Abstract

Reading is a complex process and demands a wide range of knowledge and skills at different levels of text processing. Many students who make slow progress in their reading experience difficulty at the word level. They are unable to take words apart effectively and accurately as they read. This study investigates the correlation between performance in segmenting and blending letter clusters in words and accurate word reading ability.

The hypothesis being investigated in this study is:
Explicitly teaching Grade 2 children who have difficulty with reading to process orthographic information in words by recognizing and phonologically segmenting and blending letter clusters improves their ability to accurately read words in isolation and in prose.

Two grade 2 students were chosen for this research because they were identified by their classroom teachers as making slow progress in their reading over the last 6 months. The classroom teachers were concerned that both students were reading at instructional levels below their classmates and were experiencing some difficulty taking words apart as they read and were often reading words inaccurately.

This study uses an OXO design. The students were tested using 3 word tests and running records were taken to determine the instructional text level for each student. From the results an intervention program was designed and implemented. The students were withdrawn, together, from their classrooms for a series of 13 lessons over 2 weeks. Each lesson went for 30-40 minutes. The series of lessons focused on explicitly teaching letter cluster sound pattern links and the skill of segmenting and blending and also included 3 revision lessons. Each lesson involved isolated word reading and reading short texts. At the conclusion of the intervention further testing was carried out.

The results seem to indicate a strong correlation between the students' performance in orthographically and phonologically segmenting and blending letter clusters in words and their ability to read words accurately in isolation and in prose. These findings imply that intervention in the form of explicit teaching of orthographic knowledge and word processing skills is required for students experiencing reading difficulties at the word level. Further to this the results of this study imply that accurate word reading assists in raising the reading level of the students.

Introduction

Reading is a complex process and demands a wide range of knowledge and skills at different levels of text processing. The word level is one of these levels (Munro, 2004). Many children with reading difficulties are unable to take words apart effectively and accurately as they read. Acquiring knowledge and skills that allow for efficient word recognition is an essential part of learning to read. It has been highlighted by research that word reading ability plays a significant role in literacy learning. 'The very act of word solving expands students' power over language…Solving words… sustains reading.' (Fountas & Pinnell, 2001 p. 370). Researchers often refer to skilful readers as having efficient and well established word reading abilities. 'Even competent readers…sometimes need to slow down and analyze an unfamiliar word' (Fountas & Pinnell,1999, p. 6).

When children learn to read they learn that words have more than one part and there are common clusters of sounds that tend to go together. Children with reading difficulties at the word level may have insufficient knowledge of some letter clusters and have difficulty phonologically and orthographically segmenting and blending letter clusters when attempting to read unknown words. It is widely considered by researchers of literacy learning that phonological and orthographic awareness are basic bodies of knowledge that are the keys to the process of solving words (Adams, 1990; Fountas & Pinnell, 1999; Munro, 1998). Immature phonological awareness and orthographic knowledge affect the ability to develop knowledge about the printed word and to be able to read words accurately.

Children who are aware of sound segments such as letter clusters have developed phonological awareness and can use this knowledge to connect their oral language with the written language as they read. A number of researchers agree that the development of this sound awareness is necessary in order for readers to understand that print represents speech. (Adams, 1990; Clay, 1991;) Phonological awareness means that children can connect words and know that words are made up of sequences of sounds (Fountas & Pinnell, 1999). Phonological awareness allows for the ability to identify and manipulate the sounds in words. Consequently children who have immature phonological awareness may find it difficult to develop the skills of segmenting and blending**.**

'Children learning to read need to attend closely to letters or letter clusters to recognize a word, to anticipate and to confirm their initial response. Skilled readers tend to use clusters of letters, focusing on the largest cluster of letters, within a word, that will enable them to analyze the word most rapidly. The skilled reader recognizes a familiar cluster at once and links it with sounds to produce a response that fits the sense of the passage. As a further check, the reader may ensure that the sounds of the word are represented by letters on the page.' (NZ Ministry of Education, 1997 p. 43)

Researchers agree that efficient readers read in chunks or clusters (Adams 1990; Clay 1991 & 1999). Clay tells us 'good readers read in chunks' (Clay, 1999, p.47). They notice larger chunks of information including clusters of letters. 'The larger the pronounceable units a child can discover and use, the less learning effort will be required' (Clay, 1991, p.290) If children are recognizing and learning the largest possible chunks or letter cluster groups in words and are able to assemble them this will allow for quick and accurate word reading. Clay argues that a child's ability to use phonological information for letter clusters and ability to analyze words in larger units, such as letter clusters, makes for more efficient reading (Clay, 1991).

Learning about words is a strategic process. 'Skilful word solvers use the largest chunks of information they can and are constantly searching for connections.' (Fountas & Pinnell 2001, p.371) Children learning to read need to see the visual patterns of words and this includes recognizing the sequence of letters in words and letters in a letter cluster. This knowledge of letter clusters allows them to consider which parts of a word they know and how this can assist them in the process of solving words. In a discussion of a study carried out by Philip Gough that compared the effectiveness of learning words by memory verses decoding words, Sebastian Wren argues the importance of the skill of being able to break words apart for accurate word reading. Because most words share many visual features with many other words children who attempt to memorize words as wholes tend to confuse words. 'In order to become competent readers children need to learn to decode words rather than simply memorizing them. Decoding words is much more generative and flexible and requires much less attention and memory.' (Wren, 2004)

A child's immature knowledge or acquisition of skills at the word level may interfere with the development of other levels of reading ability. Researchers argue that rapid and accurate word reading frees children to focus their attention on the meaning of what they read. (Armbruster & Osborn, 2004; Clay, 1991) If children are able to notice familiar patterns in words and strive to recognize these automatically they spend more time reading for understanding and less time decoding words (Harris, Turbill, Fitsimmons & McKenzie, 2001). As Clay puts it children need to be 'successful analyzers of word…' (Clay, 1999) They need to be thinking more about how words work in the service of meaningful reading. A proficient reader will work at all levels of the reading process simultaneously (Munro, 2004). Word reading accuracy is the focus for this study, however, as researchers have found, other levels of the reading process must be considered to achieve a standard of efficient and effective reading ability.

The aim of my study is to explore the influence recognizing, segmenting and blending of letter clusters, using phonological and orthographic knowledge, has on the students' ability to read words accurately. The research aims to confirm that children who are able to recognize chunks or letter clusters in words and attach a sound to them will become more successful at reading words accurately. Work on words should take place as examples occur in the context of reading texts. If children are going to learn to be effective word solvers they need to do

so while reading texts. Hence, this study will attempt to explore the students' ability to transfer isolated word reading ability to reading words accurately in prose.

Researchers Goswami and Bryant suggest that children will be able to read unfamiliar words easier by using the break between the initial consonant or consonant cluster and the rest of the word as in *str-aw* (Goswami & Bryant, 1990, as cited in Fountas & Pinnell, 1999). These natural breaks are known as onset and rime. Researchers suggest that it is easy for speakers to break the single-syllable word at the onset and rime break. I have considered this in my study and used these types of breaks when teaching the students to segment and blend word parts using letter cluster knowledge. The words used in the teaching will be predominantly monosyllabic words.

Method

Design

This study uses an OXO design. The study monitors year 2 students' gain in word reading accuracy in isolation and in prose following explicit teaching of segmenting and blending of letter clusters in words. Two students from year 2 were chosen for this study because the classroom teachers were concerned that their literacy score results from ongoing classroom testing had not improved greatly in the last 6 months or accelerated similarly to the rest of the year 2 students. Formal testing of the students was implemented and an analysis of the data carried out. A strategic plan of action was designed and implemented followed by further testing and analysis to determine the gains made by the students in word reading accuracy after the completion of explicit teaching and intervention in orthographic processing focusing on knowledge of letter clusters and phonological skill of segmenting and blending.

Participants

The participants for this study were two female Year 2 students who have been identified as having reading difficulties since the beginning of Year 1. Both students have attended the same Catholic Primary School since beginning school in Prep and have both successfully completed the Reading Recovery Program in Year 1. They are both in a Year 1 and 2 composite grade of 32 students, however they are not in the same grade. Both students have English as their first language. In the past the Classroom Teachers and Reading Recovery Teacher have identified that a reading difficulty both students have had is with word reading in texts. Both students have made some progress in literacy since the beginning of Grade 1. However the classroom teachers are concerned that the students' progress has slowed down in the last few months and they are working below the text level of the rest of the Year 2 students, who are reading at level 28 and beyond according to the PM Benchmark Kit 2. The similar concern expressed by the classroom teachers for these students is identifying the possible reason/s for the

continual word errors made or word difficulties they have when reading text and what strategies to use to assist these students.

Student A was 8 years and 4 months at the time of the study. She is a quiet student. She is reading at an instructional level 23 according to the PM Benchmark Kit 2. Her classroom teacher has made the following observations:

When **Student A** reads she will sometimes completely stop at a word she doesn't know and make no attempt at solving it or on errors she will read words incorrectly often replacing the word in text with a nonsense word that looks similar.

Student A can often give a general summary of what she has read but often cannot recall all details.

Student A reads prose very fast and when there are many word errors made there is minimal hesitation or self-corrections made.

Student A rarely interacts with the text as she reads.

Student A often isolates herself from the reading group she is working in. She will move herself to the back of the group and the teacher needs to draw her into the activities and discussion because she will not volunteer to do this herself.

Student B is 8 years and 1 month at the time of the study. **Student B** is attentive in class and will often participate in small group reading activities but doesn't appear as confident in whole class reading tasks. She is reading at an instructional level 22 according to the PM Benchmark Kit 2. Her classroom teacher has made the following observations:

When reading text **Student B** will often appeal for help at a difficult word and if an attempt is made it's often only an attempt to search the initial visual part of a word and there is no attempt to search the rest.

Student B will often question whether a word she's read incorrectly makes sense in the context of the text. She will sometimes comment when she becomes confused or the text is not making sense so she appears to be attempting to monitor for meaning.

Student B will recall some details in text and often interact well with the text, asking questions or clarification.

Both students may have insufficient knowledge of letter clusters and be unable to recode some letter clusters to sounds when attempting to read an unknown word in text.

Materials

- *Materials used for Pre-Test & Post-Test:*

  *Prose Reading - Students read aloud texts from PM Benchmark Kit 2 (Levels 20-27) to determine their instructional text level of reading, which is the measure of reading ability used in the classroom. Running Records were taken on the students' reading and an analysis of the types of word errors that were made.

  *Word Reading Tasks – The students read individually presented 1-syllabic words on the *Orthographic Reading Test* (J. Munro) and the *Rime Units Test* (37 Dependable Rime Units) to determine their letter cluster sound strategies, word accuracy and ability to segment and blend letter clusters.

  The students also read individually presented words on the BURT Word Test which included 1-syllable and multi-syllabic words to determine letter cluster sound strategies and segmenting and blending ability.

- *Materials used during teaching:*

  *Flashcards – For each new letter cluster taught the teacher had a set of 2 or 3 words on cards and each child had their own set of 3 or 4 words on cards in an envelope. All the words on cards were different but all contained the same letter cluster.

  *Teacher invented text using the words containing the letter clusters that had been taught

  *Children invented text (written during the lessons-typed and printed)

Procedure:

These tasks were administered to both students in the following order:

Rime Units Test

Orthographic Reading Test

BURT Word Test

Prose Reading using PM Benchmark Kit 2

Each student was individually pre-tested using all the tests in one session. The pretests included Running Records to determine instructional text level; Orthographic Reading Test; Rime Unit Test, BURT Word Test.

The results were analyzed and letter clusters types that the students were having difficulty with were identified. These letter cluster/sound types included vv, vc and vcv digraph patterns. The 14 lessons included 11 formal lessons that each introduced a new letter cluster and 3 revision lessons to allow for review, consolidation of learning and to determine the teaching for the next lesson.

At the completion of the 14 lessons Running Records were taken again to determine the students' instructional text level and the same 3 word tests used in the pretest were administered to measure word reading accuracy and ability to segment and blend using knowledge of letter clusters taught.

The students were withdrawn from their classroom each day and worked together with the teacher in the Reading Recovery Room. They were withdrawn each day over a 2 week period for a total of thirteen 30-40 minute sessions. Because of teacher commitments and timetabling restrictions at school the students were withdrawn twice on 4 of these days and once on the remaining 5 days.

The focus of the lessons was to explicitly teach letter cluster sound pattern links and skill of segmenting and blending using onset and rime units in words. Each lesson introduced a new type of digraph (Appendix 2) Lessons 1 to 6, 8 to 10 and 12 to 13 followed a similar lesson plan and sequence of activities (Appendix 1). Each lesson began with revision of previous words learnt and reading of prose from previous lessons. New words were introduced that included the new letter cluster to be taught. The teacher read and cut into onset and rime 2 or 3 new words as the students worked with the teacher to identify common letter clusters in the words, the onset and rimes and the sounds the letter clusters made. The students worked as a pair and then individually to cut up words (segment), re-assemble (blend) and read. They were encouraged to experiment with words-manipulating sounds and letter clusters. During each lesson the students were asked to verbalize their new learning and to list the new word beginnings and word endings they had learnt. These lists were displayed and added to each day. A list of the letter clusters and phonic generalizations was also displayed and added to each day (ir, ou, ate etc.) At the end of every lesson the students read a short prose that included new word types they had learnt. The text was invented by the teacher or students.
Lessons 7, 11 and 14 were revision lessons that included the following activities: re-reading prose from previous lessons, reading a list of a mixture of words learnt so far to develop the students ability to discriminate different word types and move from one sound pattern to another, and a concentration game.

Each student participated at all times throughout the lesson, given equal opportunity by the teacher to participate and to work independently, as partners and with the teacher.
Each task the students were asked to do was modelled by the teacher first.
The students were given constant feedback by the teacher and praise for their effort and success.

Results

Both students were withdrawn from their grades and worked together with the teacher at the same time. Their behaviour in this situation, including the way they interacted, was interesting to observe. They were both willing to come to the lessons and at times were excited. Overall they worked well together and often helped one another with the activities.

Student B showed confidence and enthusiasm from the very first lesson and was initially able to complete tasks faster than **Student A** and verbalize her understandings clearly. By the 3rd lesson **Student B** was sometimes behaving in a competitive nature, trying to answer first and **Student A** would sometimes stop what she was doing and be less inclined to give an answer or respond to teaching instructions. So the teaching needed to be adapted to allow both students to participate equally. This was done when the teacher moved from one student to the other allowing each of them equal opportunities to talk about what they were doing. Positive feedback was consistently given. For the remainder of the lessons these problems did not occur as often.

During most of the later lessons **Student A** was attentive and responded appropriately to the teacher, being able to complete many tasks on her own. This followed some deliberate one to one teacher assistance in the earlier sessions and teaching strategies to encourage and enable **Student A** to be more responsive and active in the lessons. After about the 4th lesson **Student A** was familiar with the routine of the lesson and was working more independently.

The Students' performances are described by comparing the results of the *pretest* with the results of the *post test*. The students' word reading accuracy and ability was determined by calculating and comparing the score and word solving skills on their pre and post tests. The students' prose reading ability was measured using running records taken on unfamiliar texts during pre and post testing.

Student A's scores on Pre and Post tests are presented in the following table:

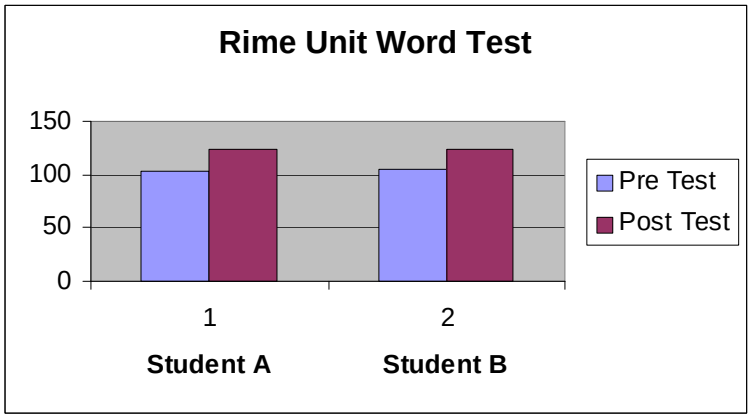
Tests	**Pre Test**	**Post Test**
Orthographic Reading	45/84	74/84
Rime Units	103/128	124/128
Burt Word Reading	39/60 (words attempted)	43/60 (words attempted)
Instructional Text Level	23	26

Student B's scores on Pre and Post tests are presented in the following table:

Tests	**Pre Test**	**Post Test**
Orthographic Reading	46/84	77/84
Rime Units	105/128	124/128
Burt Word Reading	36/53 (words attempted)	41/54 (words attempted)
Instructional Text Level	22	24

The trend for both students indicated a significant improvement in word accuracy ability and text level achievement at the completion of the lessons.

*The following graph shows the individual word reading accuracy on the **Rime Unit Tests** for **Student A and Student B***



Student A

Student A's word accuracy on the Rimes Unit test increased by 17% after explicit teaching. The errors **Student A** made on the *Pretest* included all 3 types of lengths of words with 88% of errors made on 4 and 5 letter words. Although only 4 errors were made on the *posttest* there were still examples of each word length.
On the *pretest* there was 1 self-correction made and there were no attempts made to segment the words and **Student A** appeared to be using distinctive visual features on all errors. The list of words was read very fast in 3 minutes and 29 seconds.

On the *posttest* there was 1 self-correction made again, however her self-correction rate changed from 1:26 to 1:5. There were 18 attempts to segment and blend the letter clusters or onset and rimes in words, 17 of which were successful. On 3 errors **Student A** appeared to be using distinctive visual features. The list of words was read in 5 minutes and 59 seconds, so read much slower than the pretest but with improved accuracy.

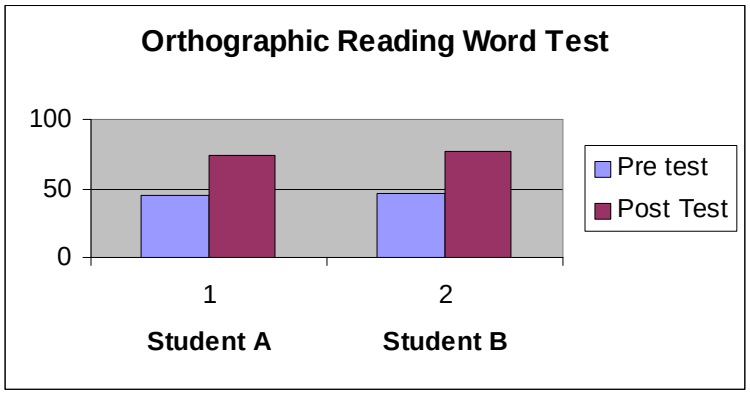
Student B

The word accuracy for **Student B** on the Rime Unit Test increased from 15%. The errors Student B made on the *Pretest* included 65% of errors on 4 letter words and 35% of errors on 5 letter words. Of the 4 errors made on the *posttest* 2 (50%) were made on 4 letter words and 2 (50%) were made on 5 letter words. So the more difficult words to decode for both students were the 4 and 5 letter words.

On the *pretest* there were 7 self-corrections made and there were 9 attempts made to segment the words, 3 of which were successful. On most errors **Student B** often attempted the initial part of the word and some dominant consonants but stopped at this and either appealed for help or made no further attempts and moved onto next word. The list of words was read very slowly in 7 minutes and 42 seconds.

On the *posttest* there were 2 self-corrections made so there was an improvement in her self-correction rate from 1:4.3 to 1:3. There were 15 attempts to segment and blend the letter clusters or onset and rimes in words, 14 of which were successful. The list of words was read in 6 minutes and 57 seconds, so results show she read the words a little faster with much higher accuracy.

The following graph shows the individual word reading accuracy on the ***Orthographic Reading Test*** *for* ***Students A and B***



The following tables shows analysis of ***word errors*** *on the* ***Orthographic Reading Test*** *for* ***Student A***

Word Type	3 letter	4 letter	5 letter	6 letter	High freq.	Middle freq	High freq.
Pretest	6	8	11	4	8	15	16
posttest	0	3	2	5	2	4	4

Word Type	1:1	Vc reg	Vc irreg	Vv irreg	Vv reg	Vcv reg	cc
Pretest	6	8	5	8	2	8	2
posttest	3	0	1	3	3	0	0

Student A

The word accuracy for **Student A** on the Orthographic Reading Test increased by 34% after explicit teaching. All words were attempted.

On the *pretest* **Student A** made errors on all the word types that included the different letter patterns. 80% of the errors were made on words that included vc, vv or vcv digraphs. On the *posttest* no errors were made on the words with vcv, cc and vc regular digraphs and very few errors were made on all the other word types.
On the *pretest* errors were made on all frequency types of words. These errors decreased on the posttest. **Student A**, therefore, improved word reading accuracy on most word types.

On the *pretest* 97% of the errors were made using distinctive visual features, 2 attempts were made to segment and blend of which 1 was successful. **Student A** completed the test very fast, in 3 minutes and 3 seconds. Comparing this with the results of the *posttest* she took much longer to complete the test but her word accuracy increased significantly after more attempts at taking words apart. The *posttest* took her 8 minutes and 2 seconds to complete and she made 32 attempts at segmenting and blending, 26 of which were successful. These results show an increase in word decoding behaviour and word accuracy, but slower reading.
No self-corrections were made on either of the tests so this behaviour did not change.

*The following table shows analysis of **word errors** on the **Orthographic Reading Test** for **Student B***

Word Type	3 letter	4 letter	5 letter	6 letter	High freq.	Middle freq	High freq.
Pretest	10	10	10	8	7	14	17
Posttest	2	3	2	0	3	2	2

Word Type	1:1	Vc reg	Vc irreg	Vv irreg	Vv reg	Vcv reg	cc
Pretest	6	5	5	9	1	9	3
Posttest	0	1	1	2	2	1	0

Student B

The word accuracy for **Student B** on the Orthographic Reading Test increased 37% after explicit teaching. On the pretest 1 word was not attempted and she hesitated 14 times, 9 of these leading to incorrect responses. When she hesitated she would appeal for help or ask if she could skip that word. All words were attempted on the *posttest* and 1 hesitation led to an incorrect response.

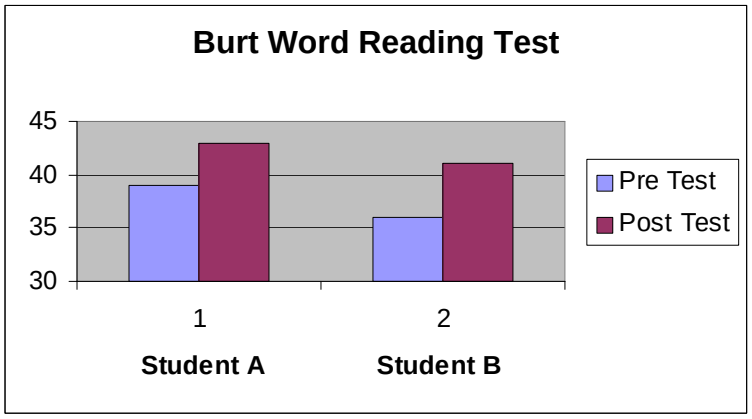
On the *pretest* there were examples of errors made on words with each of the letter pattern types, 76% made on words with vv, vc or vcv digraphs. On the *posttest* there were only 1 or 2 errors made on each of the words with the vc or vv or vcv digraph and there were no errors made on words with 1:1 letter/sound mapping or cc digraph. **Student B** showed an improvement in word reading accuracy of all word types.

Similar word length errors were made on both tests, most of the errors being on the 3, 4 or 5 letter words. However the error scores were significantly low on the *posttest* compared to the *pretest* and there were no errors made on any of the 6 letter words on the *posttest*. While most errors (82%) were made on middle and high frequency words on the pretest there were an almost even small number of errors made on low, middle and high frequency words on the *posttest*. These results show that **Student B** improved her accuracy with all word types and the *posttest* shows that she doesn't appear to be having difficulty with any one word type in particular.

On the *pretest* 84% of the errors appeared to be made using distinctive visual features, and by guessing the word or not knowing how to attack it. 15 attempts were made to segment and blend of which 8 were successful and on 6 she unsuccessfully read the word letter by letter. **Student B** completed the test in 9 minutes and 37 seconds. She completed the *posttest* faster, in 7 minutes and 6 seconds and made 23 attempts at segmenting and blending, 22 of which were successful. There were no appeals for help. These results show a significant improvement and success in word decoding skills and more rapid reading.

4 self-corrections were made on the *pretest* and 7 self-corrections on the *posttest* so her self-correction rate improved from 1:10.5 to 1:2.

*The following graph shows the individual word reading accuracy on the **BURT Reading Test** for **Student A and B***



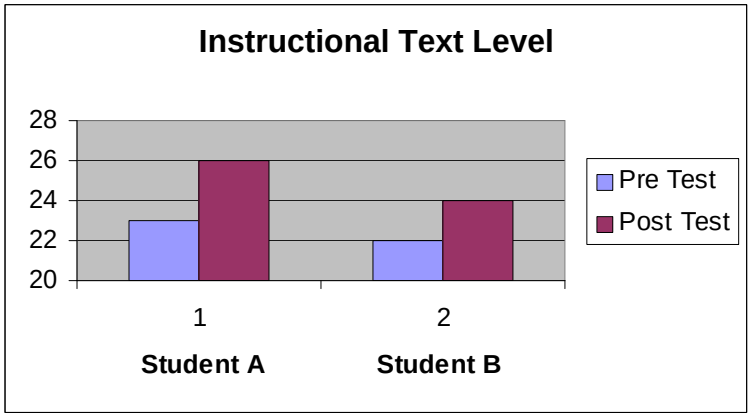
Student A attempted the same number of words on the BURT tests and increased her score by 4 correct responses.

On the *pretest* she hesitated on 2 words, made no attempt on one word and there were no self-corrections. She appeared to be using distinctive visual features on 86% of the errors and made 2 unsuccessful attempts to segment and blend. There was no other segmenting behaviour displayed.

On the *posttest* she hesitated on 9 words and made no attempt on these. One self-correction was made using segmenting and blending strategy. On 5 errors (29% of errors) she appeared to be using distinctive visual features and 3 unsuccessful attempts were made to segment and blend. **Student A** took 44 seconds longer to complete the *posttest* on the same number of words. She used distinctive visual features less often on the *posttest* but at the same time made no attempts on more of the words. According to the EBA (Equivalent Age Bands) for the Burt Reading Test, **Student A** gained in reading age from age band 7:03-7:09 to 7:07-8:01. The results also show minimal change in self-correction behaviour.

In comparison to her *pretest* **Student B** attempted one more word on the *posttest* and had 5 more correct responses. On the *pretest* she hesitated on 7 words, made 3 self-corrections, used distinctive visual features on 10 word errors and made 8 attempts at segmenting and blending, only 1 of which was successful. On the *posttest* she made no hesitations, 2 self-corrections, used distinctive visual features on 6 word errors and made 10 attempts at segmenting and blending, 3 of which were successful. It took her 13 seconds longer to complete the posttest. These results show a slight increase in word reading accuracy and segmenting and blending behaviour, less hesitations and an increased ability to attempt to take an unknown word apart. According to the EBA (Equivalent Age Bands) for the Burt Word Reading Test, **Student B** gained in reading age from age band 7:00-7:06 to 7:05-7:11. The self-correction rate did not significantly change.

*The following graph shows the **instructional text reading levels** for **Students A and B***



*An **analysis of reading behaviour** on text reading for **Student A** is represented in the following table:*

Student A	Instructional Level	Using dvf	Self corrections	Successful segmenting & Blending	Unsuccessful segmenting & Blending	Deleted a word	Inserted a word	hesitated
Pretest	23	15	2	0	2	1	0	0
Postest	26	7	5	2	2	1	3	2

Student A moved 3 text levels and she increased the number of self-corrections from 2 self-corrections on the pretest to 5 self-corrections on the post test. This is an improvement of a self-correction rate from 1:10 to 1:4.75. The results show a slight improvement in the number of successful attempts to segment and blend and less errors were made using distinctive visual features.

*An **analysis of reading behaviour** on text reading for **Student B** is represented in the following table:*

Student B	Instructional Level	Using dvf	Self corrections	Successful segmenting & Blending	Unsuccessful segmenting & Blending	Deleted a word	Inserted a word	Hesitated (& appeal for help)
Pretest	22	9	2	1	5	0	0	5
Postest	24	8	3	6	7	0	0	0

Student B moved 2 text levels. She made 2 self-corrections on the pretest and 3 self-corrections on the posttest so her self-correction rate improved from 1:10.5 to 1:6. **Student B** made 5 appeals for help on the *pretest* compared to none on the *posttest* and the results show an increase in segmenting and blending behaviour and an improvement in the number of successful attempts. She has made a similar number of errors using distinctive visual features.

These results show an overall gain in text level reading after a short 3 week period of intense intervention, although this may also be due to a confounding variable of on-going classroom teaching.

In summary the trend for both students shows a significant increase in word accuracy reading and the use of segmenting and blending strategy along with recognition of functional letter clusters in monosyllabic words. While **Student A's** results showed an improvement in these skills her word reading slowed down and there was minimal change in self-correction behaviour. **Student B's** results showed an overall increase in these skills along with some increase in speed of word processing and slight increase in self-correction behaviour overall.

Discussion

The results of this action research study support the hypothesis being examined. As a result of intervention and the explicit teaching of specific letter cluster knowledge and the skill of segmenting and blending the overall results show that both students increased their word accuracy ability. They demonstrated an increase in segmenting and blending behaviour as they attempted words in isolation and in prose. Both students were enthusiastic to participate in the lessons and, after instruction and guidance, were able to complete tasks independently once they had been demonstrated to them. There were some similarities between the results of the students.

In comparing the pre and post data of all tests in this study the improvement of the word accuracy results for both students on the Rime Unit and Orthographic Reading Test were greater than the results of the other 2 tests and two independent variables may have contributed to this. One of these variables is the fact that all of the letter clusters taught in the sessions as part of the intervention, were taken from examples of words in these 2 tests. The other independent variable that may have impacted on these results is the fact that most of the words used in the teaching sessions were monosyllabic. Unlike the text reading and the Burt test all words on the orthographic and rime unit test were monosyllabic.

On the word tests Student A's word accuracy improved after a substantial increase in successful attempts to segment and blend letter clusters, however her word reading was much slower. This suggests that Student A was spending more time trying to take the word apart to improve accuracy. Similarly, Student B's word accuracy improved on the word tests and she also displayed an increase in use of segmenting and blending strategy, however her reading was faster. This indicates an improvement in accurate and rapid, automatic reading for Student B. Because Student B did not appeal for help on the posttests to the extent she had on the pretests this may have also contributed to the faster reading. The significant increase in word accuracy and segmenting and blending behaviour by both students supports the theory by many researchers that word accuracy is dependant on the readers ability to recognize chunks or clusters of letters in a word and to then be able to assemble these parts successfully (Munro, 2004; Adams, 1990; Clay, 1999; Fountas & Pinnell, 1999). The results of this study partially support what Clay tells us that, 'if children are recognizing and learning the largest possible chunks of letter cluster groups in words and are able to assemble them this will allow for quick and accurate word reading' (Clay, 1991). Although this study did not set out to explore the impact segmenting and blending letter clusters has on rapid reading it is worth noting the different results in the length of time taken to complete the pre and post tests by each student in this case and raises the question of how this may impact on their overall reading ability including their fluency and comprehension.

Clay and Adams tell us that efficient readers read in chunks or letter clusters (Adams, 1990; Clay 1991 & 1999). The results for Student B on the orthographic reading test, in particular, support this theory because her reading behaviour changed from sometimes taking words apart letter by letter to segmenting and blending using clusters or chunks of letters.

The results of both students' tests show a decrease in using distinctive visual behaviour. As the students attempted to read most of their unknown words they often verbalized the parts of the words they knew and then successfully read the word. This indicates an increase in the recognition of familiar letter clusters and the ability to attach a sound to these. This supports the theory by many researchers that phonological and orthographic awareness are basic bodies of knowledge that are the keys to the process of solving words (Adams, 1990; Fountas & Pinnell, 1999; Munro, 1998)

The results of the rime unit and orthographic word tests for both students show that there was an improvement in reading a range of word types accurately. This, along with the increased use of the segmenting and blending strategy by both students, may suggest that once the children had learnt this strategy and were familiar with some functional letter clusters they were able to apply this new skill and knowledge to a variety of word types. The children were able to use analogy and apply what they knew to attempt unknown words. As Sebastian Wren tells us 'decoding words is much more generative and flexible than memorizing words' (Wren, 2004). Contrary to this, although the results for both students on the Burt test show a slight improvement in word accuracy and

use of segmenting and blending strategy, there were less successful attempts at word reading accuracy in comparison to the other two word tests. The explanation for this could be that they had insufficient orthographic knowledge of letter clusters, and the words they were having difficulty taking apart were mostly multi-syllabic. This may explain why Student A hesitated and made no attempt at words as often as she did on the Burt posttest. Further studies could explore and aim to extend the students' ability to recognize, segment and blend letter clusters in multi-syllabic words. The students' ability to read words *rapidly* using the skill of segmenting and blending and comparing their ability to do this on isolated words with their ability to do this on words in prose could also be explored.

Both students made gains in their instructional text level, which is significant given that the intervention was carried out over a short period of time and the classroom teachers had not had evidence of a significant improvement in text level ability for both students over recent months. The students' word reading ability in prose improved and there was an increase in successful attempts to segment and blend unknown words in text. So although there is the confounding variable of daily, ongoing literacy learning in the classroom the results of this study suggest that the intervention made an impact on their overall word reading ability in both isolation and in prose.

When comparing the behaviour of the students as they attempted unknown words on the posttest, overall student B made less appeals for help and almost made no hesitations to read a word. Instead she was prepared to have a go even though some attempts were unsuccessful. Student B's results suggest an increase in orthographic knowledge of letter clusters, ability to attack words and to work independently. On the other hand Student A's reading behaviour on the posttests, as mentioned before, slowed down and she hesitated more often and especially on the Burt test she made no attempt at all on words she didn't know. This behaviour is in contrast to student B's, even though both students word reading accuracy has improved, as already stated. However, the increase in student A's self-correction rate and an increase in hesitations suggests that she is, in fact, paying more attention at a word level and her monitoring behaviour has improved, but she hasn't the same amount of confidence as student B and is not prepared to make an error. It can only be assumed when watching her behaviour that she was searching for parts of the word that she might know and looking for ways to segment and blend but did not have sufficient orthographic knowledge of the letter clusters in these unknown words to do this.

After the initial lessons when Student B was often dominating, offering up answers faster than Student A, both students interacted well during the remainder of the lessons. Having to do 2 lessons on some days didn't seem to worry the students and they participated just as well in the 2nd lesson as they did in the first. So although the results showed that Student A's word reading confidence wasn't as obvious this independent variable did not seem to effect the students enthusiasm to attend the lessons. They equally participated and contributed.

As many researchers suggest, the ability to read words accurately frees children to pay more attention to meaning (Clay, 1999; Turbill, Fitsimmons & McKenzie, 2001). Although this study involved an analysis of reading words accurately in isolation and in prose it raises the question of whether an improvement in word accuracy has assisted the students' ability to comprehend what they read. Hence, further studies could explore how the ability to read words accurately improves comprehension.

The attention of this study was on accurate word reading with the focus being on searching visual information, matched with phonological knowledge. The findings, while supporting the hypothesis, suggest that ongoing intervention is required for those students experiencing reading difficulties in order to achieve overall improvement in reading ability. Other studies could extend what has been explored here to include multi-syllabic words and RAN and how these affect student's word reading accuracy in isolation and in prose. Further to this other studies could be conducted to research the difference that improved word reading ability has on comprehension.

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Appendix 1

The following teaching sessions are designed to teach the children to read words accurately in isolation and in prose. They aim to teach some functional letter clusters and how to use these to segment and blend using onset and rime units.

The first 6 lessons followed the same steps to help students become familiar with the procedure and to establish a routine. 3 revision lessons were taken in between including one before final testing.

Lesson Procedure for lessons: 1,2,3,4,5,6, 8,9,10, 12,13:

Step 1 Revision of previous lessons: Re-read words learnt from the previous lessons and/or re-read passage from the last session and children verbalize what they had learnt from this.

Step 2 The teacher presents 2 or 3 new words on individual cards that have the same letter cluster pattern in them, reads them to students and explains meaning of unknown words. Eg. purse, slurp, blurt

Step 3 Ask students to say what they can see is the same in each word. Match the letter cluster to its sound. Eg. u..r **can** make the sound 'ur' (as in church)

Step 4 **Self Script: Each student verbalizes the new learning: 'They all have u…r and in these words the u….r makes the 'ur' sound.'**

Step 5 Teacher models cutting 2 or 3 of the words into onset and rime. Eg. sp/urt
Students say the onset and rime units, pushing the letter clusters as they say them or holding a piece each and then blend them together. Eg. Student A holds 'sp' and Student B holds 'urt'. They each say what they are holding and then blend them together to say word, 'spurt'. The students take it in turns to hold the onset and the rime, so for the next word Student B holds the onset and Student B holds the rime.
Students run their finger underneath each blended word and read them fast.

Step 6 Constructing the word using correct letter sequence: Each student makes 1 or 2 of the words with magnetic letters.

Step 7 In an envelope each child receives 3 or 4 words with the same letter cluster being taught (i.e. 'ur'). With teacher assistance they cut (segment) into onset and rime, put the pieces back together (blend) and read each word.

Step 8 The students swap and read one another's words (cut into pieces), practicing segmenting and blending.

Step 9 Each student has a scrapbook and they blend and paste the words they've made and they read their own words and then one another's.

Step 10 At the back of their scrapbook the students list the new letter clusters they've learnt, written as onset and rimes, under the headings – '*Word Beginnings'* and '*Word Endings'*.
For Example:

Word Beginnings	Word Endings
ch	urch
sp	urt
sl	ur

Step 11 Writing the word: Students read one or more of their words again and close their eyes and 'make a picture' of it and then write it and check it.

Step 12 Ask students if they know of other examples of words that have this letter cluster in it. When the letter cluster is not a dependable one, the teacher gives 1 or 2 examples of words where the same letter cluster is making a different sound. A copy of all the words explored in this lesson is given to the children to paste in their scrapbook and any new examples are added to it.

Step 13 The teacher presents a short passage invented by the teacher that includes words that have the new letter cluster taught.

Step 14 Before reading the passage students take it in turns to find words in the passage with the taught letter cluster in it.

Step 15 Alternatively students invent their own sentences using some of the new words taught.

Step 16 Transferring letter cluster to prose: Students read the passage or sentences.

Step 17 Discriminating the word type from similar words: The teacher places a few words down that include examples of words with the new letter cluster taught and words with other letter clusters and the students read them as fast and as accurately as they can.

Step 18 **Before each child leaves they are asked to verbalize what they have learnt in this session.**

Revision Lesson Procedure for lessons 7,11,14:

- Each student reads one or two of the teacher or student invented texts from the previous lessons.
- The students read a **mixture** of word types taught so far, which are written on flashcards and placed on the table in front of them. These words are chosen at the teachers' discretion after observing the children during the previous lessons.
- Concentration Game: Using examples of a mixture of the word types taught so far the children play concentration game together. Flashcards with the words written on them are placed faced down on the table and children take it in turn to find a pair.

Each student reads one or two of the teacher or student invented texts from the previous lessons. (These are different to the ones read at the beginning of this revision lesson)

Appendix 2

The lesson sequence

Lesson 1: letter cluster – 'ou'
Lesson 2: letter cluster – 'ir'
Lesson 3: letter cluster – 'ur'
Lesson 4: letter cluster – 'aw'
Lesson 5: letter cluster – 'ar'
Lesson 6: letter cluster – 'ai'
Lesson 7: *revision*
Lesson 8: letter clusters – 'ee' & 'ea'
Lesson 9: letter cluster – 'ew'
Lesson 10: letter cluster – 'oi'
Lesson 11: *revision*
Lesson 12: letter cluster – 'a-e' (ate; ale; ape; ake; ame)
Lesson 13: letter clusters – 'i-e' & 'u-e' (ine; ide; ite; ike; ice; ipe; ine; ive & une; ube; ute)
Lesson 14: *revision*

The following information includes, for each lesson, the letter cluster being taught, the list of words used and the prose passage or sentences used.

Lesson 1 *Letter Cluster:* 'ou'

Teacher's words on separate cards:	ground	out	count	lounge
Student A's words on separate flashcards:	found	shout	couch	trout
Student B's words on separate flashcards:	sound	sprout	loud	house

Prose Reading:
Jack got up off the couch in his lounge room. He had heard someone shouting out his name. It was very loud. When he went out through the back door of the house he found his little sister standing in the garden. She was making a funny sound and was jumping up and down. As Jack got close to her he saw what she was excited about. They had planted some seeds in the ground and they could see sprouts. They counted six of them.

Lesson 2 *Letter Cluster:* 'ir'

Teacher's words on separate cards:	bird	girl	squirt	shirt
Student A's words on separate flashcards:	squirm	skirts	firm	
Student B's words on separate flashcards:	flirt	twirls	stir	

Prose Reading:
Anne and Tom went to the park near their house with their mum and dad. Anne wore a skirt and top and Tom wore shorts and a shirt. Tom was happy to sit on the ground and play with sand and dirt. He found a stick and began to stir the dirt and sand together. This made Anne squirm. Anne met a little girl and they played together. Anne and the girl spun around in a circle making twirls with their skirts. It was hot so dad squirted them with water from his drink bottle. As they walked home they enjoyed listening to the sound of birds singing.

Lesson 3 *Letter Cluster:* 'ur'

Teacher's words on separate cards:	slurp	burnt	hurt	
Student A's words on separate flashcards:	purse	spurt	turn	blurt
Student B's words on separate flashcards:	nurse	burst	blur	church

Prose Reading:
On the way to our school we could see a fire. As we turned the corner we saw a burst of flames coming from the church next to our school. The fire truck was there and we counted six firemen. They had some hoses and were squirting the fire with water. One fireman was sitting on the ground and he looked hurt. We thought he might have been burnt. Someone gave him a drink. He was slurping the drink through a straw. We went into school and looked at the fire through the curtains of the windows. The school nurse went out to help the hurt fireman.

Lesson 4 *Letter Cluster:* 'aw'

Teacher's words on separate cards:	drawn	saw	fawn	
Student A's words on separate flashcards:	dawn	prawn	thaw	sprawl
Student B's words on separate flashcards:	lawn	spawn	yawn	crawl

Student invented sentences (5 each)
A spider crawled up the wall.
I yawn when I'm feeling tired.
I bought some prawns from the supermarket.
I am going to draw a picture in my book.
Fish eggs are called spawn.
When I get home from school I am tired and I sprawl on my bed.
The grass is very long so we have to mow the lawn.
A baby crawled along the floor.
When I woke up in the morning I yawned.
I like to eat a prawn with my dinner.

Lesson 5 *Letter Cluster:* 'ar'

Teacher's words on separate cards:	start	dark	harp
Student A's words on separate flashcards:	party	market	march
Student B's words on separate flashcards:	chart	shark	scar

Prose Reading:
At dawn I was sprawled on my bed when I looked out the window into the garden. I saw my little brother crawling on the lawn. Dad picked him up. I yawned and started to get out of bed. Mum came marching into my room and told me to get dressed. We were going to the market and then to Mark's birthday party. Dad started the car and we were on our way. In the car I made a card for Mark. I had drawn a shark on the front because Mark likes sharks. At the market we saw people marching and a lady playing a harp. We bought Mark a dartboard and a little cart.

Lesson 6 *Letter Cluster:* 'ai'

Teacher's words on separate cards:	aid	aim	snail	train
Student A's words on separate flashcards:	trail	drain	claim	
Student B's words on separate flashcards:	frail	chain	braid	

Prose Reading:
Lisa is a new girl in our grade. We think she is a brain! She can do many things. Lisa likes to paint. She painted a picture of a snail in the rain. She comes from Spain and she has a braid in her hair. In Spain she went to school by train. Now she rides her bike to our school. She chains her bike to a rail near the drain outside. She likes to ride her bike but it is a strain going up the hill on the way to school. She has to get off her bike at the hill. Her aim is to ride her bike all the way to school without getting off.

Lesson 8 *Letter Cluster:* 'ee' & 'ea'

Teacher's words on separate cards:	seen	fleet	bleat	
Student A's words on separate flashcards:	cream	wheat	screen	sheet
Student B's words on separate flashcards:	scream	treat	spleen	greet

Prose Reading:
On Sunday my family and I went to the beach. It was hot so we put on some sunscreen. Our friend, Ben, came up to see us and we greeted him. My family sat on the beach and Ben went in for a swim. As we sat on the beach we heard a scream. We looked up and saw Ben waving to us from the water. We had not seen him waving to us and that's why he screamed. A fleet of ships had gone by and it made big waves in the water. The waves looked great. Ben couldn't swim in the big waves. We went out to help him. When Ben was safe Mum gave us an ice-cream as a treat.

Lesson 9 *Letter Cluster:* 'ew'

Teacher's words on separate cards:	blew	knew	strewn	dew
Student A's words on separate flashcards:	drew	grew	crew	new
Student B's words on separate flashcards:	screw	chew	flew	stew

Student invented sentences (3 each)
I was making a cubby house and I had to screw some screws into the wood.

The strong wind blew the trees down in the yard.

A pigeon flew into the corridor at school and ate all our lunches.

It was so cold this morning that there was dew all over the grass.

The crew on the ship were feeing very tired and seasick.

Last night we had vegetable stew for dinner.

Lesson 10 *Letter Cluster:* 'oi'

Teacher's words on separate cards:	boil	coil	foil
Student A's words on separate flashcards:	broil	toil	spoilt
Student B's words on separate flashcards:	spoil	soil	boiling

Prose Reading:
My family has a vegetable garden at our new house. My sister and I look after it and we don't want it to be spoilt. Mum and Dad knew we could take care of it. We built a little fence around it. My brother screwed a sign onto the fence and it read, "Emma and Rachel's Garden". The sign was made of foil and we drew a picture on it. It had coiled wire around it. On cold mornings we could see dew on our garden. Some days the wind blew the seeds away and the birds flew over wanting to eat the seeds strewn across our garden. Now we press the seeds down in to the soil. We keep our dog out of the garden because he chews on the plants. When our vegetables grew mum put them in a stew. We could smell the vegetables cooking as they boiled on the stove.

Lesson 12 *Letter Cluster:* 'a-e' (ate; ale; ape; ake; ame)

Teacher's words on separate cards:	flame	flake	crate	shale	ape
Student A's words on separate flashcards:	shame	brake	plate	stale	grape
Student B's words on separate flashcards:	frame	shake	state	whale	shape

Student invented sentences (3 each)
It is a shame that I can't go to the party. I saw a whale diving in and out of the ocean.

When we went to the country we saw grapes growing on the vines.

My family had their photo taken and we put it in a frame. The children shake all over when they dance.

I accidentally dropped the plate on the kitchen floor and it smashed.

Lesson 13 *Letter Cluster:* 'i-e' & 'u-e' (ine; ide; ite; ike; ice; ipe; ive & une; ube; ute)

Teacher's words on separate cards:	flute	rice	strive	bite
Student A's words on separate flashcards:	cube	slide	stripe	bride
Student B's words on separate flashcards:	tune	strike	spine	pride

Prose Reading:
Jake and Blake went to an amusement park in Queensland. Queensland is a state of Australia. It was a beautiful, sunny day and they knew the sun would shine brightly for them. Jake and Blake liked to go on all the rides. They went on a big side and played in a tube with long stripes on it. Inside the tube there was an ape, a snake and a whale. One of the rides had a flame coming out of the top of it. When they stopped to have lunch they sat on a crate near a lake. They ate 2 slices of cake on a plate, some grapes and a chocolate flake. A drake took a bite of Jake's apple. On the way home from the park they saw a bride coming out of a church. A man was playing a tune on a flute. People were throwing rice.