Hypothesis

Explicit teaching of mapping sounds orally onto letter patterns using a commercial technology program, will improve children's orthographic knowledge, prose reading accuracy and spelling.

Abstract

Reading is a complex process in which we process text at a word, sentence, topic, concept and dispositional level in order to gain meaning. Underpinning these text processing levels are effective self-management strategies and sound oral language knowledge. This study aimed to trial the hypothesis that explicit teaching of the mapping of sounds, orally, onto letter patterns, using a technology program, would improve student's knowledge at the word level when reading and spelling. The students worked in pairs, using the computer program, Sounds Great Two, throughout twelve sessions, with explicit instruction to vocalize their responses. The study included three aspects; instruction and repetition of the mapping of sounds onto letter patterns; the presentation of the instruction via the computer program; and the vocalization of responses. A comparison was then made with the results from a research project in which students followed the same program but were not explicitly instructed to vocalize their responses. The students participating in the present research project showed improvement in their prose reading, orthographic knowledge and spelling. When comparison was made with the results in which the students were not instructed to vocalize, it was evident that the independent variable, vocalization of responses, had made an impact on the students results. While all students showed improvement in the post tests, the students who vocalized responses were able to transfer their knowledge of letter patterns to less familiar words with greater accuracy, therefore using analogy. The consistent and motivating repetition of skills and the explicit instruction to vocalize responses resulted in success for the students participating in this study. The impact of vocalization of student responses during literacy intervention at other levels of text processing would be an interesting area for further research.

Introduction

Many children at the year two level have not moved from reading individual letter sounds in words to mapping sounds onto letter clusters. Individual letter identification brings about a degree of success for beginning readers as they decode regular two and three letter words. As stimuli increases in length and complexity the strategy becomes inefficient and results in inaccurate word identification. Children, beyond beginning reader stage who continue to rely on identification of individual letter sounds in words read neither fluently nor accurately.

The mapping of sounds to letter clusters provides the reader with the ability to make analogies between words. Onset and rime awareness is connected to the reader making analogies between the spelling patterns representing the rimes in words (Goswami & Mead 1992). The teaching of onset and rime units is also suggested by Trieman (Mayer 1998), who is reported to have demonstrated that people find it easier to segment syllables into onset and rime than into units than cut across onset and rime patterns. It is also important that students are explicitly taught to use phonemic awareness to correctly match sound units to letter clusters. Phonemic segmentation is shown to be the best predictor of spelling and reading success (Nation & Hulme 1997). The NICHD also supports the theory that deficits in phonemic awareness when learning to read is a major factor in reading difficulties (Grossen 1997).

Assisting students to read more accurately at the word level of text processing requires repetition of skills in order to gain automaticity (Munro 2003). The student also requires oral language knowledge, regarding how words are said, what they mean and awaresnss of sounds in words when matching text directly with stored letter cluster knowledge. Research carried out at North Western University suggests that both orthographic and phonologic processes become more automatic with skill development. Brain regions were identified for processing unimodally presented written and spoken word forms, and for converting between the orthographic and phonological representations of these word forms. The study also demonstrates that, "…. better performance is associated with greater activation of the neural information processing routes required by the specific cognitive demands of each lexical task (Northwestern University)".

Students who continue to break words into individual sounds when reading are possibly lacking in the ability to map phonological and phonemic knowledge onto letter clusters. They require automaticity in order to read fluently and therefore could benefit from repetition of specific skills. In activating the neural information processing routes, the combination of hearing, looking at the word/ letter pattern and saying it aloud could provide the activation necessary to improve orthographic knowledge, prose reading accuracy and spelling accuracy.

The present investigation aims to extend earlier research by examining the influence of vocalizing letter clusters on (1) orthographic knowledge (2) prose reading accuracy (3) spelling accuracy.

Prediction:
Explicit teaching of mapping sounds orally onto letter patterns using a commercial technology program, will improve children's orthographic knowledge, prose reading accuracy and spelling.

Method

Design
The study uses a case study OXO design, in which the gain in orthographic knowledge, prose reading accuracy and spelling accuracy is monitored for year two students who are having reading and spelling difficulties.

The participants are 2 year 2 students who have reading and spelling difficulties. The student's age, entry prose reading accuracy for both a levelled text and the Program text, entry orthographic knowledge and spelling accuracy are shown on table 1.

Student	Chronological Age (at date of pre-test)	Reading Level	Entry Orthographic Knowledge (percentile)
A	7yrs 7mths	15	15th
T	7yrs 2 mths	13	24th

Table 1

Participants

The students chosen for the study both had reading levels at a year below an expected level for their ages. Each student focused heavily on reading using individual letter sounds and also distinct visual features. Neither student re -read to regain meaning. Auditory assessment of both student T and A had revealed no deficits in this area. Student T had been noted to have some difficulty concentrating on tasks, while student A appeared to lack confidence generally in learning. Both student T and A had developed the habit of looking at the teacher for reassurance when attempting to read an unknown word. Neither student had under gone formal educational assessment.

Materials
  ➢ Reading Recovery levelled texts.

> ➢ Sounds Great 2 Interactive Resource for Early Literacy Technology Program (Mimosa Shortland Publications)

> ➢ Orthographic Reading Test: Stimulus sheet containing words varying in length and complexity; Record Sheet and Percentile Rankings (John Munro Lecture notes 2003).

> ➢ Spelling test, using dictation of Sounds Great Program text

Procedure

The assessment tasks were administered to the students in the following order;
- Miscue analysis of levelled text
- Miscue analysis of program text
- Orthographic Reading test
- Spelling test, dictation of program text, assessing both the use of letter patterns taught and the degree of correct spelling.

The 12 teaching sessions were conducted each morning for 35 to 45 minutes on consecutive school days. During each of the intervention sessions the students worked together at a computer. The children were instructed on how to use the program (also contained in the program itself), but were also given the instruction to say the words and letter patterns out aloud. They worked through the tasks on the technology program Sounds Great 2, beginning with a repeated reading of the story preceding each set of tasks. The tasks contained 6 items:

1. matching pictures that begin with the same onset letter pattern or the same rime pattern (phonological awareness)
2. matching the spoken word to the word highlighted in the sentence
3. locating initial blend or vowel sound from the written text
4. identifying 3 written words that have the same rime pattern as the target word
5. listening to 6 words to identify the 3 that rhyme with the target word
6. selecting letters to spell words, with 2 stages of word building for each word, onset and rime patterns and individual phonemes.

The students repeated the same story and tasks 3 times after which they completed the appropriate Sounds Great 2 Assessment Quiz. Each Quiz assesses the particular letter pattern knowledge taught. Detail of the procedure is located in the Appendix 4. Before beginning the research project a pilot study was carried out in order to trial the procedures effectiveness (Appendix 5).

Results

Prose Reading Accuracy
Trends for the 2 students in reading prose accuracy for both the levelled text and the program text indicated a significant improvement, as shown in figures 1& 2. The results indicate an average variation in miscues between the pre-test and post-test of 18.5. (Prose Reading Analysis Appendix 1).

Student A Prose Reading Accuracy
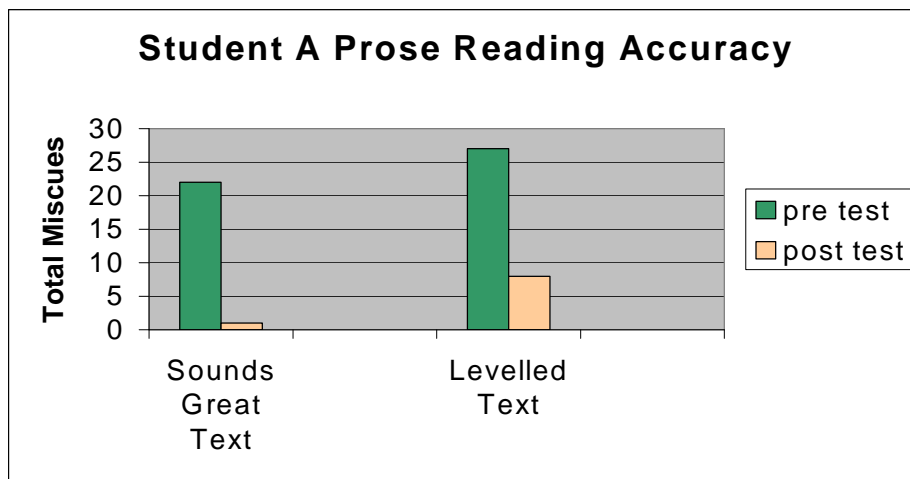
Figure 1

The results for student A indicated fewer miscues for both texts with 21 miscues in the post-test for the program text and 19 less for the levelled text.

Student T Prose Reading Accuracy
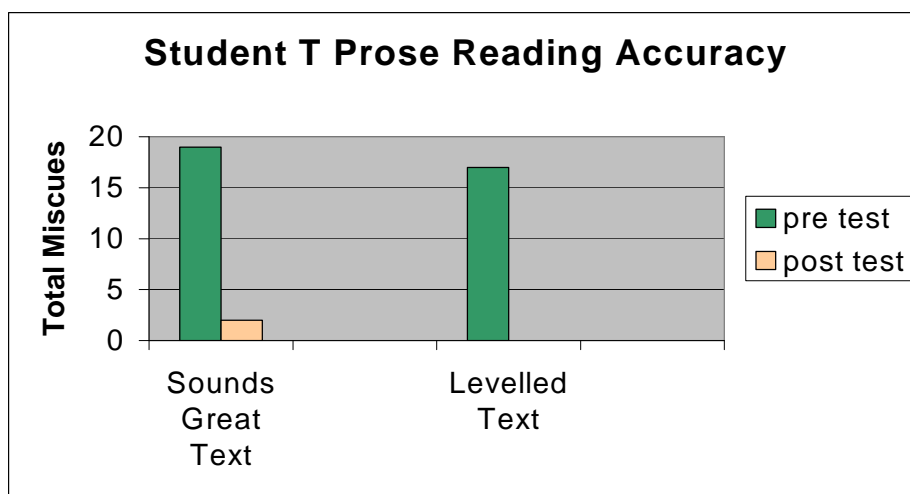
Figure 2

The results for student T also indicated fewer miscues for both texts with 17 less miscues on the post-test for the program text and 17 less for the levelled text. This

showed no difference between the text containing the letter patterns taught and the levelled text.

Orthographic Knowledge

Results for the orthographic test (Figure 3) indicate an improvement in percentile scores with an average increase of 25 in percentile scores. (Orthographic Analysis Appendix 2).

Orthographic Test Percentile Scores

Figure 3

Student A Orthographic Test Analysis Pre Test & Post Test

Figure 4

Student A showed an improvement from the 15th percentile to the 29th percentile in the results. Specific changes in the types of errors made are shown in Figure 4. Errors include fewer words containing letters jumbled and significantly fewer words with letters deleted indicating some improvement in mapping sounds onto letter patterns. The number of words that have similar visual features has decreased while the number of words containing mistakes with vowel digraphs increased. All words continued to have orthographic similarity.
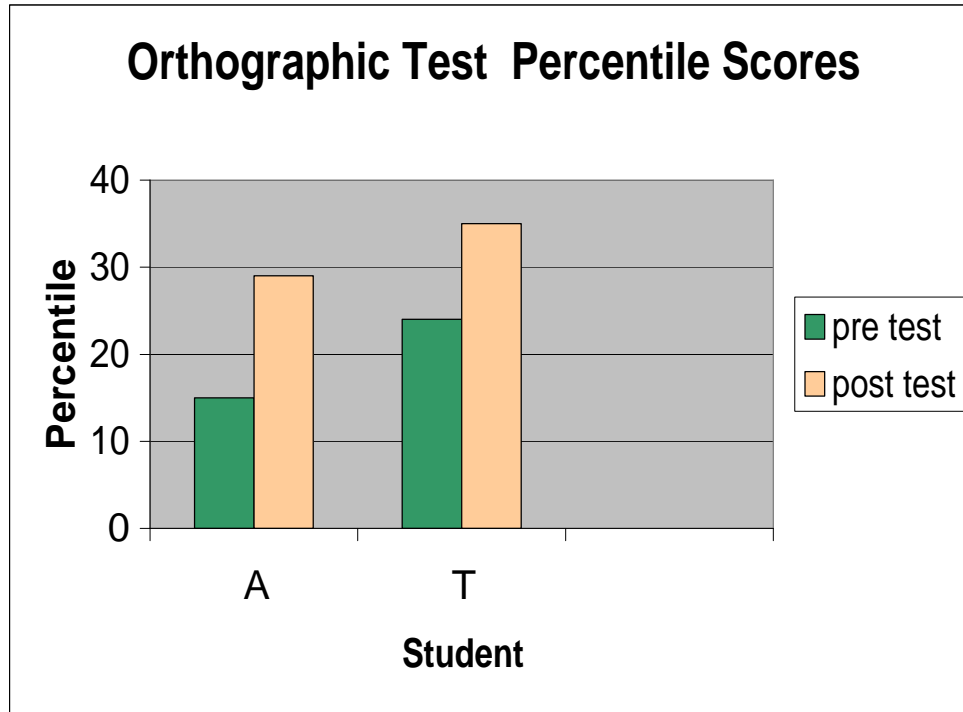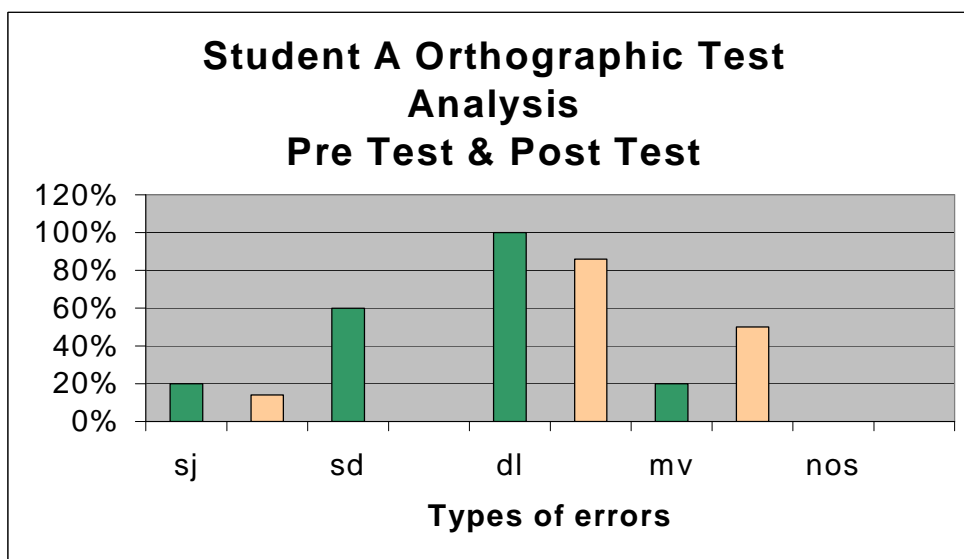
Student T Orthographic Test Analysis Pre Test & Post Test

Types of errors: sj, sd, dl, mv, nos
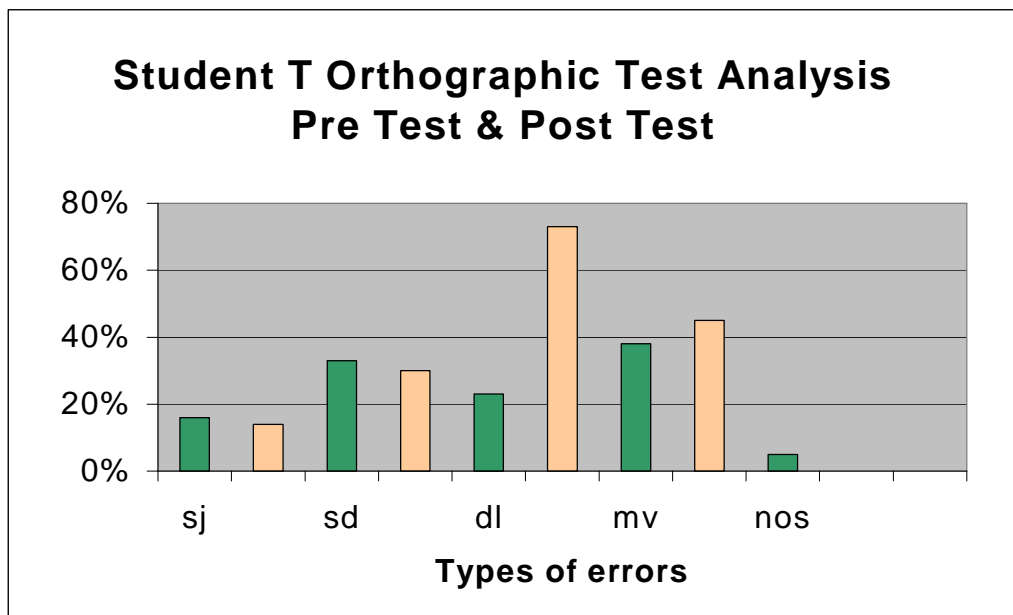
Figure 4

Student T also showed an improvement in orthographic knowledge from a pre test ranking of 24th to a post-test ranking of 35th percentile. As shown in Figure 4 the types of errors made include less letters jumbled and less letters deleted in words, a difference which, although slight would indicate an increased ability to map sounds onto letter clusters. Student T showed a significant increase in the use of visual features in identifying words and an improvement in the pronunciation of vowel digraphs also indicating improved skill in mapping sounds onto letter patterns.

Spelling
The trend for both student A and T indicate an improvement in spelling using letter patterns taught, with a average increase of 11 words containing letter patterns taught. Both students also show an improvement in the number of words spelled correctly, with an average increase of 9.5 words spelled correctly. (Data record chart Appendix 3).

Student A showed a significant improvement in using letter cluster knowledge to attempt to write the words and made similar gains in correctly spelling words (Figure 5).
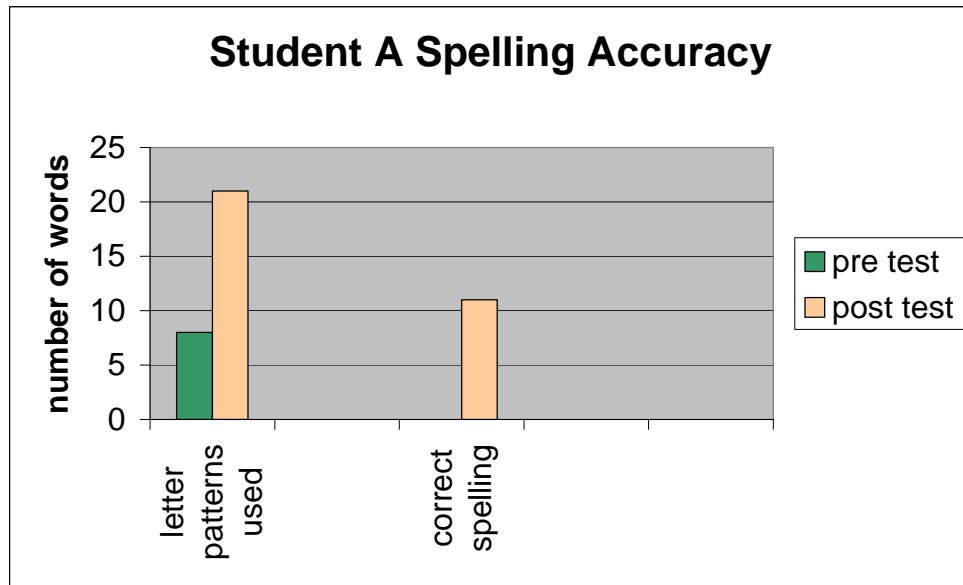
Figure 5

Results for student T showed an improvement of 9 for letter patterns and 8 for correct spelling, demonstrating an increase in the frequency in the use of letter pattern knowledge when writing (Figure 6).
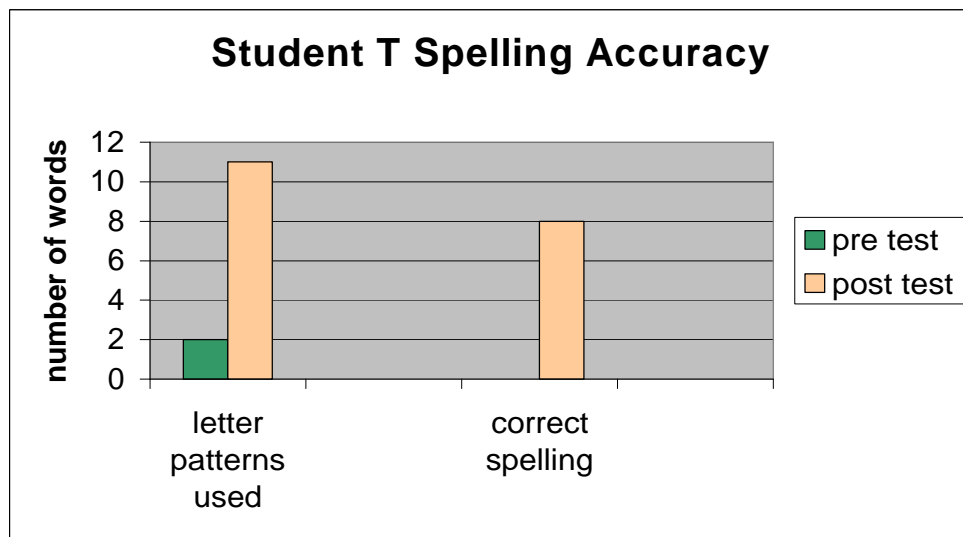
Figure 6

Comparison of Action Research Results

As a part of the hypothesis, the students were to be explicitly instructed to vocalize the text. The results of the present study were compared with a study in which students

followed the program without specific instructions to articulate the words and letter patterns (Kelly 2003). Students A and T (present study) were given instruction to say the letter patterns aloud while students J and H (Kelly 2003) were not.

Changes in Prose Reading Accuracy
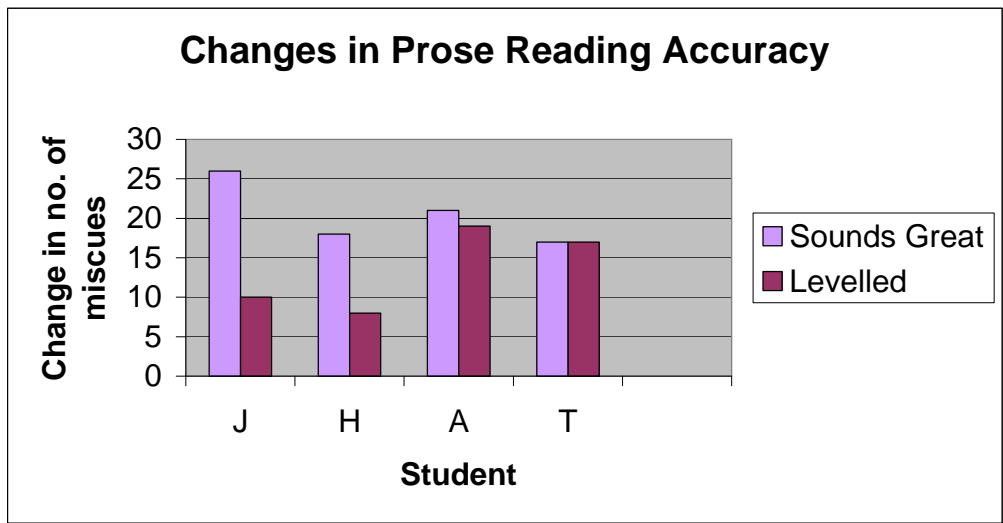
Figure 7

Accuracy as shown in Figure 7 is measured by the difference in pre-test and post-test miscues. Trends for the group (Figure 7) for prose reading accuracy indicated that all students had variation between pre and post-tests. Students J and H showed comparable to greater improvement in their results for the Sounds Great text to students A and T, although students A and T showed considerably greater improvement in scores in the levelled text results. This suggests that the students who vocalized the words and letter patterns were more efficient in transferring their orthographic knowledge to new words in less familiar texts, therefore making analogy.

Trends in the improvement for the group (Figure 8), in correctly spelling dictated text, were comparable for students H, A & T, but to a lesser degree for student J. However the variation in results for the students A and T who vocalized the letter patterns during teaching sessions was greater than for the student J and H who were not instructed to vocalize the stimulus, with student J showing no gains in use of letter patterns when spelling.

Improvement in Spelling Accuracy
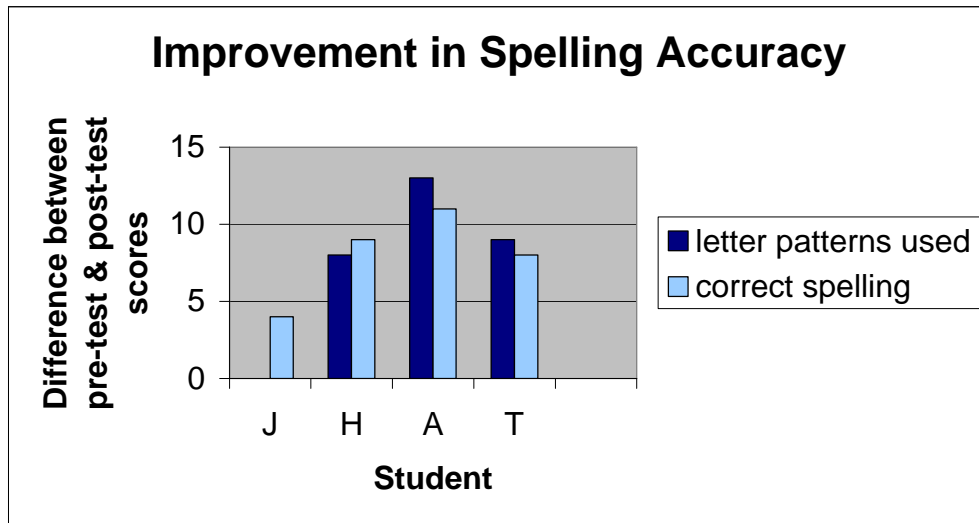
Figure 8

The trend in the results of the orthographic test (Figure 9) shows an improvement in ranking for all students, however a greater improvement in the percentile ranking is shown for students who vocalized during the sessions than those who did not.

Orthographic Test Results
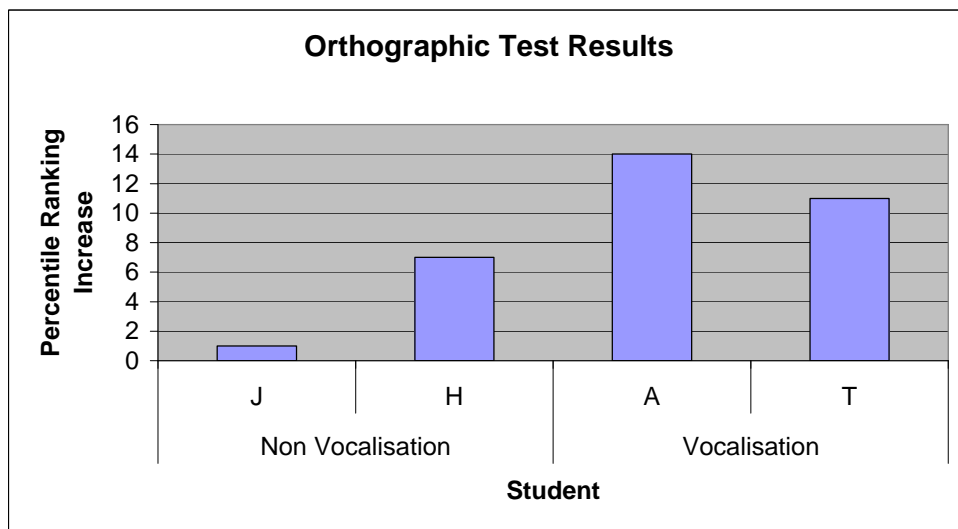
Figure 9

Discussion

Interpretation of results in relation to the hypothesis and reasons:

The trend in the results indicates that the explicit teaching of the mapping of sound onto letter patterns did improve the student's prose reading accuracy, orthographic knowledge and spelling accuracy. One of the key intervention strategies that affected the dependent variables was the vocalizing of words and letter patterns. This was shown when comparing the study in which children were not instructed to vocalize the sounds with the present study. The research carried out at Northwestern University supports this as it was found that there is an increased performance in lexical tasks when there is greater activation of neural processing routes. The saying of the letter patterns and words as they are read activated the student's neural processing routes.

The link between phonemic segmentation and reading success as pointed out in research by NICHD (1997) and also Nation & Hulme (1997) supports the findings of the present study as the explicit teaching of the matching of sound to letter patterns resulted in improved prose reading accuracy. The increase in spelling accuracy shown in the present study is supported by the research carried out by Goswami & Mead (1992), as the student is able to make analogies between the rime patterns in words when s/he has onset and rime awareness.

The students' ability to respond more automatically, as shown in the results of the orthographic tests (Appendix 1&2) matches the research carried out at Northwestern University, which suggests that both orthographic and phonologic processes become more automatic with skill development.

The comparison between the two groups of students' intervention programs, vocalizing and non-vocalization of letter patterns, shows that both sets of students showed similar improvement in prose reading accuracy, orthographic knowledge and spelling accuracy. The major improvement shown is in the ability of the students who vocalized during the teaching sessions to make the analogy between words and apply their knowledge to a less familiar prose text.

The physical conditions remained consistent throughout the intervention as the students worked in a studio away from the classroom. The distraction level was minimal. The children worked together under supervision but were prompted where necessary to vocalize the words and letter patterns using the computer as an instructional tool. Research focusing on computer assisted reading instruction at Alberta Vocational

College, Calgary (1997), concludes that both student attitude and motivation increases when technology is used to assist instruction. The technology program used in the present research was observed to stimulate interest and enjoyment of the students during the intervention sessions. It also provided a consistent presentation of intervention sessions, which eliminated the confounding variable of teacher inconsistency in the manner of presentation. As the independent variable of vocalizing has considerable impact on the results of the study it would be advisable for computer software designers to include instructions for students to vocalize responses.

Part of the program also entailed worksheet material, which had either a scripted teacher instruction sheet or independent activities. As the independent activities were taken home by the students the extent to which the students were assisted becomes a confounding variable in the intervention process.

The implications for teaching practice indicated by the present study include various aspects. The inclusion of a systematic program that explicitly teaches the mapping of sound onto letter patterns with the specific instruction to vocalize each sound/ word is advised. Underpinning the program should be the development of phonological skills as the matching of sound to letter patterns requires phonological knowledge in the form of awareness of sounds in words; segmentation of words into syllables; sound blending; manipulation of sounds within words; phonemic recoding, bridging to written words (Munro 2003). The underpinning role of oral language is evident, as the vocalization of the letter patterns and words has shown to have a positive influence on the student's progress. As technology provided a consistent delivery and motivation during the intervention, the use of appropriate software that teaches the skills included in this study may also be of benefit when planning an instructional intervention.

Appendix 1

Student A Pre test SG Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
flash	flashed	X		X		*		X		X		*		P	
five	fire	X		X		X		*		X		*		P	
look	looked	X		X		*		*		X		*		P	
sighed	shouted	X		X		X		*		*		P		X	
why	away	X		X		X		*		X		P		X	
is that	said	X		X		X		*		X		X		X	
inside	outside	X		X		X		*		*		*		P	
now	new	X		X		X		*		X		*		P	
want	went	X		X		X		*		X		*		P	
groaned	grumbled	X		X		*		*		*		P		P	
yummy	yum	X		X		*		X		X		P		P	
Dinner	---														
frightened	----														
Can't	----														
hide	---														
growled	---														
treat	---														
beast	---														
feast	----														
through	---														
glue	---														
They'll	---														
Summary Data	Errors-11	✔	0	✔	0	✔	4	✔	9	✔	3	✔	1	✔	0
	No response-11	X	11	X	11	X	7	X	2	X	8	X	6	X	3
	Total miscues-22	P	0	P	0	P	0	P	0	P	0	P	4	P	8

Student name: A   title : Sounds Great Texts The Green Frog, Five Frightened Mice, The Grizzly Bears Feast, Blue Boots:
Date: 5.6.03

Student A Post-test SG Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
groaned	grumbled	X		X		*		*		*		P		P	
Summary Data	Errors-1	✔	0	✔	0	✔	1	✔	1	✔	1	✔	0	✔	0
	No response-0	X	1	X	1	X	0	X	0	X	0	X	0	X	0
	Total miscues-1	P	0	P	0	P	0	P	0	P	0	P	1	P	1

Student name: A   title : Sounds Great Texts The Green Frog, Five Frightened Mice, The Grizzly Bears Feast, Blue Boots :24.6.03

Student A Pre test Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
stay	sat	X		X		*		*		*		P		X	
bodies	backs	X		X		*		*		*		X		X	
nostrils	nose	X		X		*		*		*		P		X	
feed	find	X		X		X		*		X		P		X	
fill	full	X		X		*		X		X		*		P	
might	many	X		X		X		X		X		X		X	
long	log	X		X		X		*		X		*		*	
moment	minute	X		X		*		*		*		P		P	
busy	bugs	X		X		X		*		*		P		X	
feeding	found	X		X		X		*		*		X		X	
stay	---														
floating	---														
ears	---														
around	---														
squirt	---														
carefully	---														
sniff	----														
crocodiles	---														
would	---														
bend	---														
spread	---														
way	---														
stay	---														
hours	---														
worms	---														
where	---														
cool	---														
Summary Data	Errors-10	✔	0	✔	0	✔	5	✔	8	✔	6	✔	2	✔	1
	No response-17	X	10	X	10	X	5	X	2	X	4	X	3	X	7
	Total miscues-27	P	0	P	0	P	0	P	0	P	0	P	5	P	2

Student name: A   title : At the Waterhole level: 15 Date: 5.6.03

Student A Post test Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
bodies	backs	X		X		*		*		*		X		X	
nostrils	nose	X		X		*		*		*		P		X	
might	must	X		X		X		*		*		P		X	
moment	minute	X		X		*		*		*		P		P	
busy	bugs	X		X		X		*		*		P		X	
feeding	found	X		X		X		*		*		X		X	
carefully	---														
only	---														
Summary Data	Errors-6	✔	0	✔	0	✔	3	✔	6	✔	6	✔	0	✔	
	No response-2	X	6	X	6	X	3	X	0	X	0	X	2	X	5
	Total miscues-8	P	0	P	0	P	0	P	0	P	0	P	4	P	1

Student name: A   title : At the Waterhole level: 15 Date: 24.6.03

Student T SG Pre test Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
A	at	*		*		x		*		x		P		P	
a	the	x		x		*		*		*		x		x	
flash	fish	x		x		x		x		x		*		*	
sighed	Saw/ said	*		x		*		*		*		p		p	
inside	In here	x		x		*		*		*		p		p	
groaned	grumbled	x		x		*		*		*		p		p	
let	last	x		x		x		*		x		p		p	
shoe	shop	x		x		x		*		*		p		p	
dinner	---														
Can't	---														
hide	---														
treat	---														
beast	---														
feast	---														
uncle	---														
Luke	---														
through	---														
mend	---														
glue	---														
Summary Data	Errors-8	✔	*	✔	1	✔	4	✔	7	✔	5	✔	1	✔	1
	No response-11	X	6	X	7	X	4	X	1	X	3	X	1	X	0
	Total miscues-19	P	0	P	0	P	0	P	0	P	0	P	6	P	7

Student name: T title : Sounds Great Texts: The Green Frog, Five Frightened Mice, The Grizzly Bears Feast, Blue Boots
 Date: 22.5.03

Student T SG Post test Prose Reading (Reading Aloud) Analysis Table
✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
groaned	grumbled	x		x		*		*		*		p		p	
growled	grumbled	x		x		*		*		*		p		p	
Summary Data	Errors-2	✔	0	✔	0	✔	2	✔	2	✔	2	✔	0	✔	0
	No response-0	X	2	X	2	X	0	X	0	X	0	X	0	X	0
	Total miscues-2	P	0	P	0	P	0	P	0	P	0	P	2	P	2

Student name: T   title : Sounds Great Texts: The Green Frog, Five Frightened Mice, The Grizzly Bears Feast, Blue Boots
Date: 24.6.03

Student T Pre test Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
It's	lets	X		X		X		*		X		*		*	
road	roof	X		X		X		*		X		P		P	
sang	brushing	X		X		X		X		X		X		X	
song	brush	X		X		X		X		X		X		X	
way	was	X		X		X		X		X		*		X	
clean	cleaning	X		X		*		X		X		*		P	
on	off	X		X		X		X		*		X		X	
blow	light	X		X		X		*		X		X		X	
Here comes	Her hair	X		X		X		*		X		X		X	
you	your	X		X		X		X		X		*		P	
Ted	tend	X		X		X		X		*		*		P	
tea	---														
matches	---														
yellow	---														
before	---														
smiled	---														
sang	---														
Summary Data	Errors-11	✔	0	✔	0	✔	1	✔	4	✔	2	✔	5	✔	1
	No response –6	X	11	X	11	X	10	X	7	X	9	X	5	X	6
	Total miscues-17	P	0	P	0	P	0	P	0	P	0	P	1	P	4

Student name: T   title : Candle-light level: 13 Date: 16.6.03

Teacher:

TR Post test Prose Reading (Reading Aloud) Analysis Table

✔ = Read correctly   X = No   P = Partially

Text word or phrase	What was read (include hesitations)	Text re-read?		Error corrected?		Meaning of context retained?		Up to point of error, that part of the sentence make sense?		Fits with grammar?		Looks like text?		Sounds like text?	
Summary Data	Errors-0	✔		✔		✔		✔		✔		✔		✔	
		X		X		X		X		X		X		X	
		P		P		P		P		P		P		P	

Student name: T   title : Candle-light level: 13 Date: 25.6.03
Comment: No errors- moved to level 15

Teacher:

Appendix 2

Orthographic Profile: Pretest Student A

How a word is read:						
Correct and Rapid Ford, new, pen, she, kiss, cow, miss, cart, ate, tea 10						
Correct and slow goal 1						
No response: Claim hiss dart drill counts boil ail stripe place braid den dune ale screen send foal burst stamp fend crawl spoon pew burnt shy prompt sprung ash cramp toil squirm still scream swoop train skirts tune twirls drawn stream gloom ground strike horn aim splint dew ear strive sprout clamp string bend grape sort spleen low spread road street spurt soil strict spawn ape cube throng **66**	Types of errors:					
Correct and slow, part of it read before reading the word 0						

Incorrect
    Part-pat
    Plate-plant
    Aid-add
    Grill-girl
    Tow-to
	sj
	
	*
		sd
		*
		
		*
		*
			dl
			*
			*
			*
			*
			*
				nos	mv
					
					*	

5	1 20%	3 60%	5 100%	0	1 20%	

Raw score 11
Percentile 15th
Sj: letters in the stimulus word were jumbled in the spoken response
Sd: letters in the stimulus word were deleted in the spoken response
Dl: response is a word read accurately by the reader and shares visual features with the stimulus
Mv: mispronounces vowel digraph
Nos: response is a word read accurately by the reader but has no orthographic similarity to the stimulus

Orthographic Profile: Post test Student A

How a word is read:	
Correct and Rapid Hiss drill new place eat den send fend spoon ash pen she swoop train gloom kiss cow horn goal sprout miss string cart bend sort ate tea 27	
Correct and slow 0	
No response: Claim dart counts boil ail stripe braid dune ale screen foal burst stamp crawl pew burnt shy prompt sprung cramp toil squirm still scream skirts tune twirls drawn stream ground strike aim splint dew ear strive clamp grape spleen low spread road street spurt soil strict spawn ape cube throng **50**	
Correct and slow, part of it read before reading the word 0	Types of errors:

Incorrect	sj	sd	dl	nos	mv	
Plate-party						
Men-man			*			
Aid-add			*		*	
Ear-air			*		*	
Tow-two	*		*			
Part-parrot			*			
Throng-through			*			
7	1 14%	0	6 86%	0	2 50%	

Raw score 27
Percentile 29th
Sj: letters in the stimulus word were jumbled in the spoken response
Sd: letters in the stimulus word were deleted in the spoken response
Dl: response is a word read accurately by the reader and shares visual features with the stimulus
Mv: mispronounces vowel digraph
Nos: response is a word read accurately by the reader but has no orthographic similarity to the stimulus

Orthographic Profile: Pretest Student T

How a word is read:	
Correct and Rapid Men, hiss, new, eat, den, fend, spoon, pen, she, 9	
Correct and slow Plate, ford, stamp, burnt, still, kiss, cow, splint, miss, bend 10	
No response: Claim, counts, tune, strike, pew **5**	
Correct and slow, part of it read before reading the word place 1	Types of errors:

Incorrect	sj	sd	dl	6	mv	
Dart-dirt			*	5%		
Boil-bill			*		*	
Stripe-spit	*	*	*			
Braid-bird	*	*	*		*	
Dune-den		*	*			
Ale-el	*	*				
Screen-scen		*			*	
Send-scend		*	*			
Foal-full			*		*	
Burst-best		*	*			
Crawl-wall	*	*	*			
Shy-sir						
Prompt-pot		*				
Sprung-song		*	*			
Ash-has	*					
Cramp-camp		*	*			
Toil-toll		*	*		*	
Squirm-som		*				
Scream-scam		*	*		*	
Swoop-shop		*	*		*	
Train-shan		*			*	
Skirts-skit		*	*			
Aid-add			*		*	
Twirls-walls						
Drawn-down		*	*			
Stream-sam		*			*	
Gloom-golum	*				*	
Ground-gond		*			*	
Grill-gill		*	*			
Home-hom		*				
Aim-im		*			*	
Dew-wed	*					
Ear-air					*	
Sprout-spot		*	*		*	
Clamp-clam		*	*			
String-sewing		*	*			
Cart-cavet		*				
Grape-pad		*				
Sort-sot		*				
Spleen-spen		*			*	
Low-lon						
Spread-spad		*			*	
Road-rad		*			*	
Tow-two	*					
Part-parrot			*			
Street-spet		*			*	
Spurt-spoot						
Soil-sole			*		*	
Strict-sock		*				
Spawn-spinning						
Ate-aren't	*		*			
Tea-tat					*	
Ape-apple			*			
Cube-ked		*				
Throng-tong		*				

Incorrect: 55	9 16%	36 33%	25 23%		21 20%	

Sj: letters in the stimulus word were jumbled in the spoken response
Sd: letters in the stimulus word were deleted in the spoken response
Dl: response is a word read accurately by the reader and shares visual features with the stimulus
Mv: mispronounces vowel digraph
Nos: response is a word read accurately by the reader but has no orthographic similarity to the stimulus

Orthographic Profile: Post test Student T

How a word is read:	
Correct and Rapid Ford, hiss, new, eat, den, send, stamp, fend, spoon, pew, burnt, shy, prompt, ash, pen, cramp, still, scream, she, swoop, train, gloom, kiss, cow, grill, aim, splint, dew, goal, miss, cart, bend, low, part, street, tea 36	
Correct and slow 0	
No response: Drill, counts, stripe, dune, screen, crawl, sprung, squirm, skirts, tune, aid, string, grape, sort, spleen, road, strict, spawn, cube, throng **20**	
Correct and slow, part of it read before reading the word men 1	Types of errors:

Incorrect	sj	sd	dl	nos	mv	
Claim-clim		*			*	
Plate-platter			*			
Dart-date			*			
Boil-bill			*		*	
Ail-al		*	*		*	
Place-please			*			
Braid-bird	*	*	*		*	
Ale-allie						
Foal-feola	*				*	
Burst-better						
Toil-tall			*		*	
Ground-groaned			*		*	
Strike-stuck		*	*			
Strive-strivy					*	
Sprout-spout		*	*		*	
Clamp-clumps			*		*	
Spread-street						
Tow-two	*		*			
Spurt-spewt			*			
Soil-sil		*	*			
Ate-art			*			
Ape-apple			*			
Incorrect : 22	3 14%	6 30%	16 73%	0	10 45%	

Raw score 11

Percentile Rank 15th

Sj: letters in the stimulus word were jumbled in the spoken response

Sd: letters in the stimulus word were deleted in the spoken response

Dl: response is a word read accurately by the reader and shares visual features with the stimulus

Mv: mispronounces vowel digraph

Nos: response is a word read accurately by the reader but has no orthographic similarity to the stimulus

Appendix 3

Spelling: Student A						
	Pre test			Post test		
Stimulus word	written response	Uses letter pattern taught	Correct spelling	response	Uses letter pattern taught	Correct spelling
fright	fitd			figth		
light	lit			light	*	*
sky	Siy	*		sciy	*	
Firefly	Flu fly			fireu fly	**	
flew	fluo	*		flew	*	*
nine	ning			nine	*	*
slide	slid			slide	*	*
friendly	friendl	*		friendll	*	
frog	fog			frog	*	*
meet	met			meet	*	*
beetle	btl			beetl	*	
Friday	fiuday			friday	*	*
sheep	seppy			sheep	*	*
cheese	cess			cheese	**	*
with	whth	*		with	*	*
queen	qen			qeen	*	
grizzly	gezzle			grezzy	*	
bear	ber			bare		
growled	rad			grar	*	
something	sometheg	*		something	*	*
groaned	greenod	*		grood	*	
grumbled	grmbd	*		grumld	*	
treat	teat	*		teat	*	
himself	himsife			himsfle		
hungry	hore			harrey		
best	best			best		
yummy	eume			yumme		
feasr	fest			fest		
28		8	0		21	11

Spelling: Student T						
	Pre test			Post test		
word	response	Uses letter pattern taught	Correct spelling	response	Uses letter pattern taught	Correct spelling
five	fiv			five	*	*
mice	mis			mics		
fright	firt			frilt		
was	wos			wos		
night	nit			nite	*	
they	fay			vay		
saw	sor			sow		
light	leit			lite	*	
sky	siy			sice		
firefly	firefiy	*		firfiy		
that	there	*		vat		
flew	fow			flow	*	
over	ovre			ovar		
slide	slid			slide	*	*
friendly	fndle			fendl		
green	girn			geene	*	
frog	fog			frog	*	*
will	wil			wil		
meet	meit			mete		
beetle	betl			bedl		
Friday	fiday			Friday	*	*
they	vaei			vay		
sheep	thepi			sheep	*	*
eat	eit			eat	*	*
cheese	these			these		
with	wihte			whte		
queen	qenei			qeene	*	
grizzly	gsyyli			gisl		
bear	ber			ber		
growled	gowd			god		
something	satf			smfth		
groaned	gond			gond		
grumbled	gambled			gad		
treat	thet			thte		
said	sed			sed		
himself	hemsalf			hemsaf		
hungry	hagi			hag		
beast	best			best		
and	nad			and		*
feast	fest			fet		
44		2	0		11	8

Appendix 4

Teaching Sessions

Physical Organisation of each session:
- ➤ 2 Children work together on a computer in a withdrawal area
- ➤ load computer program Sounds Great Two Interactive Phonics and Spelling by David Hornsby and Robyn Platt
- ➤ Photocopy materials

Session 1

Letter patterns: i-e, y, igh
Story: Five Frightened Mice
Time:45 minutes
Preparation:
Load Sounds Great Two disc 2 Five Frightened Mice
copy worksheet FFM8 and use with directions provided on page FFM6
copy worksheet FFM5 (writing about the picture)
copy story strip FFM1

Instruction:
Say: *You will be using this program to practice your reading and spelling.*
Click on the story twice before you begin the activities. Click on the sound symbol to listen to the letter patterns, words and sentences. Click on the question mark (indicate*) if you are not sure what to next. The program will tell you what to do*
.You will work through each book three times before moving to the next story.
I want you to say the words and letter patterns out aloud.
Computer component:
Children work through the story, *Five Frightened Mice* twice and then each on the six activities in order.
Observations:
Children took turns to complete each activity and helped each other with answers. They did not say the words or sounds out aloud automatically, but needed continual reminders to vocalize what they were hearing. Each child pointed to the screen to help the other with answers. Children also needed to be reminded to click on the sound symbol to hear the word or pattern and say it before choosing.

Worksheet Component
Children complete teacher directed activity FFM8 following directions from teacher provided on FFM6 (letter cloze and onset & rime matching). Children were encouraged to say the words and letter patterns out aloud during these tasks.
Complete independently FFM5 (writing about a picture from the story).
Worksheets pasted into scrapbook.

Follow up home activity
Children read the story strip FFM1-five Frightened Mice

<p align="center">Session 2</p>

Letter patterns: i-e, y, igh
Story: Five Frightened Mice
Time:30 minutes
Preparation:
Load Sounds Great Two disc 2 Five Frightened Mice
copy worksheet FFM7 and use with directions provided on page FFM6

Instruction:
Remember to click on the story twice before you begin the activities. Click on the sound symbol listen and __say__ the letter patterns, words and sentences. Click on the question mark (indicate*) if you are not sure what to next. The program will tell you what to do.*

Computer component:
15 minutes
Children work through the story, *Five Frightened Mice* twice and then each on the six activities in order.
Observations:
Children began to read the story aloud and needed reminding to say the words and patterns out aloud.

Worksheet Component
15 minutes including explanation of home activity
Children complete teacher directed activity FFM7 following directions from teacher provided on FFM6 (identification of picture to match spoken stimulus word & sentence completion with a choice of 3 words). Children were encouraged to say words and letter patterns aloud during these tasks.

Follow up home activity
Word and picture matching FFm4

<p align="center">Session 3</p>

Letter patterns: i-e, y, igh
Story: Five Frightened Mice
Time:45 minutes
Preparation:
Load Sounds Great Two disc 2 Five Frightened Mice
copy worksheet FFM2 (generating words with y, I-e & igh patterns)
copy worksheet FFM3 (jigsaw matching onset & rime)

Instruction:
Ask: *What will you need to do while you are working through the program?* Remind children of the need to say words and sound patterns aloud.
Computer component:
Children work through the story, *Five Frightened Mice* twice and then each on the six activities in order.

Observations:
Children were saying words and letter patterns aloud. Praise was given when children vocalised the text.

Worksheet Component
Complete independently FFM2 (generating words with y, i-e & igh patterns)
Worksheet pasted into scrapbook.

Follow up home activity
Children complete worksheet FFM3 (jigsaw matching onset & rime)

Assessment Quiz
Each child completes the assessment quiz (included in the computer program) for Five Frightened Mice individually while the other completes a worksheet activity.
Children were reminded to say the words and letter sounds aloud before choosing an answer.

Session 4

Letter patterns: fr, ee
Story: The Green Frog
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Green Frog
copy worksheet GF7 and use with directions provided on page GF6
copy worksheet GF5 (writing about the picture)
copy strip book GF1
Instruction:
Remember to click on the story twice before you begin the activities. Click on the sound symbol to listen and <u>say</u> the letter patterns, words and sentences. Click on the question mark (indicate*) if you are not sure what to next. The program will tell you what to do.*

Computer component:
15 minutes
Children work through the story, The Green Frog twice and then each on the six activities in order.
Observations:
Vocalising the words and letter patterns became more automatic as part of the routine.

Worksheet Component
15 minutes
Children complete teacher directed activity GF7 following directions from teacher provided on GF6 (identification of picture to match spoken stimulus word & sentence completion with a choice of 3 words). Children were encouraged to say sounds and letter patterns aloud.
Children also complete the independent writing task GF5.
Sheets pasted into scrapbook.

Follow up home activity
Children take the fold up book GF1 to read.

<center>Session 5</center>

Letter patterns: fr, ee
Story: The Green Frog
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Green Frog
copy worksheet GF8 and use with directions provided on page GF6
copy worksheet GF4 (Matching words and pictures)

Instruction:
You will work through The Green Frog again today. Remember to click on the sound button or the question mark if you are not sure. Keep saying the words and letter patterns aloud before choosing.

Computer component:
15 minutes
Children work through the story, The Green Frog twice and then each on the six activities in order.
Observations:
Children have developed the habit of saying without being cued to do so.

Worksheet Component
15 minutes
Children complete teacher directed activity GF8 following directions from teacher provided on GF6 (single word cloze –chn fill in the letter pattern. Also creating words using onset & rime patterns).
Children were encouraged to say the words and sounds aloud.
Children complete the independent GF4 (matching words and pictures).
Sheets pasted into scrapbook.

Follow up home activity
None

<center>Session 6</center>

Letter patterns: fr, ee
Story: The Green Frog
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Green Frog
copy worksheet GF2 (word find)

Instruction:
Continue to say the words and letters aloud before choosing.
Computer component:
Children work through the story, *The Green Frog* twice and then each on the six activities in order.
Observations:
Children continued to automatically vocalise words and letter patterns.

Worksheet Component
Complete worksheet GF2 (word find) independently
Worksheet pasted into scrapbook.

Follow up home activity
None

Assessment Quiz
Each child completes the assessment quiz (included in the computer program) for The Green Frog individually while the other completes a worksheet activity. Children were asked to say the pictures, letter patterns and words aloud before choosing an answer.

Session 7

Letter patterns: gr, ea
Story: The Grizzly Bear's Feast
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Grizzly Bear's Feast
copy worksheet GBF7 and use with directions provided on page GBF6
copy worksheet GBF5 (writing about the picture)
copy fold up strip book GBF1

Instruction:
Today you will read about the Grizzly Bear's Feast. Work Through the activities the way you did for the other stories. Remember to click on the story twice before you begin the activities. Click on the sound symbol to listen to the letter patterns, words and sentences. Click on the question mark (indicate*) if you are not sure what to next. The program will tell you what to do. Remember to say the words and sounds aloud.*

Computer component:
15 minutes
Children work through the story, The Grizzly Bear's Feast twice and then each on the six activities in order.
Observations:
Children automatically vocalize responses.

Worksheet Component
15 minutes
Children complete teacher directed activity GBF7 following directions from teacher provided on GF6 (identification of picture to match spoken stimulus word & sentence completion with a choice of 3 words).
Children also complete the independent writing task GBF5.
Sheets pasted into scrapbook.

Follow up home activity
Children take the fold up strip book GBF1 to read.

Session 8

Letter patterns: gr, ea
Story: The Grizzly Bear's Feast
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Grizzly Bear's Feast
copy worksheet GBF8 and use with directions provided on page GF6
copy worksheet GBF3 (categorising words containing the same rime pattern)
Instruction:
You will work through The Grizzly Bear's Feast again today. Remember to click on the sound button or the question mark if you are not sure.

Computer component:
15 minutes
Children work through the story, The Grizzly Bear's Feast twice and then each on the six activities in order.
Observations:
Children continue to show enjoyment of the sessions and appear to be comfortable with the routine of saying responses aloud.

Worksheet Component
15 minutes
Children complete teacher directed activity GBF8 following directions from teacher provided on GBF6 (single word cloze –chn fill in the letter pattern. Also creating words using onset & rime patterns). Children complete the independent GBF3 (categorising words containing the same rime letter patterns). Sheets pasted into scrapbook.

Follow up home activity
None

Session 9

Letter patterns: gr, ea
Story: The Grizzly Bear's Feast
Time:35 minutes
Preparation:
Load Sounds Great Two disc 3 The Grizzly Bear's Feast
copy worksheet GBF2 (word cloze filling letter patterns to complete words)
copy worksheet GBF4 (matching words and pictures)
Instruction:
You will work through the The Grizzly Bear's Feast again today, next session you will read a new story. What will you do when you respond?

Computer component:
15 minutes
Children work through the story, The Grizzly Bear's Feast twice and then each on the six activities in order.

Observations:
Working in pairs, the children support each other in choosing answers and encouraging each other to vocalize responses.

Worksheet Component
15 minutes
Children complete teacher directed activity GBF2(word cloze filling letter patterns to complete words)
Children complete the independent GBF(matching words and pictures)

Sheets pasted into scrapbook.

Follow up home activity
None

Assessment Quiz
Each child completes the assessment quiz (included in the computer program) for The Grizzly Bear's Feast individually while the other completes a worksheet activity.

Session 10

Letter patterns: long u sound: oo, u-e, ew, oe
Story: Blue Boots
Time:35 minutes
Preparation:
Load Sounds Great Two disc 1 Blue Boots
copy worksheet BB7 and use with directions provided on page BB6
copy worksheet BB5 (writing about the picture)
copy fold up strip book BB1

Instruction:
Today you will read the story Blue Boots. Work Through the activities the way you did for the other stories. The program will tell you what to do. You are doing a great job of saying your responses out aloud.

Computer component:
15 minutes
Children work through the story, Blue Boots twice and then on the six activities in order.
Observations:
Children vocalize text confidently of the text.

Worksheet Component
15 minutes
Children complete teacher directed activity BB7 following directions from teacher provided on BB6 (identification of picture to match spoken stimulus word & sentence completion with a choice of 3 words).
Children also complete the independent writing task BB5.

Sheets pasted into scrapbook.

Follow up home activity
Children take the fold up strip book BB1 to read.

Session 11

Letter patterns: long u sound: oo, u-e, ew, oe
Story: Blue Boots
Time:35 minutes
Preparation:
Load Sounds Great Two disc 1 Blue Boots
copy worksheet BB8 and use with directions provided on page BB6
copy worksheet BB2 (categorising words containing the same rime pattern)
Instruction:
You will work through Blue Boots again today. Remember to click on the sound button or the question mark if you are not sure. I'm am going to listen to see who says their responses out aloud each time.

Computer component:
15 minutes
Children work through the story, Blue Boots twice and then each on the six activities in order.
Observations:
Children have become familiar with the routine and are independent in vocalizing when completing the tasks.

Worksheet Component
15 minutes
Children complete teacher directed activity BB8 following directions from teacher provided on BB6 (single word cloze –chn fill in the letter pattern. Also creating words using onset & rime patterns). Children complete the independent BB2 (categorising words containing the same rime letter patterns). Sheets pasted into scrapbook.

Follow up home activity
None

Session 12

Letter patterns: long u sound: oo, u-e, ue, ew, oe
Story: Blue Boots
Time:45 minutes
Preparation:
Load Sounds Great Two disc 1 Blue Boots
copy worksheet BB3 (crossword)

Instruction:
You will work through the The Grizzly Bear's Feast again today. Let me hear you respond aloud.

Computer component:
15 minutes
Children work through the story, Blue Boots twice and then each on the six activities in order.

Observations:
The children have developed a routine in which they support each other and say the program instructions aloud. They have developed the habit of saying words and letter patterns aloud.

Worksheet Component
15 minutes
Children complete independent activity BB3.
Sheet pasted into scrapbook.

Follow up home activity
None

Assessment Quiz
Each child completes the assessment quiz (included in the computer program) for Blue Boots individually while the other completes a worksheet activity.

Appendix 5

PILOT STUDY

In order to assess the effectiveness of the proposed procedure I worked through the program with 2 students who were having reading difficulties, were the same age and would not be participating in the research.

Sessions 1 to 3

Time : Between 35 and 45 minutes

Story: Five Frightened Mice
Letter sound patterns: i-e y   igh

Instructions given for the computer component of the activity:
Click on the story twice.
Listen carefully for the instructions on the computer.
Work through the activities in order from one to six.
Say the words and sounds you hear. (This took constant reminding with the child.)

Instructions given for follow up activity:

Match the pictures with words.
Say the picture name first then look for the word that matches the sounds you hear.

Assessment
Sounds Great Quiz (no instructions given by the teacher).

Observations/ Adjustments

➢ The children displayed obvious excitement in using a computer program.
➢ The student required at least 3 sessions repeating the same activities before they were confident with tasks.
➢ It was important to emphasize the vocalization of responses as much as possible as children are often asked to work quietly at tasks.
➢ During the first session the children worked individually at a computer each but the second session was more effective when the children worked together at a computer.

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