The relationship between rime unit knowledge, analogy and a self-extending system.

Abstract
Children who are unable to segment and blend words are often unable to make attempts on new or unpredictable words in text. This has important consequences for their reading ability and their ability to build a self-extending system that will enable the transfer of knowledge through analogy. This study compares results before and after specific teaching of segmenting and blending words into onset and rime and use of analogy of rimes. The results showed that the students could use the process of segmenting to locate the rime unit and blending to blend the new onset with the familiar rime. It also showed that they were able to apply this process to previously unmet rimes in new words, showing that they had started to develop a self-extending system. This finding suggests that the process of analogy has far-reaching implications in early reading.

Introduction

Some year one children on Reading Recovery complete twenty weeks on the program without achieving fluency in reading at the class average. While using skills which have been explicitly taught such as monitoring their own reading, reading for meaning, reading on, re-reading, predicting text and planning own reading, attending to punctuation and phrasing the reading, often it is these children who have not mastered the skill of segmenting unknown words and decoding them "on the run" within text.

This slows their reading down and reduces their ability to comprehend. It also reduces their ability to build a self-extending system of reading, as they are not able to use analogy to decode new words by using segments of known words. They remain reliant on using contextual cues to approach new words and by the time they are reading slightly above their own oral language norms, they are unable to use reading to feed back into and improve their level of complexity of oral language usage. Hence it is important that they are given the skills to de-code new vocabulary.

Related Research.
Children who show that they are reading for meaning and attend to the initial visual cue of words on text, and sometimes the final visual cue, but get the medial vowel or vowel blend incorrect are usually attending to distinctive visual features within the word, rather than common letter clusters such as onset and rime or common vowel digraphs. Savage & Stuart (2001) investigated whether children attended to the rime unit or the vowel digraphs and found that their study could not reliably state which letter cluster was a more useful tool to support readers. The fact that these children do not attend to these letter clusters could because of either of two things: 1) They do not identify them as a visual pattern (orthographic knowledge) and/or, 2): (as a pre-requisite), they cannot hear the different segments within the words (phonological awareness). (Dixon, Stuart & Masterson, 2002)

Phonological awareness is related to orthographic storage (Lundberg, Frost & Peterson, 1988). While whole word acquisition is vital in the early stages of reading development, this method of learning new words becomes clumsy as the words become longer and therefore harder to remember and less durable as the huge number of words needed for accessing wide reading makes individual word teaching a burden to any memory. What is needed is the transfer of knowledge from one word to another as a self-teaching mechanism. This can be done by teaching analogy, using onset and rime or common letter cluster patterns. The theory that children might use orthographic inference has been investigated by Goswami (1990), where she considered the relationship between phonological awareness and the ability to perform orthographic analogies in a clue word. The results supported the view of a specific link between rime awareness and analogy use. In her 1986 study, she investigated whether children made analogies with the beginning or the ends of words and found that although they used both, they found analogies between the ends of words easier. She concludes that analogy plays an important part in reading development. She maintains that what is actually developing is an increase in the number of words in a child's mental lexicon from which analogies can be made. (Goswami, 1986).

The present investigation aims to:
1) Further examine the relationship between rime awareness and analogy use.
2) Specifically teach some rime units, and demonstrate how to generalize and use analogy.
3) Develop the number of words in the student's mental lexicon from which analogies can be made.
4) Test whether this knowledge transfers to improved reading of unpredictable words in text which use a known rime unit.

Prediction:
1) That teaching year 1 students the process of segmenting words into onset and rime will enable them to decode new words in text using this knowledge.
2) That specific teaching of certain rime units and their orthographic representation in cue words and subsequent rhyming words, demonstrating analogy, will increase the transfer of this knowledge to a new word with that rime unit when it is met both in isolation and in text.

Method

Design
The study uses a case study design, with the same pre and post tests issued to compare and measure gains in word reading, text reading, phonological awareness and transfer of knowledge to previously unseen words in text. The students were tested using the Munro Rime Units Test and a text reading passage was devised using the rime units that both the students knew on the test. This passage also used unpredictable words using these same rime units to test whether the students were able to transfer their knowledge of the known rime units to previously unmet words.

After 5 sessions, during which 10 new rime units were taught, another text reading passage was issued using the 10 new rime units learned so far in the cue words learned and also in unpredictable words, again to test if they had made any gains in their ability to transfer their knowledge.

After 10 sessions, during which the same 10 rime units were re-taught, the same Munro Rime Unit Test was issued and the second text reading passage was re-issued.

Participants.
The participants are 2 year 1 students who have attend the same Catholic primary school for the past two years. Both are from English speaking backgrounds. They have each participated in 20 weeks of Reading Recovery and have not achieved class average reading levels. Both students read using meaning cues and using initial visual cues, but neither read accurately nor fluently, often needing to re-read to check meaning. Neither student is looking at the medial vowel in words either when reading them in isolation or on text. Student A refuses to attempt unknown words, while student B resorts to letter by letter de-coding. In both instances this slows the reading down as neither are useful strategies.

Materials.
The materials used include the following:

Phonological awareness tasks: These were oral recognition of the rime unit within single syllable rhyming words, orally segmenting words into onset and rime, deleting onset, substituting new onset, blending tasks where onset and rime are said in a segmented way and students blend them into a word. The words used for this task are listed in Appendix 1, but many more rhyming words were suggested and used by the teacher and children, including non-words.
Word reading tasks: Using magnetic letters and whiteboard, the teacher makes 2 cue words using the same rime unit. These words are in Appendix 1 and are presented to the children in order of complexity. The first 2 sessions start with words with rime units that they knew on the onset- rime test. The following sessions present words with rime units that occur most frequently in year 1 PM reader vocabulary, but that the children have failed to read in the Munro Rime Units test. All cue words are single syllable with no more than *cc* blend in the onset and up to 3 letters in the rime units. The words suggested by the students are recorded in Appendix 1 also.
Reading Tests: These are written specifically using the cue words and previously unseen words with rime units in common with the cue words to test whether the children are using analogy to read the new words. These passages are issued at the start of the teaching unit, half way and at the end. See Appendix 2
Writing Tasks: The students use both whiteboard and paper and colored markers to write the cue words and the suggested rhyming words as a memory aid.
Oral language task: Children dictate sentences using two words from session. These are written on a sentence strip by the teacher using colored pen. These are read in that session and re-read in subsequent sessions.

Procedure:
The children were withdrawn from class daily for 45 minutes for 10 sessions in the reading recovery room.
The tasks (see above) were administered to both students at the same time in the following order:
1) Phonological awareness tasks. 10 mins
2) Word reading tasks. 20 mins
3) Writing task 10 mins
4) Prose reading task 5mins

For the detailed teaching unit see **Appendix 3.**

The data collected through the specific questions asked throughout the teaching sessions drives the subsequent teaching and modification of the sessions according to the student's ability to demonstrate understanding of the process of using analogy and ability to store and recall rime units presented.

Results

Performance change on Rime test after 10 sessions introducing 10 new rimes. Student A
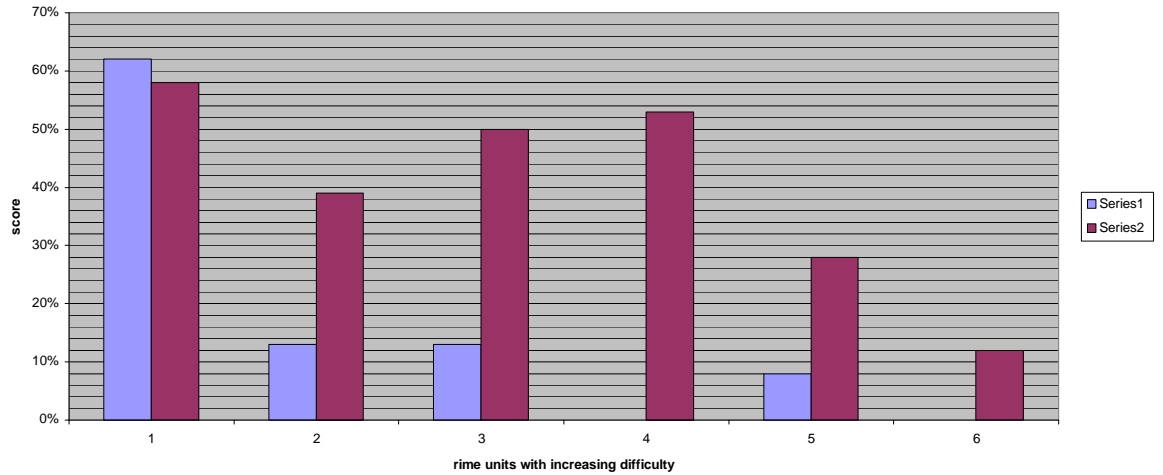
Performance improvement on Rime unit test after 10sessions Student B
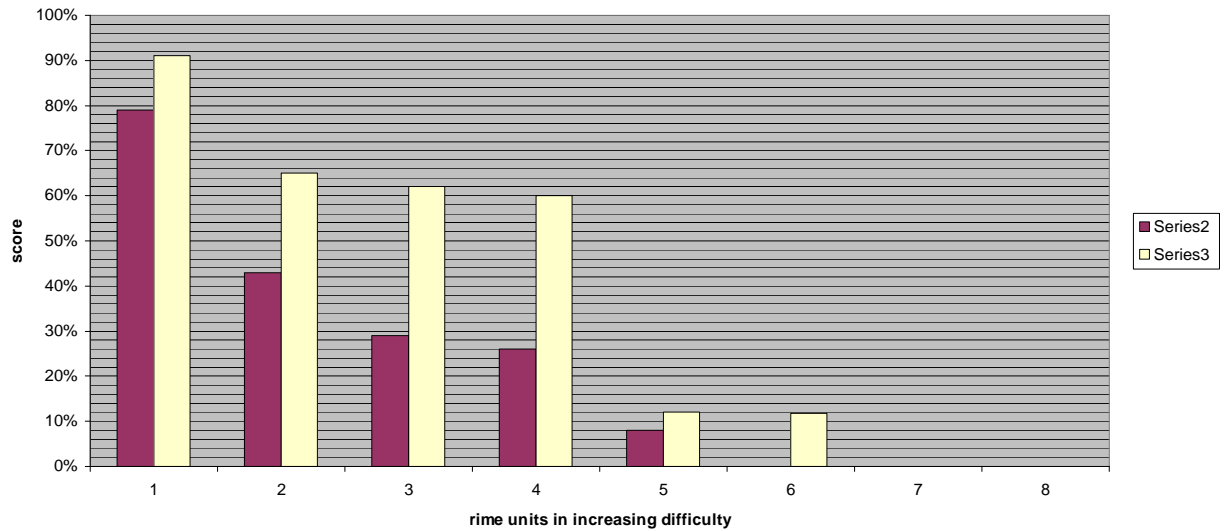
Table 1: Rime Units Test
The results of the Rime Unit Test are as follows in the table below.

Word Type	Student A		Student B	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
vc in 3 letter word	15	14	19	22
vc in 4 letter word	3	9	10	15
vcc in 4 letter word	3	12	7	15
vcc in 5 letter word	0	8	4	9
vvc or vcv in 4 letter word	2	7	2	3
vvc or vcv in 5 letter word	0	2	0	2

An overall improvement in performance is apparent in all word types, but especially in the vc in 4 letter words and vcc in 4 and 5 letter words. 4 of the taught rime units fell into this category which could account for this improvement. This supports the theory that by learning specific rime units and the process of analogy, the students are able to transfer the knowledge from a known cue word to an unmet word. However there was also an overall improvement in reading words with rime units that had not been specifically taught. As shown on the graphs, student A showed a slightly poorer performance in the 3 letter word category, but gains in all other categories of the rime unit test from between 12% to 52%, while student B showed gains of 4% to 34%.
This supports the theory that learning the process of segmenting words into onset and rime can assist reading of unknown words, as the students learn to attend to the medial visual detail in words.

Table 2: Comparison of scores for words with rime units taught and untaught in rime unit post-test.
The scores below show how the two students performed on the Rime Unit test, comparing their performance on words with rime units that had been taught and completely new words.

Student	Score for words with taught rime units	Score for words with untaught rime units
Student A	70%	34%
Student B	78%	47%

This shows that the students improved through the intervention and could transfer the knowledge of the taught rime units from the cue words that were used in the sessions to previously unmet words using those rime units in the test. The scores indicate that both students were more than twice as successful in reading words that contained familiar rime units than those that did not. This supports the theory that the students were actually transferring their knowledge of the rime units to the new words. It also supports the theory that the students could use the learned process of segmenting words, segmenting them and blending the familiar rime with the new onset.

Table 3: Text reading with taught cue words and unpredictable words using taught rime units.
Scores for word reading in text and use of analogy.
1: rapid, correct
2: hesitant, correct
3: incorrect, but with correct rime unit
4: incorrect.
A: student A
B: student B

Cue Word known rime unit	Score 1	Score 2	Score 3	Score 4	Unpredictable word with known rime unit	Score 1	Score 2	Score 3	Score 4
Text 1									
Day	A B				Clay				A B
Shop	A B				Slop			B	A
Hot	A B				Trot				A B
Sit	B	A			Bit	B			B
Drip	B			A	Slip			B	A
Back	A B				Black			A B	
Text 2									
Hop	B	A			stop	B			A
Back	A B				track				A B
Saw				A B	claw				A B
Well	A			B	shell				A B
Best	B			A	test	B			A
Tail	A			B	sail	A			B
Sink	A B				think	A			B
Boat	A			B	goat	A			B
Sock				A B	dock				A B
Rain	A B				brain				A B
Text 2 Repeated									
Hop	A B				Stop	A B			
Back	A B				Track	B			A
Saw	A B				Claw	A B			
Well	A B				Shell	A B			
Best	B	A			Test	B	A		
Tail	A			B	Sail				A B
Sink	A	B			Think	A B			
Boat	A B				Goat		A		B
Sock	A			B	Dock		A B		
Rain	A	B			Brain	A			B

In the first text reading passage the cue words used were ones that both students were able to identify correctly on the initial rime units test. The unpredictable words in the passage used those same rime units. This passage was used as a pre-test to establish whether either student was transferring their knowledge of rime units to unknown words in text. It can be seen that both students were able to correctly read the cue words in text, but failed consistently to read the unpredictable word in text, even though they knew the rime unit. Student B however, was able to attend to the rime unit in 50% of the unpredictable words but was unable to correctly read the word even though the rime unit was correct. It shows that although student B recognizes some rime units in unknown words he is unable to blend onset and rime successfully and student A is not using analogy to read unknown words.

In Text 2 the cue words were the words that were specifically taught as examples of the rime units to be taught. The process of using analogy had been specifically taught using both words in isolation and in text reading. (See Appendix 5 for lessons). After 5 sessions introducing 10 new rime units, this text reading result (above) showed that Student A could correctly read only 70% of the cue words and only 20% of the unpredictable words. Student B's results showed he could read only 40% of the cue words and 20% of the unpredictable words. Neither student used the knowledge of the rime units known to attempt the unpredictable words. They both used the initial letters of the words to attempt to read them, but did not attend to the medial vowel that would signal the start of the rime unit. It was apparent at this stage that more solid grounding in the rime units taught so far was necessary before any improvement would be seen.

After another 5 sessions using the same method, but introducing no new rime units, only repeating the ones previously taught, the same text reading was given. The results this time indicate that both students significantly increased their ability to recognize the cue words (both improved by 30%). But the biggest change was seen in their ability to transfer their knowledge of known rime units in cue words to unpredictable words in text. Both improved markedly: Student A by 60% and student B by 30%.
This supports the theory that specific teaching of rime units and the process of analogy lead to more ready transfer of rime unit knowledge to new words.

Discussion

Both predictions, 1) That teaching year 1 students the process of segmenting words into onset and rime will enable them to decode new words in text using this knowledge. And, 2) That specific teaching of certain rime units and their orthographic representation in cue words and subsequent rhyming words, demonstrating analogy, will increase the transfer of this knowledge to a new word with that rime unit when it is met both in isolation and in text, were supported by the results.

Text reading Tests

Overall the results appear to indicate that, by increasing the student's lexicon of rime units in their memory, they are able to draw on that to use analogy and de-code new or unpredictable words. However, the knowledge of the rime units must be sound and automatic, before analogy can be used. This was demonstrated by the difference in the results of the reading of text 2. On the first reading, after only 5 sessions the 10 rime units were not embedded in their memory. Neither was able to read all the cue words with 100% accuracy and their performance on the unpredictable words using the taught rimes was poor. Yet, after another 5 sessions teaching the same rime units, the text reading test showed both students made significant gains in their ability to read unpredictable words with known rime units. (See Table 3) The importance of giving students the opportunity to automatize their learning is thus demonstrated. That the students will then be able to transfer their knowledge from one situation to another is further demonstrated by the improvement in both test cases in their performance on the unpredictable words in the passage. Specific teaching of how to transfer this knowledge, ie., using analogy, was an important component of the teaching unit and the results showed that, given time the links could be made by the students.

Although student B was already using recognition of known rime units in his attempts to read unknown words in the pre-test (see Table 3), he was unable to correctly blend the new onset with the known rime. This demonstrates the importance of specifically teaching the process of segmenting into onset and rime and the phonological awareness that precedes this ability. (Dixon, Stuart & Masterson, 2002) As the intervention strategy employed a deliberate emphasis on phonological awareness, segmenting and blending onset and rime orally, student B was able to learn this. His subsequent improvement in the text reading test, passage 2, showed that he had made significant gains in his ability to blend known rimes with new onsets.

There was a 50% increase in the incidence of self-corrections for student A and a 300% increase for student B in the repeat test of passage 2 after 5 more sessions with the same rime units. This may indicate that both students were noticing the medial visual information or the rime units in the words and were making links with their rime unit knowledge in their memory, enabling them to self-correct more frequently. With both students there was only a 10% difference between their score on correctly read cue words and the unpredictable words using the same rime units in the final text reading test. This compares favourably to the first test given after only 5 sessions where student A showed a 50% difference and student B a 20% difference. Again this must indicate that these students performed better when given time to allow new learning to become embedded.

Implications
This implies that the transfer of knowledge from the cue word to the new word will improve given time and the implications for teaching are obvious: that manipulation of knowledge can only occur with embedded knowledge. This supports Goswami's (1986)

theory that analogy is used when there is sufficient words in a child's mental lexicon from which analogies can be made.

Rime Unit Tests

The rime unit tests were given pre intervention and post intervention. Both students showed an overall improvement, with student A going from 17% to 38% and student B from 31% to 51%. This shows a greater than 20% improvement in both cases. The improvement could not be accounted for by the increased knowledge of cue words and rime units, as only 10 new rime units were taught and only 6 were ones that appeared on the rime unit test, while only 4 of the actual cue words used in the lessons appeared on the rime units test. The results would indicate that the students were able to generalize from the learned process of segmenting words into onset and rime and apply the process to previously unmet words. This helped them to attend to the visual detail in the words, especially the medial vowel, which they had previously neglected, giving them a higher success rate.

Student A showed a much improved rate of attempting all the words. She had previously passed over unknown words, but in the second test, demonstrated that she had acquired a method or process with which to approach unknown words. She was more confident, self-corrected on 4 words and attempted every word on the test. On almost all words she made an attempt to say the medial vowel.

Student B had approached the initial rime unit test with a letter-by-letter method. He attempted most words, but slowly and without being able to blend the letter sounds together to form correct words. In the post- test, he was more confident and faster. He did not hesitate over the 3 letter vc words and, as with student A was able to improve most in the 4 and 5 letter words with vcc. While this student was not able to blend the individual sounds to make a recognizable word, he was not experiencing success. The oral language component of the intervention was of most use to him and enabled him to put together the process of segmenting larger units of sound and the orthographic units that represent them. Then he was able to blend these more easily than the individual sounds.

Implications
The theory that children might use orthographic inferences from the pronunciation of known words to derive pronunciation of unknown words is well published (e.g. Baron 1977, Goswami 1986). The importance of this is that such inferencing is that it shows that a self-teaching mechanism has developed. The above results indicate that the students were indeed able to apply their knowledge of the process of segmenting and blending to new words, even with rime units they had not previously learnt.

Conclusion
The results have shown that specific training in segmentation and blending and in the use of rime analogies has significant impact on student's ability to read words both in text

and in isolation. The most significant thing was that this knowledge led to a self-teaching mechanism which allowed the students to improve their reading of words in isolation that used rime units other than those that had been taught during the intervention.
A further conclusion can be drawn that unless the process is embedded, the transfer of the knowledge will not occur.

The results support the theory that phonological awareness is related to orthographic storage (Lundberg, Frost & Peterson, 1988). They also support the notion that analogy use develops, as there is an increase in the number of words in a child's mental lexicon from which analogies can be made. (Goswami, 1986). The results tie in with the theory of Share and Stanovich (1995) that explains how blending combined with letter sound knowledge may act as a self-teaching mechanism.

It now remains to be seen if these particular students can maintain these results over time and whether they are able to continue using their self-teaching mechanism to make even more links and add to their success.

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Appendix 3: Teaching Unit.

Phonological Awareness Task

1) Teacher says cue word, eg: hop. Students repeat word.
2) Teacher models segmenting the word into onset and rime, students repeat.
3) Teacher asks students to delete onset, say the rime.
4) Teacher asks students to provide rhyming words
5) Teacher says a rhyming word in a segmented way, asks students to blend into a word.
6) Repeat steps 1-5 using different cue word.

Text Reading Task

In Sessions 1, 5 and 10 the students will be presented with the assessment reading tasks. In all the other sessions the dictated texts from the previous session will be re-read.

Word Reading Task and Using Analogy.

1) Teacher makes the cue word with magnetic letters. Says it.
2) Teacher segments the word into onset and rime by moving the letters apart. Students point to the two parts, saying the onset and rime as they point to them.
3) Teacher takes off onset, children say the rime unit.
4) Teacher introduces new onset, saying it.
5) Students blend the new onset with the rime and say the new word.
6) Teacher asks each student for a rhyming word, handing the student the onset for the word which the student then makes.
7) The student points to the onset and the rime, saying each part, then the blended word.
8) All four words are read together.
9) Teacher asks "What have you learned about breaking words into onset and rimes? "What have you learned about how to make new words that rhyme?"
10) Repeat steps 1-9 for the new rime unit. The students should be able to initiate the steps of the process eventually and become very articulate in their reflection in step 9.

Writing Task.

1) Students are asked to write the 8 words using the "look, cover, write, check" method. Teacher asks: "What makes it easy to write these words? What helps you to remember them?"
2) Students make up sentences using the words and these are written by the teacher. The students read them back.

Reflection

Teacher asks: "How does knowing how to break words into onset and rime help us to read words? How does knowing some rime units easily help us to read many more words?"
This is an important part of the process and the student's answers should reflect increasing understanding of the process of acquiring new words through use of analogy.

Prose Reading Tests.
These will indicate whether the children are retaining the words learned when placed in the context of prose reading and whether they are able to use analogy to read unpredictable words with known rime units in the context of prose reading. Results will be recorded under 4 headings: whether the words were read correctly without pause (1), hesitantly (2), incorrectly but with correct rime units (3) or incorrectly (4) See Table 1 below.

1) This passage uses words (in italics) that both children were able to read on the rime units test. It also uses words (in bold) that are less predictable but use the same known rime units, in order to test whether they are using analogy to read these words The inflections in the font are not used on the passage read by the children.

One *day* the boy went to the *shop* for his mum. It was *hot* and he went to *sit* under a tree. He felt a **drop** of cool water *drip* down his *back*.
"I like the **slip** and **slop** of the **clay** in this wet **bit**," he said as he sat in a … puddle. "I will be wet and **black** when I **trot** home, but I will be cool."

2) This passage will be given after session 5 to test progress. Italics are used to indicate the cue words taught to date and the words that use the same taught rime units but have not been specifically taught and are located in less predictable ways in the text are in bold type.

A little girl *saw* the *best* little *boat* on the sea. It was floating very *well* and did not *sink*. The *rain* came and the girl tried to *hop* onto the boat. Her *sock*s got wet and she went *back* home. When she got home she said, "I can **draw** the boat and I **think** I can draw a **shell** too. Here is a crab with a **claw** and a **goat** with a *tail*."
"**Stop**!" said her mum. "You are on the wrong **track**! A goat cannot **sail** on the sea like a boat. **Test** your **brain** and think of one more thing that lives by the sea or by the **dock**."

3) *This passage will be given at the start and at the end of the 10 sessions, to evaluate, describe the changes in performance before and after the intervention. It uses all the cue words taught during the intervention (those in italics) as well as words which have not been used as cue words but which use the rime units taught in the sessions (in bold print). These new words are used in a less predictable way to encourage use of visual cues rather than meaning cues. This has been done rather than testing words in isolation because of the more natural aspect of contextualising the words, but also because it tests the children's *preferred* strategy and how they deal with segmenting words "*on the run*". I wanted to know if they would transfer their learning about segmenting words to text reading and if that increased their fluency. I wanted to see if they would use what they know about the cue word to segment and de-code the new word, using analogy,

but doing it in the context of text reading, where the links are not as obvious as when presented with words in isolation.

*This passage was not given at the end of the tenth session as testing after session 5 showed that more repetition of the first 10 rime units was necessary.

Anne and her *best* friend Jim were riding their bikes. Anne *saw* Jim fall *down*.
"I will *hop back* onto my bike," he said.
But the *rain came down* and made him *jump*.
"I will need a *boat* or I will *sink* in all this water. My T-shirt is wet. And look at my *sock*! The bike **chain** has torn it! I am so wet I will **drown**!"
Anne said, "I have a *nice* **coat**. I can give it to you. That will *make* you dry. You can come home with me and have a *mug* of hot chocolate."
"I will run and *beat* you home," said Jim.
"Don't be *mean*," said Anne. "The **track** is muddy and **wettest** here. It looks like a **moat**."
They ran home to **heat** up the chocolate. Anne drank it with a **straw**. Then they played dress-ups.
Anne wore a **clown** *mask* and gave Jim a **shock.** Jim dressed up as a bird. He put on a *tail* with a *bow* and he put a **jug** on his head.
"I am a **Bean** Bird," he said. "Can you tell what my **name** is?"
"**Jake** the **Bump**?" asked Anne.
"No," said Jim.
"Are you a **jail** bird?" asked Anne.
"No. Here are some clues. I can **glow** in the dark, I like to **bask** in the sun and I eat **twice** a day, and I live by the **lake,**" said Jim.
"I can't tell," said Anne with a **shrug**. "I don't want to play **again."**
"Well I am going home now," said Jim with a **wink**. "Thanks for a **top** time today."

Appendix 1:
Word Reading Task.
Words were presented at the rate of 2 cue words per session. The children's analogies are also noted.

Cue Word	Rhyming Word	Child A Analogy	Child B Analogy
Hop	Drop	mop	Chop
Back	Snack	tack	Mack
Saw	Claw	caw	Jaw
Well	Smell	bell	Sell
Best	Chest	nest	Rest
Tail	Snail	hail	Nail
Sink	Blink	wink	tink
Boat	Float	coat	moat
Sock	Clock	jock	Tock
Rain	Stain	again	main
*Beat	Cheat		
Down	Brown		
Mug	Plug		
Mask	Flask		
Jump	Grump		
Nice	Spice		
Make	Flake		
Bow	Slow		
Mean	Clean		
Came	Flame		

*From *beat* to *came*, words were not part of the10 session program, as testing at session 5 showed more reinforcement of the first 10 words were necessary.