the current study. At School 1, the research intervention was introduced in Term 2 (May 2013)

and implemented as a small-group (six students) withdrawal intervention programme by two teacher aides, with students attending four sessions each week for 1 hour per session. Agility with Sound activities were incorporated within a variety of other literacy activities and each day was structured differently with different activities.

At School 2, the intervention was introduced in Term 3 (July 2013) and implemented as an individual withdrawal programme by one literacy teacher, with students attending three sessions each week for 30 minutes. Agility with Sound activities were used as the primary intervention activities and each literacy session was highly structured, as outlined in the description of Agility with Sound in the above section.

2.7.1 School 1 intervention sessions

At School 1, the intervention programme was often run differently on a day to day basis, with different activities employed and in a different order. A typical session often, however, included students arriving at the literacy room and sitting at the front of the classroom to receive stickers on a sticker chart for activities completed during the previous session and for good behaviours (e.g. asking questions by putting up their hand and sitting on their chair while waiting for the session to begin). The students would then sometimes complete an individual spelling test (out of 20) and then hand the test back to the teacher before receiving the next week's spelling lists (which comprised words from the essential spelling list). The beginning of the session thus deviated from the Agility with Sound intervention and had a focus on high-frequency, rather than phonetically regular, items. The students were then divided into four groups and completed three activities in order with that group, with one group involved in free time (in which the student could complete learning activities of their choosing). Activities from the Agility with Sound programme included onset-rime cards, which are used to help students think of words as a series of known parts,

and requires students to read all the words on a onset-rime sheet that rhyme (e.g. cat, bat, hat) while ignoring others. Once students are able to complete the cards with relative accuracy, they are timed to measure their speed. Another activity consisted of phonological awareness exercises (such as ‘Mystery words’ where the sounds of a word are placed upside down and the sounds are shown one at a time. At the end of each syllable the child is asked what they have so far and only says the full word at the end. When children are competently able to complete this activity, they complete the same activity but begin with the rime, which were alternated each week. The rest of the lesson involved activities that did not derive from ‘Agility with Sound’ (e.g. online computer activities, spelling etc). All participants attended the majority of the intervention sessions (with the exception of Participant 1 who spent two weeks in respite care).

2.7.2 School 2 intervention sessions

At School 2 a typical session comprised a structured lesson involving listening to sounds in big words (which involved the student using grapheme tiles to sound out words), phonological substitution work (in which the student was asked to substitute one or more of the grapheme tiles to create new words e.g. change bad into band), onset-rime card reading and book reading (which consisted of reading stories developed as part of the Agility with Sound programme, and illustrating the stories when prompted to show understanding). Other activities are also included when time permits such as the ‘Sliders’, which are used in combination with the onset-rime sheets and require the teacher to hold one side of the slider card still while moving the other to create new combinations of words. The student is asked to say the word out loud as well as indicate if the combination is a real word or not. Head-tummy-tail cards are also occasionally used to help build decoding and processing skills. A range of cards that are considered by the teacher to be at the appropriate level for the student

are chosen, then a pile of heads, tummies, and tails are made. One card from each pile is then chosen (by the teacher or student) and placed together to make a word, the student then reads out loud what the animal is called. The student is then asked to put their word into a simple sentence. When a student comes across an unfamiliar word in a story, the teacher can ask them to find a head, tummy, and tail as most of the early stories provided by Agility with Sound comprise words with this composition. Homework reading was given to the students, however, the literacy teacher reported that the students often did not complete these tasks. All participants attended the majority of the intervention sessions, with no prolonged absences from school, with the exception of Participant 9 who attended only two literacy sessions each week.

Pre- and post-test levels of the research intervention reached by each participant are presented below for School 2. Levels for School 1 cannot be presented as work for each session was chosen based on the activity not on the levels of the research intervention, therefore, a variety of material from different levels were given to each participant each day.

Table 1: Pre- and post-test levels of participants at School 2

Participant	Pre-test level	Post-test level
3	3	4
4	3	5
5	3	4
6	1	3
7	3	4
8	3	4
9	2	4
10	2	3

2.8 Reliability

To ensure the reliability of the data collected by the first author during pre- and post-test, all literacy assessment raw scores and behaviour measure raw scores were verified by an

independent individual who recalculated the total sum of raw scores for over 30% of the assessment data (i.e., three participant's pre- and post-test scores). For the Experimental spelling test, all 20 words were coded by an independent individual for phoneme-grapheme matches, and the percentages of phoneme-grapheme matches were calculated. There was initial inter-rater reliability of 90%, however, differences in coding between the first author and the independent researcher were discussed until a consensus was determined.

3. Results

3.1 Individual Results

The first section of this chapter details the individual literacy and behaviour results for each participant in which raw and standard scores, as well as qualitative data are presented. A total literacy (WJ III DRB, QUIL, HAST, Experimental spelling test) and behaviour (CPBI classroom observation and teacher questionnaire) score at pre- and post-test is also presented for each participant. Case study participants' data is discussed within their individual results. The second section presents group results for literacy and behaviour and for the correlation between changes in literacy and changes in classroom behaviour.

Standard Error of Measures (SEMs) were used to establish if standard score changes were clinically significant or substantial. This was calculated by adding the SEM for Form A on each subtest to the pre-test score, thus establishing the 'highest possible score' at pre-test, and then, subtracting the SEM for Form B on each subtest to the post-test score, thus establishing the 'lowest possible score' at post-test. Should the post-test standard score not overlap the range of possible scores, a clinically significant or substantial change was present (Apel, 2001).

Participant 1

Participant 1 showed improvements in raw scores on all of the reading measures. All standard post assessment scores, however, remained below the expected performance for Participant 1's age. Participant 1's post-test score did not overlap the SEMs for the Letter-word Identification or the Word Attack subtest indicating a clinically significant change from pre- to post-test within these domains. Participant 1's post-test score did, however, overlap the SEMs for the Passage Comprehension subtest indicating that there was not a clinically significant change from pre- to post-test.

Table 2: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 1.

Subtest	Pre-test	Post-test
Letter-word Identification	29(7)	33(77)
Passage Comprehension	16(76)	17(77)
Word Attack	4(75)	6(82)

Note: scores in brackets represent student's standard scores.

At pre-test, on the Phoneme Detection subtest, Participant 1 demonstrated knowledge of the end sounds in words, whereas at post-test Participant 1 also demonstrated knowledge of both first and end sounds. On the Spoonerism and Phoneme Detection subtests, Participant 1 remained below the expected range of performance for their age following the intervention. As shown in Table 2, on the Phoneme Segmentation subtest, Participant 1 demonstrated an increase in raw score and standard score, locating her post-assessment score in the expected range of performance. Participant 1's Phoneme Deletion subtest raw score and standard score remained below the expected range of performance. However, descriptive

analysis revealed that an increase in deletion of sounds that were part of a blend were demonstrated in the post-assessment performance.

Table 3: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 1.

Subtest	Pre-test	Post-test
Spoonerisms	0(3)	0(3)
Phoneme Detection	3(3)	5(3)
Phoneme Segmentation	1(3)	6(9)
Phoneme Deletion	3(3)	1(1)

Note: scores in brackets represent student's standard scores.

For spelling, Participant 1 increased 6 months in spelling age on the HAST, during the intervention period. However, at aged 9, this remains below the expected spelling age for Participant 1. Participant 1 also demonstrated an increase in spelling of regular (15/24 to 21/27) and irregular (2/3 to 3/7) words on the HAST. She continued to misuse vowels in spelling words (e.g. spelling 'waf' instead of 'with', and 'bags' instead of 'bugs') in the post-assessment.

On the Experimental spelling test, Participant 1 demonstrated an improvement in the accuracy of sounds in the experimental spelling test, increasing from 48% to 67% from pre- to post-test. In parallel with the phoneme detection data presented above, Participant 1 demonstrated enhancement in the spelling of end sounds (e.g. at pre-test spelling 'band' as 'bat' and at post-test as 'band', and at pre-test spelling 'happy' as 'happe' and at post-test as 'happy').

Table 4: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 1.

Test	Pre-test	Post-test
HAST	17	24
Experimental spelling	1	3

At pre-testing on the SDQ, Participant 1's scores were consistent with the pre-test classroom observation, in which 10 observations of classroom problem behaviours were observed, including not following the teacher's instructions (n=2), fidgeting (n=2), arguing verbally with a peer (n=2), and annoying other students so that they cannot perform their duties (n=4). Prior to the intervention period, Participant 1 showed a raw score of 9 on the CPBI teacher questionnaire and the classroom teacher also noted that, prior to the intervention period, Participant 1 "can lie sometimes to get others in trouble" and has "small arguments with peers".

Table 5: Raw scores for the Strengths and Difficulties Questionnaire for Participant 1.

Scale	Score at Pre-test
Emotional Systems	0
Conduct Problems	2
Hyperactivity	6*
Peer Problems	5**
Prosocial	9
Total Difficulties	13*

*Borderline score

**Abnormal score

At post-testing, Participant 1 demonstrated a decrease in observations of problem behaviours in the classroom, with only 2 observations of classroom problem behaviours made, including observations of being more interested in stimuli outside the classroom (n=2). Subsequent to the intervention period, Participant 1 showed a decreased raw score of 6 on the CPBI teacher questionnaire, however, the classroom teacher also noted that over the course of the intervention, she had not noticed “a great change” in Participant 1’s classroom behaviour but that “she is wandering around the room less which is good”.

Figure 4, demonstrates that while Participant 1’s reading, spelling, and phonological awareness scores increased from pre- to post-test, her classroom and teacher reported behaviour decreased.

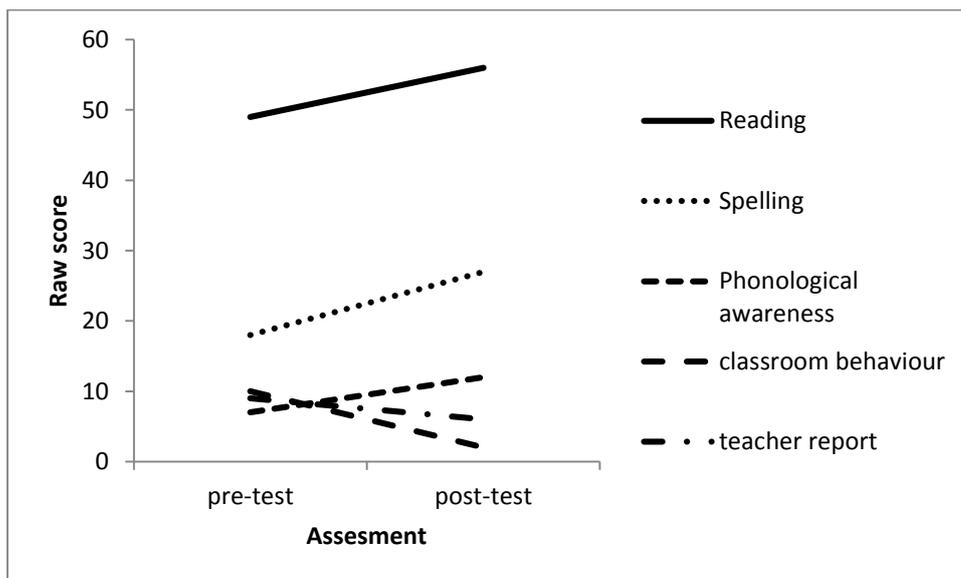


Figure 4: Participant 1’s total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.

Participant 2

On the Letter-word Identification subtest, Participant 2's score moved into the expected range of performance for her age. On the Passage Comprehension subtest her score remained below the expected range of performance. Although a decrease in standard score was identified for the Word Attack subtest, Participant 2's score remained within the expected range of performance for her age. Participant 2's post-test score did not overlap the SEMs for the Letter-word Identification subtest indicating a clinically significant change from pre- to post-test. Participant 2's post-test score did, however, overlap the SEMs for the Passage Comprehension and Word Attack subtests indicating that there was not a clinically significant change from pre- to post-test.

Table 6: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 2.

Subtest	Pre-test	Post-test
Letter-word Identification	28(81)	36(90)
Passage Comprehension	16(84)	17(84)
Word Attack	12(98)	12(97)

Note: scores in brackets represent student's standard scores.

As shown in Table 7, on the QUIL, Participant 2 demonstrated a decrease in raw and standard score on the Spoonerism subtest, while remaining below the expected range of performance for her age. On the Phoneme Detection subtest, Participant 2's score also remained below the expected range of performance. However, Participant 2 showed an increase in detection of first, end, and middle sounds on the Phoneme Detection subtest from pre- to post-test. On the Phoneme Segmentation and Phoneme Deletion subtests, Participant

2's scores remained within the expected range of performance. Participant 2 also demonstrated an increase in deletion of single phonemes and parts of a blend from pre- to post-test.

Table 7: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 2.

Subtest	Pre-test	Post-test
Spoonerisms	1(5)	0(4)
Phoneme Detection	2(3)	5(5)
Phoneme Segmentation	7(8)	11(9)
Phoneme Deletion	5(8)	7(10)

Note: scores in brackets represent student's standard scores.

For spelling, Participant 2 demonstrated a 3 month increase in spelling age from 7.3 to 7.6 years over the 12 week intervention period (which, at aged 8 fell below Participant 2's expected age of spelling). Participant 2, also demonstrated an increase in spelling of regular (31/35 to 34/36) words on the HAST. In line with this participant's improved performance on the phoneme detection subtest, she demonstrated an increase in spelling of middle and end sounds (e.g. at pre-test spelling 'eat' as 'eta' and at post-test as 'eat', at pre-test spelling 'next' as 'nxt' and at post-test as 'next', and at pre-test spelling 'there' as 'ther' and at post-test as 'there'). On the Experimental spelling test, Participant 2 showed an increase in accuracy of sound score (87% to 95%). Parallel to the Phoneme Detection subtest and the HAST, Participant 2 demonstrated an increase in spelling of first, middle, and end sounds from pre- to post-test.

Table 8: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 2.

Test	Pre-test	Post-test
HAST	38	41
Experimental spelling	10	8

At pre-testing on the SDQ, Participant 2's scores were consistent with the pre-test classroom observation, in which no observations of classroom problem behaviours were made. Prior to the intervention period, Participant 2 showed a raw score of 0 on the CPBI teacher questionnaire. No comment was made by the teacher regarding the student's improper conducts or overall classroom behaviour prior to the intervention period.

Table 9: Raw scores for the Strengths and Difficulties Questionnaire for Participant 2.

Scale	Score at Pre-test
Emotional Systems	5*
Conduct Problems	2
Hyperactivity	2
Peer Problems	2
Prosocial	7
Total Difficulties	11

*Borderline score

**Abnormal score

At post-testing, Participant 2 demonstrated an increase in observations of problem behaviours in the classroom (n=2), with observations of 'student speaks without permission' (n=1) and 'squirms in seat' (n=1) made. Subsequent to the intervention period, Participant 2

showed an increased raw score of 4 on the CPBI teacher questionnaire, and again no comment was made regarding any changes in the student’s classroom behaviour over the course of the intervention.

Figure 5 demonstrates that Participant 2’s reading, spelling, and phonological awareness scores, as well as their classroom behaviour and teacher reported behaviour increased from pre- to post-test.

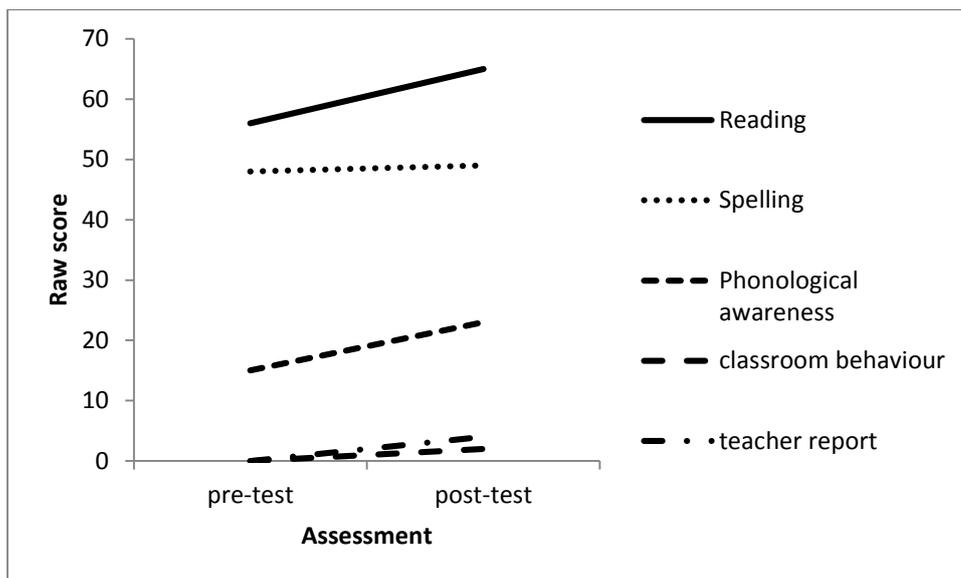


Figure 5: Participant 2’s total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.

Participant 3

As shown in Table 10, Participant 3 demonstrated an increase in raw and standard score on the Letter-word Identification and Passage Comprehension subtests of the WJ III DRB, remaining within the expected range of performance for the participant’s age. On the Word Attack subtest Participant 3’s score remained within the expected range of performance. Participant 3’s post-test score did not overlap the SEMs for the Letter-word

Identification subtest indicating a clinically significant change from pre- to post-test. Participant 3's post-test score did, however, overlap the SEMs for the Passage Comprehension and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test within these domains.

Table 10: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 3.

Subtest	Pre-test	Post-test
Letter-word Identification	52(92)	57(98)
Passage Comprehension	30(93)	31(94)
Word Attack	19(93)	18(92)

Note: scores in brackets represent student's standard scores.

On the QUIL, Participant 3 demonstrated no change in detection of first, end, last, or middle sounds. Participant 3 demonstrated an increase in deletion of parts of a blend. All standard scores on the QUIL, however, remained below the expected range of performance for Participant 3's age.

Table 11: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 3.

Subtest	Pre-test	Post-test
Spoonerisms	19(2)	19(2)
Phoneme Detection	8(4)	8(4)
Phoneme Segmentation	4(4)	3(3)
Phoneme Deletion	6(4)	7(6)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 3 demonstrated an increase in spelling age of 9 months over the intervention period (9.3 to 10 years). Participant 3’s spelling age, however, remained two years below the expected age of reading. An increase in spelling of regular words from pre- to post-test was also demonstrated (39/48 to 47/54). A decrease in spelling irregular words from pre- to post-test was demonstrated (21/22 to 20/23). Contrary to scores on the Phoneme Detection subtest, Participant 3 demonstrated an increase in spelling of end sounds (e.g. at pre-test spelling ‘prey’ as ‘prie’ and at post-test as ‘prey’, at pre-test spelling ‘crack’ as ‘crake’ and at post-test as ‘crack’, and at pre-test spelling ‘bamboo’ as ‘bambo’ and at post-test as ‘bamboo’).

On the Experimental spelling test, Participant 3 showed an increase in accuracy of sounds score (85% to 90%). An increase in spelling of taught words (67% to 75%) and untaught words (13% to 25%) was also shown. Similar to the HAST, Participant 3 demonstrated an increase in the spelling of middle and end sounds (e.g. at pre-test spelling ‘truck’ as ‘turck’ and at post-test as ‘truck’, at pre-test spelling ‘gift’ as ‘gifit’ and at post-test as ‘gift’, and at pre-test spelling ‘splash’ as ‘spalth’ and at post-test as ‘splash’).

Table 12: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 3.

Test	Pre-test	Post-test
HAST	60	67
Experimental spelling	8	13

Based on the SDQ results, Participant 3 was selected as a case study participant and additional information was collected from her literacy teacher. Participant 3’s literacy teacher described her cooperation, level of activity, level of attention and concentration, and level of

confidence during literacy sessions as typical for her age. The literacy teacher, however, reported for her care in responding that at times Participant 3 responded too quickly. It was also reported that in response to difficult tasks, she showed a noticeably increased level of effort. Her literacy teacher described her overall behaviour during the literacy sessions as “Positive, chatty, and confident”, and in response to any changes in the student’s behaviour over the course of the intervention noted that she is “more confident and enjoys one-on-one”.

At pre-testing, on the SDQ, Participant 3’s scores were consistent with the pre-test classroom observation, in which 33 problem classroom behaviours were observed, including observations of speaking without permission (n=2), moving from place without permission (n=2), not following the teacher’s instructions (n=1), annoying other students so that they cannot perform their duties (n=2), argues (verbal) in the classroom (n=2), looks away when being spoken to (n=1), squirms in seat (n=7), makes sound (n=2), fidgeting (n=10), and more interested in stimuli outside the classroom (n=4). Prior to the intervention period, Participant 3 showed a raw score of 14 on the CPBI teacher questionnaire, and the classroom teacher also noted that prior to the intervention period, Participant 3 “Doesn't get involved, worries about what others are doing, has loud outbursts/over the top responses to others.” and is “Very respectful to teachers/adults, childish in her relations and reactions with peers in her age group, and great with younger students”.

Table 13: Raw scores for the Strengths and Difficulties Questionnaire for Participant 3.

Scale	Score at Pre-test
Emotional Systems	4
Conduct Problems	2
Hyperactivity	4
Peer Problems	7**
Prosocial	9
Total Difficulties	17**

*Borderline score

**Abnormal score

At post-testing, Participant 3 demonstrated a decrease in observations of problem behaviours in the classroom (n=17), with observations of not following instructions (n=1), wanders in classroom instead of performing duties (n=2), annoys other students so that they cannot perform their duties (n=5), argues (verbal) in the classroom (n=1), fidgeting (n=3), and being more interested in stimuli outside the classroom (n=5) made. Subsequent to the intervention period, Participant 3 showed a decreased raw score of 13 on the CPBI teacher questionnaire, and the classroom teacher also noted that over the course of the intervention, Participant 3 was “More confident in their own ability with writing/spelling”.

Figure 6, demonstrates that Participant 3’s reading and spelling scores increased from pre- to post-test, however, phonological awareness scores showed no change. A decrease in classroom and teacher reported behaviour was also demonstrated.

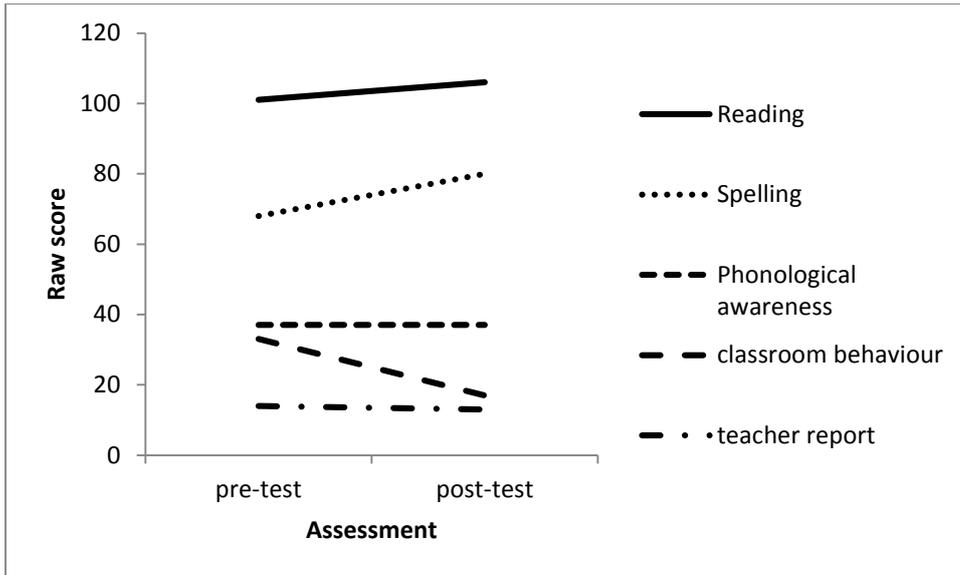


Figure 6: Participant 3’s total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.

Participant 4

As shown in Table 14, Participant 4 demonstrated an increase in raw score on all three of the WJ III DRB subtests. Participant 4’s score on the Letter-word Identification subtest remained below the expected range of performance for the student’s age. Participant 4’s scores on the Passage Comprehension and the Word Attack subtests both moved into the expected range of performance for the student’s age. Participant 4’s post-test score did not overlap the SEMs for the Passage Comprehension subtest indicating a clinically significant change from pre- to post-test. Participant 4’s post-test score did, however, overlap the SEMs for the Letter-word Identification and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test.

Table 14: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 4.

Subtest	Pre-test	Post-test
Letter-word Identification	42(80)	44(83)
Passage Comprehension	19(69)	27(87)
Word Attack	9(82)	11(85)

Note: scores in brackets represent student's standard scores.

On the QUIL, Participant 4's scores on the Spoonerism and Phoneme Detection subtests moved into the expected range of performance for the student's age from pre- to post-test. An increase in detection of first, last, and middle sounds was also shown. On the Phoneme Segmentation and Phoneme Deletion subtests, Participant 4's scores remained within the expected range of performance for the student's age. An increase in deletion of parts of a blend was also demonstrated.

Table 15: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 4.

Subtest	Pre-test	Post-test
Spoonerisms	5(3)	16(9)
Phoneme Detection	4(3)	9(7)
Phoneme Segmentation	6(8)	6(8)
Phoneme Deletion	7(7)	9(11)

Note: scores in brackets represent student's standard scores.

Participant 4 showed an increase in spelling age of 6 months over the intervention period (7.6 to 8 years). Participant 4's spelling age, however, remained almost three years

behind their expected spelling age. An increase in spelling of regular (33/36 to 34/41) and irregular (9/16 to 13/16) words was demonstrated, and similarly to scores on the Phoneme Detection subtest, Participant 4 showed an increase in spelling of middle sounds (e.g. at pre-test spelling ‘arm’ as ‘amr’ and at post-test as ‘arm’, and at pre-test spelling ‘people’ as ‘pepole’ and at post-test as ‘people’). On the Experimental spelling test, Participant 4 showed an increase in accuracy of sound score of 92% to 94%. Participant 4 also showed an increase in spelling of taught words (50% to 53%) but a decrease in spelling of untaught words (13% to 0%) between pre- and post-test. As demonstrated on the Phoneme Detection subtest and the HAST, Participant 4 showed an increase in spelling of middle sounds (e.g. at pre-test spelling ‘happy’ as ‘hapy’ and at post-test as ‘happy’, and at pre-test spelling ‘middle’ as ‘midle’ and at post-test as ‘middle’).

Table 16: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 4.

Test	Pre-test	Post-test
HAST	42	47
Experimental spelling	7	9

At pre-testing on the SDQ, Participant 4’s scores were consistent with the pre-test classroom observation, in which observations of 14 classroom problem behaviours were made, including not following the teacher’s instructions (n=1), annoying other students so that they cannot perform their duties (n=1), squirms in seat (n=3), fidgeting (n=5), and more interested in stimuli outside the classroom (n=4). Prior to the intervention period, Participant 4 showed a raw score of 13 on the CPBI teacher questionnaire and the classroom teacher also noted, prior to the intervention period, that Participant 4 “Finds following instructions

challenging and can spend a long time sitting”. The classroom teacher also stated that his overall behaviour is “lovely, and he works hard to complete work that he is familiar with.”

Table 17: Raw scores for the Strengths and Difficulties Questionnaire for Participant 4.

Scale	Score at Pre-test
Emotional Systems	1
Conduct Problems	1
Hyperactivity	6*
Peer Problems	0
Prosocial	10
Total Difficulties	8

*Borderline score

**Abnormal score

At post-testing, Participant 4 demonstrated a decrease in observations of problem behaviours in the classroom, with only 6 observations of classroom problem behaviour, including observations of wandering inside the classroom instead of performing duties (n=2), annoys other students so that they cannot perform their duties (n=2), student makes sound (n=1), and more interested in stimuli outside the classroom (n=1). Subsequent to the intervention period, Participant 4 also showed a decreased raw score of 8 on the CPBI teacher questionnaire. However, the classroom teacher also noted that over the course of the intervention, she had noticed “No change”, also that he “works well when supported by someone other than his friends, has a great attitude toward learning, is often distracted but is aware of this.”

Figure 7, demonstrates that Participant 4's reading, spelling, and phonological awareness scores increased from pre- to post-test, and that their classroom and teacher reported behaviour decreased.

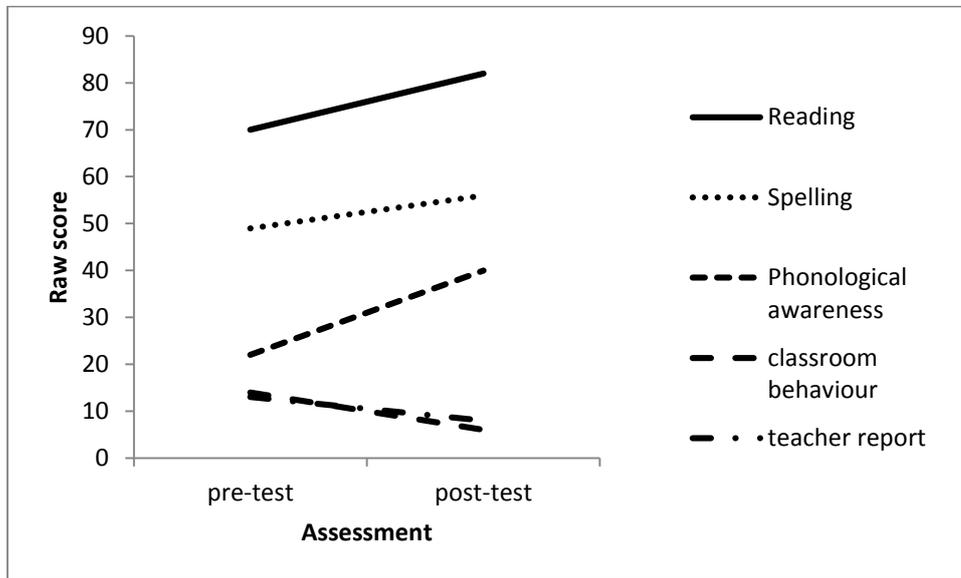


Figure 7: Participant 4's total raw score for reading, spelling, phonological awareness, classroom behaviour, and teacher reported behaviour at pre- and post-test.

Participant 5

On the WJ III DRB, Participant 5's scores on the Letter-word Identification and Passage Comprehension subtests remained below the expected range of performance for the student's age. Participant 5's score on the Word Attack subtest remained within the expected range of performance for their age from pre- to post-test. Participant 5's post-test score overlapped the SEMs for the Letter-word Identification, Passage Comprehension, and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test in any reading measure.

Table 18: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 5.

Subtest	Pre-test	Post-test
Letter-word Identification	31(70)	33(71)
Passage Comprehension	13(62)	7(44)
Word Attack	10(87)	10(86)

Note: scores in brackets represent student's standard scores.

As shown in Table 19, on the QUIL, Participant 5 showed a significant decrease in raw and standard score on the Spoonerism subtest, moving their score from within the expected range of performance for their age to below. The decrease in scores, however, was possibly due to the fact that he chose not to respond, saying “I don’t know” to all questions on the post-test. On the Phoneme Detection subtest, Participant 5’s score remained below the expected range of performance for their age. Participant 5 did, however, show an increase in detection of first and last sounds. On the Phoneme Segmentation subtest, Participant 5’s score remained within the expected range of performance for his age. On the Phoneme Deletion subtest, Participant 5’s score moved from within the expected range of performance for his age to below.

Table 19: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 5.

Subtest	Pre-test	Post-test
Spoonerisms	13(7)	0(0)
Phoneme Detection	6(3)	4(3)
Phoneme Segmentation	8(11)	8(11)
Phoneme Deletion	7(8)	6(6)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 5 showed a one month increase in spelling age (6.5 to 6.6 years) remaining three and a half years below the expected spelling age for the student. Participant 5 demonstrated an increase in spelling of regular (22/27 to 26/31) and irregular (2/7 to 3/8) words, and contrary to scores on the Phoneme Deletion subtest, showed an increase in spelling of middle sounds (e.g. at pre-test spelling 'pump' as 'pup' and at post-test as 'pamp', and at pre-test spelling the 'next' as 'nest' and at post-test as 'next'). On the Experimental spelling test an increase in accuracy of sound score (71% to 77%) was demonstrated. Participant 5 also showed an increase in spelling of taught words (17% to 38%), however, a decrease in spelling of untaught words (13% to 0%) was shown. In line with the data reported from the Phoneme Detection subtest, Participant 5 showed an increase in spelling of last sounds (e.g. at pre-test spelling 'gift' as 'gife' and at post-test as 'gift', and at pre-test spelling 'them' as 'then' and at post-test as 'them').

Table 20: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 5.

Test	Pre-test	Post-test
HAST	24	29
Experimental spelling	3	6

No behaviour results were collected for Participant 5. Participant 5’s teacher did not provide consent for participation in the research.

Figure 8, demonstrates that while Participant 5’s spelling score, increased from pre- to post-test, their reading and phonological awareness scores decreased indicating a mixed response to the research intervention which may have been influenced by the participant’s lack of engagement in parts of the post-test assessment.

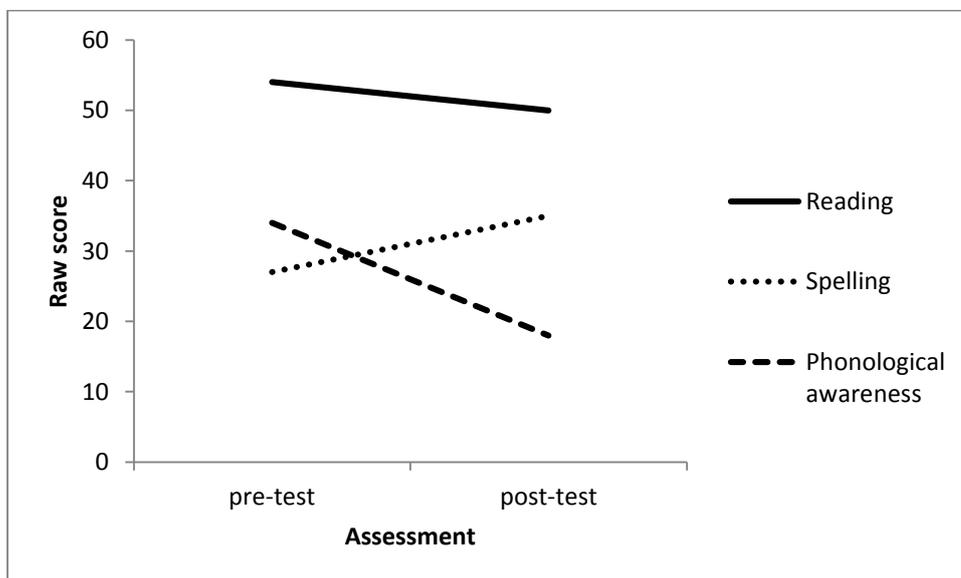


Figure 8: Participant 5’s total raw score for reading, spelling, and phonological awareness, at pre- and post-test.

Participant 6

On the WJ III DRB, Participant 6's scores on the Letter-word Identification, Passage Comprehension, and Word Attack subtests, remained below the expected range of performance for the student's age. Participant 6's post-test scores overlapped the SEMs for the Letter-word Identification, the Passage Comprehension, and the Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test for any reading measure over the intervention period.

Table 21: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 6.

Subtest	Pre-test	Post-test
Letter-word Identification	36(70)	39(74)
Passage Comprehension	21(74)	22(75)
Word Attack	7(78)	7(75)

Note: scores in brackets represent student's standard scores.

On the QUIL Spoonerism and Phoneme Detection subtests, Participant 6's scores moved into the expected range of performance for the student's age. Participant 6 demonstrated an increase in detection of middle sounds from pre-to post-test. On the Phoneme Segmentation subtest, Participant 6's score remained within the expected range of performance for the student's age. On the Phoneme Deletion subtest, Participant 6's score remained below the expected range of performance for the student's age.

Table 22: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 6.

Subtest	Pre-test	Post-test
Spoonerisms	11(3)	12(4)
Phoneme Detection	8(5)	10(9)
Phoneme Segmentation	6(8)	8(10)
Phoneme Deletion	6(5)	6(5)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 6 showed a two month increase in spelling age (6.3 to 6.5 years), although remained over four years below the expected spelling age at the post-test assessment. Participant 6 decreased in spelling of regular words (28/34 to 21/28) and showed no change in spelling of irregular words (8/12 to 8/11). There was a decrease shown for spelling of taught words (100% to 25%), however, an increase in spelling of untaught words (0% to 25%) was shown. Parallel to the Phoneme Detection subtest, Participant 6 showed an increase in spelling of middle sounds (e.g. at pre-test spelling 'foot' as 'frot' and at post-test as 'foot', at pre-test spelling 'eat' as 'et' and at post-test as 'eat', and at pre-test spelling 'have' as 'hevsd' and at post-test as 'have'). On the Experimental spelling test, an increase in accuracy of sound score (71% to 76%) was demonstrated. An increase in spelling of middle sounds was also demonstrated (e.g. at pre-test spelling 'happy' as 'happy' and at post-test as 'happy', and at pre-test spelling 'think' as 'firck' and at post-test as 'think').

Table 23: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 6.

Test	Pre-test	Post-test
HAST	36	29
Experimental spelling	3	5

At pre-testing on the SDQ, Participant 6's scores were consistent with the pre-test classroom observation, in which no observations of classroom problem behaviour were observed. Prior to the intervention period, Participant 6 showed a raw score of 0 on the CPBI teacher questionnaire and no comment was made by the classroom teacher regarding the student's improper conducts or overall classroom behaviour.

Table 24: Raw scores for the Strengths and Difficulties Questionnaire for Participant 6.

Scale	Score at Pre-test
Emotional Systems	0
Conduct Problems	0
Hyperactivity	0
Peer Problems	0
Prosocial	8
Total Difficulties	0

*Borderline score

**Abnormal score

At post-testing, Participant 6 demonstrated no change in raw score of observations of problem behaviours in the classroom. However, as Participant 6 showed no classroom problem behaviours at pre- or post-testing, demonstrating no change in raw score is not

problematic. Subsequent to the intervention period, Participant 6 showed no change in raw score on the CPBI teacher questionnaire (again not problematic as the raw score remained at 0). The classroom teacher also noted that, over the course of the intervention, she had noticed “No change, as he is very compliant anyway and will remind others of expectations, rules, and tasks”.

Figure 9, demonstrates that while Participant 6’s, reading and phonological scores increased from pre- to post-test, their spelling score decreased, and both classroom and teacher reported behaviour showed no change remaining at n=0.

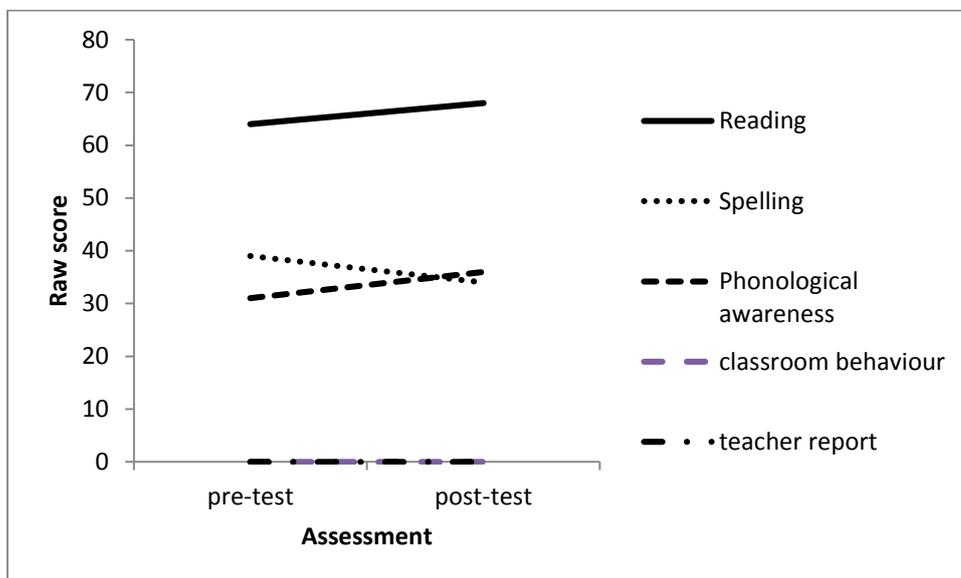


Figure 9: Participant 6’s total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.

Participant 7

On the WJ III DRB, as shown in Table 25, Participant 7 demonstrated an increase in raw and standard score on the Letter-word Identification subtest, remaining below the expected range of performance for the student’s age. On the Passage Comprehension subtest,

Participant 7's scores moved into the expected range of performance for the student's age. On the Word Attack subtest, Participant 7's score remained within the expected range of performance for the student's age. Participant 7's post-test score did not overlap the SEMs for the Passage Comprehension subtest indicating a clinically significant change from pre- to post-test. Participant 7's post-test scores did, however, overlap the SEMs for the Letter-word Identification and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test for these word level reading measures.

Table 25: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 7.

Subtest	Pre-test	Post-test
Letter-word Identification	42(76)	43(77)
Passage Comprehension	23(75)	30(91)
Word Attack	14(87)	17(90)

Note: scores in brackets represent student's standard scores.

On the QUIL, Participant 7's score on the Spoonerism subtest remained below the expected range of performance for their age. On the Phoneme Detection and Phoneme Deletion subtests, Participant 7's scores moved into the expected range of performance for the student's age. Participant 7 showed an increase in detection of first and middle sounds from pre- to post-test. On the Phoneme segmentation subtest, Participant 7's score moved from within the expected range of performance for the student's age to below. Participant 7 showed an increase in deletion of single phonemes and parts of a blend.

Table 26: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 7.

Subtest	Pre-test	Post-test
Spoonerisms	9(3)	9(3)
Phoneme Detection	8(4)	11(10)
Phoneme Segmentation	6(7)	4(4)
Phoneme Deletion	5(3)	9(11)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 7 increased in spelling age by 17 months (8.5 to 9.10 years) over the intervention period. Despite these gains, her spelling age remained almost three years below her expected spelling age at the post-test assessment. Participant 7 demonstrated an increase in spelling of regular (36/42 to 45/50) and irregular (16/20 to 20/25) words, and similar to the Phoneme Detection subtest, an increase in spelling of middle and end sounds was demonstrated (e.g. at pre-test spelling 'said' as 'seid' and at post-test as 'said'). On the Experimental spelling test, Participant 7 showed a slight decrease in accuracy of sound score (94% to 92%). A decrease in the spelling of taught words (75% to 63%) and untaught words (25% to 0%) was also demonstrated. In line with the Phoneme Detection subtest and the HAST, an increase in the spelling of middle sounds was also demonstrated on the Experimental spelling test (e.g. at pre-test spelling 'picnic' as 'picnk' and at post-test as 'picnik', and at pre-test spelling 'build' as 'buid' and at post-test as 'bulid').

Table 27: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 7.

Test	Pre-test	Post-test
HAST	52	65
Experimental spelling	11	10

At pre-testing on the SDQ, Participant 7's scores were moderately inconsistent with the pre-test classroom observation, in which 16 observations of classroom problem behaviour were observed, including moving from place without permission (n=1), not following the teacher's instructions (n=3), annoying other students so that they cannot perform their duties (n=4), looks away when being spoken to (n=3), squirms in seat (n=1), fidgeting (n=1), and more interested in stimuli outside the classroom (n=3). Prior to the intervention period, Participant 7 showed a raw score of 5 on the CPBI teacher questionnaire and the classroom teacher also noted, prior to the intervention period, that Participant 7 is "Very social" and that she "Wants to learn, however, learning is challenging and she is aware of her level which can sometimes get in the way of her motivation".

Table 28: Raw scores for the Strengths and Difficulties Questionnaire for Participant 7.

Scale	Score at Pre-test
Emotional Systems	4
Conduct Problems	2
Hyperactivity	4
Peer Problems	0
Prosocial	10
Total Difficulties	10

*Borderline score

**Abnormal score

At post-testing, Participant 7 demonstrated a decrease in observations of problem behaviours in the classroom, with only 11 observations of classroom problem behaviour being made, including observations of wandering in the classroom instead of performing duties (n=2), annoying others so that they cannot perform their duties (n=4), arguing in the classroom (n=1), squirms in seat (n=1), making sound (n=2), and fidgeting (n=1). Subsequent to the intervention period, Participant 7 showed a decreased raw score of 3 on the CPBI teacher questionnaire. However, the classroom teacher also noted that over the course of the intervention, Participant 7 showed that she “Wants to do well, but is often off task when seated with friends” the classroom teacher also noted that Participant 7 “Can get involved with other people's dramas, and her in class behaviour is better than her playground behaviour”.

Figure 10, demonstrates that while Participant 7’s reading, spelling, and phonological awareness scores increased from pre- to post-test, her observed classroom and teacher reported behaviour decreased over the intervention period.

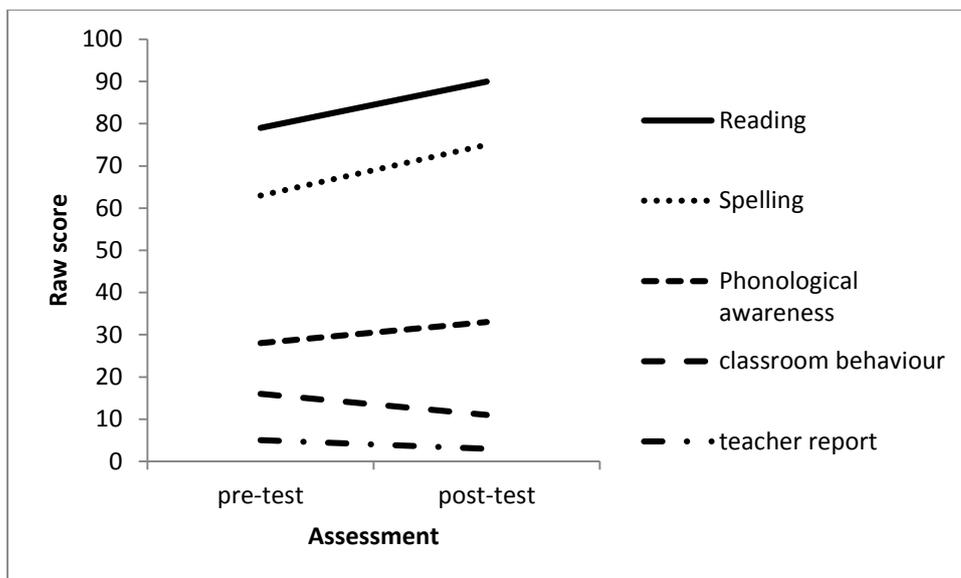


Figure 10: Participant 7’s total raw score for reading, spelling, phonological awareness, classroom and teacher reported behaviour at pre- and post-test.

Participant 8

On the WJ III DRB, Participant 8's score on the Letter-word Identification subtest remained below the expected range of performance for the student's age. Participant 8's scores on the Passage Comprehension and Word Attack subtests moved into the expected range of performance for the student's age. Participant 8's post-test scores did not overlap the SEMs for the Passage Comprehension or Word Attack subtests indicating a clinically significant change from pre- to post-test. Participant 8's post-test score did, however, overlap the SEMs for the Letter-word Identification subtest, indicating that there was not a clinically significant change from pre- to post-test for this task.

Table 29: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 8.

Subtest	Pre-test	Post-test
Letter-word Identification	41(79)	42(80)
Passage Comprehension	23(79)	26(85)
Word Attack	6(76)	14(88)

Note: scores in brackets represent student's standard scores.

On the QUIL Spoonerism and Phoneme Deletion subtests, Participant 8's scores moved into the expected range of performance for the student's age from pre- to post-test. On the Phoneme Detection and Phoneme Segmentation subtests, all scores remained within the expected range of performance for the student's age. An increase in the deletion of single phonemes and parts of a blend were also demonstrated from pre- to post-test.

Table 30: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 8.

Subtest	Pre-test	Post-test
Spoonerisms	14(6)	18(11)
Phoneme Detection	9(7)	9(7)
Phoneme Segmentation	5(7)	6(8)
Phoneme Deletion	3(3)	7(7)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 8 demonstrated an increase of seven months in spelling age (8.5 to 9 years) over the intervention period. Participant 8's spelling age, however, remained almost three years below their expected spelling age at the post-test assessment. An increase in spelling of regular (38/46 to 39/49) and irregular (14/17 to 19/22) words was shown, and contrary to scores on the Phoneme Detection subtest, an increase in the spelling of last sounds was demonstrated (e.g. at pre-test spelling 'pretty' as 'peret' and at post-test as 'preety'). On the Experimental spelling test, Participant 8 demonstrated a slight decrease in accuracy of sound score (85% to 82%). A decrease in the spelling of taught words (58% to 50%) and untaught words (38% to 25%) was also demonstrated. Contrary to scores on the Phoneme Detection subtest and the HAST, Participant 8 demonstrated an increase in the spelling of middle and end sounds (e.g. at pre-test spelling 'truck' as 'track' and at post-test as 'truck', and at pre-test spelling 'gathered' as 'gather' and at post-test as 'gathered').

Table 31: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 8.

Test	Pre-test	Post-test
HAST	52	58
Experimental spelling	10	9

Based on the SDQ results, Participant 8 was selected as a case study participant and additional information was collected from her literacy teacher. Participant 8's literacy teacher described her level of cooperation during literacy sessions as uncooperative at times, and her level of activity as fidgety and restless at times. Participant 8's level of attention and concentration, care in responding, and response to difficult tasks were reported as typical for her age. It was also noted that she appeared confident and self-assured during the literacy sessions, more than is typical for her age. Her literacy teacher described her overall behaviour during the literacy sessions as "trying to run the session" and noted that when she made mistakes she would say "I didn't say that". In response to any changes in the student's behaviour over the course of the intervention, the literacy teacher noted that her behaviour is "mood dependent".

At pre-testing on the SDQ, Participant 8's scores were consistent with the pre-test classroom observation, in which 18 observations of classroom problem behaviour were observed, including observations of the student moving from their place without permission (n=1), not following the teacher's instructions (n=1), annoying other students so that they cannot perform their duties (n=5), squirms in seat (n=1), Fidgeting (n=5), and more interested in stimuli outside the classroom (n=4). Prior to the intervention period, Participant 8 showed a raw score of 26 on the CPBI teacher questionnaire. However, the classroom teacher made

no comment regarding the participant’s improper conducts in the classroom and overall classroom behaviour.

Table 32: Raw scores for the Strengths and Difficulties Questionnaire for Participant 8.

Scale	Score at Pre-test
Emotional Systems	0
Conduct Problems	7**
Hyperactivity	10**
Peer Problems	2
Prosocial	5*
Total Difficulties	19**

*Borderline score

**Abnormal score

At post-testing, Participant 8 demonstrated a decrease in observations of problem behaviours in the classroom (n=16), with observations of not following the teacher’s instructions (n=1), wandering in the classroom instead of performing duties (n=2), annoying other students so that they cannot perform their duties (n=5), arguing (physical) in the classroom (n=1), making sound (n=2), and fidgeting (n=5) being made. Subsequent to the intervention period, Participant 8 showed a decreased raw score of 22 on the CPBI teacher questionnaire, however, the classroom teacher also noted that over the course of the intervention, Participant 8 was “very social and always has a reason/answer for her behaviour”, will “work well with strong, confident people”, however, “often dominates in friendships”. The teacher also described Participant 8 as “popular with peers, but argumentative” and “when spoken to away from others realises how her behaviour gets in the way of her learning”. The teacher also noted that these “are difficult habits to change”.

Figure 11, demonstrates that while Participant 8's, reading, spelling, phonological, and classroom observation scores increased from pre- to post-test, their teacher reported classroom behaviour decreased over the intervention period.

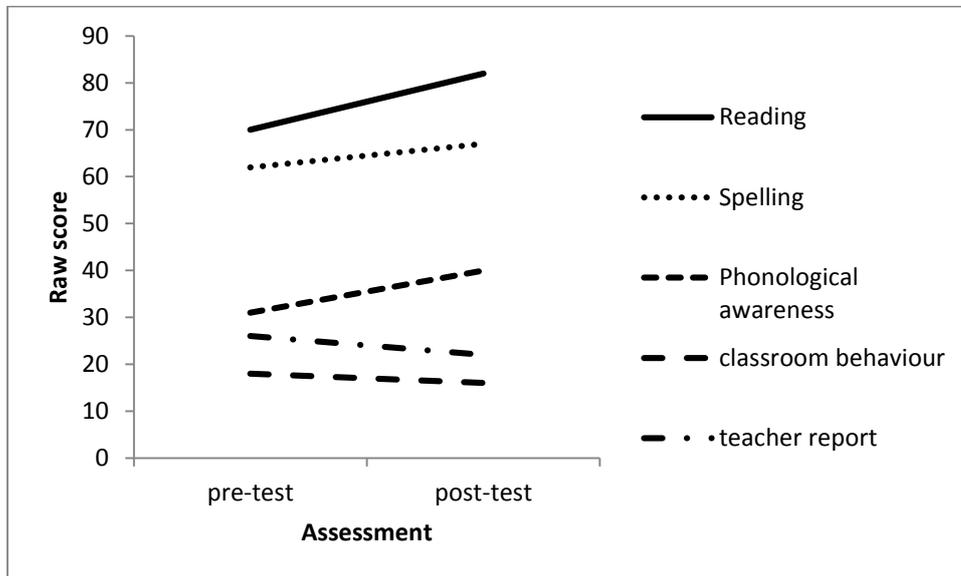


Figure 11: Participant 8's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.

Participant 9

On the WJ III DRB, Participant 9's scores on the Letter-word Identification and Passage Comprehension subtests remained below the expected range of performance for the student's age following the intervention period. On the Word Attack subtest, Participant 9's score moved into the expected range of performance for the student's age. Participant 9's post-test score did not overlap the SEMs for the Letter-word Identification subtests indicating a clinically significant change from pre- to post-test. Participant 9's post-test score did, however, overlap the SEMs for the Passage Comprehension and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test.

Table 33: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 9.

Subtest	Pre-test	Post-test
Letter-word Identification	35(76)	40(83)
Passage Comprehension	20(79)	21(80)
Word Attack	8(84)	9(85)

Note: scores in brackets represent student's standard scores.

On the QUIL Spoonerism, Phoneme Detection, and Phoneme Deletion subtests, Participant 9's scores remained below the expected range of performance for the student's age. Participant 9 demonstrated an increase in detection of end sounds from pre- to post-test. On the Phoneme Segmentation subtest, Participant 9's score moved from within the expected range of performance for the student's age, to below. An increase in deletion of parts of a blend was also demonstrated from pre- to post-test.

Table 34: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 9.

Subtest	Pre-test	Post-test
Spoonerisms	0(3)	2(3)
Phoneme Detection	3(3)	2(3)
Phoneme Segmentation	6(9)	2(5)
Phoneme Deletion	1(3)	3(3)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 9 showed a one month decrease in spelling age (7.3 to 7.2 years), remaining nearly three years below the student’s expected spelling age. A slight increase in spelling of regular words was demonstrated from pre-to post-test (32/37 to 33/37), and a decrease was shown in spelling of irregular words (6/10 to 4/10). Contrary to the Phoneme Detection subtest, Participant 9 showed an increase in spelling of middle sounds (e.g. at pre-test spelling ‘foot’ as ‘fot’ and at post-test as ‘foot’). On the Experimental spelling test, a slight increase in accuracy of sound score (80% to 81%) was shown. Participant 9 demonstrated a decrease in the spelling of taught words (63% to 44%) and untaught words (17% to 0%). Similarly to the Phoneme Detection subtest, Participant 9 demonstrated an increase in spelling of end sounds (e.g. at pre-test spelling ‘hugging’ as ‘hag’ and at post-test as ‘hagging’, and at pre-test spelling ‘truck’ as ‘take’ and at post-test as ‘truck’).

Table 35: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 9.

Test	Pre-test	Post-test
HAST	38	37
Experimental spelling	7	7

Based on the SDQ results, Participant 9 was selected as a case study participant and additional information was collected from her literacy teacher. Her literacy teacher reported that she was uncooperative throughout the literacy sessions, and that her level of activity was overly active (resulting in difficulty attending to tasks). Participant 9 was also reported to appear overly anxious during literacy sessions, impulsive and careless in responding, and responded to difficult tasks by attempting, but giving up easily. Participant 9’s literacy teacher described her overall behaviour during literacy sessions as “not wanting to be there” or as “just wanting to chat”, and in response to any changes in the student’s behaviour over

the course of the intervention noted that she has shown changes over the course of the intervention but that this may be the result of an “alternative plan” that was introduced for her.

At pre-testing, on the SDQ, Participant 9’s scores were consistent with the pre-test classroom observation, in which 32 observations of classroom problem behaviour were observed, including observations of speaking without permission (n=10), moving from their place without permission (n=2), not following the teacher’s instructions (n=4), wandering in the classroom instead of performing duties (n=2), annoying other students so that they cannot perform their duties (n=1), uses impolite language in the classroom (n=2), answers teacher in a rude manner (n=2), argues (physical) in the classroom (n=2), squirms in seat (n=1), makes sound (n=1), and fidgeting (n=5). Prior to the intervention period, Participant 9 showed a raw score of 27 on the CPBI teacher questionnaire and the classroom teacher also noted, prior to the intervention period, that Participant 9 is “constantly calling out, distracting others in conversations that aren’t relevant” and “can be helpful in 1 on 1 conversations with teacher, is empathetic, but has a disconnected attitude towards others e.g. saying ‘oi you’”. Participant 9’s teacher also noted that she is eager to be helpful to gain praise but is shy to accept it in front of others”.

Table 36: Raw scores for the Strengths and Difficulties Questionnaire for Participant 9.

Scale	Score at Pre-test
Emotional Systems	3
Conduct Problems	5**
Hyperactivity	9**
Peer Problems	5**
Prosocial	8
Total Difficulties	22**

*Borderline score

**Abnormal score

At post-testing, Participant 9 demonstrated a decrease in observations of problem behaviours in the classroom, with only 5 observations of classroom problem behaviours made, including observations of not following the teachers instructions (n=1), and being more interested in stimuli outside the classroom (n=4). Subsequent to the intervention period, Participant 9 showed a decreased raw score of 20 on the CPBI teacher questionnaire, and although the classroom teacher made no comment on the participant's change over the course of the intervention, it is important to note that any change in behaviour may be influenced by the additional management programme that was introduced for Participant 9.

Figure 12, demonstrates that while Participant 9's reading increased from pre- to post-test, their spelling and phonological awareness scores decreased. Participant 9's classroom and teacher reported behaviour also decreased from pre- to post-test.

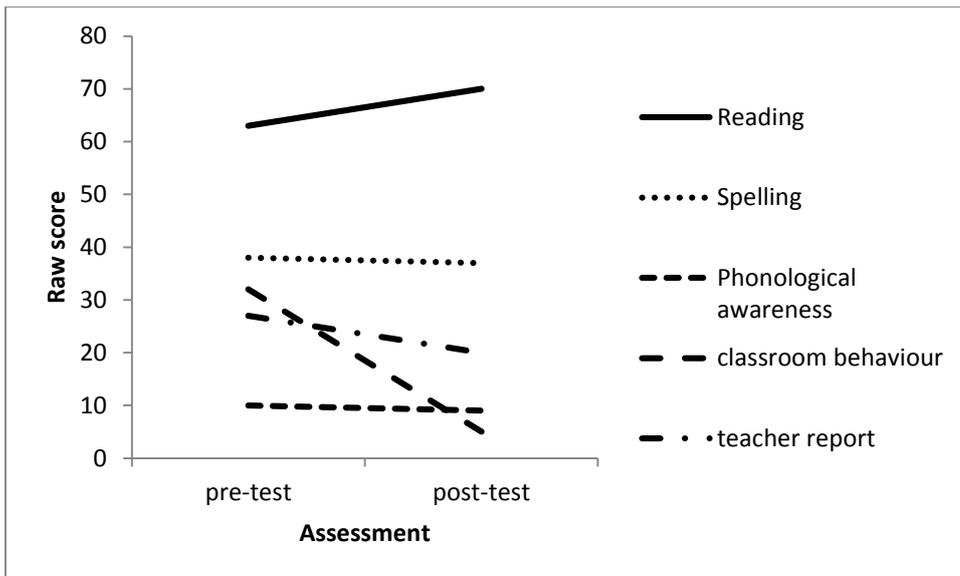


Figure 12: Participant 9’s total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.

Participant 10

On the WJ III DRB, Letter-word Identification and Passage Comprehension subtests, Participant 10’s scores remained below the expected range of performance for the student’s age. Participant 10’s score on the Word Attack subtest moved into the expected range of performance for the student’s age. Participant 10’s post-test score did not overlap the SEMs for the Word Attack subtest indicating a clinically significant change from pre- to post-test. Participant 10’s post-test score did, however, overlap the SEMs for the Letter-word Identification and Passage Comprehension subtests, indicating that there was not a clinically significant change from pre- to post-test.

Table 37: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 10.

Subtest	Pre-test	Post-test
Letter-word Identification	33(68)	35(71)
Passage Comprehension	21(77)	22(79)
Word Attack	7(80)	16(92)

Note: scores in brackets represent student's standard scores.

On the QUIL Spoonerism subtest, Participant 10's score remained below the expected range of performance for the student's age. On the Phoneme Detection and Phoneme Deletion subtests, Participant 10's scores moved into the expected range of performance for the student's age. Participant 10 demonstrated an increase in detection of last and middle sounds from pre- to post-test. On the Phoneme Segmentation subtest, Participant 10's score moved from above the expected range of performance for the student's age to within. Participant 10 also demonstrated an increase in deletion of parts of a blend from pre- to post-test.

Table 38: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 10.

Subtest	Pre-test	Post-test
Spoonerisms	7(3)	13(5)
Phoneme Detection	8(5)	10(9)
Phoneme Segmentation	11(14)	8(11)
Phoneme Deletion	5(3)	7(7)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 10 demonstrated a nine month increase in spelling age (6.7 to 7.4 years), remaining almost four years below the expected spelling age of the student. Participant 10 demonstrated an increase in spelling of regular (27/32 to 31/35) and irregular (3/8 to 8/13) words, and consistent with the data presented for the Phoneme Detection subtest showed an increase in spelling of middle and last sounds (e.g. at pre-test spelling ‘bring’ as ‘briing’ and at post-test as ‘bring’, at pre-test spelling ‘give’ as ‘gife’ and at post-test as ‘give’, and at pre-test spelling ‘there’ as ‘ther’ and at post-test as ‘there’). On the Experimental spelling test, an increase in accuracy of sound score (87% to 91%) was demonstrated. Participant 10 showed an increase in spelling of taught words (38% to 42%) and untaught words (8% to 38%). Contrary to scores on the Phoneme Detection subtest and the HAST, Participant 10 demonstrated an increase in the spelling of end sounds (e.g. at pre-test spelling ‘truck’ as ‘truk’ and at post-test as ‘truck’, at pre-test spelling ‘gift’ as ‘gifed’ and at post-test as ‘gift’, and at pre-test spelling ‘splash’ as ‘splasd’ and at post-test as ‘splash’).

Table 39: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 10.

Test	Pre-test	Post-test
HAST	30	39
Experimental spelling	4	8

At pre-testing on the SDQ, Participant 10’s scores were consistent with the pre-test classroom observation, in which 13 observations of classroom problem behaviours were observed, including observations of not following the teacher’s instructions (n=5), wandering in the classroom instead of performing their duties (n=1), annoying other students so that they cannot perform their duties (n=1), makes sound (n=1), fidgeting (n=2), and more interested in

stimuli outside the classroom (n=3). Prior to the intervention period, Participant 10 showed a raw score of 18 on the CPBI teacher questionnaire, and the classroom teacher noted that Participant 10 “ignores teacher instructions, and has work avoidance” and that the participant is “loud, shows disrespect to teachers, and has a strong attitude”.

Table 40: Raw scores for the Strengths and Difficulties Questionnaire for Participant 10.

Scale	Score at Pre-test
Emotional Systems	1
Conduct Problems	2
Hyperactivity	10**
Peer Problems	0
Prosocial	5*
Total Difficulties	13*

*Borderline score

**Abnormal score

At post-testing, Participant 10 showed no change in observations of problem behaviours in the classroom (n=13), with observations of not following the teacher’s instructions (n=1), annoying other students so that they cannot perform their duties (n=2), making sound (n=2), fidgeting (n=2), and being more interested in stimuli outside of the classroom (n=6) made. Subsequent to the intervention period, Participant 10 showed a slight increase in raw score of 19 on the CPBI teacher questionnaire, and no comment was made by the classroom teacher regarding any changes in the participant’s classroom behaviour over the course of the intervention.

Figure 13, demonstrates that while Participant 10's, reading, spelling, and phonological awareness increased from pre- to post-test, their classroom behaviour remained the same and teacher reported behaviour increased from pre- to post-test.

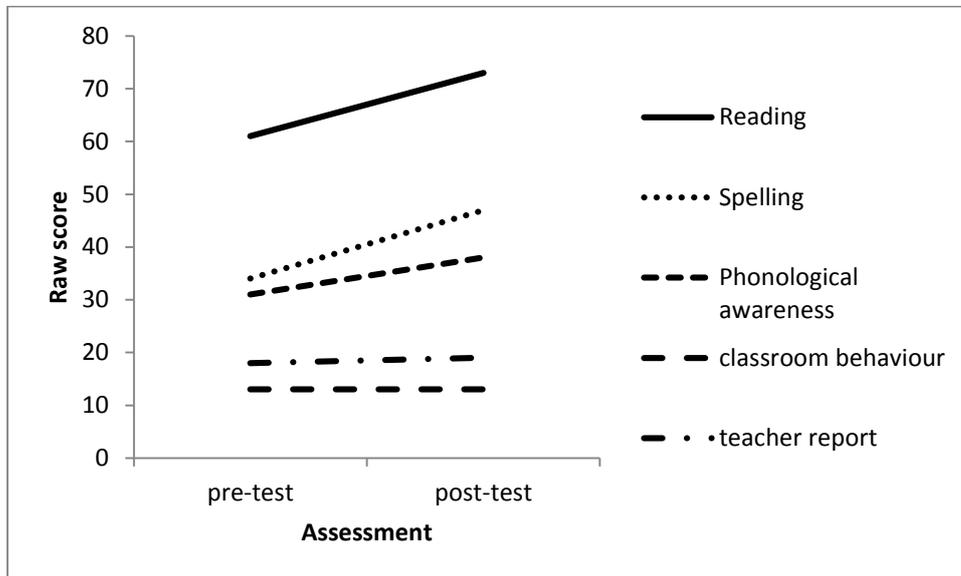


Figure 13: Participant 10's total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.

Participant 11

On the WJ III DRB Letter-word Identification, Passage Comprehension, and Word Attack subtests, Participant 11's scores remained within the expected range of performance for the student's age. Participant 11's post-test scores overlapped the SEMs for the Letter-word Identification, Passage Comprehension, and Word Attack subtests, indicating that there was not a clinically significant change from pre- to post-test.

Table 41: Raw and standard scores for the Woodcock-Johnson III DRB subtests for Participant 11.

Subtest	Pre-test	Post-test
Letter-word Identification	29(88)	30(87)
Passage Comprehension	17(89)	19(91)
Word Attack	7(94)	10(97)

Note: scores in brackets represent student's standard scores.

On the QUIL Spoonerism, Phoneme Detection, and Phoneme Deletion subtests, Participant 11's scores remained within the expected range of performance for the student's age. Participant 11 also demonstrated an increase in detection of first, last, and end sounds from pre- to post-test. On the Phoneme Segmentation subtest, Participant 11's scores remained above the expected range of performance for the student's age. Participant 11 also demonstrated an increase in deletion of parts of a blend from pre- to post-test.

Table 42: Raw and standard scores for the Queensland Inventory of Literacy subtests for Participant 11.

Subtest	Pre-test	Post-test
Spoonerisms	1(7)	7(9)
Phoneme Detection	7(9)	6(7)
Phoneme Segmentation	10(14)	9(12)
Phoneme Deletion	6(10)	6(10)

Note: scores in brackets represent student's standard scores.

On the HAST, Participant 11 showed a one month increase in spelling age (7.3 to 7.4 years) over the intervention period, remaining nine months below the student's expected

spelling age at post-test. No change was shown in spelling of regular words (32/35 to 32/35), however, an increase in spelling of irregular words (6/13 to 7/14) was demonstrated. Contrary to the Phoneme Detection subtest, Participant 11 showed an increase in spelling of last sounds (e.g. at pre-test spelling ‘there’ as ‘ther’ and at post-test as ‘there’). On the Experimental spelling test, Participant 11 demonstrated an increase in accuracy of sound score (90% to 94%). Similar to the Phoneme Detection subtest, Participant 11 demonstrated an increase in spelling of middle and first sounds (e.g. at pre-test spelling ‘hugging’ as ‘haging’ and at post-test as ‘hugging’, and at pre-test spelling ‘truck’ as ‘chrack’ and at post-test as ‘truck’).

Table 43: Raw scores for the Helen Arkell Spelling Test and the Experimental spelling test for Participant 11.

Test	Pre-test	Post-test
HAST	38	39
Experimental spelling	8	10

Based on the SDQ results, Participant 11 was selected as a case study participant and additional information was collected from her literacy teacher. Participant 11’s literacy teacher described her cooperation during literacy sessions as uncooperative at times, and her level of activity as typical for her age. Participant 11 was reported as attentive during one-on-one situations, however, she was reported to be consistently inattentive and distracted in group situations. The literacy teacher reported that she appeared tense or worried at times during literacy sessions, and at times responded too quickly. In response to difficult tasks, it was noted that she attempted but gave up easily. Participant 11’s literacy teacher described her overall behaviour during literacy sessions as “Excellent in one-on-one situations with a lot of positive support” but that she “becomes angry and frustrated easily and makes

inappropriate comments to other children”. It was also reported that she is “easily distracted and requires huge amounts of attention to remain on task and in a positive learning mind-set”. In response to any changes in the student’s behaviour over the course of the intervention the literacy teacher noted that she doesn’t think her behaviour has changed but that the environment has been set up so that she receives a lot of attention.

At pre-testing, on the SDQ, Participant 11’s scores were not highly consistent with the pre-test classroom observation, in which 8 observations of classroom problem behaviour were observed, including observations of fidgeting (n=2), and more interested in stimuli outside the classroom (n=6). Prior to the intervention period, Participant 11 showed a raw score of 12 on the CPBI teacher questionnaire, and the classroom teacher noted that Participant 11 demonstrates “negative comments to other children, non-compliance, lies, and makes up stories about her family”, also that she “swears a lot, can snatch, but is good with adults”.

Table 44: Raw scores for the Strengths and Difficulties Questionnaire for Participant 11.

Scale	Score at Pre-test
Emotional Systems	5*
Conduct Problems	9**
Hyperactivity	7**
Peer Problems	6**
Prosocial	3**
Total Difficulties	27**

*Borderline score

**Abnormal score

At post-testing, Participant 11 showed no change in observations of problem behaviours in the classroom (n=8), with observations of annoying other students so that they cannot perform their work (n=1), fidgeting (n=3), and being more interested in stimuli outside of the classroom (n=4) made. Subsequent to the intervention period, Participant 11 showed a decrease in raw score (n=11) on the CPBI teacher questionnaire, and the classroom teacher noted that over the course of the intervention Participant 11 has been “more kind to other students, shows less arguing back, and less swearing”.

Figure 14, demonstrates that while Participant 11’s, reading, spelling, and phonological awareness increased from pre- to post-test, their classroom behaviour remained the same, but teacher reported behaviour decreased from pre- to post-test.

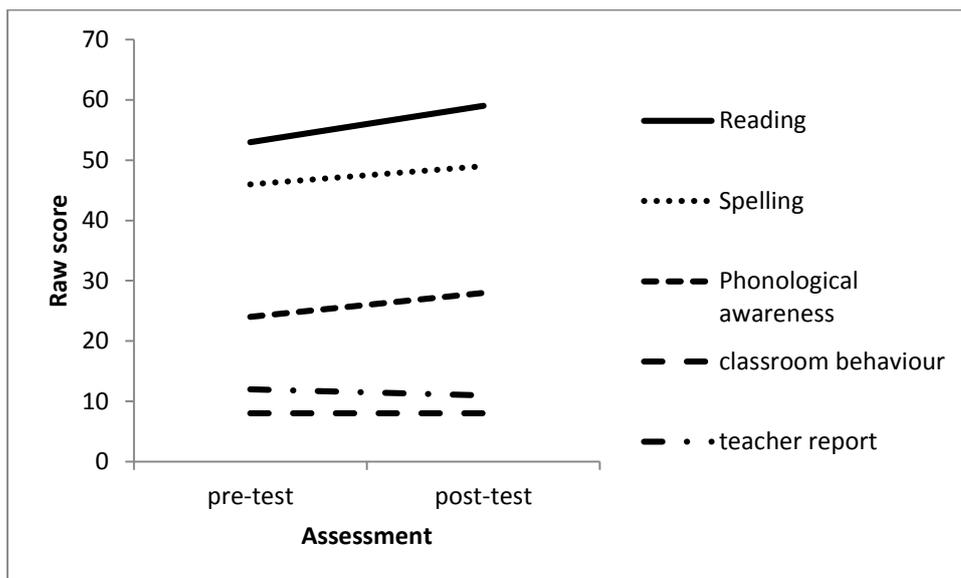


Figure 14: Participant 11’s total raw score for reading, spelling, phonological awareness, classroom, and teacher reported behaviour at pre- and post-test.

3.2 Group Results

3.2.1 Statistical Analyses:

All statistical analyses were carried out using the, Statistical Product and Service Solutions (SPSS) software. Paired t-tests were conducted to compare participant's pre- and post-test scores for literacy and behaviour. Pearson correlations were also conducted to examine linear relationships between behavioural measures. A significance level of 0.05 was utilised in the current study to assess the statistical outcome of the research measures.

3.2.2 WJ III DRB

As shown in Table 45, paired samples t-tests revealed that on the Letter-word Identification and Word Attack subtests, there was a significant difference in the mean raw scores for pre- and post tests. These results suggest that the research intervention had a statistically significant, positive impact on the participants' word identification and decoding skills. On the Passage Comprehension subtest, there was not a significant difference in the mean raw scores for pre- and post- tests, indicating that the research intervention did not have a statistically significant, positive impact on the participants' passage comprehension skills.

Table 45: Paired samples t-tests for Woodcock-Johnson III DRB subtests.

Subtest	Pre-test		Post-test		<i>T</i>	P
	M	SD	M	SD		
Letter-word Identification	36.18	7.41	39.27	7.43	4.64	.001
Passage Comprehension	19.91	4.60	21.73	6.91	1.66	.127
Word Attack	9.40	4.25	11.82	4.00	2.50	.032

3.2.3 *QUIL*

On the *QUIL* Spoonerism, Phoneme Detection, Phoneme Segmentation, and Phoneme Deletion subtests there was not a significant difference in the mean raw scores for pre- and post- tests. These results suggest that the research intervention did not have a statistically significant, positive impact on the participants' spoonerism or phoneme detection, segmentation, or deletion skills. It is important to note that the Phoneme Deletion sub-test was close to statistical significance.

Table 46: Paired samples t-tests for *QUIL* subtests.

Subtest	Pre-test		Post-test		<i>t</i>	P
	M	SD	M	SD		
Spoonerism	7.27	6.51	8.73	7.42	0.80	.441
Phoneme Detection	6.00	2.53	7.18	2.93	1.84	.096
Phoneme Segmentation	6.36	2.73	6.45	2.71	0.11	.916
Phoneme Deletion	4.91	1.87	6.18	2.36	2.22	.051

3.2.4 *Spelling*

On the HAST, a paired samples t-test revealed that there was a significant difference in the mean raw scores for pre- and post- tests. These results suggest that the research intervention had a statistically significant, positive impact on the participants' spelling skills.

On the Experimental spelling test, a paired samples t-test revealed that there was not a significant difference in the mean raw scores for pre- and post- tests, indicating that the research intervention did not have a statistically significant, positive impact on the participants' spelling of short-vowel sounds. There was a significant difference in the mean accuracy of sound scores for pre- and post-tests indicating that the research intervention had a

statistically significant, positive impact on the participants' accuracy of sound skills. No significant differences in the percentage of taught or untaught words for pre- and post-tests were demonstrated.

Table 47: Paired samples t-tests for spelling subtests and descriptive analyses.

Subtest/Analysis	Pre-test		Post-test		T	P
	M	SD	M	SD		
HAST	38.18	12.81	43.10	14.71	3.94	.003
Experimental spelling test	6.64	3.41	8.00	2.72	2.10	.067
Accuracy of sound	63.91	10.50	67.50	7.31	2.61	.027
Taught	58.25	24.70	48.75	15.40	0.92	.391
Untaught	15.88	11.42	14.13	15.69	0.24	.820

3.2.5 Behaviour

As demonstrated in Table 48, a paired samples t-test revealed that there was not a significant difference in the mean raw scores for pre- and post- tests for observations of problem classroom behaviour or on the teacher CPBI questionnaire. These results suggest that the research intervention did not have a statistically significant, positive impact on the participants' classroom behaviour as indicated by classroom observations or teacher-reports on the CPBI.

Table 48: Paired samples t-tests for behaviour subtests.

Subtest	Pre-test		Post-test		T	P
	M	SD	M	SD		
Classroom Observation	13.80	11.24	8.00	6.04	1.92	.087
Teacher-report CPBI	12.40	9.51	10.60	7.72	1.80	.105

Additional questions from the pre-test teacher CPBI indicated that prior to the research intervention, teachers reported that seven participants (1, 3, 6, 7, 9, 10, and 11) demonstrated problem behaviours in the classroom, including “Can lie sometimes to get others in trouble”, “Worries about what others are doing”, and “Finds following instructions challenging”. Participant 4 was reported by their teacher as “Very well mannered”, and there was missing data as no comment was made by teachers for Participants 2, 5, and 8.

After the intervention, some degree of change was reported for four participants (1, 3, 7, and 11), including “Not a great change but is wandering around the room less which is good”, “More confident in their own ability with writing/spelling”, and “more kind to other students, less arguing back and less swearing”. No change was reported for three participants (4, 6, and 8), and no comment was made for Participants 2, 5, 9, and 10.

3.2.6 Correlations

Correlations were carried out between participants’ pre-test scores on the teacher CPBI, researcher observations of classroom behaviour, and the SDQ to examine the reliability of these measures for assessing participants’ classroom behaviour. A correlation was also conducted for participants’ overall change in literacy and behaviour. Overall change in literacy was calculated from the difference in raw scores on the WJ III DRB, QUIL, HAST, and Experimental spelling test between pre- and post-test. The overall change in behaviour was calculated from the difference in raw scores of classroom observations and teacher reports on the CPBI between pre- and post-test.

Results showed that classroom observation pre-test scores were correlated with teacher CPBI survey pre-test scores. ($r=.64$, $p=.048$). These results suggest that researcher observations are likely an acceptable account of the behaviour that is observed by teachers in

the classroom. Results also showed that teacher CPBI survey pre-test scores were correlated with SDQ survey scores. ($r=.64$, $p=.045$). These results suggest that teacher observations of classroom behaviour are in line with their reports of students' overall behaviour. Results, however, showed that classroom observation pre-test scores were not correlated with SDQ survey scores ($r=.45$, $p=.192$), indicating that classroom observations were not associated with teacher's reports of student's overall behaviour on the SDQ.

Results showed that there was not a significant correlation between overall change in literacy and overall change in behaviour ($r=.22$, $p=.535$). These results indicate that changes in literacy were not associated with changes in behaviour.

4. Discussion

The aim of the current study was to examine the effectiveness of Agility with Sound (a specialist reading intervention) on children's literacy skills and behaviour. Participants were from two Christchurch Primary schools; who had low progress in reading and were already participating in the Agility with Sound intervention. Participants completed pre- and post- literacy and phonological awareness assessments. Additionally, each student was observed in the classroom setting. Teachers completed surveys in regards to the students' classroom behaviour. Four case study students' literacy teachers also completed a questionnaire regarding the students' behaviour during literacy sessions and change over the course of the intervention. At School 1, participants attended the intervention as a group, and participants attended four, one hour sessions each week. At School 2, participants attended the intervention one-on-one with the literacy teacher, and participants attended three, half hour sessions each week (with the exception of Participant 9).

Several results were found to indicate that the research intervention in the current study was effective in enhancing participants' literacy skills. Results, however, did not strongly indicate that the research intervention had significant effects on the participants' classroom behaviour. An additional finding also indicated that changes in literacy skills following the intervention did not show a significant relationship with changes in behaviour. The following section discusses the findings in relation to previous research. Limitations, theoretical, clinical, and practical implications, and future directions are then discussed.

4.2 Link between research findings and previous research

The following section provides a discussion of the current findings and how they are related to the current hypotheses. The first hypothesis of the current research (that the research intervention will enhance participants' phonological awareness, reading, and spelling skills), was partially supported by the study by findings of a significant difference in mean raw scores on the Letter-word Identification and Word Attack subtests, and on the HAST. The hypothesis is also supported by individual results which demonstrated improvements for the majority of participants in raw and standard scores on the Letter-word Identification (n=11 and 10 respectively), Passage Comprehension (n=10 and 9 respectively), and Word Attack (n=7 and 6 respectively) subtests. The first hypothesis was further supported by findings that the majority of participants (n=6) demonstrated an increase in spelling age of more than 12 weeks over the intervention period, with Participant 11 demonstrating a 17 month increase from pre- to post-test. The majority of participants also showed an increase in raw score (n=7) and accuracy of sounds (n=9) on the Experimental spelling test.

The finding that word identification and decoding skills were enhanced in response to the research intervention is consistent with previous research indicating that phonological awareness training has a significant impact on word identification skills. Calhoon (2005) examined the effects of peer-mediated instruction in phonological skills and reading comprehension for middle school children (with a mean age of 12.11 years) with reading disabilities. Thirty-eight participants from four special education classrooms were included in the experimental group. Participants completed a phonological skills programme that consisted of linguistic skills training and peer assisted learning strategies. Participants in the control group completed a widely implemented remedial reading programme. Measures on the Woodcock-Johnson test of Achievement-III showed that participants in the experimental

condition significantly outperformed the control group on measures of Letter-word Identification, Word Attack, and Passage Comprehension. Although in the current study, there was no control group, findings indicated that participants demonstrated a significant increase in word identification and decoding skills following the intervention period. Standard scores also showed improvements for the majority of participants on the Letter-word Identification and Word Attack subtests following the intervention period.

The research intervention's impact on enhancing spelling skills, which included instruction in phonological awareness, is consistent with previous studies that have shown positive effects of phonological awareness instruction on spelling skills with younger children. The current study's findings are consistent with, and add support to Carson, Gillon, and Boustead's (2013) study where the effects of targeted phonological awareness instruction on children's reading and spelling development were examined in a quasi-experiment in which the intervention was conducted in the classroom setting. One hundred and twenty nine participants (all aged five years old) were randomly assigned to one of two conditions (classroom phonological awareness program or literacy curriculum as usual). The classroom phonological awareness program included instruction in onset-rime knowledge, linking speech to print, and phoneme analysis, identity, blending, and segmentation. Findings from the research showed that participants in the classroom phonological awareness program group showed significantly higher results on end of year reading and spelling measures in comparison to participants who had received the literacy curriculum as usual only. The research intervention in the current study used similar activities (although in a different setting) to Carson, Gillon, and Boustead (2013) with successful results. Results thus indicated that instruction in onset-rime knowledge, linking speech to print, and phoneme analysis, identity, blending, and segmentation is beneficial for enhancing children's spelling skills both

as a general classroom teaching in the first year of school and via withdrawal intervention for older students with literacy difficulties.

Contrary to the first hypothesis, no significant differences were found in the current study on the Passage Comprehension, Spoonerism, Phoneme Detection, Phoneme Segmentation, or Phoneme Deletion subtests, or the Experimental spelling test. These findings are inconsistent with previous findings from longitudinal studies that have shown positive effects of phonological awareness instruction on phoneme awareness and comprehension skills. This is highlighted in a study by Swanson, Hodson, and Schommer-Aikins (2005) who examined the effects of a systematic phonological awareness intervention for seventh-grade poor readers (most spoke English as a second language). The researchers found that after 12 weeks of intervention (45 minutes of instruction each day) participants who had received the intervention performed significantly better on measures of word identification, word attack, word comprehension, and passage comprehension. This contrasts the findings of the current study as clinically significant differences for passage comprehension were not found. It is important to note that the previous study, however, incorporated more intensive instruction per week than was included in the current study. Furthermore, Blachman, Ball, Black, and Tangel (1994) investigated the effects of an 11 week phonological awareness intervention on 159 school children's reading and spelling skills. The researcher's findings showed that participants who had completed the phonological awareness instruction had significantly higher scores on measures of phoneme segmentation, invented spelling, and letter name and letter sound knowledge than did children in the control group.

It is possible that these findings were not replicated in the current study because passage comprehension is a more complex literacy task, and the short time between pre- and post-testing did not allow for participants to reach the research intervention level that

consisted of instruction focused on reading comprehension (as evidenced in Table 1). It is also possible that word recognition accuracy may have improved, but was still somewhat laborious for participants meaning that they had less cognitive resources to focus on the meaning of connected text (despite more accurate reading). Furthermore, it is possible that as the instructions are more complex for the QUIL subtests than they are for the WJ III DRB or either of the spelling tests, that factors such as researcher administration and behaviour factors (including inattention) may have resulted in participants not accurately understanding what the subtest required.

The finding that there was no significant difference in mean scores on the Experimental spelling test is likely explained by the progress achieved by students throughout the intervention phase. As the test included words from levels 1 to 8 of the research intervention, and participants had limited time to move up levels between pre- and post-testing, therefore, it is unlikely that participants were exposed to a large number of new words/sounds between pre- and post-testing and as such would not be expected to be able to spell words that are included in the higher levels of the research intervention. Future examinations of the effectiveness of the research intervention must be careful to match between items included in the teaching and any experimental measures.

It was, however, found that there was a significant difference in the mean accuracy of sound scores for pre- and post-tests on the Experimental spelling test supporting the first hypothesis. Consistent with previous research by Gillon (2002), findings from the current study indicated that phonological awareness intervention is effective in enhancing individuals' accuracy of sounds skills. Similar to Gillon's (2002) study the current research also found improvements in participants word recognition skills. Adding to Gillon (2002) who included participants who were five to seven years old, the current research

demonstrated improvements in accuracy of sounds and word recognition skills for older children aged seven to twelve years old.

The second hypothesis (that the research intervention will enhance participants' classroom behaviour in the classroom context) was partially supported as the findings from the current research showed that the majority of participants decreased in observations of classroom problem behaviours and on teacher reported classroom problem behaviour on the CPBI. Contrary to the second hypothesis of the current research, however, findings of the study showed that there were no significant differences in mean raw scores for classroom observations or teacher CPBI between pre- and post-test. It is possible that factors additional/alternative to literacy difficulties (e.g., home, parenting etc.) had an impact on participants' classroom behaviour. Without explicit intervention to address these factors or provide alternatives, it is likely that maximal enhancement of classroom behaviour problems could not be reached.

The additional finding that changes in literacy skills did not have a significant relationship with changes in behaviour is in contrast to previous studies that have highlighted the effects that behaviour have on literacy instruction, and children's ability and motivation to learn. From their review of the literature, Stewart, Martella, Marchand-Martella, and Benner (2005) concluded that an integrated model of reading and behaviour instruction is needed to reach children who have significant difficulty with both skills, and that it is imperative that schools address the issues simultaneously. It is possible that as not all of the participants were identified by the SDQ as having behaviour difficulties in the abnormal range, the inclusion of students without behavioural issues may have masked these results.

Examination of the case study participants (i.e., participants with behavioural difficulties according to the SDQ) in isolation showed that Participant 9 who had the most

reported difficulties during literacy sessions by her literacy teacher (including uncooperative throughout, overly anxious, active, and impulsive, careless in responding, and gives up easily), showed the least progress in literacy with decreases in spelling and reading scores following the intervention period. The remaining case study participants all demonstrated increases in reading, spelling, and phonological awareness (with the exception of Participant 3 who showed no change in phonological awareness). It could be suggested that as Participant 9 showed numerous difficulties with behaviour during literacy sessions, she was unable to utilise the intervention sessions as much as other students, impacting her literacy progress. It is also possible that as Participant 9 attended only two of the three sessions that the remaining children from her school received, she had less opportunity for literacy instruction and in turn improvement. Consistent with Morgan and Fuchs (2007), findings from the current study indicate a possible bidirectional relationship between children's reading motivation and their reading skills, with participants who indicated greater motivation during literacy sessions gaining greater increases in overall literacy skills following intervention.

All of the case study participants demonstrated decreases in classroom problem behaviours from pre- to post-test (with the exception of Participant 11 who showed no change in observations of classroom problem behaviours) as evidenced by observations of classroom problem behaviours and teacher reports on the CPBI. These findings are consistent with Coie and Krehbiel (1984) and Cook et al. (2012) who have demonstrated that literacy intervention can have successful impacts on children's classroom behaviour skills; even for children with considerable behavioural difficulties.

4.3 Limitations of the current research

Before accepting the results, there are several practical and methodological limitations that need to be considered. Firstly, as the impact of the intervention was only monitored for one part of the specialist teaching (i.e., participants at both schools had been participating in the intervention prior to the pre-test assessment), this may have lessened the ability to detect change resulting from the intervention. Ideally, change would have been recorded and observed before starting the intervention and after completion to determine the full impact of the intervention on the participant's literacy and behaviour skills. Secondly, as the intervention period was relatively short (12 weeks), participants had more limited opportunity for instruction in literacy which could have explained the limited change in participant's results on some tests. In addition, Participant 1 spent two of the twelve weeks in respite care and Participant 9 attended only two sessions each week. It is important to note, however, that meta-analyses of the impact of phonological awareness intervention (e.g., Ehri et al., 2001) have demonstrated that around 15 hours of intervention should be sufficient to show accelerated change in the literacy skills that were monitored in this project.

Thirdly, due to the availability of teachers and students, repeated measures could not be conducted and only pre- and post-test assessments and observations were conducted, limiting the reliability and validity of the results. There was also no follow-up period conducted, therefore further changes in literacy skills and behaviour, and whether identified changes in these skills was sustained could not be recorded. Additionally due to further issues with availability, another limitation included participants' behaviour being observed during different classroom activities. All observations took place during the morning period before interval, however, there was a wide variety of activities that were observed (such as mat time, learning games, reading, spelling etc.) which could have influenced the participants' behaviour.

A further limitation of the current study was that there was unattained consent from one teacher and several students to participate in the study which restricted the sample size. Additionally, there were a large number of unanswered questions, which resulted in missing data that limited analyses that could be conducted. A possible explanation may be that survey instructions were not clear or not followed appropriately.

Another limitation of the current study was that only classroom problem behaviour was observed and reported, omitting other behaviour factors such as motivation and intervention enjoyment from the analysis. The inconsistencies between the two schools in the current research also limited the results of the study. Each school implemented the intervention differently (School 1 as a group intervention and School 2 as a one on one intervention) and at School 1, Agility with Sound was combined with other literacy activities, introducing various confounding factors to the results. Finally, as the current study involved a case study design, generalisation of the results is limited.

4.4 Theoretical, clinical, and practical implications of the findings

The current study has several theoretical and clinical implications. Firstly, findings from the current study contribute to evidence that instruction based on the dual-route model of word recognition and spelling can be successful in enhancing reading and spelling skills. The phonological route was utilised in the research intervention for spelling and reading development through activities in initial phoneme identification, syllable awareness, and phoneme segmentation.

The current study also reaffirms previous research that has emphasised the high co-morbid relationship between reading and behaviour difficulties. Hinshaw (1992) has previously noted that co-morbidity between externalising behaviour and academic

underachievement is present at levels as high as 50%. Of the 10 students that behavioural data was collected for in the current study, six participants were identified by their teachers as having an abnormal or borderline total difficulties score on the SDQ. The results also add to the literature through their contrast to Cornwall and Bawden (1992), and Kempe, Gustafson, and Samuelsson (2011) who have suggested that reading difficulties and behaviour problems are independent.

A further theoretical implication of the current study is that it corroborates with previous studies that have noted the importance of phonological awareness instruction (specifically phoneme awareness) for enhancing children's reading and spelling skills. The research intervention in the current study focused primarily on phonological awareness in instruction activities. Findings showed that the majority of participants showed post-test scores on phonological subtests (phoneme detection, deletion, and segmentation) that were within the expected range of performance for the participant's age. Furthermore, the majority of participants showed significant increases in spelling age from pre- to post-test. Further, the findings from the current study add to the literature by presenting positive results for older students with identified difficulties, in a withdrawal setting; previous phonological awareness research has tended to have a primary focus on younger children (i.e. 4 to 7 years old) and/or general classroom instruction.

Previous studies have noted that children's motivation and self- concept are reciprocally related to academic achievement. Although the current study found no correlation between changes in participants' literacy and behaviour skills, individual data adds to the limited literature that difficulties in behaviour (including motivation) may impact children's literacy skills. Participant 5 was noted to respond "I don't know" to all questions of the Spoonerism subtest suggesting a possible lack of motivation on this phonological awareness activity. Participant 5 demonstrated a decrease in overall score of phonological

awareness which may possibly be explained by his lack of motivation during these activities. Participant 3 was also reported by her literacy teacher as “more confident” which could possibly be a contributing factor to increased reading, phonological awareness, and spelling scores.

Future research could take into account the results from the current research as it adds to the literature regarding the importance of considering co morbidity of literacy skills and behaviour in practice, and literacy intervention research for New Zealand school children with low progress in reading. However, as the current study included a relatively small sample (n=11) and was conducted over a short period of time (n=12 weeks) results should be interpreted with care.

The current study adds to the limited literature that has examined the impact of literacy intervention on children’s behaviour skills. Adding to Coie and Krehbiel (1984) and Cook et al. (2012), the current study demonstrated that a reading intervention could have an impact on children’s behaviour skills. Findings from the current study indicated that the majority of participants showed decreases in both classroom observations and teacher reports on the CPBI, as well as a small decrease in classroom behaviour for some participants as evidenced by qualitative data collected from students’ classroom and literacy teachers. The current study added further to previous research as it contrasted previous studies, the current research had a large number of females participating in the study (n=7), was conducted over a short period of time (12 weeks), and included quantitative and qualitative data. The current study did not find clinically significant changes in participants’ mean raw scores for classroom observations or on the teacher CPBI following the intervention period which contrasts previous studies. The contrary findings support Bruhn and Watt (2012) and Lane et al. (2002) who have previously proposed that reading intervention alone is not sufficient for positive impacts on both reading and behaviour skills.

The current study adds to the literature proposing that reading motivation and reading skills may be reciprocally linked. Individual results from case study participants showed that Participant 9 who was reported by her literacy teacher as demonstrating several difficult behaviours during literacy sessions and as “not wanting to be there or just wanting to chat” demonstrated the least improvement in overall literacy skills.

Results from the current study indicated that there was not a significant correlation between changes in literacy and changes in classroom behaviour. While qualitative data from classroom and literacy teachers reported changes in participant’s confidence and motivation following the intervention period, adding support to Fuerst et al. (1989) who proposed that children’s difficulties with learning may be more frequently associated with internalising rather than externalising disorders. These findings suggest further research in this area is warranted and may provide information for more effective intervention.

The current research has important implications in providing evidence for the feasibility and validity of researching the effects of reading interventions on both literacy skills and behaviour in a longitudinal, wider population study. Conversely, the findings highlight the need for further research regarding children with co-morbid literacy and behaviour difficulties. Findings from the current research indicate that literacy intervention alone is not enough to significantly enhance children’s classroom behaviour.

Multi-component intervention that addresses children’s motivation and self-concept in addition to their literacy skills may be necessary to have successful and lasting impacts on children’s co-morbid literacy and classroom behaviour difficulties. Although these two suggestions counter one another, they are both feasible with the potential that some literacy interventions with behavioural components may be sufficient in improving behaviour

significantly in some populations, but that others may require separate interventions for both domains.

The findings also have specific implications for the research intervention, indicating that it is an effective intervention for enhancing phonological skills, specifically letter-word identification and decoding skills, and spelling skills. These findings have specific implications for use with Christchurch primary school children aged 7 to 12 years with low progress in reading. The current study was the first that examined the effectiveness of Agility with Sound, which adds further support to the benefits it provides.

4.5 Future Directions

To substantiate that the research intervention had a positive impact on aspects of literacy (especially word identification, decoding, and spelling) skills, future research should include a longitudinal study beginning prior to participant's introduction to the intervention, and include repeated measures to monitor progress. An extended follow-up phase to determine the maintenance of changes in participant's literacy and behaviour skills would also be beneficial. It would also be useful to compare participants receiving Agility with Sound as their sole intervention, to participants receiving Agility with Sound in addition to a behavioural skills intervention to determine differences in literacy and behaviour scores. Additionally, it would be useful to observe participant's classroom behaviour during the same classroom activity (preferably reading) to reduce confounding factors that may possibly influence participant's classroom behaviour and allow maintained consistency in measurement.

Generalisation of the results could be enhanced by including a larger sample, including a control group, and ensuring intervention conditions remained the same for all

participants. Alternatively, if conditions did not remain the same, if numbers were sufficient, comparisons could be made between variations of the intervention. Further research is needed into a variety of variables that may serve as risk or protective factors (e.g. family, home, socio-economic) for classroom problem behaviour. Increased understanding of the individual differences between children presenting with reading difficulties and behaviour problems, as well as identification of protective factors for these individuals, could help aid the development of specialised early interventions, effectively targeting literacy and behaviour skills, as well as individual needs (Semrud-Clikeman, 2005).

Future research would benefit from including and controlling for such variables as presented above, as research could facilitate the development of more cost-efficient and effective interventions for school children with co-morbid literacy and behaviour problems. The current study may suggest that there is a need for clarification of the reciprocal relationship between reading difficulties and behaviour problems, as well as the impact of reading interventions on children's classroom behaviour.

4.6 Conclusion

The current research findings indicate that the research intervention is an effective reading intervention for enhancing letter-word identification, decoding, and spelling skills, for primary school children with low progress in reading. Qualitative data indicated that, for four of the participants, the research intervention also showed a small impact on classroom behaviour over the 12 week intervention period. Although the change in behaviour was not significant, individual participant results suggest that there is a relationship between literacy and classroom behaviour that can in part be altered through targeting literacy alone.

The findings from the current research add to previous literature regarding the dual-route model of word recognition, the link between behaviour and literacy, the impact of motivation on reading, and the impact of literacy intervention on children's classroom behaviour. The findings from the current study also emphasise the importance of phoneme awareness in literacy intervention for reading and spelling, and suggest a need for multi-component intervention for children with both reading and behaviour difficulties. In the practical application of interventions this would be a cost-effective method of improving non-clinical behavioural difficulties, however, findings suggest a multi-component intervention may be needed of both behavioural and literacy intervention in more severe cases.

Encouraging findings from the current study support the use of the Agility with Sound intervention to enhance school children's literacy skills (specifically word identification, decoding, and spelling skills). The findings also highlight the importance of combining literacy instruction with behaviour management instruction in cases where difficulties are co-morbid. Future research examining the link between reading and behaviour especially in regards to early intervention is crucial and would help inform more effective instruction and intervention for school children with co-morbid difficulties.

5. References

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Appendix A: Human Ethics Committee Approval Letter.

Ref: 2013/27/ERHEC

31 May 2013
Samantha Robinson
School of Health Sciences
UNIVERSITY OF CANTERBURY

Dear Samantha

Thank you for providing the revised documents in support of your application to the Educational Research Human Ethics Committee. I am very pleased to inform you that your research proposal “The effects of a specialist reading intervention on children's literacy and behavioural skills for children with low progress in reading” has been granted ethical approval.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 30 May 2013.

Should circumstances relevant to this current application change you are required to reapply for ethical approval.

If you have any questions regarding this approval, please let me know.

We wish you well for your research.

Yours sincerely
Nicola Surtees
Chair
Educational Research Human Ethics Committee

Appendix B: Experimental Spelling Test

1. Dog – The Dog chased the cat. Dog
2. Man – the man went to the bank. Man
3. Rug – the mouse ran under the rug. Rug
4. Them – I saw them on the weekend. Them
5. Hugging – the two friends were hugging. Hugging
6. Banned – yelling in the classroom is banned. Banned
7. Winner – the boy was the winner of the running race. Winner
8. Happy – the girl was happy that she made a new friend. Happy.
9. Always – I always do my homework. Always.
10. Middle – the children sat in the middle of the classroom. Middle.
11. Picnic – the family went on a picnic. Picnic.
12. Truck – the truck was parked in the garage. Truck.
13. Shocked – the girl was shocked to find that her toy was missing. Shocked.
14. Gift – on her birthday the teacher got a gift from her class. Gift.
15. Think – I think I've lost my backpack. Think.
16. Sparkle – at night the stars sparkle. Sparkle.
17. Gathered – all the children gathered around to see the puppy. Gathered.
18. Bounce – I like to bounce on the trampoline. Bounce.
19. Splash – the boy jumped in the pool and made a big splash. Splash.
20. Build – I like to build towers out of blocks. Build.

Apeendix D: Teacher Instructions for Story Reading.

The student should be given several practice runs through the appropriate onset-rime sheets before they begin a story, and should be able to decode the words in the story before reading.

Reading a story:

1. Where there is a new sound that the student has been learning (such as the ending 'ay'), it will be used multiple times throughout the story. The student is asked to use a coloured marker to find all of the new sounds on the first page and circle them.
2. If there are any difficult words the teacher should colour them according to the onset-rime sheets before the student arrives at them in the story.
3. The teacher should encourage the students to use their finger or a ruler to follow a line of text and should use their finger to follow text when necessary.
4. If the student comes across a word that they cannot read, the teacher should make the word with the letter tiles and break the work into parts for the student to work out.
5. The teacher should draw a line in the story to where the child is expected to read to that day. The teacher should choose this point in the story based on the individual student, the time available, and the student's confidence in reading. This may be discussed with the student.
6. After the first page of the story, the student is required to point to the sounds and longer words rather than colouring them in the book.
7. The teacher should guide the students to discover the meaning of words. Many of the questions at the bottom of the page require the students to stop and think, the teacher should provide scaffolding to this thinking. If the student is stuck on a question, the teacher may give half the answer to prompt the student, however, the teacher should try not to give the full answer.

8. Following the reading of the story, the student should complete the illustrations in the book. The teacher should explain to the students that not all students will have the same picture but that the story has told them things that must be included. Discuss for example that the story may have said “the house had four windows”, however, the story did not say what colour they were.
9. The student does not need to complete all the illustrations (especially if this is an activity the student largely dislikes), the teacher may find it sufficient to discuss what the student could have drawn in the given space.
10. Some stories had unlabelled illustrations included in the story, the student is encouraged to find out what these illustrations refer to as part of the comprehension.
11. Time permitting, the students should discuss with others what they have drawn and why.
12. At the end of the story the teacher should tell the student how many words they have read today (number is included in teaching manual), and possibly write it down so the students can show their parents.

Appendix E: Instructions for Using the Sliders.

1. The sliders should be used in conjunction with the onset-rime sheets. Both encourage students to immediately recognise the parts of words and put them together.
2. The sliders are used differently for different students, and as students become more competent. Each slider has a different sound written on it to make up words.
3. At level 1, one side of the slider should be held still, and the other side should be moved to create new words. The slider should be moved at a rate the student can keep up with and when the child is easily able to complete the words, move both sliders at the same time.
4. As a further load on processing, the student should be asked whether the word created is a real word or a made-up word. Students do not need to think about the meaning of the words.
5. There are different combinations of slider cards for different student needs. For example a student may have difficulty detecting the 'm' and 'n' sounds in final blends, therefore the teacher can use the set of sliders where those sounds are randomly included or excluded. More complex rimes can also be included for advanced decoding practice.