Action research undertaken to establish whether teaching grade prep students Cued Articulation in conjunction with explicit teaching of graphophonic relationships improves their knowledge of grapheme-phoneme correspondences.

ABSTRACT

Many students experiencing reading difficulties encounter difficulties decoding text at word level due to poor knowledge of grapheme-phoneme correspondences. In order to develop competence in reading, extensive evidence-based literacy research holds that during their early years of schooling, students "must first master the alphabetic code – the system of grapheme-phoneme correspondences that link written words to their pronunciations" (Australian Government, 2005, p.37). Strong anecdotal reports, feedback from speech pathologists and class teachers, and some informal studies promote the use of Cued Articulation as a strategy for developing early literacy skills. Despite such reports, a search of current literature has not found any comprehensive formal research evidence supporting the use of Cued Articulation as a means to facilitate the development of grapheme-phoneme correspondences.

The purpose of the present action research is to establish an evidence-base for the use of Cued Articulation as a tool to develop knowledge of grapheme-phoneme correspondences. The hypothesis of the study is that teaching grade prep students Cued Articulation in conjunction with explicit teaching of graphophonic relationships improves their knowledge of grapheme-phoneme correspondences.

This study compared the outcomes of two groups of students, an intervention group and a control group. The intervention group was taught Cued Articulation in conjunction with explicit teaching of graphophonic relationships, whereas the control group received explicit teaching of graphophonic relationships only. The results of this study reveal that both the intervention group and the control group demonstrated statistically significant improvements in overall outcomes for knowledge of grapheme-phoneme correspondences as a result of the teaching. The use of Cued Articulation, however, did not assist the intervention group to achieve a greater outcome in knowledge of grapheme-phoneme correspondences than the control group. Additional analyses highlighted that within the intervention group, those students who were more engaged by, and responsive to, the use of Cued Articulation made significantly greater progress with overall grapheme-phoneme identification than those students who were less responsive to Cued Articulation.

INTRODUCTION

Provision of high quality literacy education in our schools is an essential foundation for equipping students with the requisite skills for school-based learning across the curriculum, occupational and social success, and increasing the skill level of our workforce to contribute to social and economic prosperity at a national level. A national inquiry into the teaching of literacy was commissioned by the federal government reporting that "a significant minority of children in Australian schools continue to face difficulties in acquiring acceptable levels of literacy" (Australian Government, 2005, p.1). In 1996, Prior (cited in Westwood, 2001, p.25) estimated that the prevalence rate in Australia for students experiencing significant literacy learning difficulties to be at least 16 percent. This has implications both educationally and for life, as these students are more likely to be retained at school, leave school early, and have limited postsecondary school and work options.

Children enter their primary schooling with varying competencies in literacy knowledge, which can be attributed in part to their differing experiences in preschool through incidental learning or home teaching and factors intrinsic to the child. The challenge for educators early in the school year is to evaluate students' literacy skills and to provide relevant literacy instruction targeted to the various needs of the class. Early literacy evaluation by classroom teachers often involves taking a running record, evaluating the students' letter identification skills and their concepts about print. Scarborough (1998) was interested in the early identification of students at risk for reading disabilities and in a longitudinal study found that among the reading readiness skills that are commonly evaluated by classroom teachers, the strongest predictor of future reading success was a students 'letter identification' ability - the ability to name written letters and associated speech sounds.

In order to develop competence in reading, extensive evidence-based literacy research holds that during their early years of schooling, students "must first master the alphabetic code – the system of grapheme-phoneme correspondences that link written words to their pronunciations" (Australian Government, 2005, p.37). Some students require explicit and well-sequenced instruction in graphophonic relationships – the connections between the common letter patterns of written language and the associated speech sounds. Westwood (2001, p.6) refers to several studies highlighting that "for optimum impact on reading skills, phonemic training needs to be accompanied by explicit instruction in the relationships between phonemes and the letters used to represent them in print", and Castle (1999; cited in Westwood, 2001, p.68) claims that this would "significantly reduce the number of children experiencing reading failure". This idea is supported by Ball and Blachman (1991, pp.53-54), who cited several studies whereby positive effects on reading outcomes were attained as a result of students receiving explicit instruction in sound-letter relationships.

Students who experience difficulties relating spoken sounds to written letters encounter subsequent difficulties decoding text, reading fluently, and comprehending text. Having difficulties with lower order cognitive processes such as decoding, places a high demand on the students working memory. As their mental effort is used to retrieve sound-symbol relationships from long term memory by inefficiently decoding individual words letter by letter, the students' fluency is compromised. This lack of automaticity in decoding and reduced fluency means that students are often unable to cope with the additional cognitive capacity required for text comprehension and learning. As Chan and Dally (2000; cited in Westwood, 2001, p.32) describe, "… the labour-intensive efforts of poor readers to decode words, due to deficits in either phonological or orthographic processing, tax the limited resources of working memory. When the lower level skills of word recognition are not automatic, less attention is available for comprehending the meaning of text." It is essential then, that knowledge of grapheme-phoneme correspondences is embedded in literacy instruction.

Teachers are faced with the enormous task of facilitating the acquisition of early literacy skills in their students. They are expected to have a thorough understanding of a range of national literacy initiatives, curriculum expectations, reading programs, and specific teaching methods and strategies for reading; and then to combine these in the classroom to provide an inclusive and balanced approach to literacy instruction for all students. One of the many roles of a speech pathologist working in an educational context is to provide professional development to teachers, aides and whole schools and to equip them with a repertoire of effective strategies and programs in order to enhance the learning outcomes for students with communication difficulties. Speech pathologists need to be ever mindful of the demands on teachers in their important role, and of all that they are expected to absorb and then implement within the classroom. One professional development program that has been frequently requested of speech pathologists by schools for many years due to its ease of use in the classroom, and simple, practical application as an 'add-on' technique in conjunction with other literacy programs being used, is the 'Cued Articulation' (CA) course.

Based on linguistic principles, CA is a method of using hand cues to represent the English speech sounds. The position, shape, and movement of the hand together with the number of fingers used indicate placement of the articulators, the manner and voicing of the phoneme. Passy (2003, pp.xiv-xv), developer of the CA system, describes that "the position of the hand indicates whether the phoneme is a back, front, or nasal sound. The shape of the hand suggests lip and tongue positions and movements. The number of fingers used indicates whether the phoneme is to be voiced or voiceless."

CA as a means to support the development of articulation has been highly regarded by the speech pathology profession for over a couple of decades. An expanding role of CA has been its use by teachers and speech pathologists to facilitate students' early literacy acquisition. Strong anecdotal reports, feedback from class teachers, and some informal studies support the use of CA as a means to develop early literacy skills in students. Educators report the benefits of CA in catering for visual learners and those with auditory processing difficulties by providing a tangible visual cue to supplement fleeting auditory information. CA has also been reported to be beneficial as a method for teachers to comprehensively and confidently teach students to think and talk about speech sounds and their properties at a meta-phonological level, and how these sounds map onto the written letters. As Snow, Burns, and Griffin (1998; cited in Westwood, 2001, p.5) describe, "because phonemes are the units of sound that are represented by the letters of the alphabet, an awareness of phonemes is the key to understanding the logic of the alphabetic principle and thus to the learnability of phonics and spelling." CA is one tool to provide such an awareness of sounds.

An oral language screening project involving approximately 800 prep students was conducted in 2001 by Victorian Department of Education and Training speech pathologists within the Springvale cluster. This screening included evaluation of students' early phonemic awareness skills and found that for students who were exposed to CA on a regular basis in the classroom, performance on initial sound identification tasks was consistently higher (Balfe, 2001; cited in Passy, 2003, pp.9-10). Speech pathologists at Mt Evelyn Special Development School report observations of a strong correlation between knowledge of the signs of CA, and the ability to provide the sounds associated with letter names (Boer, 2001; cited in Passy 2003, p.90). Despite such reports, a search of current literature has not found any comprehensive formal research evidence to support the use of CA as a means to facilitate the development of grapheme-phoneme correspondences.

A critical recommendation arising from the national inquiry into the teaching of literacy asserted the need for teachers to be "well equipped with evidence-based teaching practices that are demonstrably effective in meeting the learning needs of children – especially for those who experience reading difficulties" (Australian Government, 2005, p.61). In order to maximise literacy teaching and learning, and to provide the impetus for effecting pedagogic change in light of this recommendation, it is incumbent upon educators to critically review current literacy teaching practices and to establish an evidence-base for these - including the use of CA as a tool to develop knowledge of grapheme-phoneme correspondences.

The purpose of the present action research is to establish whether teaching grade prep students CA in conjunction with explicit teaching of graphophonic relationships improves their knowledge of grapheme-phoneme correspondences.

METHOD

Design

This study followed an OXO design and comprised of two groups of students assigned to an intervention group and a control group. The intervention group was taught CA in conjunction with explicit teaching of graphophonic relationships, whereas the control group received explicit teaching of graphophonic relationships only. The study was conducted in the school environment familiar to the students.

Participants

Participants in this study were selected from the total enrolment in three grade prep classes in a primary school in an outlying suburb of Melbourne. Formal written consent to conduct the study was given by the principal of the school and by parents (Appendix 1).

A total of 10 students were initially selected to participate in the study on the basis of their results from early literacy testing conducted by class teachers three weeks prior to the commencement of the study (Table 1). All students had reading text level scores of 0 except for one student who was reading at text level 1. On the Clay Observation Survey, all students achieved Letter Identification scores at or below 20. Students' Record of Oral language Scores ranged between 13 and 40.

The students' ages ranged from 5;0 to 6;7 (*M = 5;5*). Seven males and three females participated in the study. All students spoke English as their only language and teachers did not suspect any of the students to be experiencing any difficulties with attention, hearing, behaviour, oral language or intellectual functioning. None of the students were participating in any other individual or specialised literacy intervention program.

Students were matched according to results on early literacy testing conducted by class teachers, and on their performance on pre-test assessment tasks (Table 2). Five students were then assigned to the intervention group and their matched pair was assigned to the control group. Overall pre-test scores for groups as a whole were also considered when assigning students to particular groups. One student who was initially assigned to the intervention group was eventually eliminated from the study due to excessive absences during the intervention phase, and on the day of post-testing. This resulted in four students participating in the intervention group, and five students participating in the control group.

Table 1: Participants - Early Literacy Testing Data (Raw Scores)

Student	Intervention /Control Group	Gender	Age in YEARS	Reading Text Level PRE (0-28)	Letter Identification PRE (0-54)	Record of Oral Language PRE (0-42)
A1	I	M	5;1	0	4	22
A2	I	M	5;6	0	3	23
A3	I	M	5;0	0	7	13
A4	I	M	5;3	0	17	40
B1	C	F	5;5	0	4	21
B2	C	M	5;3	0	20	20
B3	C	M	5;9	0	10	26
B4	C	F	5;3	0	16	14
B5	C	F	6;7	1	13	33

Table 2: Participants - Pre-test Data (Raw Scores)

Student	Intervention /Control Group	Names Letter PRE (0-24)	Produces Sound for Letter PRE (0-24)	Provides Real Word Example PRE (0-24)	Selects Letter for Sound PRE (0-24)	Reads Initial Sound in Nonword PRE (0-23)	Overall Raw Score PRE (0-119)
A1	I	1	1	1	2	0	5
A2	I	14	8	6	8	2	38
A3	I	7	5	4	9	7	32
A4	I	16	9	11	18	1	55
B1	C	6	2	1	8	1	18
B2	C	15	5	8	15	1	44
B3	C	6	4	3	13	0	26
B4	C	5	1	1	9	2	18
B5	C	12	9	6	13	7	47

Materials

The following materials were used for the pre-testing phase and the post-testing phase:

- Grapheme-Phoneme Identification Pre-test (Appendix 2);
- Grapheme-Phoneme Identification Post-test (Appendix 3).

Both of the Grapheme-Phoneme Identification tests were developed by the researcher for the purpose of the study and were based on a combination of elements in other tests used to evaluate grapheme-phoneme identification, including the Letter Identification Test (Clay, 1993, pp.43-46), the Phonological Knowledge Profile (Munro, 1998), and the Sound-Letter Knowledge Chart (Love and Reilly, 1999, p.15).

The following materials were used for the intervention phase:

- Grapheme cards showing individual graphemes using 'Victorian Modern Cursive' font in lower case, large enough for the students to trace with their finger;
- An object bag containing various objects whose names start with the grapheme-phoneme correspondence being targeted on each particular day;
- Activity Sheets for initial grapheme-phoneme identification activities, developed by the researcher for the purpose of the study (see example Appendix 4);
- 'Post boxes' for posting grapheme cards;
- Snakes and Ladders Board Game;
- 'Sound Starter' picture cards (Love and Reilly, 1999, pp.137-138) for each grapheme-phoneme correspondence targeted, as a stimulus when singing the relevant alliterative phrases / alphabet song for each phoneme.

Procedure

Pre-testing was conducted in a quiet 1:1 setting and took approximately twenty minutes for each student to complete. The Grapheme-Phoneme Identification Pre-test (Appendix 2) was administered, evaluating students' ability to:

- Provide names for written letters;
- Produce the corresponding sound for each letter;
- Provide an example of a real word starting with the sound or letter;
- Select the corresponding written letter (from a choice of 6) for a heard phoneme;
- Read initial sounds in nonwords of consonant-vowel structure.

Following pre-testing students were matched and then assigned to either the intervention group or the control group (as described).

During the intervention phase, students were withdrawn from the regular classroom program during the literacy block. Both groups participated in 8 x 40 minute sessions each, across 8 consecutive school days. Session plans were developed for the intervention phase (Appendix 5). The principles from the Model of Teaching and Learning (Collins, et al 1989) were used as an underlying structure for each of the sessions, whereby the researcher provided modeling, coaching and scaffolding, and the students were required to reflect on and articulate what they had learned in the session, and explore ideas for how they could apply what they had learned.

The first two sessions for each group focused on teaching the concepts of a 'sound', 'letter' and a 'word'. Additionally within these first two sessions, the 12 grapheme-phoneme pairs selected to be targeted within the intervention phase were introduced to both groups at a basic level. These pairs were selected following consideration of the needs of the students (established from their pre-test data), the developmental sequence of the sounds in speech, their phonemic and orthographic

properties, and the most consistent grapheme-phoneme patterns found in text. As such, students were introduced to grapheme-phoneme correspondences where the phonemes were:

- plosives (/p/, /b/, /t/, /d/, /k/, and /g/);
- fricatives (/f/, /v/, /s/, and /z/);
- nasals (/m/ and /n/).

All grapheme-phoneme correspondences introduced were consonants. There were no vowels, consonant blends, or digraphs targeted. The intervention group was also introduced to the CA hand cues for each phoneme within these sessions, and taught at a basic level how these relate to the place, manner, and voicing of the sound.

The remaining six intervention sessions all followed the same basic structure. Two grapheme-phoneme correspondences were targeted in each session, that were highly contrastive both visually and phonemically. A multi-sensory approach to teaching the grapheme-phoneme correspondences was taken, incorporating auditory, visual and tactile modalities. Activities within each session targeted students' visual discrimination of graphemes, visual memory / imagery of graphemes, phonemic awareness (initial sound identification), grapheme-phoneme matching, alliteration songs, and finger tracing of enlarged graphemes on cards and in the air. Initially activities were also planned to facilitate development of the students' ability to read consonant-vowel nonsense words within the session, however due to time constraints and the challenge of the task for these students, this aspect was only briefly targeted within the sessions. Throughout all of these activities the intervention group was also introduced to the CA hand cue for each grapheme-phoneme correspondence. The researcher used the CA hand cue for the targeted phonemes consistently throughout the sessions with the intervention group, and the students were encouraged to use these also.

Post-testing was conducted in a quiet 1:1 setting and took approximately twenty minutes for each student to complete. The Grapheme-Phoneme Identification Post-test (Appendix 3) was administered, re-evaluating students' ability to:

- Provide names for written letters;
- Produce the corresponding sound for each letter;
- Provide an example of a real word starting with the sound or letter;
- Select the corresponding written letter (from a choice of 6) for a heard phoneme;
- Read initial sounds in nonwords of consonant-vowel structure.

RESULTS

Pre and post intervention raw score data for each student across all tasks can be found in Appendix 6. The mean performance and standard deviation of both groups *(Intervention Group = I, Control Group =C)* for each task on the Grapheme-Phoneme Identification Test pre and post intervention are shown in Table 3.

Table 3: The mean performance of each group for each task pre and post intervention

Task	Group	N	Mean	Std. Dev
Names Letter PRE	I	4	7.00	5.354
	C	5	10.80	5.070
Names Letter POST	I	4	14.00	5.715
	C	5	16.40	5.983
Produces Sound for Letter PRE	I	4	4.00	3.162
	C	5	5.60	3.435
Produces Sound for Letter POST	I	4	10.50	2.646
	C	5	11.80	4.658
Provides Real Word Example PRE	I	4	3.00	2.449
	C	5	5.80	3.962
Provides Real Word Example POST	I	4	8.75	3.775
	C	5	10.00	4.690
Selects Letter for Sound PRE	I	4	6.75	3.202
	C	5	13.60	3.286
Selects Letter for Sound POST	I	4	16.75	2.062
	C	5	18.00	3.873
Reads Initial Sound in Nonword PRE	I	4	2.50	3.109
	C	5	2.20	2.775
Reads Initial Sound in Nonword POST	I	4	5.25	3.862
	C	5	6.40	4.722
Overall Raw Score PRE	I	4	23.25	14.773
	C	5	38.00	15.411
Overall Raw Score POST	I	4	55.25	15.840
	C	5	62.60	20.864

The t-test for independent samples showed that the two groups did not differ significantly in compared mean performances for any of the tasks. In other words, under the described research conditions, the use of CA in conjunction with explicit teaching of graphophonic relationships did not assist the intervention group to achieve a greater outcome in knowledge of grapheme-phoneme correspondences than the control group (who also received explicit teaching of graphophonic relationships). Therefore the hypothesis is not supported by the data outcomes.

The t-test for correlated samples was used to evaluate the comparison between the means for pre and post intervention tasks. The t value for each comparison is shown in Table 4.

Table 4: The t value for the comparison between the means for pre and post intervention tasks for each group

Task	Intervention Group	Control Group
Names Letter	-3.934*	-4.221*
Produces Sound for Letter	-4.914*	-7.207**
Provides Real Word Example	-6.734**	-4.118*
Selects Letter for Sound	-4.140*	-3.415*
Reads Initial Sound in Nonword	-2.200	-1.853
Overall Raw Score	-6.555**	-6.781**

** p<.01 *p<.05

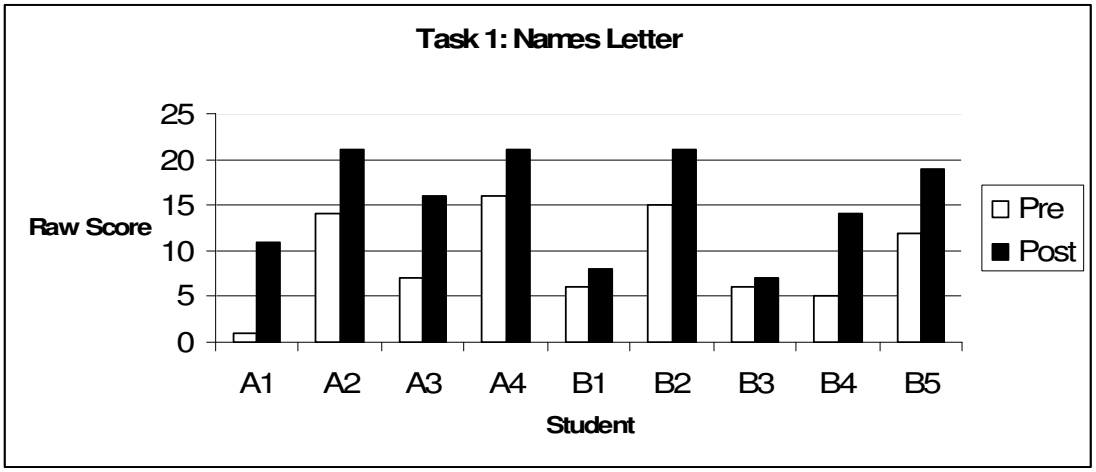
Analysis of the data shows that both the intervention group and the control group demonstrated statistically significant improvements in overall outcomes for knowledge of grapheme-phoneme correspondences as a result of the teaching of graphophonic relationships (p<.01). Significant improvements were also noted for both groups following the teaching in their ability to provide names for written letters, produce corresponding sounds for letters, provide examples or real words starting with the sound or letter, and to select corresponding written letters for a phoneme (significance ranging from p<.01 to p<.05 as represented in Table 4). There was no significant improvement for either group in reading initial consonant sounds in nonwords of consonant-vowel structure.

Outcomes for Providing Names for Written Letters

Both groups made significant improvements in providing names for written letters as a result of the teaching (p<.05). The control group made slightly greater gains with this task when comparing the t value for comparison between means pre and post testing for both groups as shown in Table 4.

Figure 1 represents the individual pre and post test raw score data for all students for providing names for written letters. From the intervention group, student A1's raw score for this task increased from 1 to 11 following intervention. Nine of the ten new letters that he was able to identify were targeted within the intervention sessions. This was similarly the case for student A3 from the intervention group and student B4 from the control group with 100% (9/9) of the new letters they each identified post intervention having been targeted within the intervention sessions.

Figure 1: Individual pre and post test data for Task 1: 'Names Letter'

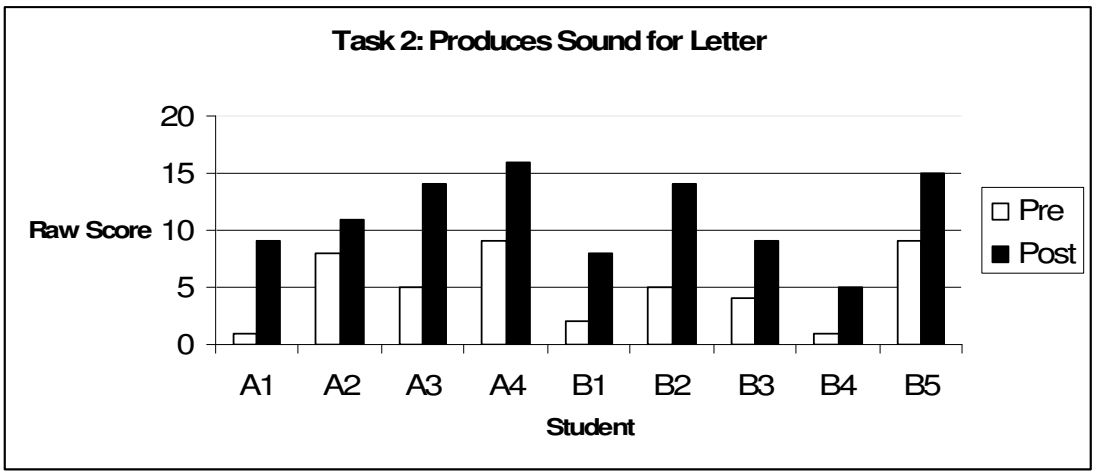


Outcomes for Producing the Corresponding Sounds for Letters

Both groups made significant improvements in producing the corresponding sound for written letters as a result of the teaching. For the control group this improvement was more significant ($p<.01$) than for the intervention group ($p<.05$), as shown in Table 4 by the t value for comparison between means pre and post testing for both groups

Figure 2 represents the individual pre and post test raw score data for all students for producing corresponding sounds for written letters. Intervention students A1 and A3 and control students B1 and B2 demonstrated the greatest gains in post test performance following intervention. It is interesting to note that during the intervention sessions, students A1 and A3 were more likely to use the CA hand cues without prompting and to more readily respond the researchers' use of CA, as compared with the other two students in the intervention group. Additionally, student A1 was also reported by his class teacher to spontaneously use the CA hand cues he had learnt within the intervention sessions, during sound awareness activities within the classroom.

Figure 2: Individual pre and post test data for Task 2: 'Produces Sound for Letter'

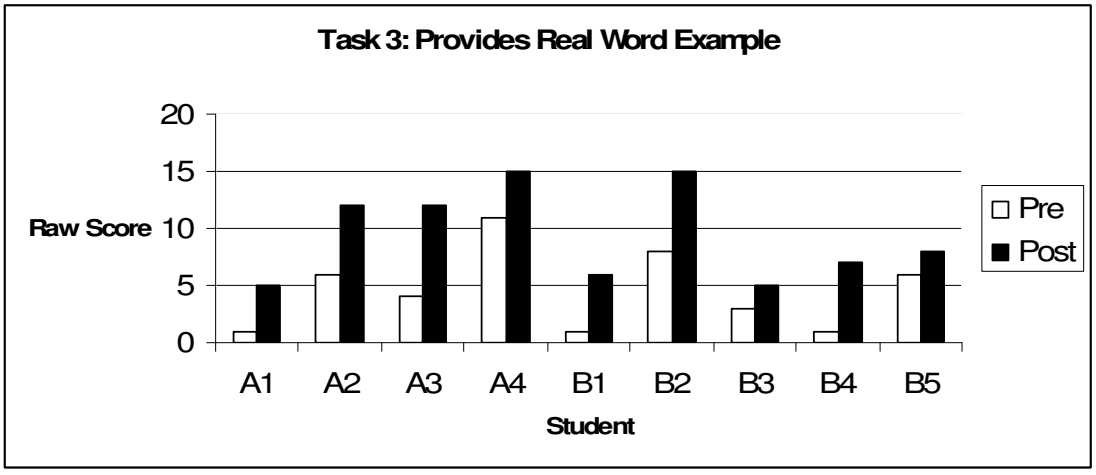


Outcomes for Providing Real Word Examples

Both groups made significant improvements in providing examples of real words starting with certain sounds or letters, as a result of the teaching. For the intervention group this improvement was more significant ($p<.01$) than for the control group ($p<.05$), as shown in Table 4 by the t value for comparison between means pre and post testing for both groups

Figure 3 represents the individual pre and post test raw score data for all students for providing read word examples for sounds and letters. It was interesting to note that when post tested for this task, every student provided at least one real word example from the alliteration songs *(e.g. 'funny fish, f - f - f')* that had been taught in the intervention sessions, and those students who made the most gains compared to their pretest performance (students A1, A2, A3 and B4) provided the most real word examples from these alliteration songs. During the intervention sessions, student A3 used CA consistently throughout the alliteration songs for each sound without requiring prompting to do so.

Figure 3: Individual pre and post test data for Task 3: 'Provides Real Word Example'



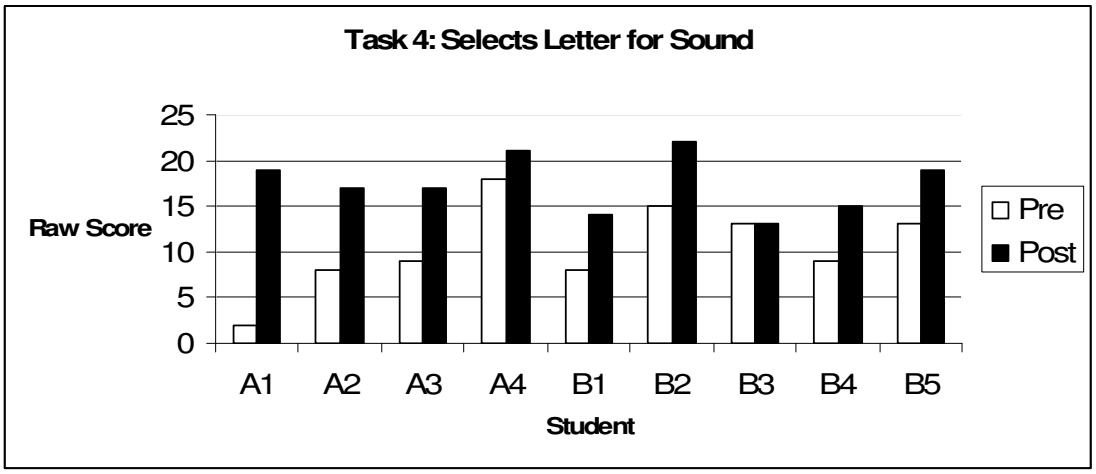
Outcomes for Selecting Letters for Sounds

Both groups made significant improvements in selecting corresponding written letters (from a choice of 6) for a heard phoneme, as a result of the teaching ($p<.05$). The intervention group made slightly greater gains than the control group with this task when comparing the t value for comparison between means pre and post testing for both groups as shown in Table 4.

Figure 4 represents the individual pre and post test raw score data for all students for selecting letters for heard sounds. Student A1 from the intervention group made significant gains in his ability to perform this task post intervention. His pre test score of 2 was the lowest of all students; however at post test he scored 19 which was the equal third highest score out of the nine students. He was the only student who used CA spontaneously during actual post testing for this task.

Observations during the intervention sessions revealed student B3 to be a particularly passive learner and required the most encouragement and support with intervention tasks. He achieved identical pre and post test scores for this task, and also the lowest post test score out of the nine students.

Figure 4: Individual pre and post test data for Task 4: 'Selects Letter for Sound'

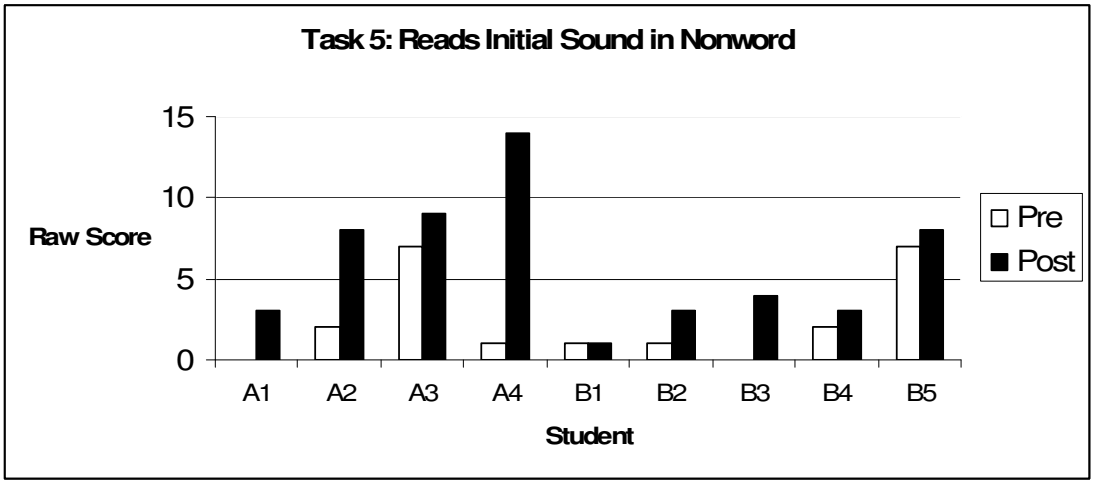


Outcomes for Reading Initial Sounds in Nonwords

Both groups made some gains in reading initial sounds in nonwords following the intervention, however this was not to any significant degree ($p>.05$). The intervention group made slightly greater gains than the control group with this task when comparing the t value for comparison between means pre and post testing for both groups as shown in Table 4.

Figure 5 represents the individual pre and post test raw score data for all students for reading initial sounds in nonwords. As discussed, this skill was targeted only briefly within the intervention sessions. Despite this, student A4 made significant improvements in his ability to perform this task. It is interesting to note that he presented with the most advanced graphophonic knowledge of all students pre and post intervention, as reflected by his overall raw scores.

Figure 5: Individual pre and post test data for Task 5: 'Reads Initial Sound in Nonword'

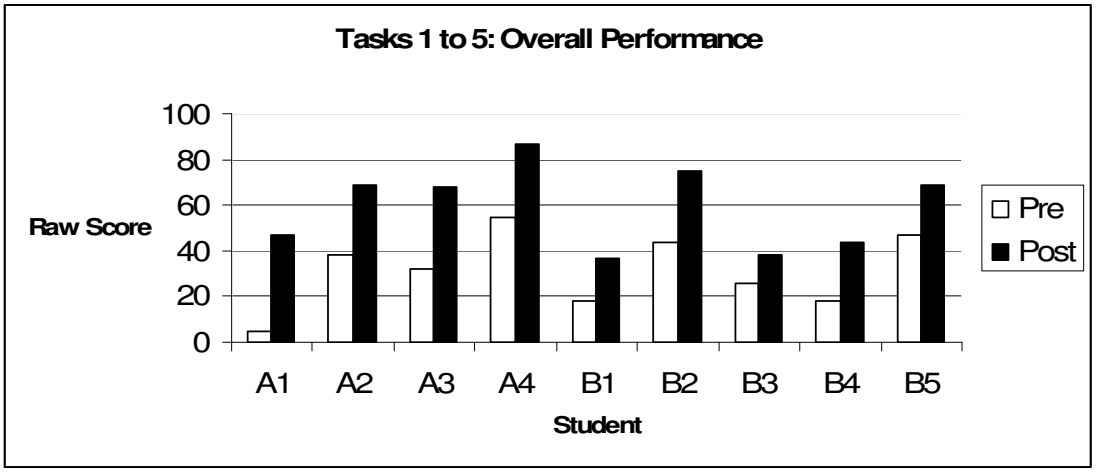


Outcomes for Overall Grapheme-Phoneme Identification

Both groups made statistically significant improvements in their overall grapheme-phoneme identification skills as a result of the teaching ($p<.01$). This is evident when comparing the t value for comparison between means pre and post testing for both groups, as shown in Table 4.

Figure 6 represents the individual pre and post test raw score data for all students for overall grapheme-phoneme identification across the five tasks. Student A1 made the greatest overall gains as a result of the teaching, and student A4 achieved the highest overall raw score pre and post intervention. Student B1 made the least overall gains as a result of the teaching, and also achieved the lowest overall raw score post intervention.

Figure 6: Individual pre and post test data for overall performance on tasks 1 to 5



Of the four students within the intervention group, students A1 and A3 were more readily engaged by, and responsive to, the use of CA within the intervention sessions. They were more likely to use the CA hand cues without prompting, more responsive to the researchers' use of CA, and student A1 was reported by his class teacher to spontaneously use the CA hand cues during sound awareness activities within the classroom. An interesting trend became apparent when analysing the data for students within the intervention group across the five tasks, in that students A1 and A3 (who were more responsive to CA) made greater progress in the majority of the tasks than did students A2 and A4 (who were less responsive to CA). An analysis of the overall raw scores for these two subgroups within the intervention group, showed that the two students who were more responsive to the use of CA (students A1 and A3) made 2.4 times that amount of progress within the intervention sessions than did the two students who were less responsive to CA (students A2 and A4).

DISCUSSION

The results of this study indicate that under the described research conditions, the use of CA in conjunction with explicit teaching of graphophonic relationships did not assist the intervention group to achieve a greater outcome in knowledge of grapheme-phoneme correspondences than the control group (who also received explicit teaching of graphophonic relationships). Therefore the hypothesis is not supported by the data outcomes.

However, additional analyses highlighted an interesting trend. Within the intervention group, those students who were more responsive to the use of CA (i.e. more likely to use the CA hand cues without prompting, more responsive to the researchers' use of CA, and more likely to spontaneously use the CA hand cues within the classroom) made significantly greater progress with overall grapheme-phoneme identification than the two students who were less responsive to CA. This raises possible questions for future research about whether there are certain factors intrinsic to a student, such as preference for a particular learning style, for which the use of CA is more effective in teaching grapheme-phoneme identification. Given that CA provides a tangible visual cue to supplement fleeting auditory information, it may be that CA caters more effectively for students who have a strength or preference for visual learning, or for those students who have a weakness in the processing of auditory information. Furthermore, the tactile-kinesthetic aspects of using CA hand cues may also be beneficial for students with a preference for this mode of learning.

Research results also indicate that both the intervention group and the control group demonstrated significant improvements in overall outcomes for knowledge of grapheme-phoneme correspondences as a result of the teaching of graphophonic relationships. Significant

improvements were noted for both groups following the teaching in their ability to provide names for written letters, produce corresponding sounds for letters, provide examples of real words starting with the sound or letter, and select corresponding written letters for a phoneme. As the activities implemented within the intervention sessions were based on current research evidence, these results are not surprising. The instruction provided was explicit, sequenced, multi-sensory, and developmentally appropriate; all of which are founded in research evidence. These results lend support to the recommendation arising from the national inquiry into the teaching of literacy, that teaching needs to be linked to "evidence-based teaching practices that are demonstrably effective in meeting the developmental and learning needs of all students" (Australian Government, 2005, p.12).

Post intervention data also showed that there was no significant improvement for either group in reading initial consonant sounds in nonwords of consonant-vowel structure. As discussed, this skill was targeted only briefly within the intervention sessions. Despite this, student A4 made significant improvements in his ability to perform this task and it was noted that he presented with the most advanced graphophonic knowledge of all students pre and post intervention, as reflected by his overall raw scores. Considering his higher pre and post intervention scores in comparison to the other students, this could reflect the possibility that student A4 may have been more developmentally ready to attempt the more advanced task of reading initial sounds in nonwords.

The present study was limited by constraints of time and resources. If not for such constraints, a more comprehensive and rigorous approach to selecting students for the study would have been undertaken in order to confidently ensure that they were truly representative of the grade prep population to which the outcomes would be generalised. Ensuring that a sample is representative is particularly important in studies such as the present one, where the sample size *(n=9)* was small.

Time constraints on the research also meant that students were only able to participate in 8 x 40 minute intervention sessions. This limited the amount of skills that could be targeted, the depth to which they were taught, and the amount of time the students had to apply these skills in a contextualised way which is so necessary for their consolidation. Westwood (2001, pp.31-32) states that the teaching of these early decoding skills "must provide abundant opportunity for a child to apply phonic knowledge successfully to the decoding of many different words in order to build confidence in the decoding strategy". Such an abundance of opportunity for application of these skills was difficult to provide within eight intervention sessions whereby the skills and concepts being taught were relatively new to the students.

While the results of the study show that under the described research conditions the use of CA did not assist the intervention group as a whole to achieve a greater outcome in grapheme-phoneme identification, as described there is some strong evidence to suggest that there are certain factors intrinsic to a student, such as preference for a particular learning style or modality, for which the use of CA is more effective in teaching grapheme-phoneme identification. This certainly warrants further research investigation. It is recommended that as a part of such an investigation, formal evaluation and profiling of all students' learning styles be conducted and compared with outcomes. This would establish if there is a statistically significant correlation between the use of CA to develop grapheme-phoneme identification and the progress for students with preferences for particular learning styles.

Furthermore, the use of two whole grade prep classes in the study would be beneficial given that this would increase the sample size from 9 to approximately 60 and therefore add strength to any generalisation made from the research cohort to the general population. As such, CA could be embedded into all aspects of the usual literacy program for the 'CA class', whereas the 'control class' would continue with their usual literacy programming without exposure to CA. The specific literacy programming implemented, activities undertaken and resource materials used would all need to be controlled for across the two classes. Extension of the intervention phase of the study to an entire academic year would enable ample opportunity for the early literacy skills to be applied and consolidated in a contextualised way. With interval measures being taken at the end of each term, any difference in the rate of progress between the two groups could be identified. The impact of CA on various elements of early literacy development in addition to grapheme-phoneme identification could also be evaluated including initial, medial, and final sound identification tasks, rhyme awareness and production, and further investigation into the use of CA to develop decoding of nonsense words and real words.

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APPENDICES

APPENDIX ONE

Catholic Education Office
Archdiocese of Melbourne

LITERACY INTERVENTION PROJECT

Request for parental consent for your child to participate

A literacy intervention project will be conducted in term 2, 2008 at Primary School . This project will involve selected grade prep students whose parents have provided consent for them to be involved in the project.

This research will be conducted by , Speech Pathologist with the Catholic Education Office who currently services this school. is studying her Postgraduate Certificate in Early Literacy Intervention.

The research will be looking at a literacy intervention strategy related to the early literacy skills of developing sound and letter awareness. This is an essential skill in learning to read and spell.

Students selected to be involved in the study may participate in a brief (20 minute) screening assessment at the beginning and end of the research, as well as up to 8 x 40 minute intervention sessions in a small group at the school. These intervention sessions will involve activities to develop the students' awareness and knowledge of sound-letter links and will support the literacy activities being implemented in the classroom.

All identifying information relevant to the child will remain confidential including your child's name and date of birth.

If you give consent for your child to be involved in the research project, please sign the attached consent form, and return it to the school office attention to .

If you have any additional queries regarding the research, you can contact at the Catholic Education Office Western Region on . Thank you.

Catholic Education Office
Archdiocese of Melbourne

PARENT CONSENT FORM

I / We give my / our consent for _____
Full name of child

to be involved in the activities related to the literacy project being conducted at

Primary School, .

I have been informed of the nature of the activities involved in the research.

I understand that my child may be withdrawn from the classroom for these activities.

I understand that I can withdraw my consent at anytime by notifying the School Principal.

Signature of parent(s)/Guardian(s): _____

_____

Principal's endorsement: _____

Date: _____

APPENDIX TWO

GRAPHEME-PHONEME IDENTIFICATION PRE-TEST

PRE-TEST **Date:** _____ **Student:** _____

Letter	Name	Sound	Gives Example of Real Word	Selects Letter For Sound	Reads Initial Sound in Nonword
b					ba
g					ge
l					li
q					quo
v					vu
ch					cha
c					ce
h					ho
m					mi
r					ru
w					wa
z					ze
d					di
j					jo
n					nu
s					sa
x					–
th					thi
f					fe
k					ko
p					pu
t					ta
y					ye
sh					shi

PRE-TEST: Letter-Sound Identification

b	g	l	q	v	ch
c	h	m	r	w	z
d	j	n	s	x	th
f	k	p	t	y	sh

PRE-TEST: Nonword Reading

ba	ce	di	ko
ge	ho	jo	pu
li	mi	nu	ta
quo	ru	sa	ye
vu	wa	thi	shi
cha	ze	fe	

APPENDIX THREE

GRAPHEME-PHONEME IDENTIFICATION POST-TEST

POST-TEST **Date:** _____ **Student:** _____

Letter	Name	Sound	Gives Example of Real Word	Selects Letter for Sound	Reads Initial Sound in Nonword
b					bu
g					ga
l					le
q					qui
v					vo
ch					chu
c					ca
h					hu
m					mo
r					re
w					wu
z					za
d					de
j					ji
n					na
s					su
x					–
th					tho
f					fa
k					ki
p					po
t					tu
y					ya
sh					sho

POST-TEST: Letter-Sound Identification

b	g	l	q	v	ch
c	h	m	r	w	z
d	j	n	s	x	th
f	k	p	t	y	sh

POST-TEST: Nonword Reading

bu	ca	de	ki
ga	hu	ji	po
le	mo	na	tu
qui	re	su	ya
vo	wu	tho	sho
chu	za	fa	

APPENDIX FOUR

	v	b
	v	b
	v	b
	v	b

APPENDIX FIVE

SESSION PLAN

Several activities were developed and used regularly across the sessions for both groups. Descriptions of frequently used activities are outlined below:

- **Alliterative Phrase** / **Alphabet Songs:** Students shown a particular picture card from the Sound Starters program (Love and Reilly, 1998, pp.137-138), and sing the corresponding song for that picture (e.g. Picture of 'funny fish'. Sing *"Funny fish, /f/ – /f/ – /f/, funny fish, /f/ – /f/ – /f/, funny fish /f/ – /f/ – /f/, that's the sound the 'F' makes"*). Researcher holds up both the picture and the corresponding grapheme card while students sing.

- **Isolated Sound/Letter Matching – Postbox:** Students listen to an individual sound spoken by the researcher and must select the corresponding grapheme card from a choice of two targeted within that particular session. Students must visually match the grapheme card selected with the appropriate grapheme displayed on the front of a postbox (from a choice of two graphemes/post boxes) and then post the grapheme card into the appropriate post box.

- **Grapheme Memory Activity:** Students trace their finger over a particular grapheme on a card then close their eyes and visualise the grapheme. Students then trace their finger over the grapheme on the card once again before 'writing' the grapheme in the air. Finally students write the grapheme on a piece of paper.

- **Initial Sound/Letter Identification for Objects – Object Bag:** Each student selects an object from a bag. As a group students determine the initial sound of the name of each object (e.g. /p/ for 'pig'). Students then identify which letter represents that sound and place the object on the relevant grapheme card.

- **Initial Sound/Letter Identification for Pictures - Activity Sheet:** Each student is given an activity sheet with four pictures. Students must identify the initial sound of the name of each picture, choosing from the two sounds targeted within that particular session. Students then circle the corresponding written letter for the sound identified (see example in Appendix 4).

- **Reading Initial Sounds in Nonwords:** Students are shown one of the two graphemes targeted within the session on card, as well as a grapheme for a short vowel which together make a consonant-vowel nonword. As a group and with the support of the researcher, students then identify the corresponding sound for the initial grapheme and then the sound for the final grapheme. Shadowing the model of the researcher, students blend the two sounds together to read the nonword.

- **Grapheme-Phoneme Identification - Review Games:** These activities review grapheme-phoneme correspondences taught in previous sessions. Students participate in a variety of games (e.g. Snakes and Ladders, Snap, Memory etc) whereby whenever a student has a turn, they must identify the grapheme on a card, produce the corresponding phoneme, and think of a word that begins with the relevant grapheme/phoneme.

- **Reflect, Articulate, Explore Activity:** Students reflect on and articulate what they have learned in each session and researcher scaffolds their recollections. Students explore ideas for how they could apply what they had learned to literacy activities within the group and within classroom.

SESSIONS 1 & 2

Session	Content for Both Groups	Additional Content for CA Group
1	♦ Discuss the concepts of a 'sound', 'letter' and 'word'. Brainstorm various sounds, letters, and words that the students know. Use sounds and letters from each students name, and words used in conversation as examples. Discuss the difference between sounds heard in the environment and speech sounds.	
	♦ Introduce six grapheme-phoneme correspondences for plosives as follows: *p, b, t, d, k/c,* and *g.* Say the sounds with the students and show them the corresponding grapheme card. Ask students to trace their finger over each grapheme on the cards.	♦ Introduce the relevant CA hand cue for each phoneme. Ask each student to imitate use of the hand cue while saying the corresponding sound. Discuss all of these sounds as being short sounds (plosives), and talk about how the placement of the hand shows where the sound is made in the mouth, and the number of fingers used shows if it is a loud or soft sound (voiced or voiceless).
	♦ Initial Sound/Letter Identification for Objects – Object Bag Activity for *p, b, t, d, k/c,* and *g.*	♦ Use CA with the group when identifying the initial sounds of words, and the corresponding letter for the sound. Encourage students to use CA also.
	♦ Reflect, Articulate, and Explore Activity.	
2	♦ Review concepts of a 'sound', 'letter' and a 'word'.	
	♦ Review the six grapheme-phoneme correspondences for the plosives introduced last session.	♦ Model use of the CA hand cues, and encourage students to use these also. Review concepts of how the placement of the hand shows where the sound is made in the mouth, and the number of fingers used shows if it is a loud or soft sound (voiced or voiceless).
	♦ Introduce four grapheme-phoneme correspondences for fricatives as follows: *f, v, s* and *z.* Say the sounds with the students and show them the corresponding grapheme card. Ask students to trace their finger over each grapheme on the cards.	♦ Introduce the relevant CA hand cue for each phoneme. Ask each student to imitate use of the hand cue while saying the corresponding sound. Discuss all of these sounds as being long sounds (fricatives).
	♦ Introduce two grapheme-phoneme correspondences for nasals as follows: *m* and *n.* Say the sounds with the students and show them the corresponding grapheme card. Ask students to trace their finger over each grapheme on the cards.	♦ Introduce the relevant CA hand cue for each phoneme. Ask each student to imitate use of the hand cue while saying the corresponding sound. Discuss all of these sounds as being nose sounds (nasals),
	♦ Initial Sound/Letter Identification for Objects – Object Bag Activity for *f, v, s, z, m,* and *n.*	♦ Use CA with the group when identifying the initial sounds of words, and the corresponding letter for the sound. Encourage students to use CA also.
	♦ Reflect, Articulate, and Explore Activity.	

SESSIONS 3 TO 8

Sessions 3 to 8 all followed the same structure (as outlined below). Grapheme-phoneme correspondences were targeted specifically within the sessions in the following order:

- Session 3: *p* and *f*
- Session 4: *b* and *v*
- Session 5: *t* and *s*
- Session 6: *d* and *z*
- Session 7: *k/c* and *m*
- Session 8: *g* and *n*

Session	Content for Both Groups	Additional Content for CA Group
3 to 8	♦ Alliterative Phrase / Alphabet Songs for two new sounds/letters.	♦ Model use of the CA hand cues, and encourage students to use these at appropriate times while singing.
	♦ Isolated Sound/Letter Matching – Postbox Activity for two new sounds/letters. ♦ Grapheme Memory Activity for two new letters.	♦ Use CA to help students identify the corresponding letter for the sound. Encourage students to use CA also.
	♦ Initial Sound/Letter Identification for Objects – Object Bag Activity for two new sounds/letters.	♦ Use CA to help students identify the initial sounds of words, and the corresponding letter for the sound. Encourage students to use CA also.
	♦ Initial Sound/Letter Identification for Pictures - Activity Sheet. for two new sounds/letters.	♦ Use CA to help students identify the initial sounds of words, and the corresponding letter for the sound. Encourage students to use CA also.
	♦ Reading Initial Sounds in Nonwords for two new sounds/letters *(only briefly covered).*	♦ Use CA to help students identify the initial sounds of words, and the corresponding letter for the sound. Encourage students to use CA also.
	♦ Grapheme-Phoneme Identification - Review Games for all sounds learnt in previous sessions.	♦ Use CA to help students identify graphemes, the corresponding sound for the letter, and a word starting with the relevant sound/letter. Encourage students to use CA also.
	♦ Reflect, Articulate, and Explore Activity.	

APPENDIX SIX

PRE AND POST INTERVENTION RAW SCORE DATA FOR INDIVIDUAL STUDENTS

PRE INTERVENTION

Student	Intervention /Control Group	Names Letter PRE (0-24)	Produces Sound for Letter PRE (0-24)	Provides Real Word Example PRE (0-24)	Selects Letter for Sound PRE (0-24)	Reads Initial Sound in Nonword PRE (0-23)	Overall Raw Score PRE (0-119)
A1	I	1	1	1	2	0	5
A2	I	14	8	6	8	2	38
A3	I	7	5	4	9	7	32
A4	I	16	9	11	18	1	55
B1	C	6	2	1	8	1	18
B2	C	15	5	8	15	1	44
B3	C	6	4	3	13	0	26
B4	C	5	1	1	9	2	18
B5	C	12	9	6	13	7	47

POST INTERVENTION

Student	Intervention /Control Group	Names Letter POST (0-24)	Produces Sound for Letter POST (0-24)	Provides Real Word Example POST (0-24)	Selects Letter for Sound POST (0-24)	Reads Initial Sound in Nonword POST (0-23)	Overall Raw Score POST (0-119)
A1	I	11	9	5	19	3	47
A2	I	21	11	12	17	8	69
A3	I	16	14	12	17	9	68
A4	I	21	16	15	21	14	87
B1	C	8	8	6	14	1	37
B2	C	21	14	15	22	3	75
B3	C	7	9	5	13	4	38
B4	C	14	5	7	15	3	44
B5	C	19	15	8	19	8	69