
CHAPTER 5**RESULTS OF A STUDY INTO THE EFFICACY OF A READING
INTERVENTION FOR STUDENTS WITH ATTENTION DEFICIT
HYPERACTIVITY DISORDER**

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Abstract

This paper reports on a study that investigated the efficacy of a reading intervention designed specifically for students with Attention Deficit Hyperactivity Disorder (ADHD). Research into the possible efficacy of the intervention commenced with a pilot study in one state primary school, followed by the main study in two state primary schools and one state high school. A case study method was used with a multiple-case and pre-test-post-test design. The study compared post-test data with baseline data gathered to identify the students' level of reading achievement; frequency and effectiveness of strategy use; students' attitude to reading and motivation to read; and attributional beliefs about reading success and failure. The results of the study indicated that most students' reading achievement improved in all areas evaluated and that students' attitude towards reading and their motivation to read improved. As well, students' attributional beliefs changed with data indicating that students felt an increased sense of control over their reading achievement.

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a disorder that impacts on an individual's ability to self-regulate his/her own behaviour. Affected individuals have difficulty inhibiting their behaviour (Barkley, 1996, 1997, 2000) making both social and educational success problematic. Academic success for these students is compromised both through high levels of off-task behaviour and the impact of the disorder on cognitive functioning. As a result, the long-term learning outcomes for many of these students include: a seventy percent chance of experiencing learning difficulties in one or more of the areas of mathematics, spelling and reading (Mayes, Calhoun and Crowell, 2000), with reading being the area most affected (Cutting, Koth, Mahone &

Denckla, 2003); a fifty percent chance of experiencing school failure, or failing at least one subject by the time they reach adolescence (Zentall, 1993); a thirty-three percent chance of not finishing high school (Zentall, 1993); and only a small likelihood that they will attempt tertiary education (Baker, 1994; Barkley, 2000). Even those students affected by ADHD who do not have an identified learning difficulty are more likely to fail at school than other students (Teeter, 1998).

The problem of compromised academic achievement is made more difficult by insufficient professional knowledge about ADHD amongst teachers (van Kraayenoord, Rice, Carroll, Fritz, Dillon and Hill, 2001). Besides insufficient general knowledge about the disorder in the educational community, there are few educational interventions available for teachers that are designed specifically for students with ADHD. Instead, much of the information available to teachers relates to ways of managing the behaviour of students with ADHD, rather than to ways of improving and supporting their academic achievement.

The enormity of the problem facing classroom teachers becomes clearer when the prevalence of ADHD is considered. The disorder affects approximately one in ten students in Australia (Sawyer, Arney, Baghurst, Clark, Graetz, Kosky, Nurcombe, Patton, Prior, Raphael, Rey, Whaites, & Zubrick, 2000), meaning that on an average there will be three students in every classroom whose educational success is compromised by ADHD. Clearly, more accurate and relevant information about ADHD needs to be disseminated to the teaching profession and appropriate educational interventions need to be developed as resources for teachers.

PURPOSE OF THE STUDY

The purpose of this study was to develop and evaluate a reading intervention that supported the cognitive functioning of students with ADHD and so improved students' reading achievement level. While the precise impact of ADHD on learning is not known, it is currently believed that ADHD negatively affects executive functioning (Akhutina, 1997; Anderson, 1997; Barkley, 1996, 1997, 1998; Grainger, 1997; Wall, 2000). Support for executive function deficits in students with ADHD is found

in work where students with ADHD have been identified as having difficulty carrying out strategies when working on tasks (Douglas, 1980); being less able to communicate to others the strategies they use (Saunders & Chambers, 1996); and lacking the metacognitive abilities needed for the planning and evaluation of current cognitive strategies. Difficulties with memory (Conte, 1991; Saunders & Chambers, 1996) are further indications of executive

function deficits since working memory is considered to be one aspect of these functions (Barkley, 1996, 1997). The difficulty that individuals with ADHD experience with pragmatic language (Purvis & Tannock, 1997), that is, organizing and monitoring responses, also indicates deficits in executive functioning (Barkley, 1996).

If executive functioning is compromised by ADHD, then it is possible that the learning difficulties experienced by students with ADHD are the result of deficits in this aspect of cognitive functioning. The reading intervention developed and evaluated in this study was designed to support the executive functioning of students with ADHD.

The overarching question to be answered by the study was: Does a specially designed intervention for medicated learners with ADHD, which includes strategy training, self-instruction, self-monitoring, self-reinforcement, paragraph summaries and a memory-cue bookmark, improve students'

- a. level of reading achievement;
- b. range and effectiveness of strategy use;
- c. attitude to reading/motivation to read and
- d. attributional beliefs about reading success and failure?

THEORETICAL FRAMEWORK

The reading intervention that was developed as part of this study was based on the current understanding of ADHD as developed by Barkley (1996, 1997, 2000). This theory is based on the belief that ADHD impacts executive functioning and identifies behavioural inhibition as the primary executive function that affects four other executive functions: working memory; self-regulation of affect/motivation/arousal; internalization of speech and reconstitution.

The executive function, known as behavioural inhibition, comprises three processes: response inhibition, interference control and ceasing an inappropriate on-going response (Barkley, 1997). Response inhibition allows for a delay in responding that provides time for other self-regulatory cognitive processes to occur. Interference control acts to protect and maintain the delay in responding against irrelevant stimuli. Ceasing an inappropriate on-going response allows the individual to stop a behaviour that would be ineffective in reaching the desired goal, thus providing opportunity for a more appropriate behaviour to be employed. Deficits in inhibition prevent and/or interrupt the execution of thoughtful and goal directed responses.

If the effectiveness of behavioural inhibition is compromised, then the functioning of prolongation/working memory will be affected as there is insufficient delay in responding to allow for effective use of this secondary executive function. Prolongation/Working memory is to be critical in the maintenance of attention as well as in the development of effective and appropriate responses. Working memory allows the individual to retain the intention of completing a task. It allows individuals to remember what the task requires and why they are to complete the task. If a goal directed behaviour is interrupted, working memory is able to hold on-line the intention to complete the task. Students affected by deficits in working memory may forget to act at crucial times, forget task requirements, have difficulty applying concepts learned from past experiences, and be less able to prepare for future events/tasks.

The executive function, known as self-regulation of affect, is likewise affected by an impairment in behavioural inhibition. Self-regulation of affect allows for consideration of emotional responses before responding. It facilitates modification of inappropriate responses as well as the development of objectivity. Motivation is also a product of this executive function, with self-regulation of emotion facilitating self-induced motivation and increase in arousal to allow the initiation and maintenance of goal-directed behaviour. A deficit in this executive function is likely to result in higher levels of emotional response to events, less objectivity, less empathy, and difficulties in initiating and sustaining motivation.

Internalization of speech, another secondary executive function that is supported by behavioural inhibition, allows private speech to be used to reflect upon and direct the behaviour of the self. Underdevelopment in this executive function is likely to be displayed as greater public speech or excessive talking, less reflection before acting, and reduced ability to control one's own behaviour.

A further executive function that relies on behavioural inhibition for effective operation is reconstitution. Reconstitution involves the analysis and synthesis of information that is then used to create a response. It is language based and is evident in fluent verbal responses. Children with a deficit in this area will experience difficulty in generating plans of action aimed at achieving a set goal. This difficulty will be most evident in reciprocal speech when they are required to rapidly, accurately and efficiently generate a response.

According to Barkley (1996, 1997, 2000), development in all five of these executive functions will result in greater motor control-fluency, that is, lengthy, goal-directed complex fine and gross motor actions will be able to be performed due to the interaction of these optimally developed executive

functions. Such goal-directed persistence is seen as sustained-attention that is initiated and maintained internally, rather than being contingency-shaped by the motivational qualities of the task and/or environment.

To apply this understanding of ADHD and its impact on executive functioning to a reading intervention it was necessary to also consider learning theory and current understanding of the reading process. The Sociocultural Theory of Learning developed by Vygotsky (1974,1978) influenced the design of the intervention as it highlighted the role of social interaction in learning and the development of higher order cognition. It also presented a unique view of the role of self-talk and social interaction in the learning process and in the development of higher order cognition. As such, it provided a social context for Barkley's model and a way of thinking about that in terms of developing executive functions through the dynamic social interaction between teacher and student.

To focus this understanding of learning onto learning to read an understanding of the reading process was developed by synthesising various models of the reading process. This resulted in a view of reading as a meaning making process that involves the reader in making a continuous series of hypotheses and revisions (Ruddell & Unrau, 1994). This process is monitored by executive control functions to assess progress toward the goal of understanding the text (Garner, 1994; Rosenblatt, 1994; Ruddell & Unrau, 1994; Rumelhart, 1994). It is a process that relies on the active use of the reader's past life experiences and knowledge to facilitate interaction with the text. The result of successful reading is the construction of meaning that is both relevant and meaningful to the reader and true to the intended meaning of the text (Rosenblatt, 1994), with meaning evolving through the interactions between the text and reader.

Both cognitive and affective elements form the past life experiences and knowledge that the reader brings to the reading process. The cognitive and affective conditions are interactive with a change in quality of one condition affecting the quality of the other (Ruddell & Unrau, 1994). Effective use of cognitive knowledge, for instance, is likely to facilitate comprehension and achievement of the reading goal, causing a corresponding feeling of achievement and increased motivation. The increase in motivation is likely to lead to increased effort towards effective use of cognitive knowledge (Ruddell & Unrau, 1994).

The affective condition of the reader includes such elements as motivation, attitude to reading and content, and personal values and beliefs (Ruddell & Unrau, 1994). Motivation is critical to successful reading as it is needed to initiate and maintain reading effort, including the conscious activation of

relevant background knowledge, and the implementation of appropriate strategies (Garner, 1994; Ruddell & Unrau, 1994). Reader attitude influences motivation and is shaped by perceived self-efficacy and the value placed on reading within the reader's personal value system. If a reader believes he/she cannot succeed and/or that reading is not a worthwhile ability to develop, he/she will have a negative attitude to future reading events and will not be motivated to engage in reading activity or to develop his/her reading ability.

The cognitive condition of the reader includes declarative knowledge, procedural knowledge, and conditional knowledge (Ruddell & Unrau, 1994). Declarative knowledge is knowledge about facts, events, objects, concepts, and theories about the world. This form of knowledge also includes knowledge of oral and written language such as vocabulary, knowledge of syntax or grammatical patterns of language, knowledge of text structures, and the sound-symbol relationships of written language. Procedural knowledge is the knowledge of skills and strategies for using knowledge. Procedural knowledge is used when a reader selects an appropriate strategy to identify an unknown word, or uses his/her knowledge of generic structure of a narrative to predict the organization of a story he/she is about to read. Conditional knowledge allows a reader to make decisions on when and why it would be appropriate to use declarative and procedural knowledge.

Metacognitive knowledge is another element of the reader's cognitive condition and is essential to successful reading. It allows the ongoing monitoring of meaning to occur as it provides readers with strategies to assess the progress of meaning construction (Garner, 1994). Re-reading a section of text to check that meaning is still intact and attempting to retell a section of the text are examples of metacognitive strategies that allow evaluation of meaning construction by executive control functions. Detection of a breakdown in meaning prompts the reader to select and employ a cognitive strategy from the procedural repertoire to 'fix' the breakdown. For instance a reader may choose to read on, or check for picture clues, or check back through the text, or guess and check to restore meaning. Further evaluation then occurs to assess the effectiveness of the fix-up strategy and, if meaning has been restored, the reader will continue the process with the next section of text.

Meaning, then is negotiated when affective and cognitive conditions of the reader interact with the linguistic cue systems and textual features of the text so that the reader may gather 'evidence' on which to make hypotheses about the possible meaning of the text. This process is continually monitored by executive control functions to assess current understanding of the text. Unfavourable textual features and deficits in either affective or cognitive

conditions of the reader reduce the reader's ability to successfully interact with the text.

The theoretical framework developed as a result of considering of these theories provided a way of understanding how students with ADHD experience difficulties in learning to read. This framework was used to design the intervention which is the focus of this study. The theoretical framework appears in Figure 1.

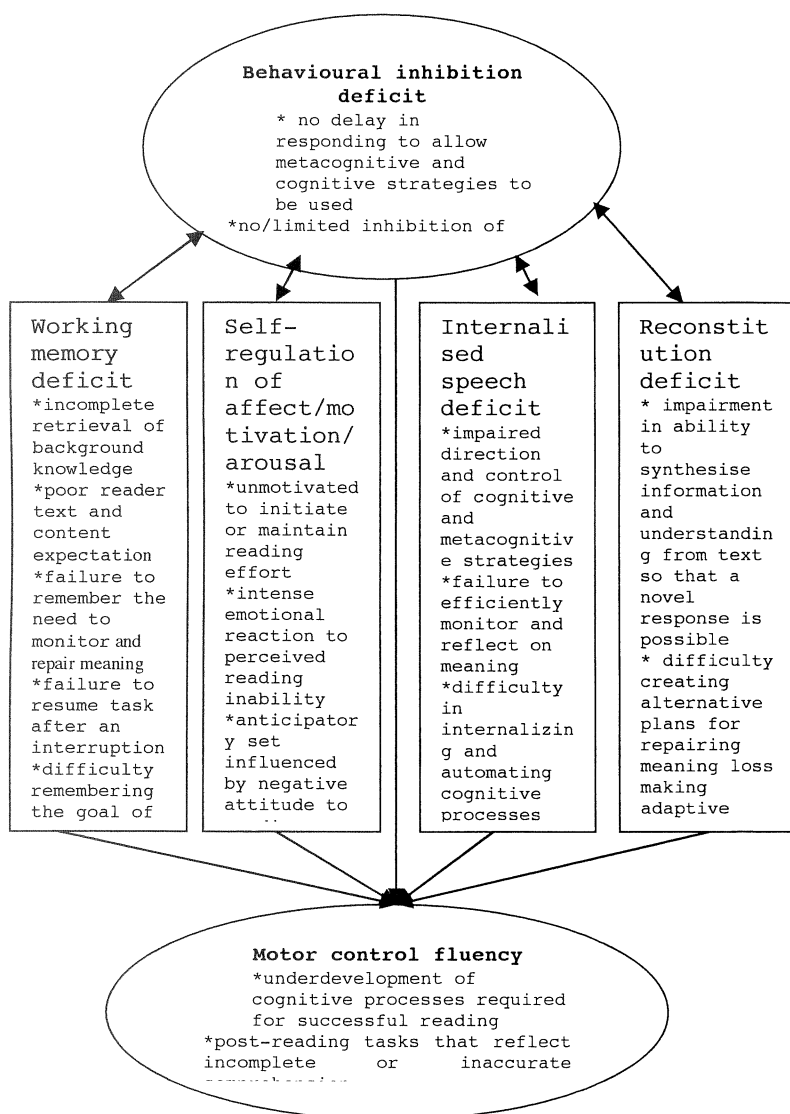


Figure 1. Theoretical framework illustrating the effects of executive function deficits on the reading process.

As can be seen from this model the influence of executive function deficits on the reading process tends to be significant and pervasive. It begins as the ADHD student attempts to engage in the reading process and continues throughout the reading experience, reducing his/her ability to successfully complete post-reading activities. The end result is generally an underachieving student who sees themselves as a non-reader, and reading as an unenjoyable, threatening experience.

THE READING INTERVENTION

Reading instruction for underachieving ADHD students is likely to be successful if it addresses the impact of executive function deficits on the reading process. The reading intervention trialed in this study supported executive functioning by combining reading strategy training, the cognitive training components of self-instruction, self-monitoring, self-reinforcement and visual memory prompts. Table 1 provides a summary of the intervention components and their role in compensating for executive function deficits.

Executive function deficits compensated for	Intervention component	Explanation of component
• Inhibition • Working memory • Self-regulation of affect/motivation/arousal • Internalisation of speech • Reconstitution	Self-instruction	*used to improve quality and content of current self-talk *focused on self-statements used to prepare for, monitor and repair the meaning-making process
• Self-regulation of affect/motivation/arousal • Internalisation of speech • Reconstitution	Reading strategy training	*used to ensure repertoire of reading strategies and that use of strategies is seen as valuable *focused on meaning monitoring ('re-read') and repair strategies ('read-on', 'picture clues', 'sound out')
• Inhibition • Self-regulation of affect/motivation/arousal • Reconstitution	Self-monitoring	*used to teach students how to observe and record their own behaviour *focused on use of reading strategies
• Inhibition • Internalised speech	Self-reinforcement	*used to improve on-task behaviour and task accuracy

• Self-regulation of affect/motivation/arousal • Reconstitution		*implemented through token economy contingent on use of reading strategies detected by self-monitoring
• Working memory • Internalised speech • Reconstitution	Bookmark	*used to prompt strategy use *monitoring and repair strategies represented by icons on cardboard bookmark
• Inhibition • Working memory • Self-regulation of affect/motivation/arousal • Reconstitution	Paragraph summaries	*used to cause a delay in responding *used to aid retention of main ideas of the text *used to aid self-evaluation of progress towards the goal of understanding the text that is read *used to assist in the development of cognitive processes need to synthesise and respond to new information

Table 1: Components of Intervention

The reading intervention included an eight-week Intervention phase and a ten-week Maintenance phase. During the intervention phase the students were scheduled to attend three, thirty-minute learning sessions each week. The sessions were delivered in an area outside of the classroom on a one-to-one basis for most students. Three students from the main study however, attended intervention sessions with one other student. During the maintenance phase classroom teachers were asked to provide two to three individual silent reading sessions per week for all class members. The students who had attended the intervention phase were supplied with an intervention reading kit that contained a number of intervention bookmarks, self-monitoring chart and stickers which the students could use during these silent reading sessions on a voluntary basis. The students had also been provided with an intervention reading kit to use at home if they wished. There was no requirement for parents to work with their child/children at home.

The reading sessions during the Intervention phase of the pilot study were conducted by the researcher, whilst the reading sessions for the main study were conducted by teacher-education students and in one instance by the students' classroom teacher. During the intervention phase of the main study the researcher made weekly visits to the 'expert readers', or those people conducting the reading sessions to offer advice and assistance where necessary and ensure the supply of all required resources. Weekly visits were also made to the classroom teachers during the maintenance phase to ensure sufficient higher-level rewards and to assist with any difficulties encountered in the support of the students.

PRE-INTERVENTION TRAINING

Prior to the implementation of the intervention phase in the main study, all classroom teachers and 'expert readers' attended one training session that included the theoretical background to the study and the application of the intervention. The sessions were conducted on site at the schools and the university with most training sessions for classroom teachers occurring on a one-to one basis. Most expert models received the training session as a group.

The training session for classroom teachers occurred outside of scheduled teaching time, either before or after school teaching hours or during a teacher's non-contact time. These sessions usually lasted for thirty to forty-five minutes depending on the time made available by the teachers. The training session for the expert models ran for approximately one hour and provided more detailed information on the implementation of the intervention. All classroom teachers and expert models also received an intervention kit that included the detailed lesson plans as well as multiple copies of the self-

monitoring chart, the bookmark, reward certificates, stickers and a range of higher level rewards such as novelty pencils, felts, erasers and sharpeners. See Baker (2004) for details of the program and lesson format.

Classroom teachers in the pilot study declined the offer of training. It is thought that this action may have occurred due to the recruitment process at this site. The school Principal had been the initial contact at the school, and before teachers were consulted parents were contacted by the Principal and verbal consent gained. The classroom teachers then may have felt coerced to participate and so were unwilling to engage in a training session that required a portion of their non-contact time.

METHODS

The research aim was to contribute to the knowledge of how to support the reading achievement of students with ADHD. A reading intervention was designed and trialed to evaluate its usefulness as a means to improve the reading achievement of students with ADHD who were experiencing reading difficulty. A multiple case study method (Yin, 1994) was used as it was suited to the characteristics and requirements of the research. The study was carried out in the natural (Bogdan & Biklen, 1998) or real-life context of the school environment. The naturalistic setting for data collection was selected because the purpose of the study was to find an intervention that is useful for teachers to use to help students with ADHD to improve their reading.

STUDY SAMPLE

A purposive sample (Merriam, 1998) of six students selected from a regional state primary school was included in the pilot study and a further six students were selected as the sample for the main study from two state primary schools and one state high school. The participants were selected on the basis of the following criteria:

- Diagnosis according to the criteria described in the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) (American Psychiatric Association, 1994) as administered by a medical doctor.
- Prescription of medication with participants having taken a stable dose for at least three months.
- Identification by a teacher as apparently experiencing reading difficulties and appearing to be reading below the level of which they are capable.

The samples in both the pilot and main study were identical except that a wider age range of students was selected in the main study. The students in

the pilot study were aged from 9 to 11 years and came from one primary school. The students in the main study were drawn from three schools and were aged from 9 to 17 years. In all cases students in the pilot study sample were selected by the principal.

DATA COLLECTION

Data were collected using the instruments identified in Table 2. This table also indicates the measurement focus or foci for each instrument.

Instrument	Measurement focus
The Burt Word Reading Test (Gilmore, Croft & Reid, 1981) This is a standardised test consisting of 110 words printed in differing sizes of type and graded in order of difficulty. Provides age norms for children from 6 to 12.11 years of age.	*Reading achievement level. This test measures reading vocabulary
The Cloze Reading Test (Young, 1982) This standardised test consists of a series of short passages with words deleted at regular intervals. Deleted words are to be written in by participants.	*Reading achievement level. This test measures reading comprehension
Running record This instrument is a systematic form of recording oral reading responses.	*Frequency and effectiveness of strategy use *Error pattern
Direct observation	*Frequency and effectiveness of strategy use *Attitude to reading/motivation
Semi-structured interviews with selected students This instrument consists of a series of focus questions designed to allow collection of data on each of the four areas.	*Reading achievement *Frequency and effectiveness of strategy use *Attitude to reading/motivation *Attributional beliefs about success/failure
Semi-structured interviews with parents and teachers of selected students This instrument consists of a series of focus questions designed to allow collection of data on each of the four areas.	*Reading achievement *Frequency and effectiveness of strategy use *Attitude to reading/motivation *Attributional beliefs about success/failure
Specific Attribution Questionnaire Two correct and incorrect oral reading responses are used to seek responses regarding why students believe they are successful or unsuccessful at reading.	*Attributional beliefs about success/failure Provides an indication of perceived personal control over achievement e.g., can control through effort or cannot control as it is due to luck.

Table 2: Data Collection Instruments

PHASES OF THE STUDY

The study compared post-test data with baseline data gathered to identify the students' level of reading achievement; frequency and effectiveness of strategy use; students' attitude to reading and motivation to read; and attributional beliefs about success and failure. Baseline data gathered through semi-structured interviews conducted with students, their teachers and parents; direct observation and standardized reading tests, were compared to post-test data to identify changes in these identified areas. Post-testing occurred at the end of the eight-week Intervention phase, and again, following the ten-week Maintenance phase. Students were withdrawn from the classroom for collection of baseline and post-test data.

Table 3 provides an overview of the main phases of the study and identifies the instruments used to collect the data.

Study	Study Tasks
Pilot study – • one state primary school	*Selection of students *Pre-testing *Trial of the intervention program *Post-testing *Maintenance phase *Post-testing
Main study – • two state primary schools • one state high school	*Selection of students *Professional development of expert models and participating classroom teachers *Pre-testing *Implementation of the intervention program by expert models (weekly visits by researcher) *Post-testing *Maintenance of intervention in the classroom by classroom teachers (weekly visits by researcher) *Post-testing

Table 3: Overview of the Study

DATA ANALYSIS

Evaluation of the effectiveness of the intervention indicated that all students had increased in their reading achievement, and in the effectiveness and range of strategy use, increasing both the range and flexibility of their use of strategies. Students' attitude to reading also became more positive and students became intrinsically motivated to read. Further, most students developed a greater sense of control over their reading achievement indicated by positive changes in their attributional beliefs about success and failure during reading. This section provides a summary of data from all areas considered.

READING ACHIEVEMENT

Initially, all students were achieving below their age peers for reading comprehension, ranging from just three months below, to eight years and four months below as measured by the CLOZE Test. As well, ten of the 12 students were achieving below their age peers for sight vocabulary. The range was from four months below, to eight years 11 months below. However, after the students learnt how to use the strategies in the intervention, their performance improved. These results continued to improve after the students used the intervention strategies within the classroom reading program. The overall improvement in reading achievement levels was likely due to the change in students' reading goal from word identification to that of making sense of text; the development of cognitive knowledge and processes required for successful reading; more positive self-efficacy beliefs; and the ability of the intervention to compensate for the cognitive executive function deficits associated with ADHD (Barkley, 1996). The following Table and Figures summarise and display aspects of change resulting from the intervention. In sum, Table 4 summarises the changes in reading achievement for both the pilot and main study. Figure 3 indicates the increase in months in reading age that students from the main study achieved from the time of the pre-test to the maintenance post-test as demonstrated by the CLOZE Test. Figure 4 indicates the increase in months in reading age that the same students achieved for the same period as demonstrated by the Burt Word Test.

Pre-test	Maintenance post-test
• Most students' sight vocabularies were below that of age peers • All students' comprehension levels were below that of age peers • Reading goal of accurate word decoding	• Most students' sight vocabularies improved • All students' comprehension levels improved • Reading goal of making sense of text • Increased ability to write paragraph summaries

Table 4: Changes in Reading Achievement

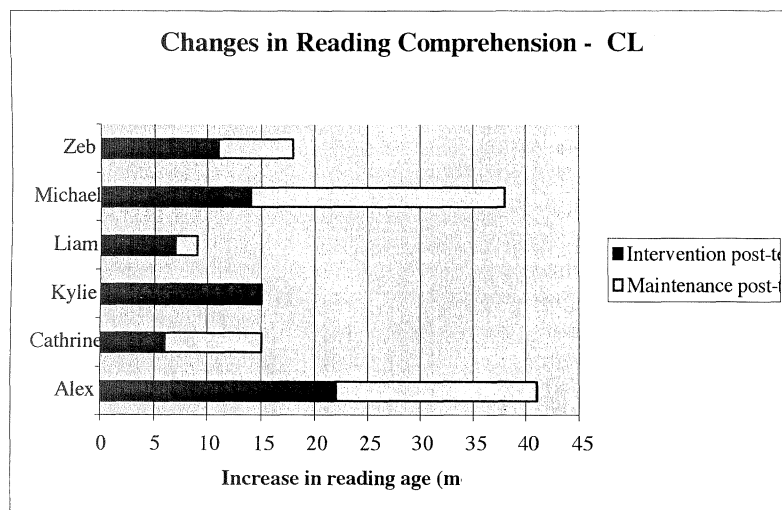


Figure 3: Changes in reading comprehension during the maintenance phase of the main study.

Note: Students names are pseudonyms

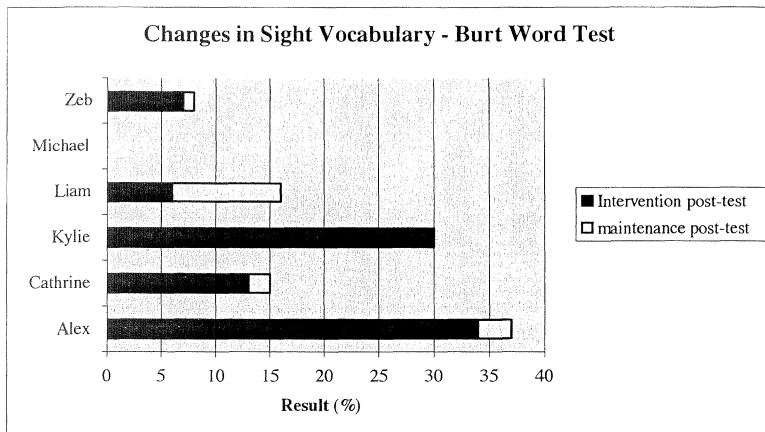


Figure 4. Changes in sight vocabulary during the maintenance phase of the main study.

At the maintenance post-test, all students except Kylie, increased their CLOZE Test results. Kylie maintained the level of her reading comprehension from the intervention post-test as indicated by the results of this standardised test. However, most comprehension reading ages were still below students' chronological ages with the exception of Alex whose comprehension reading age was now one year and seven months above his chronological age. Test results from the Burt Word Test indicated a similar result for four of the students. The exceptions were Michael and Kylie who maintained their high sight vocabulary levels. The sight vocabulary ages for Alex, Kylie and Michael were all above their chronological ages, with Alex demonstrating the greatest difference with a Burt Word Test result two years and three months above his chronological age.

Most students' comprehension levels increased more than their sight vocabulary levels did from the time of the intervention post-test to the maintenance post-test. Since the intervention focused on the development of strategic reading that would increase comprehension, it is not unexpected that comprehension levels would continue to increase by a greater extent than sight vocabulary levels. As students continue to read a greater volume of texts, their sight vocabularies may also continue to increase.

STRATEGY USE

The students' strategy use changed considerably as a result of the intervention with the range of strategies used increasing to include meaning-based repair strategies and metacognitive reading strategies. By the end of the maintenance

phase, the students were using these strategies effectively and flexibly and their strategy use had become internalised and automatic. Table 5 provides a summary of the changes to students' strategy use.

Pre-test	Maintenance post-test
- Students used a limited range of reading strategies relying predominantly on 'sound-out' - Students did not use metacognitive strategies such as 're-read' and visualisation - Students demonstrated inflexible use of repair strategies - Students accurately assessed their strategy use	- Students used an increased range of reading strategies to include meaning-based strategies - Students used meta-cognitive strategies - Students demonstrated effective and flexible use of repair and metacognitive strategies - Students accurately assessed their strategy use

Table 5: Changes in Strategy Use

ATTITUDE AND MOTIVATION

The students' attitude to reading became more positive between the time of the pre-test and that of the maintenance post-test, and they demonstrated greater intrinsic motivation to engage in reading. The students also reported feeling more confident when they read to themselves and most students reported feeling more confident when reading to others. The value that the students had placed on the use of reading strategies had also increased. That was indicated through self-report as well as their willingness to use the suggested strategies. The students also felt that their reading achievement level could continue to improve. Table 6 summaries the changes in students' attitude and motivation.

Pre-test	Maintenance post-test
- Most students demonstrated low motivation for reading - Most students did not have a positive attitude to the reading required of them in class - Students felt confident reading low text/high picture content books	- Students demonstrated increased intrinsic motivation to engage in reading - Students demonstrated a more positive attitude to reading - Students felt confident reading higher text content books to

• Most students were not confident reading aloud to others • Students did not perceive reading strategies as valuable • Students believed that their reading level could improve	themselves • Students' confidence when reading to others increased • Students perceived reading strategies as valuable • Students believed that their reading level could continue to improve
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Table 6: Changes in Attitude and Motivation

ATTRIBUTIONAL BELIEFS

At the maintenance post-test the students demonstrated an increased sense of control over success and failure incidents during reading. This finding provided some evidence that the students may have increased their sense of control over their reading achievement. The increased value assigned to strategy use may also indicate a greater sense of control over reading achievement. However while most students' sense of control over both success and failure had increased, students tended to attribute failure less to the internal cause of effort than they did success. Table 7 provides a summary of these changes.

Pre-test	Maintenance post-test
• Students indicated some sense of control over their reading achievement • Students indicated that they felt a greater sense of control over success than failure	• Most students indicated that they had a greater sense of control over their reading achievement • Students indicated that they felt a greater sense of control over success than failure

Table 7: Changes in Attributional Beliefs

The combination of components used in the intervention is likely to have assisted students in increasing their sense of control over success and failure incidents in reading. Since the self-monitoring chart and the construction of paragraph summaries may have supported students' self-evaluation, these components may also have allowed the students to recognize successful reading experiences and the causal link between their success and their effort in using reading strategies. The self-monitoring chart provided tangible representation of the students' effort in using reading strategies, and supported feedback given by the experts working with the students. The

greater sense of control over success than failure was likely due to the students protecting positive self-efficacy beliefs.

CONCLUSIONS AND IMPLICATIONS

The conclusions able to be drawn from the present study are limited by both the theoretical framework used to inform the design of the intervention and the scope of the study. The framework that influenced the design of the intervention was based on current theoretical understandings of ADHD and only included participants who had been diagnosed as having ADHD. Therefore it is not possible for this study to determine whether or not the intervention may be successful for other students who have reading difficulties. Further, since all participants had been prescribed medication to help manage their ADHD, it is unknown whether or not the intervention would be effective for unmedicated students with ADHD, or whether or not it would be effective for all medication types.

Notwithstanding those limitations, the results of the present study do indicate that the design of remediation programs should support executive functions of students with ADHD. The success of the intervention that was the focus of this research supported the premise that the learning difficulties experienced by students with ADHD occur as secondary symptoms resulting from the impact of the disorder on executive functions. However while this appears to be true for the reading difficulties experienced by the students in this study, other students with ADHD may have comorbid learning disabilities that are not the result of the impact of the disorder on executive functions. Nevertheless, the severity of the learning difficulties may be influenced by the disorder in this way. Based on this finding it could be concluded that academic remediation of students with ADHD should consider the impact of executive function deficits on the specific learning area in question and provide intervention that specifically supports these deficits within the requirements of the identified learning area.

A further conclusion of the study relates to the theory-practice nexus. The intervention was designed using Barkley's (1996) theory of the executive function deficits associated with students who are diagnosed with ADHD. In the findings of this study, the intervention was successful. Therefore, Barkley's model may be suitable as a theoretical basis for the development of other educational interventions for students with ADHD provided that the specific requirements of an identified learning area are considered in association with the possible impact of executive function deficits. At the same time, since the study was not an experimental psychological study, it remains for future researchers to test the experimental validity of Barkley's theory.

The results of the study also have implications for the use of cognitive training with students with ADHD. In the present case study, cognitive training in combination with support for specific executive function deficits was effective in improving students' reading achievement when applied at the point of performance. The findings support the use of cognitive training for students with ADHD provided that the components of self-instruction, self-monitoring and self-reinforcement are used in combination with training in the use of specific reading strategies and memory cues. Also, including self-questions prompted more active involvement in the required cognitive processes and so facilitated development and internalising of these processes. The high functional value eventually placed by students on the use of reading strategies may also have contributed to the effectiveness of the cognitive training.

The findings of the study also prompt consideration of suggestions for future research. Firstly, since the present study was qualitative and included only a small sample, a quantitative study that included a much larger sample would be needed to further evaluate the efficacy of the intervention and provide results that could be generalized to a larger population.

Secondly, it may be useful for future research to further consider the efficacy of cognitive training for individuals with ADHD when the training occurs at the point of performance and includes the components of self-instruction, self-monitoring and self-reinforcement in combination with training in the use of specific reading strategies and memory cues.

In conclusion, this paper reported on a study that considered the design and evaluation of a reading intervention for students with ADHD. The intervention was successful in improving the reading achievement levels of the twelve participants in both the pilot and main studies. Since the intervention was based on Barkley's (1996, 1997) theory that learning difficulties in students with ADHD are the result of executive function deficits, the theory is likely to be an accurate reflection of the constructs and relationships described in it. It is hoped that further research into the development of educational interventions for students with ADHD will expand this understanding.

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