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Improving Literacy Skills of Struggling Students: Evaluation of Cracking the ABC Code Literacy Program

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Abstract

The current study investigated the effectiveness of the Cracking the ABC Code literacy program, specifically designed for students having difficulty with reading and spelling, which combines a range of strategies independently shown to be beneficial. Analysis of 119 underachieving students (7 to 12 years of age), who completed the 12 week intensive one-on-one intervention program, indicated that on average students improved 18 months in reading accuracy, 23 months in reading comprehension and 14 months in spelling. The study highlights the value of developing teaching materials which combine a range of strategies shown by previous research to be independently effectively.

Key Words: reading, spelling, phonics, dyslexia

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Functional literacy is a pre-requisite of full participation in today's society. However, a significant number of children fail to learn to read at even a functional level by age 15 years. In 2014, 4.5% of Australian Year 3 students did not achieve the national minimum reading standards expected for their year level with 8.6% of the same year group achieving only the minimum standard (Australian Curriculum, Assessment and Reporting Authority, 2014). In Year 9, 6.1% of students did not meet minimum literacy standards and 16.6% achieving only the minimum standard. Clearly there is a need for literacy intervention programs that will support underachieving students. Arguably, for an intervention program to be effective it needs to be based on strategies that have been shown to effectively improve the literacy skills of students struggling in this area.

Although Frith's (as cited in Heath, Hoben & Tan, 2008) Literacy Acquisition Model was developed in 1985, the current research continues to support the validity of this model and is a useful framework when considering strategies to help develop the literacy skills of underachieving students. According to Frith, students first begin to read and spell using logographic strategies, whereby they focus on the visual appearance of words and remember words as single units. The problem with this as a long-term strategy is students can only read and spell words that they have previously seen and remembered. Unfortunately, many of the literacy acquisition strategies currently used in schools (e.g., 'look, cover, write, check' and learning lists of 'sight' words) often do not move students beyond this logographic phase.

The next stage in Frith's (as cited in Heath, Hoben & Tan, 2008) model is the alphabetic phase. This has two components. The first is having good phonological awareness. Phonological awareness is the ability to identify and manipulate the phonemes in a language. There is a long

history of research demonstrating a positive link between good phonological awareness in early childhood and future reading and spelling competency (e.g., Wagner, Torgesen, & Rashotte, 1994; Kirby, & Parrila, 1999; Heath & Hogben, 2004; McNamara, Scissons & Gutknecth, 2011). Similarly, poor phonological awareness is a significant variant in middle primary-school aged children in terms of reading (both pronunciation and comprehension) and in written language (Del Campo, Buchanan, Abbott, & Berninger, 2015) and in adults with dyslexia (Wilson, & Lesaux, 2001; Laasonen, Lehtinen, Leppämäki, Tani, & Hokkanen, 2010). It appears that specifically teaching phonological awareness leads to superior outcomes in younger (Carson, Gillon, & Boustead, 2013) and older students (Eden et al., 2004). Therefore, phonological awareness should underpin and be embedded in literacy intervention programs.

The second component in Frith's (as cited in Heath, Hoben & Tan, 2008) alphabetic phase is phonological processing, mapping phonemes to graphemes, or phonic knowledge. Students with this knowledge are able accurately and automatically encode and decode a large number of words including words they have not seen before. Functional magnetic resonance imaging (fMRI) research indicates that children with dyslexia have under-activated left hemisphere temporo parietal regions which results in deficits in phonological processing (Peterson, & Pennington, 2012). There is a large body of research showing that explicit instruction in phonics is the most effective way of improving the reading and spelling skills of students having literacy difficulties (see for example Galuschka, Krick, & Schulte-Körne's 2014 meta-analysis) and that this type of intervention leads to increased activation in previously underactive left hemisphere regions of the brain (e.g., Eden et al., 2004; Odegard et al., 2008). It is evident that the systematic and explicit teaching of phonics needs to be the core of any effective literacy intervention program to ensure that brain activation is maximised.

The third phase of Frith's (as cited in Heath, Hoben & Tan, 2008) model, the orthographic phase, is a critical component of literacy proficiency due to the complexity of the English language. At this stage, students realise that word meaning, rather than simply a direct sound-symbol relationship, can provide key information as to the graphemes to choose for the correct spelling or reading of a word. Poor orthographic knowledge and processing is a common area of weakness in students with literacy difficulties (see for example research by Holmes & Quinn, 2008; van der Mark et al., 2011). Integral to this phase is the rapid recognition of common letter strings. Once a word has been decoded (requiring good phonological processing skills), it needs to be stored in long-term memory so future encounters with the same or similar letter strings are automatically recalled (Schurz, Sturm, Richlan, Kronbichler, Ladurner, & Wimmer, 2010). Therefore, this knowledge also needs to be specifically taught.

It is not sufficient just to teach students these literary concepts. They also need to be able remember the information which requires them to firstly store the information in long-term memory and then be able to rapidly and accurately recall the information on demand. Research shows that this is most likely to occur when new knowledge is linked to current knowledge (Sjöström, Rancz, Roth, & Hausser, 2008), the different components being taught are interlinked to avoid cognitive overload (Paas, van Gog, & Sweller, 2010), pictures are used (Endestad, Magnussen, & Helstrup, 2004), multiple senses are simultaneously engaged (Krafnick, Flowers, Napoliello, & Eden, 2011) and sufficient repetition is provided (Sjöström, Rancz, Roth, & Hausser, 2008). Arguably, for intervention programs to be successful, these strategies need to be embedded into the program.

The current study aimed to investigate the effectiveness of the Cracking the ABC Code literacy program, designed for students having difficulties in reading and spelling. This program

combines a range of strategies independently shown to be beneficial with a specific focus on developing phase two and three skills in Frith's literacy acquisition model.

Method

Participants

Seven experienced teachers with university teaching qualifications were taught the techniques, strategies and research underpinning the Cracking the ABC Code literacy program in a one day workshop. The teachers taught the program to 96 students from 8 to 12 years (M=10 years 10 months) of age who were assessed, using the Neale Reading Analysis-Third Edition (Neale, 1999), to have reading accuracy ages under their chronological age (M=12 months behind chronological age). Students were self-selected in that parents sourced these teachers because their child was having difficulty with reading and spelling.

Materials

The Cracking the ABC Code program consists of four levels. This current study focused on levels 3B and 3C. The key difference between these two programs is the difficulty of the vocabulary introduced. These 12 week programs comprise several interrelated tasks designed to complement and reinforce each other: phoneme and vocabulary development, comprehension, oral reading, general and orthographic knowledge (including syllabification) and spelling. Each task has been shown in previously published research to be effective in improving the literacy skills of struggling students. Once a concept was introduced it was continually reinforced through the remainder of the program.

In the phoneme and vocabulary section, students were introduced to two phonemes and their common graphic representations (graphemes) each week. Each grapheme was linked to a key word and picture and these were combined into an integrated picture for each phoneme to

assist in retention and recall (Endestad, Magnussen, & Helstrup, 2004). For example, /ɔɪ/ was linked to a b**oy** holding a giant c**oi**n. To enhance long-term memory, each day, students were required to write the correct grapheme next to the relevant picture as they said the phoneme and the key word out loud resulting in visual, auditory and tactile input (see Krafnick et al, 2011; Sjöström et al., 2008). Students' attention was also drawn to the less common graphemes representing the phonemes, but these were not a focus of study. Rules associated with the decoding or encoding of the phonemes or graphemes were explained.

The student's first task was to colour-code four lists of 15 syllabified words according to the grapheme contained within the word (e.g., uncoil, spoilt, annoy, choice, destroy, toilet). Each day, students decoded one list of words, discussed the meaning of the word and then practised reading the words until they could be read quickly and accurately at a rate of one word per second.

Comprehension was developed in two ways. Each day, students completed a comprehension exercise which related specifically to the words being learned in the vocabulary section. These exercises were designed to reinforce the meaning of these words as increase vocabulary is linked to increased comprehension (Shany, & Biemiller, 2010). Comprehension was also developed in the oral reading activity.

The oral reading section was designed to increase the student's ability to rapidly and accurately decode text. Each passage consisted of three or four sentences and included vocabulary from the vocabulary being learned. The text was divided into eye span lengths to encourage students to look at chunks of text and move away from a word by word focus (see Rayner et al.'s, 2010 research). A fluent oral reader decodes the text ahead of the words that are being spoken. To develop this skill, a cardboard strip was placed above the line being read and the line of text was covered completely once the student read the second last word. Student

practised repeatedly reading the passage first for accuracy and then to meet a fluency time goal. This has been demonstrated to not only increase fluency, but also comprehension (e.g., Vadasy & Sanders, 2008; Sukhram, 2008: Hawkins, Hale, Sheeley, & Ling, 2011).

Once students met the time and accuracy goals for reading the passage, they reread the passage silently and answered two or three comprehension questions about the passage to assess understanding. Each passage contained one sentence that did not address the same subject matter as the other sentences. Students were required to identify this sentence. This task necessitated students first establishing the main idea of the other sentences and then making inferential judgements. In addition, each passage also included one underlined word. Students identified the part of speech and found meaningful substitute words (not necessarily synonyms but correct from a grammatical perspective).

The general and orthographic knowledge section provided the knowledge required for Stage 3 literacy development (see Frith's Literacy Acquisition model cited in Heath, Hoben & Tan, 2008). Each week students were introduced to and learned a prefix, suffix, root word, proverb, idiom, collective noun, simile and nine spelling rules. This knowledge was then applied during the teaching session using both real and pseudo words. Students were also taught a simplified syllabification strategy for decoding unknown words. Again, this strategy was practised using real and pseudo words (see Diliberto, Beattie, Flowers, & Algozzine, 2009 for research supporting the use of pseudo words and specifically teaching syllabification patterns).

The last task was for students to learn two unknown spelling words each day. Each word was colour-coded according to the phonemes in the word. Where there was a direct sound-symbol correlation between the letter of the alphabet and the basic phoneme it represented, this was coloured black. Different colours were chosen for the other phonemes. For example, in the

word ‘shocking’, the ‘sh’ would be one colour (perhaps blue, although the colour chosen in not relevant), the ‘o’ and ‘i’ would be black, the ‘ck’ would be another colour (perhaps red) and the ‘ng’ another colour (perhaps green). Students were required to orally read the word, put it into sentence and discuss other relevant orthographic information (e.g., relevant rules, affixes, alternative meanings or pronunciations). Parents then asked students a series of questions to draw students’ attention to the structure of the word (e.g., identifying syllables, phonemes, graphemes associated with the phonemes, small words inside). Students traced over the colour-coded word (visual input) with their finger (tactile input) while saying the phonemes (auditory) input. After spelling the word forwards and backwards, students wrote the word in boxes whereby each box represented one phoneme. At the next lesson, these 10 words were assessed in dictation.

Assessment Instruments

The Neale Reading Analysis-Third Edition (Neale, 1999) measures reading accuracy, comprehension and fluency (although this was not measured in this study) and the accuracy and reliability of the Australian version has been confirmed by McKay (1996, p.265). It consists of two parallel forms and was administered as outlined in the manual.

Spelling was assessed using the Schonell spelling test (Schonell, 1985) as it is widely available and still used in current studies (e.g., Carlisle, 2010; Lee, Young, Liow, & Purcell, 2015). It is a single word spelling assessment and is also available in two parallel versions.

Students were also asked to first write and then read 72 common graphemes (excluding the common sound represented by the letters of the alphabet). In the writing task, students were told a phoneme (e.g., /sh/) and then asked to write the different ways that phoneme could be represented. In the reading task, students were shown a particular grapheme (e.g., ‘ch’) and

asked the different ways the grapheme could be pronounced. Students were required to be able to read and write a grapheme for it to be considered known.

Procedure

Prior to commencing the program each student's literacy skills were assessed using the Neale Reading Analysis Form 1 (Neale, 1988), the Schonell Spelling Assessment List A (Schonell, 1985). Students were also tested on their ability to write and read 72 common graphemes (other than the letters representing the basic sounds of the alphabet – see appendix). After completing the program, students were reassessed using Neale Reading Analysis Form 2 and Schonell Spelling List B (the parallel assessments were used to reduce test-retest bias) and on their grapheme knowledge.

Based on the results obtained students were allocated to a program appropriate to their literacy level. Forty-eight students with reading ages between 7 and 8 years completed the Level 3B reading program, while 50 students with reading ages between 8 and 10 years completed Level 3C reading program. Students with a spelling age of under 8 years worked on words from a list of 300 high frequency words that they were unable to spell, while students with a spelling age of over 8 years worked on words that they couldn't spell from a graded spelling list one year above their current spelling age.

During the intervention period, the student and the parent met with the teacher for one hour each week for 12 consecutive weeks. Students were then required to complete five days of structured follow-up homework with each homework session taking approximately 30 to 45 minutes to complete. The homework was set at an instructional level and could not be completed independently. Consequently, parents were active participants in the homework tasks.

Results

There was a significant difference, $F(1,96)=6.21, p<0.05$, in the ages of students participating in the Level 3B (M=8 years 8 months) compared to the Level 3C (M=9 years 7 months) program. There was also a significant difference, $F(1,96)=34.42, p<.001$, between the reading accuracy ages of Level 3B (M=7 years 7 months) and Level 3C (M=8 years 8 months) prior to the intervention.

Over the 12 week course students made mean gains of 19 months in reading accuracy, $t(97)=14.12$, $p<.001$, 22 months in reading comprehension, $t(97)=15.18$, $p<.001$, 15 months in spelling, $t(97)=14.81$, $p<.001$, were able to read and write, on average, 44 more graphemes $t(97)=31.04$, $p<.001$.

A repeated measures ANOVA indicated that students completing Level 3C made significant (Huynh-Feldt corrected) greater gains than students completing Level 3B, $F(3,258)=4.62$, $p<0.05$. However, further investigation indicated that this differential was only significant for reading accuracy, $F(1,96)=32.47$, $p<.001$, and reading comprehension, $F(1,96)=26.52, p<.001$,with no significant difference between the two programs in improvements in spelling and grapheme knowledge. The average improvement in Level 3B reading accuracy was 12 months and in Level 3C, 25 months. In reading comprehension, the average improvement in Level 3B was 15 months and in Level 3C, 30 months.

Discussion

This current study provide further evidence for the effectiveness of explicitly teaching the skills required to master the alphabetic and orthographic phases of Frith's (as cited in Heath, Hoben, & Tan, 2008) Literacy Acquisition Model. In particular, it adds to the body of research highlight the efficacy of structured, explicitly taught phonics programs in improving the literacy skills of underachieving students.

More specifically, the findings from this study provide evidence of the efficacy of the Cracking the ABC Code 12 week Level 3B and Level 3C programs in improving the literacy skills of students struggling in this area in a relatively short time frame. It is acknowledged that the lack of a 'no-intervention' control by which to compare the size effect is a limitation of the study, although arguably the significant size of the intervention effect would imply the program has validity. In addition, each of the activities within the programs and the underlying memory retention strategies have been shown individually in previous research to be beneficial in improving the literacy skills of underachieving students. Although anecdotal evidence suggests the gains made during the program are maintained, longitudinal studies to formally investigate the long-term retention of these gains would also be beneficial.

The differential in reading achievement between students completing level 3B and 3C may be attributed to the age difference. The increased in grapheme knowledge was equivalent in both groups, however the students completing the Level 3C program appeared to demonstrate better application of this knowledge to the decoding and encoding process.

It was particularly encouraging that gains in reading accuracy were not restricted to decoding, but also resulted in significant gains in reading comprehension. It is often argued that explicitly teaching phonics results in 'barking at print' with little understanding, but this was not supported in this study.

Unfortunately many schools do not have the funding or resources to be able to effectively implement one-on-one programs. Therefore, the next step is to investigate the efficacy of the Cracking the ABC Code small group programs for use in schools.

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