

Hypothesis

Explicitly teaching analogy through onset and rime improves reading accuracy with both words in isolation and within text to underachieving Grade One students.

ABSTRACT

Learning how to read words can be a difficult process for some beginning readers. This is possibly due to the inability of some students to decode words automatically and accurately which affects their reading ability. Students need to know how to segment words quickly and to use knowledge from known words to assist in the reading of new words.

The hypothesis of this study is that explicitly teaching analogy through onset and rime improves reading accuracy with both words in isolation and within text to underachieving Grade One students.

Analogy is an implicit metacognitive strategy used by readers where parts of written words they already know are used to identify new words. Research suggests the use of analogy in reading can develop faster if it is explicitly taught. Analogies based on letter segments that correspond to rimes are made more easily and frequently than analogies based on other spelling patterns such as shared phonemes, and the use of analogies in reading provide children with a self teaching mechanism for decoding new words (Goswami, 1999).

The participants in the study were six students currently in Grade One who have been observed as having difficulty reading text at the word level. All students were chosen from the same class. Three students were chosen as the control group and three the intervention group. The intervention group was further sub-divided into an individual student and a group of two students. Both the intervention and control groups continued to participate in their daily Literacy lessons directed by the classroom teacher. In addition to daily Literacy lessons the intervention students received ten sequenced lessons focused on the explicit teaching in the use of the strategy of analogy through onset and rime. The lessons took place outside the classroom each lesson lasting approximately 40 minutes. The lessons were developed through pre-testing data gathered from the Dalheim Rime Unit Test (2004) administered to each student. Each lesson involved the composing, reading and writing of word lists with the same orthographic rime units, and the consolidation of new learning through games, shared reading and student reflection.

The results from the study showed that after explicit teaching the intervention students made greater gains in both word reading accuracy and text accuracy than the control students, showing support of the hypothesis.

Due to the findings of this study the explicit teaching of the strategy of analogy through onset and rime will become a regular focus within daily Literacy lessons for students in Prep to Grade Two.

INTRODUCTION

Reading is the ability to use, understand and reflect on written text. It involves two basic processes of learning how to decode the print and understanding what the print means. Reading requires the reader to perform metacognitive actions, and the beginning reader needs to be taught strategies that cause them to perform these actions independently.

Munro's (2007) 'Multiple Level of Text Processing' (MLOTP) is a model of reading that describes how readers work on multi levels of text processing. The model's framework shows levels of processing and areas of knowledge that effective readers combine simultaneously as they read. At each level; word, sentence, conceptual, topic and dispositional, three areas of knowledge are applied. These areas of knowledge are what we know about the structural features of text, or the 'what' of reading, reading strategies, or the 'how to', and what the reader believes and values about reading, or the 'why'. The reader is also applying self-management and control strategies to monitor and direct their reading, and bringing their existing knowledge, both oral and direct experiential, to each level of processing.

For many early readers learning to read is a complex task that requires many skills and processes to be used together. It is often at the word level that we see early readers experiencing difficulties. They are limited in the type of text they can read and often slow and inaccurate in word recognition. Learning how to read words can be a difficult process for some beginning readers. This is possibly due to the inability of some students to decode words automatically and accurately which affects their reading ability. Students in early primary need word reading accuracy skills and the ability to recognize many words automatically. Students need to know how to segment words quickly and to use knowledge from known words to assist in the reading of new words.

Both phonological and phonemic knowledge have been identified as key influences on children's ability to develop as readers. Phonological knowledge is knowledge of the sound properties of language and knowing the sound structure of speech. It can be measured by a child's ability to pronounce and produce words and rhyme and generally manipulate sound patterns. Phonemic knowledge is part of phonological knowledge and deals with individual sounds in words. Phonological knowledge is developmental from preschool age to the 3rd or 4th year of schooling. During reading, phonological knowledge is used by linking sounds to letters (phonetics). Before beginning to link sounds with the written representation of sounds (orthographic) it is important to develop a number of skills in the phonological properties of words. A reader will begin to use distinctive features of words and convert letters in a word to a sound and blend these sounds, or use the first few letters of a word with meaning. They will build on to recode a letter cluster as a sound pattern by applying phonological knowledge, that is a known sound to match a letter cluster. They develop their ability to use phonemic knowledge automatically to blend letters and sounds, make analogies between words, note similarities and manipulate sounds between similar words.

Munro explains that "those who have reading difficulty are less able to perform these processes" (Munro, 1998a, p.1). If phonemic knowledge of segmenting and blending sounds is immature it is difficult to move on past using distinct visual features and individual sounds to recognizing letter

clusters, recoding letter clusters as sound patterns and blending the sounds. Underachieving readers see individual letters rather than letter clusters and read words out by sounding individual letters. They are unable to use what they know about some words to read new words. This level of decoding words is limiting and attention demanding.

The hypothesis of this study is that explicitly teaching analogy through onset and rime improves reading accuracy with both words in isolation and within text to underachieving Grade One students.

The study looks at the area of analogy phonics in which children use parts of written words they already know to identify new words. Using onset and rime they are given explicit instruction in reading words with the same orthographic rime using letter sound correspondences, and practice reading known and unknown words both in and out of text with the same orthographic rime.

Recent findings show that grapheme-phoneme correspondences in English particularly for vowels, are most stable and consistent when considered as part of the rime (Goswami, 1999). Goswami suggests that if there is a special connection between rhyme and reading in English, then teaching children to segment words into onset and rimes and showing them how these phonological units relate to spelling sequences should have benefits for reading progress. Children should be taught the metacognitive strategy of analogy and ways of using rhyme to aid the acquisition of grapheme-phoneme correspondence. The use of analogy in reading provides children with a self teaching mechanism for decoding new words.

Goswami also states that “both children and adults use analogies to decode unfamiliar words and that through studies using the ‘clue word’ task that even beginning readers can make analogies between shared spelling patterns in words” (1986; cited Goswami, 1999, p.222). She suggests that younger readers make fewer analogies than older readers because of their smaller vocabularies and that although analogy is an implicit process this does not mean that we do not need to teach children to use analogy. “In fact the use of the analogy strategy should develop faster if it is especially ‘taught to’” (Goswami, 1999, p.222).

Studies also suggests that analogies based on spelling segments that correspond to rimes were made more frequently than analogies based on other spelling patterns such as shared phonemes (e.g. vowel digraphs). The most likely explanation for this being that phonological awareness of rhyme develops prior to phonological awareness of phonemes. Analogies based on rime precede analogies based on phonemes, however the implicit process of analogy may operate on multiple levels depending on phonological skills (Goswami & East, 2000).

Goswami & East(2000) goes on to give evidence of some debate in analogy research as to whether analogy strategies solely are being used by beginning readers or if decoding skills on the ‘clue word’ is really the evidence of analogy.

Walton and Moustafa (1995; cited Goswami and East, 2000) argued that some decoding skills were required to read new words by analogy particularly ‘nonsense’ words and that children with better decoding skills used more analogies.

Wang and Gaffney (1998) explain that although several researchers recommend the use of analogy to assist readers decoding unfamiliar words by recalling a word sharing the same spelling pattern with a new word, or to help identify words that cannot be decoded by matching individual letters or corresponding phonemes (e.g. light), analogy can have limitations because letters and sounds do not always match exactly in the English orthographic system e.g.(nose/lose) and decoding by analogy may lead to mispronunciation and misunderstandings of words and confuse children.

Following their study investigating first graders' use of analogy in word decoding (Wang and Gaffney, 1998), Wang and Gaffney stated that a clue word may contribute to the use of the analogy strategy and that their results supported previous findings (Goswami 1986, Ehri & Robbins, 1992; cited Wang and Gaffney, 1998) that most first graders found it easier to decode analogous words (same rime and pronunciation) than nonanalogous words (shared 3 common letters but not the same rime as the clue words). This is thought to be most likely because decoding words by analogy requires minimum effort because of the shared rime. Readers need only to remove the initial consonants from rimes and replace them with another phoneme to read the new word. It also helps the reader to relate a sound to the rime of another analogous word. Their research also supported that errors in misanalogous words (same rime different pronunciation) were related to an overgeneralization of the rules of analogy and the inability of to identify misuse of analogy.

Wang and Gaffney (1998) go on to explain and acknowledge that the study had several limitations which are worthy to note and address here in light of the following study. The children did not have to read analogous words within a meaningful context (prose) where words were embedded within the text and they needed to recall a word sharing the same spelling pattern with the new word and pronounce the new word to rhyme with the known word. Nor were they required to use analogy in the way they must in independent reading situations, left to their own devices without the use of 'clue words'. It is therefore suggested that to better understand if children use analogy during independent reading children may be taught using 'clue words' for a period of time and then tested for their use of analogy in word decoding within text without any access to 'clue words'.

HYPOTHESIS:

Explicitly teaching analogy through onset and rime improves reading accuracy with both words in isolation and within text to underachieving Grade One students.

METHOD

Design

The study was conducted using two groups, an Intervention group and a Control group. The Intervention Group was then subdivided again so a comparison could be made between explicitly teaching in a small group situation and an individual basis. The Intervention group(s) were pre-tested, explicitly taught analogy through ten lessons and then post tested, (OXO case study design).

The Control group was pre and post tested using the same assessment procedures as the Intervention group(s). All students were from the same classroom to control/ manage the intervention more tightly from the influence of teacher variance that may have occurred if children were from different classrooms and possibly receiving different teaching which may have impacted on student results. Comparisons were then made between groups to compare the impact of explicit teaching of analogy on word reading accuracy and reading prose.

Participants

All students chosen to participate in the study were from the same Grade One classroom and had completed one year and nine months of schooling. Their ages ranged from 78 months to 90 months. No student had been eligible for the Reading Recovery Program in the first half of the year and although each student had made gains in their reading they were observed by the classroom teacher and Literacy coordinator as having difficulty in reading words automatically and accurately compared to many of their peers of the same age group. The students in both the intervention and control groups were at the time of pre-testing all reading text at a similar instructional level. The students placed in the intervention group(s) were selected as they were often observed having difficulty independently segmenting and blending words and often used distinct visual features of words to read new words with little accuracy majority of the time. The students' age, entry reading ability, intervention and ESL information and which group they were part of is recorded in Table 1.

TABLE 1: Participants' Details

Name	Control = 0 Teaching Group=1 Teaching Individual=2	Age in MONTHS	Gender 0=Male 1=Female	Years of Schooling	ESL No=0 Yes=1	LNSLN funding 0=SLD 1=ID 2=Asp	Earlier Intervention No=0 RR=1 Bridges=2 ERIK=3...	Text Level entry	EMA No=0 Yes=1	Attendance No. of sessions
A	0	78	F	2	0	No	0	14	0	0
B	0	86	M	2	0	No	0	14	0	0
C	0	81	M	2	0	No	0	14	0	0
AA	1	87	F	2	0	No	0	14	0	10
BB	1	86	F	2	0	No	0	12	0	10
CC	2	90	M	2	0	No	0	13	0	10

Participants Background

Student A

Student A is the youngest of four siblings. She has not been referred for any assessments. Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	38	13	1	0	4	4	32
	Post-test (November)	14	53	19	12	25	36	22	39
GRADE ONE (2011)	Pre-test (February)	11	54	19	14	24	36	25	42

Student B

Student B is the eldest sibling of three. He has not been referred for any assessments. Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	45	14	0	1	--	3	33
	Post-test (November)	7	54	22	8	20	--	21	36
GRADE ONE (2011)	Pre-test (February)	10	54	21	12	21	33	33	40

Student C

Student C is the youngest sibling of two. He has not been referred for any assessments. Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	29	10	1	1	3	1	24
	Post-test (November)	8	52	20	7	13	32	15	38
GRADE ONE (2011)	Pre-test (February)	8	53	17	8	20	29	19	33

Student AA

Student AA is the youngest sibling of two. She attended private Speech Pathologist for two years prior to school due to articulation and expressive language delays. In 2011 she was referred for a Speech Pathology Assessment Report. Student AA undertook the Clinical Evaluation of Language Fundamentals (expressive language) test and the Fisher-Atkin Articulation Survey (speech sound production) test. Assessment results came back reporting student AA just below average in both expressive language and speech and were recommended by the assessor to commence a language development program at home under the supervision of her parents. Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	26	6	0	0	9	2	10
	Post-test (November)	8	48	18	10	20	34	24	16
GRADE ONE (2011)	Pre-test (February)	7	51	16	9	19	28	26	19

Student BB

Student BB is the youngest sibling of two. She has not been referred for any assessments. Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	22	6	0	0	9	2	10
	Post-test (November)	4	47	15	8	15	30	20	18
GRADE ONE (2011)	Pre-test (February)	6	50	16	9	19	28	26	22

Student CC

Student CC is the youngest sibling of four. He was referred in 2011 for Auditory Processing and Speech Pathology Assessment as he was experiencing difficulty with Literacy skill development. Routine auditory testing had reported normal hearing in both ears and normal speech. Testing of Speech/ Noise Ratio during the Auditory Processing Assessment showed below expected level in 'busy' conditions which may result in difficulty maintaining concentration and lead to student missing critical segments of instruction ('readily distractible'). Auditory Processing Assessment also showed Student CC experiences maturational delay in Short Term Auditory Memory Span (STAM) being able to recall up to 3 to 4 digits and less than 10 word sentences or instructions.

The Speech Pathology Assessment included Clinical Evaluation of Language Fundamentals for both Receptive and Expressive Language. The report showed Student CC's Expressive Language 'Just Below Average' and Receptive Language 'Significantly Below Average'.

It was recommended that Student CC be at the front of the class for explicit teaching, that instructions and information was given in 'small chunks' and that he was asked to repeat instructions for clarification. It is worth noting here that during the previous year student CC had been in an open classroom situation which may have influenced his learning ability in light of the above assessment results.

Previous testing results from school are recorded in the table below.

		Text Level	Letter ID	Concepts of Print	Reading Words	Burt Word Test	Dictation (Hearing sounds in words)	Writing Vocabulary	Record of Oral Language
PREP (2010)	Pre-test (February)	0	6	9	0	0	1	0	13
	Post-test (November)	3	49	20	8	11	19	13	20
GRADE ONE (2011)	Pre-test (February)	6	52	18	5	15	25	17	20

Materials

Assessment tools used for Pre and Post Testing

-Dalheim Rime Unit Test (Dalheim 2004)

The Dalheim Rime Unit Test assesses students' ability to read words in isolation containing dependable rime units. The test includes sets of words for rime units recorded in horizontal lines with words varying in length from 3 to 5 letters. The rimes also vary in length with most being 2 and 3 letter rimes of one vowel followed by one or two consonants. Students are required to read the words vertically beginning with 3 letter words and progressing through to words of longer length.

(One copy of the Student Reading Sheet and six copies of Teacher Recording Sheet for pre and post testing.)

-Texts (Used for pre and post running record testing)

The classroom Caterpillars (PM/ Level 14 Benchmark Text/ Fry's reading ability high Grade 1)

The King Rides By (Fry's reading ability low Grade two)

(Blank Running Record sheets for pre and post testing.)

Lesson Outlines(Appendix 1)

Outline for ten sequenced lessons providing explicit instruction for teaching of identified dependable rimes using onset and rime, and the strategy of analogy to assist reading of unknown words.

Rime unit Foci for Lessons (Appendix 2)

Outline of the rime units, texts, word lists, supporting games and activities used in each of the ten lessons.

Procedure

All students were removed individually from the classroom for both pre and post testing. Each student was tested :

-reading words in isolation using the Dalheim Rime Unit Test

-reading prose at an instructional level using unseen text (pretest), same text post test (seen): 'The Classroom Caterpillars'

- reading prose containing dependable rime units where the use of analogy would assist in the reading of unknown words : 'The King Rides By'

All testing was completed in the same quiet area over a week, and administered by same person known to all students so that each student was given as near as possible the same testing conditions.

The ten intervention group lessons were conducted outside the classroom in a quiet area over a period of three school weeks, one lesson per day and taught by the same person. The ten lessons spanned over three weeks as some days the students were not available due to other curriculum activities. Two students had the lesson together and one student alone, with each lesson lasting approximately 40 minutes.

Each lesson format began with an introductory game or activity to develop students' awareness of onset and rime within one syllable words. The activity or game focus was to develop skills in segmenting and blending words into onset and rime, and provide an opportunity to read new words using analogy. These introductory activities in the first few lessons predominantly used rimes which in pre-testing the students had shown the ability to read the whole word group for that rime on the Dalheim Rime Unit test. This provided the opportunity to introduce/teach the concept of onset and rime with words they knew. Following on from the introduction activity a specific rime unit was introduced. These rime units were also chosen from pre- testing results of students in the Dalheim Rime unit test. The rimes in lessons one to four were chosen to build on what students already knew and to build student confidence and allow them to experience success. In the pre-testing students had been correct with 1 or 2 words within the set of words for the chosen rimes so had shown some knowledge of the rime. It was hoped that starting from this entry level of the known and with a 2 letter rime of one vowel and one consonant (VC) students could build onto their knowledge and develop awareness of the reading strategy of analogy before introducing new rimes that pre-testing had shown they had not been able to read any words within the set of the rime. Lessons 5-10 introduced students to rimes of 3 letters made up of one vowel and two consonants (VCC) of which they had been able to read only one or no words within the word set of that rime of the test.

The rimes for lessons 1-10 were explicitly introduced with similar language used in each lesson. Each rime was written up on the whiteboard and the student/s discussed the corresponding sound unit to the rime. Student/s were shown how to segment and blend an onset with the rime using magnetic letters. They were then shown how the onset could be changed and a new word made using the same rime. Student/s were then encouraged to make their own new words with magnetic letters using the rimes. A word list was then made and written up with words contributed by the student/s and the target rime in each word underlined. The word lists were then read out loud. Student/s used the lists of words to copy each word onto a flashcard. These flash cards were used to practice reading the words in isolation. Some more difficult words with the same rimes that had not yet been identified by the student/s were then shown by the teacher and the student/s were asked to read the new words. The self script of 'if I can read ___ then I can read _____' was introduced and reinforced with the support of the teacher each lesson until the student/s were able to do this independently. A chosen big book or other text which had been selected that clearly identified a target rime for the day was then read by the student/s. In the case of the two students working together students alternated reading a page each. Student/s were asked to reflect on what they had learnt.

Following the ten lessons post testing was conducted on both the intervention and control groups over a week. Both pre and post Rime Unit tests were analysed. Analysis of the Rime Test was completed on overall number correct and incorrect, and then this number broken down into subgroups that looked at word length (number of letters), and type of rime e.g. vowel/consonant (VC), vowel/consonant/consonant (VCC) or vowel/consonant/vowel (VCV).

RESULTS

Results indicate support for the hypothesis that explicitly teaching analogy through onset and rime improves reading accuracy with both words in isolation and within text to underachieving Grade One students. Scores for all students in the intervention groups indicate significant improvement in both reading words in isolation and on prose.

Gains made by the intervention students were greater than those in the control group in most areas of reading words in isolation and in prose. The scores of all students in the intervention groups showed improvement across all areas in comparison to no gains or negative gains by some in the control group.

Tables of Results

Tables Two to five show all pre and post testing results in relation to the Dalheim Rime Unit Test for both the control and intervention groups. The intervention groups being recorded in coloured text for ease of distinguishing students.

Table Six shows pre and post testing results for accuracy on reading prose for both groups.

Table Two: Rime Unit Test (Dalheim, 2004)) Overall Word Results (Total number of words tested 149)

	Total Words CORRECT				Total Words INCORRECT			
	PRE-Test		POST-Test		PRE-Test		POST-Test	
	Raw Score	%	Raw Score	%	Raw Score	%	Raw Score	%
Student A	73	48.9%	82	55.0%	76	51.1%	67	45.0%
Student B	97	65.1%	119	79.8%	52	34.9%	30	20.2%
Student C	77	51.7%	91	61.0%	72	48.3%	58	39.0%
Student AA	41	27.6%	80	53.6%	108	72.4%	69	46.4%
Student BB	29	19.5%	71	47.6%	120	80.5%	78	52.4%
Student CC	48	32.3%	91	61.0%	101	67.7%	58	39.0%

The results for the 'Overall Word' results show that the improvement/gains made by the intervention students were over double of the control group. On average the control group's increase on words read correctly was 10% in comparison to the average of those students receiving the intervention making average gains of 27% on words read correctly. In the overall word results Student CC who was the intervention student working as an individual made slightly more gains than the two students working together, but not significant enough to say that there was more benefit having lessons on an individual basis. (Student AA=26%, student BB= 28%, and student CC=29%)

Table Three- Five: Rime Unit Test (Dalheim) showing breakdown of words into sub-strands dependent on type of rime unit and word letter count (c = consonant, v =vowel)

Table Three: Two Letter Rimes (VC)

	2 Letter Rimes															
	3 Letter Words (CVC) -24 words								4 Letter Words (CCVC)-24 words							
	Correct				Incorrect				Correct				Incorrect			
	PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST	
	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%
Student A	18	75.0	18	75.0	6	25.0	6	25.0	18	75	17	70.8	6	25	7	29.2
Student B	21	87.5	23	95.8	3	12.5	1	4.2	18	75	22	91.6	6	25	2	8.4
Student C	20	83.3	20	83.3	4	16.7	4	16.7	13	54.2	14	58.3	11	45.8	10	41.7
Student AA	13	54.2	18	75.0	11	45.8	6	25.0	8	33.3	17	70.8	16	66.7	7	29.2
Student BB	11	45.8	19	79.1	13	54.2	5	20.9	3	12.5	16	66.6	21	87.5	8	33.4
Student CC	13	54.2	17	70.8	11	45.8	7	29.2	11	45.8	17	70.8	13	54.2	7	29.2

The results for Table Three for 2 letter rimes show greater gains made by the intervention groups in comparison to the Control Group particularly in the 4 letter words with a VC rime unit. It must be taken into account however that on the pre test the control group students had a high percentage of these words read correctly so it is harder to show such gains as the intervention groups who had the potential to make greater gains due to the number of words read correctly in comparison in the pre test. The greatest gain possible was 25% by student A if all words were read correctly.

Following the explicit teaching to the intervention groups the gap has certainly been narrowed in the number of words read correctly in this sub group of words with all students now displaying similar ability. It is worth noting that the intervention students have achieved equal or higher scores that students A and C in the control group in some areas post testing. Both Student A and C in the control group showed no gains in the 3 letter words and student A showed a negative result in the 4 letter words.

Table Four: Three Letter Rimes (VCC)

	3 Letter Rimes															
	4 Letter Words (CVCC)-24 words								5 Letter Words (CCVCC)-23 words							
	<u>Correct</u>				<u>Incorrect</u>				<u>Correct</u>				<u>Incorrect</u>			
	PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST	
	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%
Student A	16	66.7	13	54.2	8	33.3	11	45.8	8	34.7	8	34.7	15	65.3	15	65.3
Student B	18	75.0	22	91.6	6	25.0	2	8.4	18	78.3	16	69.6	5	21.7	7	30.4
Student C	18	75.0	20	83.3	6	25.0	4	16.7	7	30.4	12	52.1	16	69.6	11	47.9
Student AA	9	37.5	16	66.6	15	62.5	8	33.4	4	17.4	10	43.5	19	82.6	13	56.5
Student BB	4	16.7	13	54.2	20	83.3	11	45.8	5	21.7	13	56.5	18	78.3	10	43.5
Student CC	10	41.6	14	58.3	14	58.4	10	41.6	6	26.0	18	78.3	17	74.0	5	21.7

Table Four shows the results for pre and post testing of the 3 letter rimes on the Dalheim Rime Unit test with the results indicating that it is in this subset the hypothesis of the study has been supported the best, particularly in the 5 letter word area. Once again the gains in the 4 letter words show significantly higher for the intervention groups with gains of 16.7% (student CC), 29.1% (student AA), and 37.5% (student BB) compared to -12.5% (student A), 8.3% (student B) and 16.6 % (student C). However again the ability to show as significant improvement is difficult for the control group because the pre test scores of words read correctly was high to begin with, limiting their scope to show as much growth as the intervention students. The highest gain possible was 43.3% for student A if all words had been read correctly, and 25% for students B and C if all words had been read correctly. It is of concern to note here that Student A has actually had negative results which will be looked at further in the individual student analysis.

It is in the analysis of the 5 letter word results where the most accurate comparison can be made so far as the pre test results for the intervention and control group students were more similar. Except for student B all students' raw score on pre test of words read correctly was within 2 to 4 words of each other. However the gains made by the intervention students were significantly more than those of the control group with their gains ranging from 26.1% to 52.3%. In the control group there was once again seen a negative gain (student B, -8.7) and student A with no gain. Student C did show considerable gain (21.7%) but did not match those of the intervention groups.

It is also evident in this table that the explicit teaching has allowed the intervention students to narrow the gap considerably in the raw scores seen in post testing compared to those in pre testing. Several results show the intervention students have actually gained higher post testing raw scores that those in the control group. In the 4 letter words intervention students equaled or gained higher than student A's post testing raw score, and in the 5 letter words all intervention students gained a higher raw score than student A, 2 students scored higher than student B, while student CC outscored all in the control and intervention group.

Table Five: Three Letter Rimes (VVC) and (VCV)

	3 Letter Rimes															
	4 Letter Words (CVVC) and (CVCV)-26 words								5 Letter Words (CCVVC) and (CCVCV)-28 words							
	<u>Correct</u>				<u>Incorrect</u>				<u>Correct</u>				<u>Incorrect</u>			
	PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST		PRE-TEST		POST-TEST	
	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%	Raw	%
Student A	11	42.3	16	61.5	15	57.7	10	38.5	3	10.7	10	35.7	25	89.3	18	64.3
Student B	12	46.2	16	61.5	14	53.8	10	38.5	10	35.7	16	57.1	18	64.3	12	42.9
Student C	11	42.3	16	61.5	15	57.7	10	38.5	9	32.1	9	32.1	19	67.9	19	67.9
Student AA	7	26.9	10	38.5	19	73.1	16	61.5	0	0	9	32.1	28	100	19	67.9
Student BB	6	23.1	8	30.8	20	76.9	18	69.2	0	0%	2	7.1	28	100	26	92.9
Student CC	4	15.4	10	38.5	22	84.6	16	61.5	4	14.3	15	53.6	24	85.7	13	46.4

The results in this subset (Table Five) are a little more scattered across both intervention and control groups than the other subsets. This may be due to the fact that these types of rime units were not covered in the 10 explicit lessons of the intervention group(s) as were the rime units belonging to the other subsets, so results could be related more to classroom teaching rather than the intervention lessons. Students may have been exposed to a variance in this area due to the structure of the teaching within the classroom and whether different rime units were taught to small groups or to the whole class. The only rime unit in this subset that was explicitly taught to the intervention students was the 'ain' rime.

In the 4 letter word area the control group gains ranged from 15.3% (student B) to 19.2% (student A and c), while the intervention groups range was from 7.7% (student BB) to 23.1% (student CC) with student AA gaining 11.6%. It is worth noting here that student CC commenced with the lowest raw score pre test thus had the greatest gains to make.

In the 5 letter words once again the intervention groups showed the more significant gains with results showing 32.1% (student AA), 7.1% (student BB), and 39.3% (student CC) in comparison to 25% (student A), 21.4% (student B), and 0% (student C). It is in this subset that the hypothesis is also well supported as in comparing students A and CC whose pre test raw scores were within a word of each other, student CC the individual intervention student showed a significantly higher gain.

Overall in this table, except for student BB, it can be noted that the gap in the post test raw scores in words read correctly had significantly lessened in comparison to the pre test raw scores.

Table Six: Prose Results-Overall Error Rate and Accuracy on Texts

Error Rate is calculated by Running words (RW)/Errors(E) e.g. 220/25 = Ratio 1: 8.7

Accuracy is calculated $100 - E/RW \times 100/1$ e.g. $100 - 25/220 \times 100/1 = 88\%$

(95% and above text is deemed easy, 90-95% is instructional, below 90% is hard)

	The Classroom Caterpillar (220 words)				The King Rides By (160 words)			
	PRE-Test		POST-Test		PRE-Test		POST-Test	
	Errors/ Error Rate	Accuracy (%)	Errors/ Error Rate	Accuracy (%)	Errors/ Error Rate	Accuracy (%)	Errors/ Error Rate	Accuracy (%)
Student A	18/ 1:12.2	92%	20/1:11	91%	30/1: 5.3	80%	13/1:12.3	92%
Student B	22/ 1: 10	90%	9/1:24	95.5%	30/ 1: 5.3	80%	16/1:10	90%
Student C	18/ 1:12.2	92%	20/1:11	91%	45/ 1: 3.5	69%	24/1:6.6	84%
Student AA	20/ 1.11	90%	8/1:27	96.5%	35/ 1: 4.5	77%	11/1:14	93%
Student BB	34/ 1: 6.2	83%	20/1:11	91%	60/ 1: 2.6	58%	26/1:6.2	83%
Student CC	25/ 1: 8.7	88%	15/1:14.6	93%	55/ 1:3	66%	24/1:6.6	84%

As the hypothesis included improving accuracy in prose reading students were given the same texts for post testing to minimize the variable that may have occurred if new texts were introduced. This allowed all students to show their growth in reading accuracy without having to factor in the use of new texts that may not have been identical in content and difficulty. Although in the post testing the texts were now seen rather than unseen, no specific teaching had been done using the texts or had they been used in between pre and post testing.

Results (Table Six) support the hypothesis with the intervention group(s) all showing greater gains on both texts than the control group.

On the first text, 'The Classroom Caterpillar' all intervention students gained between 5% and 6.5% in comparison to the control group where only student B gained 5.5%, and the other students showing -1% results. All intervention students had moved from the text deemed hard to instructional and for student AA the text was now easy. In the control group students A and C had remained in the instructional Zone with only student B just reaching the text being easy but not showing as much accuracy as student AA from the intervention group.

With the second text 'The King Rides By' all students showed significant gains but once again the intervention students' results outperformed the control group. The average gain by the control group was 12.3% in comparison to that of the intervention group(s) being 19%. On pre testing all students were in the hard zone for this text. Looking at post testing results only student AA reached the instructional level from the intervention students, with two students from the control group moving up to the instructional area. It is worthy to note however that students BB and CC from the intervention group had started with much lower accuracy rates in the pre testing and had gained the highest percentage increase of all students with student CC gaining 18% and student BB gaining 25%, the highest of all six students tested.

Intervention Group(s)

Student AA

Student AA's individual results showed support the hypothesis with significant gains across all result areas, and achieving the highest results of all students post testing with reading accuracy on both texts. Although she had shown the highest accuracy on text of the intervention students pretesting she had not matched the accuracy of those in the control group. It was particularly evident in the post test reading of the second text 'The King rides By' where the text followed a rhyming pattern that student AA was a lot more confident reading words with the same rime unit and didn't stop to sound out individual letters or guess words using distinct visual features, but was beginning to see familiar rime units within words.

When comparing student AA's pre and post testing of the Rime Unit test the reading of words across all areas was more accurate. Pre testing all responses were automatic and she guessed unknown words using distinct visual features rather than applying sounds. In many word groups with the same 2 letter rime unit she knew the 3 letter word but was unable to transfer the rime to 4 letter words (e.g. knew bin and pin, but not thin and spin. Knew hot and not, but not shot and spot). Student AA showed little awareness of blends both at the beginning or end of words only giving the initial sound of the blend. Most errors post testing were made by applying the incorrect vowel sound or through difficulty blending sounds correctly following the correct segmenting of sounds within words. This was particularly evident with the 5 letter words with 3 letter rimes, and in the VCV and VVC rimes that had not been covered in the lessons. Student AA also shown evidence of using analogy on the Rime Unit test during post testing with more groups of words with the same rime unit read correctly. Pre testing only 2 groups of words with the same rime had been read correctly compared with 7 groups post testing. Many word groups of the same rime only had one error made. This was mostly caused by Student AA either adding or omitting a letter to the onset rather than not applying the correct sound to the rime unit. This had been identified as an area in pretesting that was of concern in word reading accuracy and some further intervention on blends would be useful to improve word blending accuracy.

Student BB

Student BB worked in the small intervention group with student AA and her results also support the hypothesis. Even though Student BB commenced with the lowest pretesting results of all students, during the 10 lessons student BB showed a growing confidence in her own ability and was well supported by her peer .

Student BB was the lowest scoring in reading accuracy on both texts pretesting and showed the greatest gains post testing with an 8% gain on the first text and a 25% gain on the second. During the pretesting she had struggled to complete the text 'The King Rides By' finding it extremely challenging and unable to attempt majority of words. Post testing showed a very different student with a willingness to try new words and good attempts at many words using her knowledge of rime units and sounds. Most errors post testing were made with the onset, incorrect use of digraphs and high frequency words.

Results of reading words in isolation on the Rime Unit test post testing saw huge gains made by student BB across all the areas but particularly in the 2 and 3 letter VC and VCC rime units. Starting with raw scores well below her peers in these areas following the explicit teaching lessons results showed her raw scores rise to meet those both within the intervention group(s) and the control group.

During pretesting Student BB had not been able to read any groups of words with the same rime correctly in any of the subgroups including the 3 letter words with VC rimes. She had shown very little consistency with accuracy of short vowel sounds and most attempts at words were guessed from the initial letter of the word. When she had been able to read one word accurately from word group she had not shown any ability to use her knowledge of the known word to read another with the same rime unit,(e.g. could read day but not say, play, stay, or could read fat and that, but not pat and chat). Post testing showed that she read 9 groups of words with the same rime across both subgroups containing the 2 and 3 letter rimes of VC and VCC. In 5 other word groups only one word had been read incorrectly. Student BB had used her knowledge of the known rime unit in a new word but had had difficulty blending the word together. In some errors she actually articulated that "I know that says 'it' or 'ock'", but the difficulty was in blending the onset and rime together in the word.

Student CC

Student CC worked through the explicit intervention lessons in a one on one situation to see if this would have an effect on results in comparison to working in a small group. Overall results showed little difference however the lessons took less time and Student CC remained more focused than those in the small group situation. It was obvious during the lessons that he was making his own connections in his learning when he had 'discovered' something himself, rather than when a peer had. His learning seemed more consolidated at the end of the sequence of 10 lessons because of his own discoveries at a time that was right for him to build onto his knowledge. This may explain why results show Student CC making the most gains in the 3 letter rime units of VVC and VCV out of all the students both control and intervention when these rimes had not been targeted in the explicit lessons.

In the initial pre testing of words in isolation using the Rime Unit test student CC had shown some knowledge of onset and rime in the 3 letter words when decoding (e.g. h-it, p-it, sp-it, gr-it). Errors were made when the incorrect short vowel sound was given to a vowel. Student CC was most accurate with the rime units with the vowel 'i'. When moving on to 3 letter rimes, he continued to attempt to segment into onset and rime but continued to give the incorrect vowel sound to the rime or change one of the initial and final consonant sounds in the word. There was little use of analogy across word groups with only 3 word groups with the same rime read correctly. Post testing results showed significant gains in the reading of word families with 12 groups with the same rime read correctly. Most other groups particularly in the 2 and 3 letter VC and VCC rime units had only one error that had been made because of an incorrect onset or omitting of a final sound in the rime.

Student CC particularly did well in the VCV rimes reading 2 and 3 words in each rime family correctly through knowing one of the words and using analogy to read more in word group.

Most errors in post testing were made through confusion of the short sound of the vowels 'a' and 'u'. Further work in this area would be beneficial to student CC.

Control Group

Student A / Student B/ Student C

Without being part of the intervention group and continuing to take part in the two hour daily Literacy block all students in the control group showed some gains in most areas between pre and post testing.

Student A showed a small 6% gain in overall reading of words in isolation of the Rime Unit Test. Most post testing errors were the same as pre testing with one or two errors in word groups of the same rime unit indicating that analogy may not have been being used. In both pre and post testing the administration of the Rime Unit test was very slow and attention demanding of Student A with most words being sounded out one letter at a time and student A unwilling to make an attempt at many words beyond 2 letter rimes.

Reading accuracy had minimally decreased on one text (-1%), but there had been a 12% gain on second text 'The King rides By'. Analysis of the running record indicates this may have been because Student A waited to be told unknown words rather than make an independent attempt. Because this text was rhyming and repetitive in sections it was read by memory after prompting rather than by applying her own strategies to workout unknown words.

Student B made the greatest gains from those within the control group, however it is important to note that student B also started with the highest pre test scores in most areas. It could be argued that he started with the most reading ability therefore this is why his gains are the most significant without the explicit teaching.

Analysing student B's results on the overall words correct on the Rime Unit test shows gains of 14%. It could be said that it is more difficult for this student to show higher gains as he started with a high raw score pre testing, however there was still the potential to make gains of 34.9%. Looking at the breakdown of the test student B made very little gain in most areas without the explicit teaching and showed a negative result (-8.7%) in the area of 3 letter VCC rimes in 5 letter words. Student B's greatest gains were seen in 3 letter CVVC and CVCV rimes in 4 and 5 letter words showing 15.3% and 21.4%. However Student B had the potential to make much greater gains and these results did not match greater gains made by other students both within the control group and intervention groups(s).

On text most errors were made through applying the incorrect sound to vowels within a rime unit in particular 'a' and 'u'. Participating in some explicit lessons on onset and rime and the use of analogy would probably benefit student B in this area.

Student C's results showed a 10% gain in overall reading of words in isolation of the Rime Unit Test. Most post testing errors were the same as pre testing with one or two errors in word groups of the same rime unit indicating that analogy may not have been being used. In both pre and post testing of the Rime Unit Test words were read automatically with no attempts to segment words into onset and rime or smaller units at all. Words were guesses using the distinct visual features of the word. At times the given word was a 'nonsense' word and no attempt was made by student C to self correct (e.g. clape for chill, bracking for bring). In most areas the post testing raw score results of the intervention group(s) came close to matching or bettered those of student C.

Reading accuracy had minimally decreased on one text (-1%), but there had been a 15% gain on second text 'The King rides By'. Analysis of the running record indicates this may have been because Student C was using meaning more accurately to read text than in the pre testing. Most errors held the meaning of the text but errors had no relationship to the visual features of the words misread.

Summary

Significant gains were made by intervention students in comparison to the control group in their ability to decode words using rime units. Using analogy helped them to recognize letter patterns more easily. The students in the intervention group(s) showed an increase in their confidence in decoding unfamiliar words particularly with 2 and 3 letter VC and VCC rimes units. The next focus for these children would be working with three and four letter rimes particularly with a VVC and VCV rime pattern.

DISCUSSION

Analysis of the results indicate that explicitly teaching analogy through onset and rime produced greater gains in the ability of students in the intervention group to read words in isolation more accurately, and greater gains in accuracy reading prose in comparison to the results of students in the control group receiving no explicit teaching.

Observing students during the ten intervention sessions saw students making links between words with the same orthographic rime units and becoming more confident in the reading of groups of words with the same rime unit both on word lists and within prose. Their wanting to sound out every word with common rime units letter by letter decreased as students began to show development in the reading strategy of analogy and making connections that the same rime unit in a known word held a constant sound in a new word. All intervention students displayed increased ability and confidence to break words into onset and rime and to blend the onset and rime back together successfully. Their reliance on using initial letters and visual cues to predict words decreased especially in the reading of prose.

It is essential to make note of some variables in the study which could have influenced the final results when comparing the intervention and control groups. Although the control group was having exposure to onset and rime within the classroom teaching program it was within a large teaching group and not delivered as explicitly, particularly the specific language of analogy, as those students in the intervention group(s) were receiving. The teaching program within the classroom also did not target explicitly rime units that had been identified through pre testing as needing to be taught, as was done for those students in the intervention group. However this variable could be reversed and it may be said that the intervention group were not exposed to some rime units that were taught in class when they may have been absent from the classroom during teaching time attending their own intervention lesson.

Students in the control group were participating in lessons within the noise of the classroom situation. Each student in the intervention group was in a quiet environment removed from the busy classroom and was either in a one-on-one or small group situation that allowed for full participation in the lesson with minimal distractions.

Students in the control group were also not experiencing daily the repetition of the same lesson structure and language that students in the intervention group(s) were receiving. The repetition and lesson structure allowed for the intervention students to build on and consolidate what had been covered the previous day and experience the repetition of language and articulation of learning. All of these variables could have possibly had an impact on the results of the control group as opposed to the intervention group.

It must also be noted however that the control group commenced with much higher raw scores in all areas than those in the intervention group (s), thus having higher reading ability to begin with particularly in reading words in isolation. Christensen and Bowey state that “the precise nature of what constitutes the most efficacious approach to teaching early reading skills remains contested” (2005, p.327), however all results of this study support the hypothesis that reading using analogy and the explicit teaching of analogy through onset and rime is an important dimension in developing efficient

beginning readers at a word level. The results also support Goswami (Goswami,1990; cited in Christensen and Bowey, 2005) that beginning readers find it a natural progression to build on pre reading skills of rhyme to a reading program that includes the teaching of words through onset and rime rather than phoneme units.

Many underachieving readers in the early years of school have not developed the ability to recognize frequently occurring letter clusters. Their orthographic knowledge often does not extend beyond individual letter level. Students in the early years of school need a variety of strategies to help with their reading. The results of this study suggest that the explicit teaching of analogy through onset and rime is a useful strategy for beginning readers to develop decoding skills and accuracy in their reading of prose. By teaching analogy through onset and rime students are able to make connections to both the orthographic and phonological aspects of words.

Although the results of the study are positive and the analysis suggests students need to be taught the explicit strategy of analogy using onset and rime, it is not the only strategy and skill needed to be taught during the first years of school to develop efficient readers. Analogy fits into the 'word' level of the MLOTP model (Munro, 2007) and we need to include all levels of the model in our teaching as efficient readers use all levels when processing text.

The word level was the focus of this study as that is where the students were displaying difficulty. We cannot assume students will develop any skills and strategies need to be an efficient reader without being explicitly taught.

As a result of this study it will be proposed that the teaching of analogy through onset and rime will become a teaching focus within the two hour Literacy Block Prep to two in the coming years. It will be proposed that the Dalheim Rime Units Test (2004) becomes part of our yearly pre and post Literacy testing Prep to two. All students prep to two (excluding preps at the beginning of the prep year) will be given a pre test using the Dalheim Rime Units Test to identify the individual needs of students in relation to their knowledge of onset and rime. Analysis of results will direct explicit teaching in this area. Post testing at the end of the year will measure growth and further identify areas of need for the following year.

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Appendix One

Lesson Outline

Lesson Sequence	Description	Resource/s	Time
Introduction of lesson purpose Reinforcement of strategy	Explicitly telling students purpose of lesson and what learning to do to help our reading/what we are learning through our lessons using correct terminology of onset/rime/analogy Game or activity to reinforce use of strategy	Variety of games/ activities e.g. easy words to sound Bingo -chunks -smart kids CVC spelling game -flashcards -word lists	5-10 mins
Introduce focus rime /s Hands on segmenting and blending	Teacher introduces focus rime/s writing up on the whiteboard. Students discuss/ say rime/s. Think of some words they know with the rime and write up a list. Teacher models segmenting words into onset and rime and blending back using magnetic letters. (in later lessons have students do this to lessen scaffolding)	White board Magnetic letters Paper	5-10mins
Reading by analogy	Using magnetic letters change onset to show if I know how to read ___ I can read ____ (in later lessons have students do this to lessen scaffolding)	Magnetic letters	5mins
Writing of words	Children make flashcards with words from list to take home and practise segmenting and blending and reading words. (cards	flashcards and textas Word list	5mins

	can be cut into onset and rime) Students read through flashcards.		
Relating known to unknown/reflection on learning	Reinforce analogy by holding a card up and say 'if I can read (Flashcard word) I can read (word off list) repeat several times using different flashcards.	Individual flashcards	5mins
Reinforcement/ extension/assessment of use of strategy	Teacher writes a different word or of longer length with the 'rime' and asks student/s what is word-how do you know? Refer/reflect back to 'if I Can read___ then I can read____	Whiteboard and white board markers	5mins
Reflection Reading Text –Big Book	Students reflect on what they have learnt today/ what they know now that didn't know before/ how they can transfer this new knowledge to the reading of a text. Teacher introduces Big Book of the day Students read text with support as needed.	Big Book with the word/s containing rime of the day	10 mins

Appendix Two

Individual Lesson Foci

Lesson Number	Rime/s	Sample Words	Big book/Text	Game/activity for Introduction
Lesson 1	'it' 'en'	Bit, hit, sit, quit, spit, twit Hen, men, pen, ten, then, when	Jen the Hen's Big Book	Smart kids CVC Spelling Bard games-Beginning sounds
Lesson 2	'at' 'ag'	fat, hat, sat, mat, flat, brat Bag, rag, wag, brag, drag, flag	Pat the Cat's Big Book	Smart kids CVC Spelling Bard games-Beginning sounds
Lesson 3	'og' 'ob'	Bog, cog, dog, fog, frog, slog Bob, dob, mob, rob, slob	Tog the Dog's Big Book	Easy words to sound Bingo
Lesson 4	'in' 'ug'	Bin, win, tin, chin, grin, thin Bu, dug, mug, rug, slug, plug	Zug the Bug's Big Book	Easy words to sound Bingo
Lesson 5	'am' 'im'	Sam, dam, ram, clam, cram Dim, him, rim, slim, swim, trim	Dr Seuss; Green Eggs and Ham	Smart kids CVC Spelling Bard games-middle sounds
Lesson 6	'ump' 'ill'	Bump, jump, lump, grump, thump Fill, hill, will, skill, spill, still, thrill	Jack and Jill (Smart kids Poetry poster)	Smart kids Chunks
Lesson 7	'ick' 'ell'	Kick, sick, brick, quick, stick, trick Fell, well, bell, tell, shell, smell, spell	Pick It Pack It- Reading Comprehension Cards	Smart kids Chunks
Lesson 8	'ack' 'ast'	Back, sack, quack, black, snack, track Fast, last, mast, past, blast	Quack, Quack (Smart kids Poetry poster)	Smart kids CVC Spelling Bard games-final sounds
Lesson 9	'ust' 'ing'	Just, bust, dust, rust, King, wing, spring, sting, swing, thing	Buster Mc Cluster Big Book	Smart kids CVC Spelling Bard games-final sounds
Lesson 10	'ess' 'ain'	Less, mess, guess, dress Pain, rain, train, drain, chain	Bess the Mess- Reading Comprehension Cards	Smart kids Chunks

APPENDIX THREE

RIME UNITS TEST - TEACHER RECORD SHEET

(Underneath each attempted word, the teacher ticks words read correctly and records the student's response for incorrect and self corrected attempts)

Name: _____ Date: _____

3 letter words

4 letter words

4 letter words

5 letter words

4 letter words

5 letter words

bin	pin	thin	spin		rock	sock	block	clock		jump	pump	thump	stump
can	man	plan	than		bell	well	shell	spell		test	rest	chest	crest
day	say	play	stay		back	pack	black	track		-	-	light	night
saw	paw	draw	thaw		hill	fill	chill	spill		meat	beat	cheat	treat
cab	tab	grab	crab		ring	wing	thing	bring		cake	make	shake	snake
bug	mug	plug	slug		duck	luck	truck	stuck		date	late	plate	state
hot	not	shot	spot		sick	pick	brick	thick		name	came	shame	flame

fat	pat	chat	that		tail	mail	snail	trail		rice	mice	slice	price
cap	tap	clap	trap		bank	tank	thank	drank		ride	hide	slide	bride
hop	top	stop	shop		mask	task	flask	-		fine	mine	shine	spine
lip	zip	drip	ship		junk	bunk	trunk	chunk		more	core	store	snore
hit	pit	spit	grit		pink	wink	think	stink		woke	poke	broke	spoke
										rain	main	brain	chain
										sale	male	whale	stale

Dalheim 2004