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The effect of computer-assisted instruction for students with central auditory processing disorder using the Fast ForWord program

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The Effect of Computer-Assisted Instruction for Students with Central Auditory Processing Disorder Using the Fast ForWord Program

By
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ABSTRACT

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Central auditory processing disorder (CAPD) is a deficit in auditory perception that has been thought to be the underlying basis of many learning problems including specific reading and language disabilities. In today's classrooms many of the children with CAPD have been integrated into general education settings. These children need a program that helps them cope with or even overcome their learning difficulty. A computer program, Fast ForWord has been suggested for those students. The Fast ForWord program is a computer-assisted reading program that is linked electronically to Berkley University via the Internet.

The purposes of this study were (a) to examine the effect of the Fast ForWord program in language and reading for students with CAPD; (b) to evaluate students' satisfaction of using the Fast ForWord program; and (c) to evaluate the instructor's satisfaction of the program. Two students with CAPD were selected for the study. Each student was given a set of tests during the baseline. During the intervention both students participated in the Fast ForWord program for 100 minutes a day, 5 days a week, for a total of 5 weeks. Each day they participated in the program. An ongoing test was used to assess their performance and correct responses were recorded at Berkley University.

Each student's program was modified daily to meet his individual needs. The scores were graphed and compared to the baseline data for each student. Upon completion of the program both students and the Fast ForWord instructor were interviewed for their satisfaction with the program. Results showed that both students showed gained scores in reading and language. They enjoyed using the program, as did the instructor.

MINI-ABSTRACT

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The purpose of this study was to examine the effect of the Fast ForWord computer program on reading and language test scores for students with Central Auditory Processing Disorder (CAPD). Two 5th grade boys with CAPD were selected for this study. A single subject design with baseline and intervention phases was used. Baseline data was collected from each student on two tests, prior to the 5 weeks of implementing the Fast ForWord during the intervention. The results showed that both students gained scores in reading and language skills.

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This is to thank everyone who has supported me this past year.
It was a long journey but well worth the outcome.

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Chapter 1

Introduction

Statement of Problem

Central auditory processing disorder (CAPD) is a modality-specific perceptual dysfunction that is not due to peripheral hearing impairment (Cacace & McFarland, 1998). The rationale to diagnose CAPD in school aged children is based on the assumption that a deficit in auditory perception can be the underlying basis of many learning problems including specific reading and language disabilities (Cacace & McFarland, 1998).

Auditory processing is the term used to describe what happens when the brain recognizes and interprets sounds (Cacace & McFarland, 1998). Humans hear when energy that is recognized as sound travels through the ear and is changed into electrical information to be interpreted by the brain (Cacace & McFarland, 1998). Most professionals agree that children with CAPD have normal intelligence and hearing sensitivity (Dagenais, Cox, Southwood & Smith, 1997). They disagree with the defined characteristics of CAPD (Dagenais, 1997), because this disorder adversely affects the processing or interpretation of information (Cacace & McFarland, 1998).

A major reason for the failure to identify the defining characteristics is in part due to the "inclusive" framework currently used in the diagnosis of CAPD (Cacace & McFarland, 1998). This framework implies that performance on auditory tests alone provides sufficient evidence for diagnosis (Cacace & McFarland, 1998). The limitations

of inclusive definitions for CAPD can put the individuals without a problem of a perceptual nature at risk for misclassification (Cacace & McFarland, 1998). Appropriate testing should allow for differentiation of cases with auditory perceptual deficits from those with non-perceptual deficits (Cacace & McFarland, 1998).

The definition of CAPD alone shows that it needs more than an inclusive diagnosis (Dagenais, 1997). CAPD is defined as an observed deficiency in one or more of the auditory functions of sound localization, lateralization, discrimination, pattern recognition and lack of the ability to process competing or degraded acoustic signals, as well as temporal aspects such as masking, integration, temporal resolution and ordering (Dagenais, 1997). With this broad definition diagnosis can not be made based on one test alone. Testing through the auditory channel alone can show only those central processing problems that are auditory in nature (Dagenais, 1997). Current diagnostic procedures that employ tests with primarily auditory input as stimuli do not account for the possibility of other affected modalities (Dagenais, 1997).

According to Dagenais (1997), it is difficult to determine the particular characteristics of CAPD that may differ from other disorders because of overlapping symptomology with other disorders such as attention deficit hyperactivity disorder, language disorders and learning disabilities. Children with CAPD have problems in sequencing and organization of thoughts and speech (Dagenais, 1997). They have difficulty with reading, writing, spelling and penmanship that may impact on their learning in school (Dagenais, 1997). Short-term memory problems have also been included as a symptom although it has not been determined if CAPD has a cause/effect relationship with memory problems or merely coexists with them (Dagenais, 1997). It may be possible that CAPD

is not exclusively an auditory processing disorder (Dagenais, 1997). If the presence of other processing deficits are identified or eliminated, a more distinct definition of CAPD should be determined (Dagenais, 1997).

Many educational approaches have attempted to assist children with CAPD. The most widely used approach is computer-based instruction (Fitzgerald & Koury, 1996). Prior to 1988, preferences for using computer-assisted instruction over the teaching/learning methods were commonly presented (Fitzgerald & Koury, 1996). Computer-based instruction has been most successful in teaching elementary children with CAPD (Fitzgerald & Koury, 1996). Since 1988, educational software packages, while increasingly becoming more user friendly, have evolved into sophisticated systems of learning (Fitzgerald & Koury, 1996). Research in learning with computers is beginning to shift from a focus on short-term limited controlled studies to longer and more complex classroom-based studies (Fitzgerald & Koury, 1996).

Currently, over 70% of students with disabilities are taught in an inclusion setting where they receive some of their instruction in the general education classroom (Fitzgerald & Koury, 1996). As a result of the inclusion movement, researchers are involved in studies that include traditional general education curricula instruction in the field of special education (Fitzgerald & Koury, 1996). Students with special needs have to be given extra instruction so that they can function as well as their non-disabled peers (Fitzgerald & Koury, 1996).

In today's classrooms many of the children diagnosed with CAPD have been integrated into a regular classroom setting (Cacace & McFarland, 1998). In order to ensure their success in that setting, these children need a program that will help them

cope with or even overcome their learning difficulty in the regular education setting (Gillam, Loeb & Friel, 2001). Since 1996, the Fast ForWord program has been delivered to thousands of schools at a considerable cost in time and money (Gillam, 2001). Fast ForWord is a computer-based program designed to improve the brain's ability to represent rapidly successive sounds with greater clarity and sharper distinctions (Gillam, 2001).

The Fast ForWord program attempts to help children with CAPD function with their non-disabled peers in the regular classroom setting (Gillam, 2001). Because language is a complex dynamic system of symbols, whose conventional use is determined by interactions among biological, cognitive, psychosocial and environmental factors, it is important for these children to understand what others say, generate ideas for assertive or responsive utterances and express ideas using vocabulary and sentence structures that are appropriate to the speaking context (Gillam, 2001). This present study was conducted to focus on language and reading improvement of children with CAPD using the Fast ForWord Program.

Significance of Study

As educators it is our duty to find the appropriate programs that will be most beneficial for our students. Because of the movement of inclusion, more and more special education students have been integrated into regular education classrooms (Fitzgerald & Koury, 1996). These students need assistance to keep up with their non-disabled peers academically. Fast ForWord is a computer-based program used in schools since 1996 to help students with CAPD. Fast ForWord is one of the more costly

programs on the market. Schools want to collect data on the effectiveness of the program before they will invest and participate. Some schools may select the Fast ForWord program for their students with CAPD, as a pilot program, and others may gather data relative to a specific population. Thus, it is important to examine if the Fast ForWord program is a successful program for students with CAPD and to provide this data to schools. To date there is little empirical research on the effect of the Fast ForWord program. This present study will examine the effectiveness of the Fast Forward program for children with CAPD in learning language.

Statement of Purpose

The purposes of this study are (a) to examine the effect of Fast ForWord in language and reading for students with CAPD; (b) to evaluate students' satisfaction of using the Fast ForWord program; (c) to evaluate the instructor's satisfaction using the Fast ForWord program.

Research Questions

1. Using the Fast ForWord program, do children with CAPD gain test scores in language and reading?
2. Are children with CAPD satisfied with the Fast ForWord program?
3. Is the instructor satisfied with the Fast ForWord program as a means to teach reading and language skills to children with CAPD?

Chapter 2

Literature Review

Introduction

This chapter is a review of literature on Central Auditory Processing Disorder, computer-assisted instruction and the Fast ForWord program. In 1996, a computer program, Fast ForWord, was presented for students with CAPD. It is hoped that in this chapter an attempt will be made to link students with CAPD and academic achievement with the help of computer assisted-instruction, specifically using the Fast ForWord program.

Central Auditory Processing Disorder

Central Auditory Processing Disorder (CAPD) is defined as an observed deficiency in one or more of the auditory functions of sound localization and lateralization, discrimination, pattern recognition, ability to process competing or degraded acoustic signals, as well as such temporal aspects as masking, integration, temporal resolution and ordering (Dagenais, 1997). It is important to analyze this definition so that the characteristics and problems associated with CAPD are understood due to the popular assumption that many learning problems, including specific reading and language disabilities, stem from CAPD (Cacace & McFarland, 1998).

General characteristics of CAPD.

CAPD is a modality specific perceptual dysfunction that is not due to peripheral hearing impairment (Cacace & McFarland, 1998). In fact, it has been noted that

individuals with CAPD typically have normal intelligence and hearing sensitivity (Dagenais, 1997). Individuals with CAPD do not have a hearing deficit, but a brain-processing problem according to Cacace & McFarland (1998).

Individuals with CAPD are distractible listeners because they are unable to process complex auditory information that occurs in speech (Hutchinson & Mauer, 1999). This inability makes it difficult for individuals with CAPD to follow oral instruction, listen or concentrate in a noisy environment (Hutchinson & Mauer, 1999).

Individuals with CAPD have problems sequencing and organizing which makes it difficult for them to remember any kind of list or set of directions (Hutchinson & Mauer, 1999). It has been noted that response time to auditory stimuli is slower in individuals with CAPD making it difficult for them to stay on task (Dagenais, 1997). Because information is processed much slower for these individuals, higher level thinking skills such as drawing inferences, understanding riddles or verbal math problems are very difficult (Konde, 2001).

It is difficult to determine the particular characteristics of CAPD due to the overlapping symptomatology with other disorders (Dagenais, 1997). There is still controversy over the exact dynamics of central auditory processing and CAPD (Dagenais, 1997). It has been noted that the modality specificity of auditory-based learning problems has not always been established (Cacace & McFarland, 1998). CAPD contrasts with cognitive, language-based, and/or attention problems, where modality specific perceptual dysfunctions are not expected (Cacace & McFarland, 1998).

Diagnosis of CAPD.

Many researchers have questioned the validity of the CAPD diagnosis due to the lack of a specific testing procedure (Hutchinson & Mauer, 1999). Current diagnostic procedures employ tests with primarily auditory input ignoring a possibility of other affected modalities (Dagenais, 1997). However, testing through the auditory channel alone can show only those central processing problems that are auditory in nature (Dagenais, 1997). Thus, tests of central auditory processing should be supplemented by visual or tactile tasks that are of an analogous nature (Cacace & McFarland, 1998).

It has not yet been determined if CAPD has a cause/effect relationship with other disorders or merely coexists with them (Dagenais, 1997). Because other stimuli-response paradigms have not been adequately explored in the diagnosis of CAPD, it may be possible that CAPD is not exclusively an auditory processing disorder (Dagenais, 1997). It has been reported that many of the children evaluated for CAPD did not have obvious speech or language deficits (Hutchinson & Mauer, 1999). However, if auditory-perceptual training does improve language skills, then this renders evidence for a cause/effect relationship between CAPD and articulation and language deficits (Hutchinson & Mauer, 1999).

The most straightforward way to demonstrate that poor performance is due to a particular learning deficit is to manipulate that deficit while holding other variables constant (Cacace & McFarland, 1998). Assumptions of CAPD recognize the interaction among listening, attending processes and language use and learning (Hutchinson & Mauer, 1999). The nature of the relation between auditory-perceptual and language-

learning skills and metacognitive knowledge has not been clearly established (Hutchinson & Mauer, 1999). Research and clinical assessment in the area of CAPD for children with learning problems has typically lacked such comparisons because of the use of auditory material alone for a diagnosis (Cacace & McFarland, 1998). Auditory tests alone provide insufficient evidence to clinically diagnose children with CAPD (Hutchinson & Mauer, 1999). Academic performance tests should also be used where auditory channels are not a variable (Cacace & McFarland, 1998).

Learning disorders associated with CAPD.

Disorders of auditory perception have frequently been indicated as a cause of learning disabilities (Cacace & McFarland, 1998). If it is maintained that certain learning problems result from an auditory-specific perceptual dysfunction, then the issue is whether auditory skills are involved to a disproportionate degree, no matter whether these deficits involve language or not (Cacace & McFarland, 1998). It may be possible that an auditory processing problem is actually one affected modality of a broader processing disorder (Dagenais, 1997).

Because CAPD is auditory in nature, it has often been assumed that many reading disorders stem from CAPD (Burleigh, 1997). Specific reading disability and developmental dyslexia are terms used to describe such a disorder that has been associated with CAPD (Cacace & McFarland, 1998). Children with Dyslexia experience considerable difficulty in learning to read, despite having normal intelligence or any overt sensory, motor, or neurological impairment (Cacace & McFarland, 1998). Contemporary strategies to diagnose dyslexia involve tasks that are visual in nature (Cacace & McFarland, 1998). However, it has also been suggested that dyslexia could result from

pathology in the primary auditory cortex of the left hemisphere leading some language/speech specialists to characterize this impairment as a disorder of central auditory processing (Cacace & McFarland, 1998).

Attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) are other disorders commonly associated with CAPD (Konde, 2001). Children described as having CAPD are often characterized as having difficulties attending (Cacace & McFarland, 1998). These children are also noted as having high activity levels, especially when they are in confusing or noisy listening environments (Burleigh, 1997). It has been suggested that these characteristic traits may be coping mechanisms to deal with the frustrations they are experiencing in their auditory world (Burleigh, 1997).

Studies on cerebral glucose have found that students with ADD or ADHD have shown a frontal lobe dysfunction during auditory performance tasks, and indicated that ADD and ADHD may be related to frontal-lobe dysfunction (Cacace & McFarland, 1998). However, other studies have found evidence for heredity of ADD and ADHD (Cacace & McFarland, 1998). The relationship between CAPD and ADD/ADHD has been made due to the similarities in diagnostic characteristics such as the inability to attend and frontal lobe dysfunctions (Konde, 2001).

The evaluation and treatment of CAPD has gained much attention in the past 20 years (Hutchinson & Mauer, 1999). Most professionals agree that CAPD occurs when the ear and brain do not coordinate fully (Konde, 2001). What has not been agreed upon is that if any learning disorders can be associated with and/or remediated by the CAPD diagnosis (Hutchinson & Mauer, 1999). CAPD is often misunderstood and undiagnosed due to similarities to other learning disorders (Konde, 2001). A more distinct definition

of the disorder would enable professionals to identify or eliminate the CAPD diagnosis accurately (Dagenais, 1997).

Computer-Assisted Instruction

Computer-assisted instruction (CAI) refers to the use of computers as a form of instruction (Fitzgerald & Koury, 1996). Between 1984 and 1997 the number of computers in America's K-12 schools increased to more than eight million (Johnson, 2000). An important consideration in computer-assisted instruction is instructor training and preparation in the use of computers in classrooms (Johnson, 2000). When resources are limited, it needs to be considered whether to distribute computers to individual classroom or to have a computer lab (Brennan & Yantosh, 1996). In the mid 1990's laptop computers were introduced to the K-12 classroom (Belanger, 2000). Educators who had access to these laptops began to explore their unique advantages (Belanger, 2000).

Types of computer-assisted instruction.

There are many different terms and types of CAI in schools today. They range from drill and practice to researching the World Wide Web (Cotton, 2001). It is essential that all forms of CAI be understood so that it can be matched to the student who will be benefited (Brennan & Yantosh, 1996).

Some terms related to CAI are often used incorrectly, which may lead to some misunderstanding. Computer-based education (CBE) and computer-based instruction (CBI) are broad terms that can refer to the use of computer programs including drill and practice, tutorials, simulations, instructional management, supplementary exercises, and writing with a word processor (Cotton, 2001). Computer-assisted instruction (CAI) is a

narrower term referring to drill and practice, tutorial, or simulation activities (Cotton, 2001). Computer-managed instruction (CMI) refers either to the use of computers by school staff to organize data and make instructional decisions or to provide activities in which the computer evaluates students' test performance, guides them to appropriate instructional resources and keeps records of their progress (Cotton, 2001). Computer-enriched instruction (CEI) is defined as learning activities in which computers generate data at the students' request to illustrate relationships, execute programs developed by the students or to provide general enrichment in relatively unstructured exercises designed to stimulate and motivate student learning (Cotton, 2001).

Traditional CAI.

CAI is a complex educational innovation that presents difficult issues for educators. Whether it is effective in school settings depends on how it is integrated with educational activities (MacArthur & Malouf, 1991). There are many ways to integrate computers into the traditional classroom (Brennan & Yantosh, 1996). Classroom management becomes very important in integrating computers successfully (Payton, 1998). Computer knowledge and skills learned in class to encourage peer tutoring is essential (Brennan & Yantosh, 1996). An appropriate time schedule is very important to ensure all students get equal access to classroom computers (Brennan & Yantosh, 1996).

A center's approach to teaching is one of the easiest ways to integrate computer time equally in a classroom (Payton, 1998). Heterogeneous grouping within a classroom may allow for peer tutoring and computer assistance for those who are not adept in computer skills (Payton, 1998). When using the computer with heterogeneous groups, be sure to use it as part of an already established lesson so the computer is only being used to

reinforce previously taught skills (Brennan & Yantosh, 1996). Good classroom discipline is also essential to integrate computer technology successfully (Payton, 1998).

Research has indicated that educator training is essential for CAI to be beneficial in the traditional classroom setting (Fitzgerald & Koury, 1996). Some educators felt that too much time was needed for instructing students to use certain computer programs effectively and that too much planning time was needed to make CAI effective in their classrooms (MacArthur & Malouf, 1991).

Specialized CAI.

Students with learning disabilities need special assistance in order for them to be successful in their education. Various forms of individualized instruction have been in practice for years and have shown some merit in helping students with learning disabilities gain basic skills (Zhang, 2000). The computer revolution was expected to help American schools to teach students with disabilities more effectively and reduce education inequalities (Kleifgen, 1989). However, it was found that classroom based CAI was often difficult for educators and as a result there has been an emergence of small group computer- assisted learning labs (Wise, 2000). To meet the special needs of individual students some schools opt to put computers in a small group setting so that some students can work individually and be monitored simultaneously (Zhang, 2000).

Research has shown that dramatic linguistic and academic improvements can be made when students are given access to problem solving, word processing and communications software (Kleifgen, 1989). This was one main reason why schools began to use CAI. When it was found that only limited success was available at the classroom level, an even greater push for small group instruction grew (Wise, 2000).

Because of the emergence of small group computer labs, many programs have been developed to target areas that children with learning disabilities encounter (Wise, 2000). Research on reading and math programs has been shown to be highly successful for student with learning disabilities (Fitzgerald & Koury, 1996). It has been noted that when students see their success in the small group setting they gain a higher sense of self-esteem that is carried over to other educational settings (Astleitner & Leutner, 2000). When students feel better about themselves they are more likely to take chances in other settings that will lead to more success, eventually they notice that the more chances they take the more successful they are (Astleitner & Leutner, 2000).

CAI and student achievement.

The single best-supported finding in research is that the use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained with traditional instruction alone (Cotton, 2001). An important consideration in an analysis of student achievement in relation to CAI is teacher training and preparation in the use of computers (Johnson, 2000). While both traditional and computer-based delivery systems have valuable roles to support instruction, they are of greatest values when complementing one another (Cotton, 2001).

The greatest achievement seems to be in the area of writing (Cotton, 2001). The word processing program has made poor writers superb writers (Johnson, 2000). Spell checkers and grammar checkers have helped reduce some students' fear of writing (Cotton, 2001). As long as the students are proficient in the use of computer programs they can turn almost any writing into a masterpiece (Johnson, 2000).

Fast ForWord

Fast ForWord is a series of seven computerized exercises that hierarchically train important components of auditory processing, memory, phonological analysis and grammar (Tallal & Rice, 1997). This training program is based on research to show that children with language-learning difficulty have trouble processing sounds fast enough to distinguish rapid acoustic changes in speech (Tallal & Rice, 1997). Fast ForWord alters the acoustics of speech so that children can understand using principles derived from neuroplasticity research, adaptively speeds up the rate of neural processing (Tallal & Rice, 1997). New remedial procedures may raise old fears that there is still a lot to learn about the origins and treatment of various types of learning impairments but in light of new data it is essential to give impaired children a chance to benefit from these new procedures (Tallal & Rice, 1997).

Targets of Fast ForWord.

Since the Fast ForWord program was introduced, it has shown remarkable success with many children who suffer from CAPD (Greenwald, 1999). This program focuses on the characteristics of CAPD that impair phoneme distinction which ultimately retards reading (Greenwald, 1999). The games in the Fast ForWord program attack these problems by training youngsters to distinguish among phonemes, first at artificially slowed speeds, then, at normal rates of speech (Greenwald, 1999).

There are 44 basic units of language called phonemes, in the English language (Turner & Pearson, 1999). These phonemes occur in different transitions and the brain has to distinguish these transitions to discriminate different phonemes (Turner & Pearson, 1999). Children with CAPD cannot detect these transitions, therefore, cannot distinguish

certain phonemes (Tallal & Rice, 1997). Research shows that approximately 8% of all children with language impairment display a significant developmental language impairment that is often accompanied by CAPD (Tallal & Rice, 1997).

According to Turner and Pearson (1999) children with language impairments, including CAPD, need longer neural processing time to process successive acoustic signals. Research in neuroplasticity also indicates that sensory maps in the cortex of the brain can be altered with training, and an intensive, daily training, focusing on neural processing speed resulted in gains in auditory processing rate (Tallal & Rice, 1997). Despite the claims that this research was not scientific, slowed speech is naturally easier to perceive when more time is allowed for the phonetic representations (Turner & Pearson, 1999).

Fast ForWord remediation.

The Fast ForWord program is a computer-assisted training program with seven exercises that focus on temporal integration rate, attention, serial memory, phonological identification and discrimination, language processing and grammatical understanding (Tallal & Rice, 1997). Children in training must dedicate 100 minutes per day 5 days a week for up to 10 weeks according to McCormick (1998). Each child's progress is monitored and adapted daily via an Internet connection to experts in language impairments and the Fast ForWord program at Berkley University (Turner & Pearson, 1998). These experts screen each child's daily sessions for any difficulties or successes and adapt the follow-up sessions accordingly (McCormick, 1998). According to McCormick (1998), the interaction between the computer and learner keeps this program on the cutting edge of technology.

Children who receive the remediation of this program typically go to a small room where only Fast ForWord sessions are being held (Friel-Patti, DesBarres & Thibodeau, 2001). Learners use headphones and work one on one with a computer that records their individual progress (McCormick, 1998). At the end of each session all responses are then forwarded to an expert at Berkley where they are analyzed and used to select a following day's session (Tallal & Rice, 1997).

There are seven exercises in the Fast ForWord program that build upon skills as they are learned (Friel-Patti, 2001). For example an exercised called Circus Sequence focuses on discrimination and sequencing of tones, and another called Old McDonald's Flying Farm focuses on distinguishing phonemes in consonant vowel syllables. Others include: Phoneme Identification, focusing on discrimination between single phoneme contrasts in syllables; Phonic Words, focusing on discrimination and identification of words differing by initial or final consonant; Phonic Match focusing on matching syllables and words that vary by initial or final consonant; Block Commander focusing on increasing listening comprehension and attention by following increasingly complex commands; Language Comprehension Builder focusing on making grammatical distinctions within sentence context (Friel-Patti, 2001).

Student achievement using Fast ForWord.

It has been found that although the Fast ForWord program is not for every student, those who dedicate themselves have been moderately successful (Friel-Patti, 2001). Some researchers have found that these students may have achieved similar success with other programs if the same type of strict regimen was adhered to (Marler, Champlin & Gillam, 2001).

Some recent research has shown that even if students do not test out of the Fast ForWord program in the given parameters they still achieve moderate success and show gains in most scores (Friel-Patti, 2001). Studies have shown that participants in the Fast ForWord program have increased 2 or more standard deviations in scores over a five to ten week's period of training (Turner & Pearson, 1999).

Studies have also shown that students who are on medication for such disorders as ADD may not be as successful as others because they cannot concentrate on the program without medication (Turner & Pearson, 1999). This was found to be consistent in most studies and indicated that the intensity of the program could not fit well for children with attention disorders (McCormick, 1998). A screening procedure is recommended to select children who are to be enrolled in the program (Friel-Patti, 2001). To date, there is limited research on the effect of the Fast ForWord program, and the benefit of this program has not yet been decided.

Teaching the Fast ForWord sessions.

Even though the students spend most of their 100 minutes of a Fast ForWord session working on a computer, the program instructor is carefully selected and trained (Turner & Pearson, 1998). Because of the potential for misuse of the Fast ForWord program, professionals are required to attend a certification program (Earle, 1998). The training program focuses on an overview of the research related to the program and the technical aspects including Internet reporting on daily sessions. The training also requires that instructors pass an examination to ensure full understanding of the program (Earle, 1998).

To be eligible for the certification program instructors are required to have a background and experience in the following: understanding of auditory temporal

processing, engagement techniques and behavioral motivation for children, human/computer interaction issues and techniques and expertise in using computers (Earle, 1998). It has been found that most Fast ForWord instructors are speech therapists, psychologists or special education teachers (Turner & Pearson, 1998). The extensive training and experience requirements show the importance of the instructor and their integral role in the success of the program (Earle, 1998).

Another impact on the success of the program is the environment and the instructor's amount of interaction with learners (Tallal & Rice, 1997). Greater gains were found in settings where the instructor was solely responsible for the Fast ForWord program (Tallal & Rice, 1997). Children who were using the program in a regular classroom setting where other teaching activities were being presented, had problems showing gains despite devoting the same amount of time (Earle, 1998). This evidence shows that the instructor in the Fast ForWord program is as important as the computer itself (McCormick, 1998).

Summary

The review of literature shows that children with CAPD are severely behind their peers in the areas of reading and language. It is also shown that students with CAPD have a harder time of learning in the same environment and in the same timeliness as their non-disabled peers. In a proper setting, computer-assisted instruction can be beneficial when it is implemented for certain students. It is also found that certain computer programs work better for certain students. The Fast ForWord program has shown to be a possible remediation for children with CAPD. This program provides students particular instruction using a computer, in a particular setting better suited for them, to improve their language and reading skills. Because this program is new, there are few studies to

examine its effects on student learning, especially those with CAPD. This present study attempts to investigate individual student's learning using the Fast ForWord program. It tries to explore information on student achievement in reading and language to find ways to help children with CAPD.

Chapter 3

Method

Participants

Two 5th grade students were selected to participate in this study. They are 12 year-old boys classified as multiply disabled with learning and emotional disorders according to the state's administrative code (2000). Both students have a significant deficit in reading. Student one is on a pre-primer reading level. Student two is on a second grade reading level.

The boys used the Fast ForWord program under the direction of the schools Fast ForWord instructor. The instructor is a trained reading specialist who spends half his day in the Fast ForWord computer lab. He administered the reading tests. The speech-language specialist administered the language tests. (See Table 1)

Table 1

Participants

Student	Age	Grade	Years in Special Education
Student 1	12	5th	5
Student 2	12	5th	4
Instructor	**Area of Specialization**		**Testing or Instructing**
Instructor 1	Reading Specialist		Both
Instructor 2	Speech/Language Specialist		Testing

Research Design

A single subject design with baseline and intervention phases was used in this study. The instructor of the Fast ForWord program was assigned based on his high level of training and research into the Fast ForWord program. The Fast ForWord instructor administered the reading test and the Speech/Language specialist administered the language test. The experiment was conducted over a 5-week period and the Fast ForWord reading specialist provided instruction.

Instructional Materials

Both participants used the Fast ForWord Reading program, delivered via the Internet, from Berkley University in California, on an iMac computer. The Syvarolli Informal Reading Inventory (1997) was given by the reading specialist/Fast ForWord program instructor. The Clinical Evaluation of Language Fundamentals (CELF, 1995) was provided by the speech/language therapist.

Measurement

The first measurement instrument was the seven exercises in the Fast ForWord program focusing on specific skills. These skills include discrimination and sequencing of tones, distinguishing vowel phonemes, consonant phoneme identification, initial and final sound discrimination, sound matching, listening comprehension and complex commands, and grammatical distinction within context. The data from these exercises was recorded and graphed at Berkley University. The second measurement instrument was an interview of students in this study and teachers involved with these students to assess student and teacher satisfaction with the Fast ForWord program.

Procedures

The Syvarolli Informal Reading Inventory and the CELF were given to both students prior to instruction. These test scores were used to determine a baseline. The students went to a Fast ForWord lab for 100 minutes a day, 5 days a week for 5 weeks. The interactiveness of the program requires daily correspondence with experts at Berkley University where all program modifications are made and all gains are recorded. Session data was recorded and adapted daily by Berkley University through an online connection. Individual reports, sent from Berkley, show student gains in each of the seven target skills which include: discrimination and sequencing of tones, distinguishing vowel phonemes, consonant phoneme identification, initial and final sound discrimination, sound matching, listening comprehension and complex commands, and grammatical distinctions within context. A student is only allowed to go on to the next target skill once that he has mastered a previous target skill. Some overlapping of previous skills are taught for skill maintenance. At the end of the 5-week period all student data collected by Berkley was graphed and sent back to the Fast ForWord lab to be printed out. The data collected for each skill was compared to the baseline.

Reliability

Measurement reliability.

There were two testing measurements used in this study. The reading test, the Syvarolli, was an informal inventory. This is a series of reading passages or word lists graded in an order of difficulty. Because this is not a standardized test there is no reliability data. The language test, CELF, has internal consistency. It also has test-retest and inter-rater reliability coefficient of 0.96 (Semel, Wiig & Secord, 1995).

Procedure reliability.

The Fast ForWord instructor used 100 minutes each day for 5 days each week, with a total of 5 weeks to teach each participating student in the lab. All results of tests, both by the Fast ForWord instructor and Speech/language specialist are checks upon each other. In addition to test scores there is also a set of data that has been recorded at Berkley University.

Chapter 4

Results

Skill Achievement

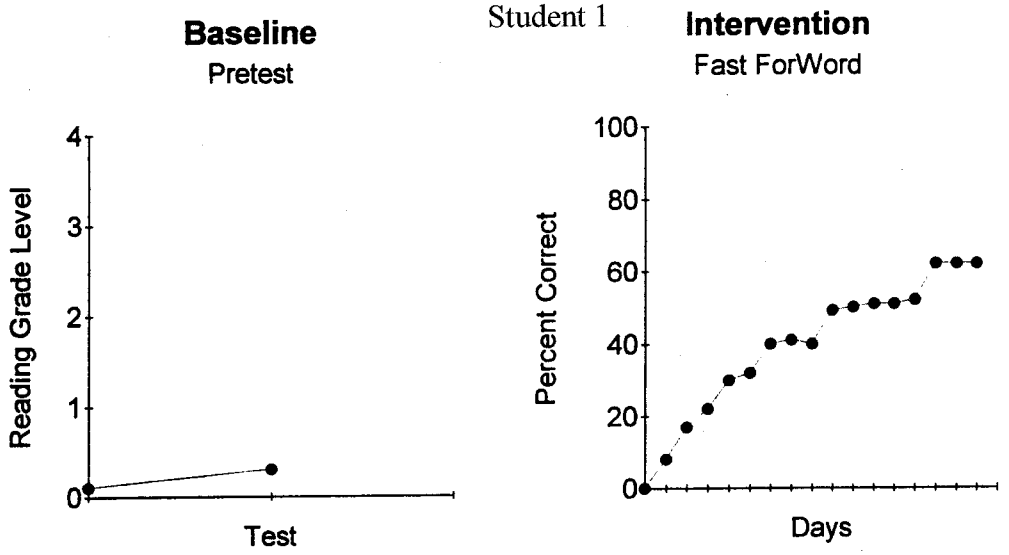
Pretests were conducted two times during the three weeks prior to the introduction of Fast ForWord program. The intervention phase was taught in 17 days. Each student's progress was recorded daily at Berkley University. This progress was calculated and graphed from the Fast ForWord program and was compared to the student's baseline data on pretests.

The Fast ForWord program has seven exercises, each targeting one of seven different reading or language skills. The first exercise is called the Circus Sequence and targets the student's ability to discriminate and sequence tones (See Table 2). The second exercise is called Phoneme Identification and targets the student's ability to distinguish vowel phonemes (See Table 3). The third exercise is called Old MacDonald's Flying Farm and targets the student's ability to identify consonant phonemes (See Table 4). The fourth exercise is called Phonic Words and targets the student's ability to discriminate initial and final sounds (See Table 5). The fifth exercise is called Phonic Match and targets the student's ability to match sounds (See Table 6). The sixth exercise is called Block Commander and targets the student's ability of listening comprehension and follow complex commands (See Table 7). The seventh and final exercise is called Comprehension Builder and targets the student's ability of grammatical distinction in text (See Table 8).

Table 2

Student Performance in Circus Sequence/ Discriminating and Sequencing Tones

Student 1



Student 2

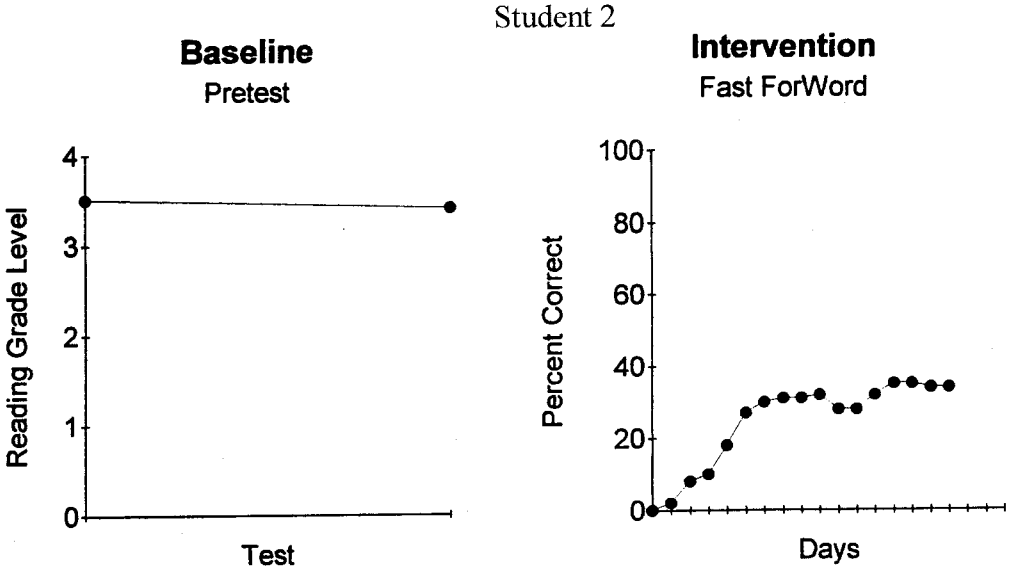
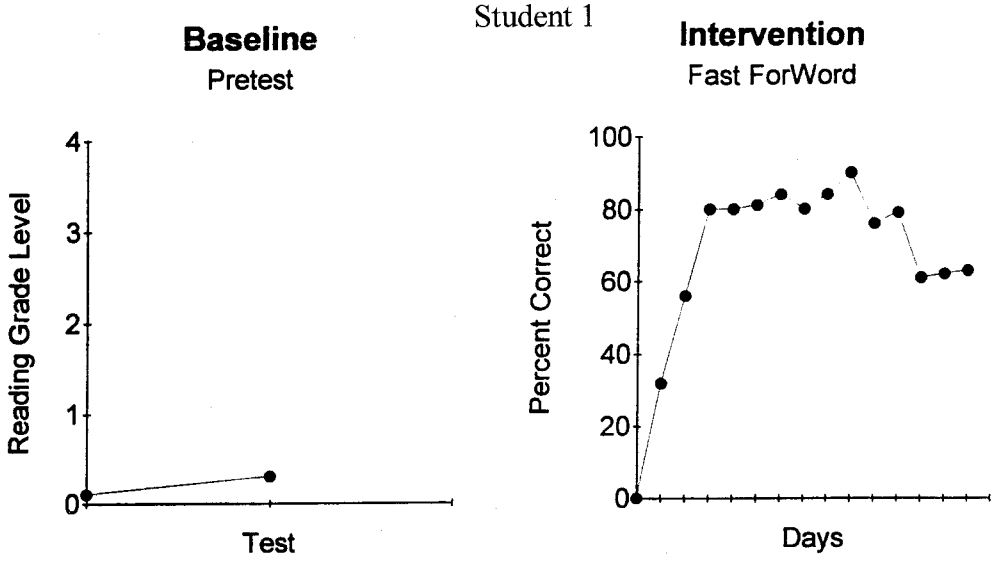


Table 3

Student Performance in Phoneme Identification/Distinguishing Vowel Phonemes

Student 1



Student 2

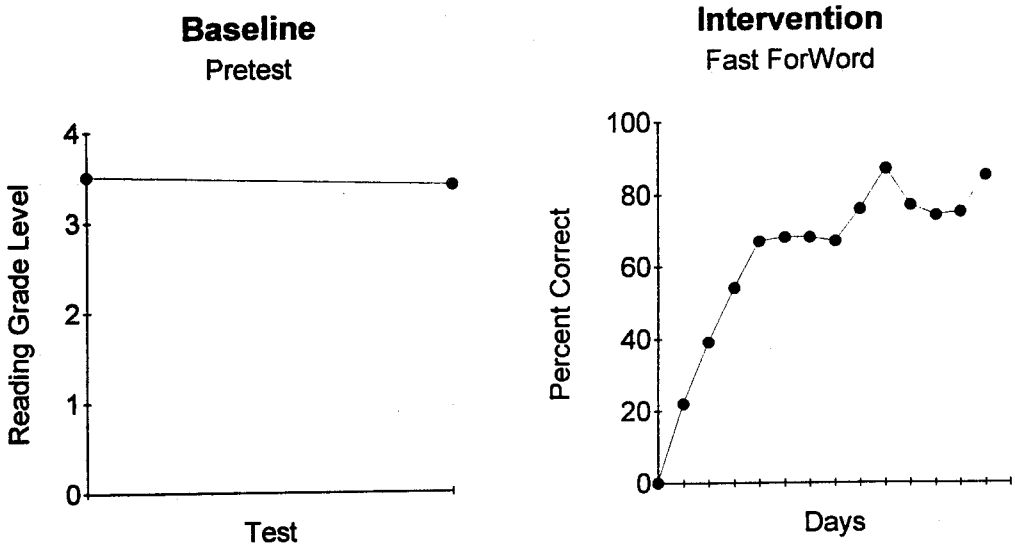
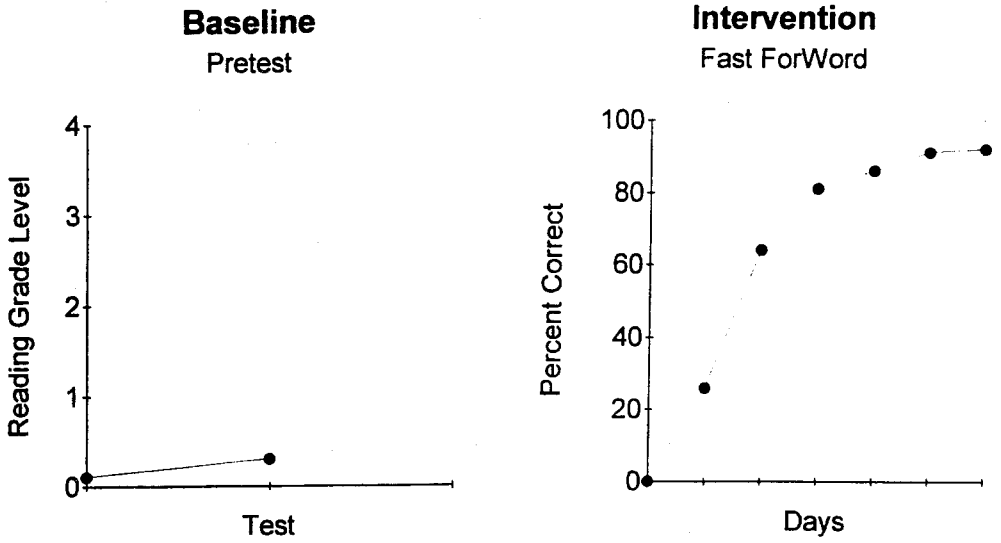


Table 4

Student Performance in Old MacDonald's Flying Farm/Identifying Consonant Phonemes

Student 1



Student 2

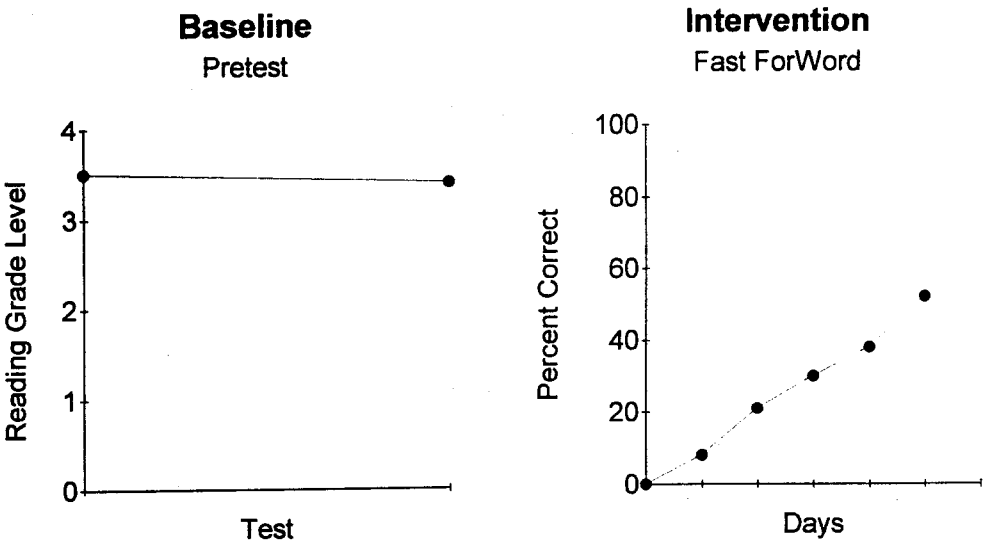
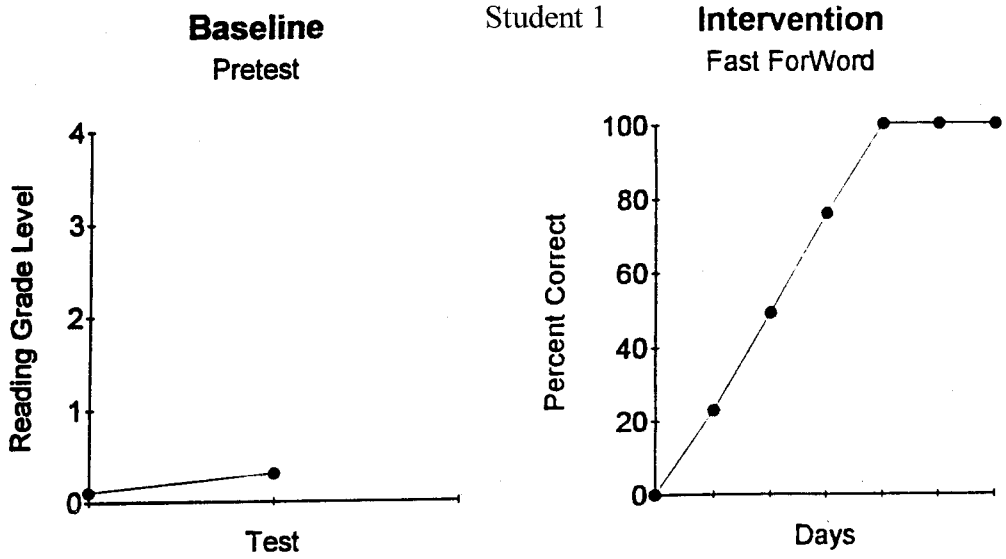


Table 5

Student Performance in Phonic Words/Discriminating Initial and Final Sounds

Student 1



Student 2

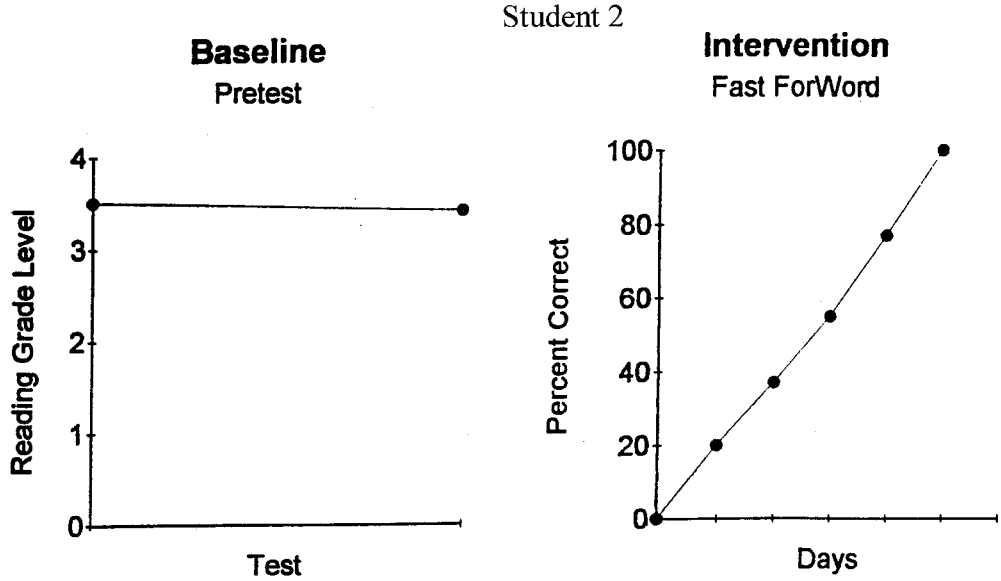
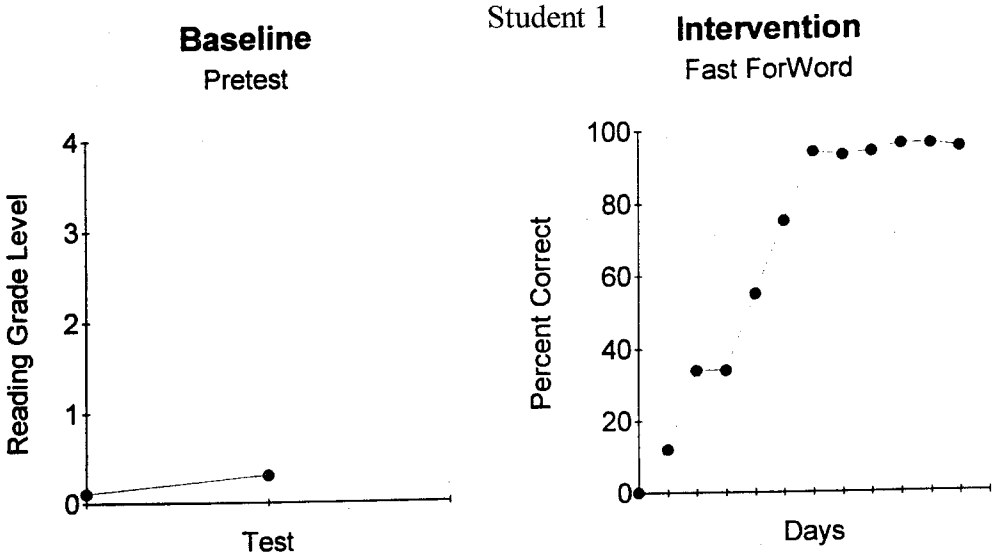


Table 6

Student Performance in Phonic Match/Sound Matching

Student 1



Student 2

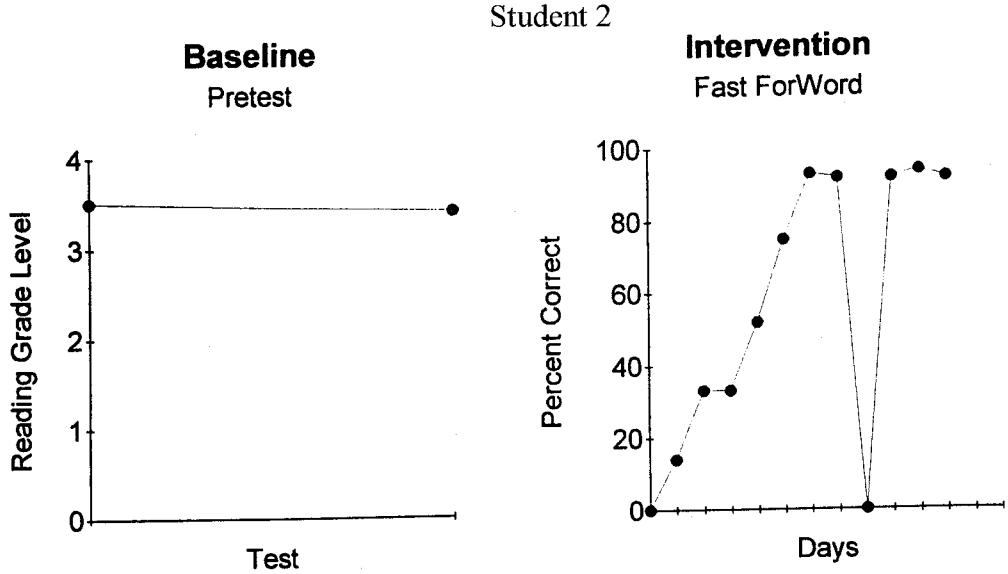
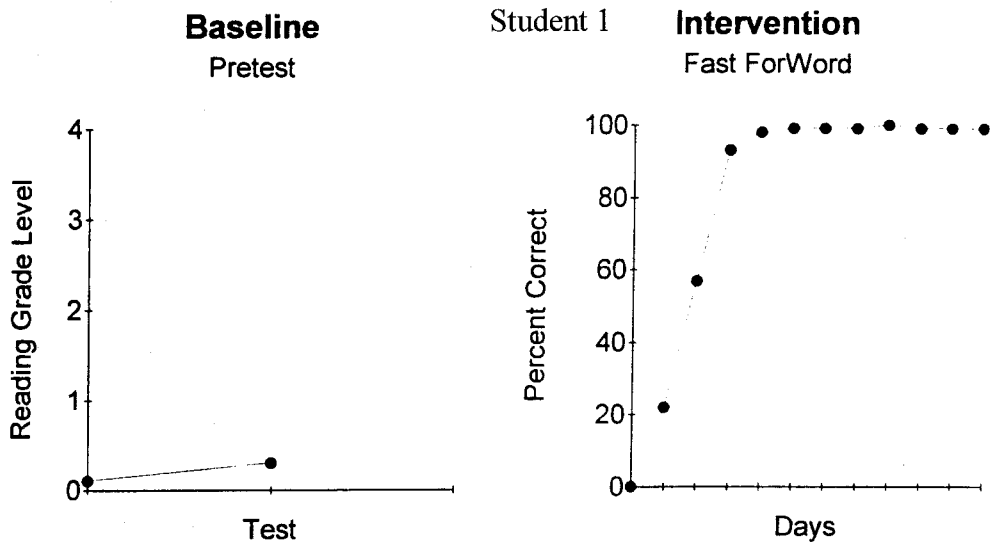


Table 7

Student Performance in Block Commander/Listening Comprehension and Complex Commands

Student 1



Student 2

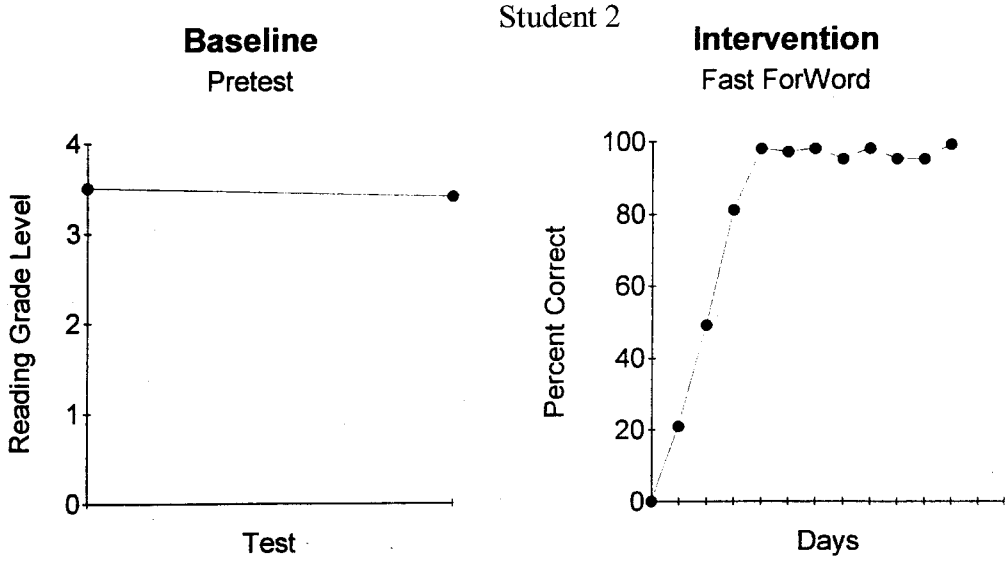
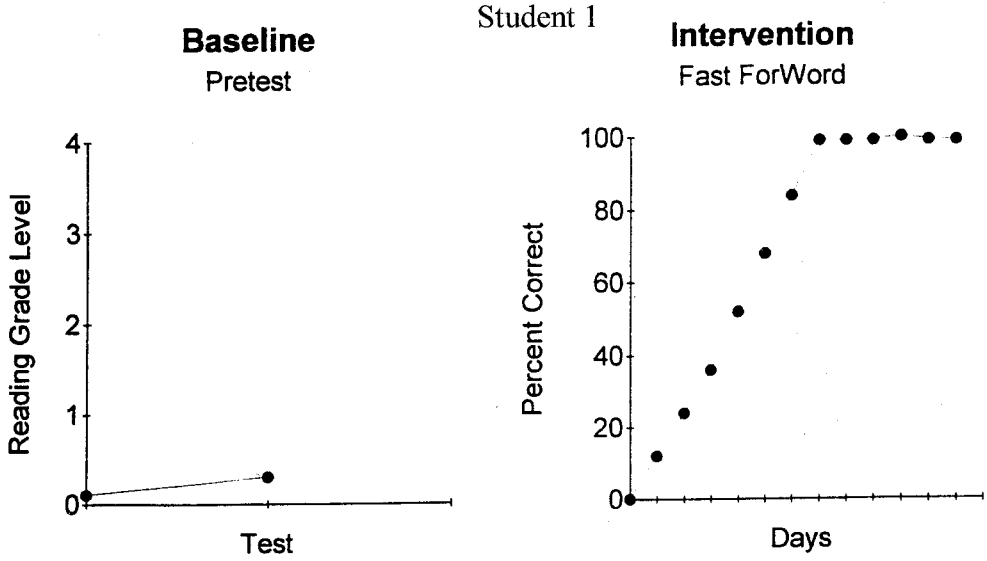


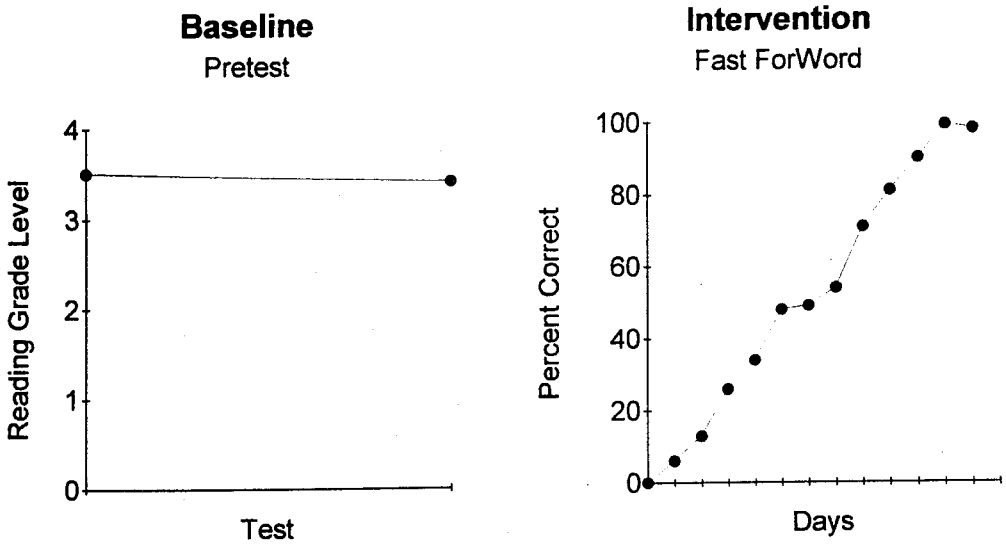
Table 8

Student Performance in Comprehension Builder/Grammatical Distinction within Text

Student 1



Student 2



Interview Results

Both students and the Fast ForWord instructor were interviewed to assess satisfaction with the Fast ForWord program. Each was interviewed individually and asked a series of questions by the researcher (See Figure 1).

When asked if they enjoyed coming to the Fast ForWord sessions both students replied that they did. Student 1 stated "This is one of my best classes." When asked if they felt they were getting better at Fast ForWord with each session both felt they were. When asked if they thought that Fast ForWord was helping them read better student 1 said, "Yes", student 2 said, " a little". Both students responded the same, "A little", when asked if they felt the rest of their schoolwork was easier to read since starting the Fast ForWord program. When asked if they thought they were volunteering more in class since they started Fast ForWord, Student 1 said he was. Student 2 replied, "I don't know." Both students admitted when asked if they had a chance to go back in time that they would still want to be in the Fast ForWord program.

The Fast ForWord instructor was asked how he felt the children were responding to the Fast ForWord program. He said, "I think they really enjoy coming here. Sometimes when I see my students in the hall they will ask if they can come with me and do Fast ForWord. I think they (the students) feel safe here because they all have the same reading difficulty." The Fast ForWord instructor was quick to say, "Definitely", when asked if the students are performing better with every session they attend. When asked if he ever had behavior problems with the students during Fast ForWord sessions the instructor responded, "Not really. Sometimes I have to keep a student on task, remind them not to waste time. But overall I really think the kids enjoy coming here (the Fast

ForWord lab). In fact, the students even compete among each other to see who is getting more correct responses. I feel this keeps the students motivated to try harder to do better." When asked what response he was getting from other teachers about the Fast ForWord program the Fast ForWord instructor replied, "I have had at least 2 teachers come to me saying "I was so surprised, this child never volunteers, now all of a sudden he always raises his hand." Even though the kids may not realize it, they really are performing better in other classes from what they are getting in here (Fast ForWord lab). Teachers, so far, seem to be impressed with student progress with Fast ForWord, I just hope they retain the knowledge after they leave the program. Since this is only the first year, I am anxious to see where the kids are academically next year."

Figure 1

Interview Protocol

Student interview questions

1. Do you enjoy coming to Fast ForWord?
2. Do you feel that you are getting better at Fast ForWord each class?
3. Do you feel that Fast ForWord is helping you to read better?
4. Do you find it easier to read the rest of your schoolwork since you have started Fast ForWord?
5. Do you think you are volunteering more in your classes since you have started Fast ForWord?
6. If you had a chance to go back in time, would you still want to be in the Fast ForWord program?

Fast ForWord Instructor interview questions

1. How do you feel the students are responding to the Fast ForWord program?
2. Are the students performing better with each Fast ForWord session?
3. Do you have the same behavior problems as in other classrooms?
4. What response are you getting from other teachers about the Fast ForWord program?

Chapter 5

Discussion

Skill Achievement

The purpose of the study was to examine the effect of the Fast ForWord program for students with CAPD to increase their reading and language scores. The data showed that both students gained reading and language scores when using the Fast ForWord program. The two students' performance showed an accelerated increase of the percentage of correct answers in the intervention phase. In the area of discriminating and sequencing phonemes only a slight increase was shown. Because the data was collected during the students' first skill of the Fast ForWord program, it seemed that as the students learned more in the program they could become more adept with it and gain more. In the area of distinguishing vowel phonemes both students made accelerated gains during the first 5 days of the program, then their scores seemed to vary on different days. In the area of identifying consonant phonemes both students made accelerated gains. In the area of discriminating initial and final sounds, both of their gains accelerated to 100 percent correct responses by the 5th day of the intervention. In the area of sound matching, listening comprehension, complex commands and grammatical distinction within text both students had accelerated gains that remained stable at approximately 98 percent from the 7th day. Both students seemed to make the same amount of reading and language gains during their 5-week session.

Interview

The information collected from an interview of participating students and the Fast ForWord instructor showed an overall positive feeling towards the program.

Student responses.

When the students were asked if they enjoyed coming to the Fast ForWord session student 1 stated, "This is one of my best classes." Student 2 thought some of the computer games were a little too babyish for a 5th grader. Even though student 2 felt the exercises were too babyish, he still made an accelerated increase on his test scores. This shows that the Fast ForWord program has assisted him. When the students were asked if they felt that they were getting better at the Fast ForWord program each class both provided a positive response. When the students were asked if they felt the Fast ForWord program was helping them to read better and to understand their schoolwork better both thought it was. When the students were asked if they thought that they were volunteering more, student 1 felt he was volunteering more while student 2 wasn't sure. When the students were asked if they could go back in time they would still want to be in Fast ForWord program, both stated they would. These responses, although not all forthcoming, show their positive feelings towards the Fast ForWord program.

Instructor responses.

When the Fast ForWord instructor was asked how the students were responding to the program he felt that most of the students really enjoyed it. Some students even ask him if they can come to work on the Fast ForWord program later in the day rather than other class activities. This shows that the students would rather be in an environment where they can be successful. When asked if the students were performing better with each Fast

ForWord session the instructor felt they were doing remarkably better at each session. The Fast ForWord instructor did not find any behavior problems during the instructional sessions, only that he may have to redirect a student to ensure the time spent for the program was appropriate. Some classroom teachers have commented to him how they feel the program is having a positive influence on self-confidence of students. The teachers also told him how students in the Fast ForWord program seem to be more active participants in other classes since starting the program. These responses show that not only is the Fast ForWord program improving reading and language skills but it is also improving students' learning attitudes and motivation. It appears that students understand the materials better and are motivated to be involved in class participation. Being able to participate in other classes where they once had difficulty will also improve student self-esteem.

General Discussion

Overall, the data seemed to support the research (Friel-Patti, 2001) previously discussed on the Fast ForWord program. Students that participated in the Fast ForWord program increased their scores in reading and language. In this present study, students with CAPD gained scores when they were taught to use the program. Because of the time, there was no chance to obtain follow-up data for student retention. It would be interesting to follow these students next year to see if they maintain the skills after the program is completed.

Even though this study had positive results it also had some limitations. First, the data for this research was incomplete. The Fast ForWord program runs for 25 days as a total training session. Both of the participating students were only present for 17 of the 25

days due to their absences. Second, the study has a small size of only 2 participating students. It would have been valuable to have more students participate and to compare data of 5 or 6 students. Finally, the baseline data may need to collect more test scores to keep stable. There were only 2 scores in the study. An ongoing assessment may need to be provided during the baseline.

In conclusion, the Fast ForWord program seemed to be an appropriate instructional method for students who have CAPD. Both students in this study had increased scores in reading and language as a result of participating in the program. Not only did the students show increased scores but they also seemed pleased with the program. The Fast ForWord instructor felt he was getting positive responses from both the students and faculty regarding the students' success both in the program and in class overall.

References

Astleitner, H., & Leutner, D. (2000). Designing instructional technology from an emotional perspective. *Journal of Research on Computing in Education, 32-4,* 497-511.

Belanger, E. (2000). Laptop computers in the K-12 classroom. *ERIC Clearinghouse On Information and Technology.* (ED440644).

Brennan, C. & Yantosh, J. (1996). Hoop happenings. *Tales from the Electronic Frontier.* 36-40.

Burleigh, J., Ph.D. (1997). Central Auditory Processing Disorder. *Center for Auditory Research.* Retrieved January 29, 2002, from http://www.engr.colostate.edu/ece/Research/cad/caplynx

Cacace, A.T., & McFarland, D.J. (1998). Central Auditory Processing Disorder in school-aged children. *Journal of Speech, Language, and Hearing Research, 41,* 355-373.

Cotton, C. (2001). Computer-assisted instruction. *NW Regional Educational Laboratory, School Improvement Research Series.* Retrieved March 12, 2002 from http://www.nwrel.org/scpd/sirs/5/cu10

Dagenais, P.A., Cox, M., Southwood, M.H., & Smith, S. (1997). Vocal reaction times of children with CAPD, age matched peers, and young adults to printed words. *Journal of Speech, Language, and Hearing Research, 40,* 694-703.

Earle, J. (1998). Fast ForWord: Is the hype justified? *Tech-NJ, 9-1.* Retrieved January 23, 2002 from http://www.tcjn.edu/~technj/win98/earle

Fitzgerald, G.E., & Koury, K.A. (1996). Empirical advances in technology assisted instruction for students with mild and moderate disabilities. *Journal of Research on Computing in Education, 28-4,* 526-554.

Friel-Patti, S., DesBarres, K. & Thibodeau, L. (2001). Case studies of children using Fast ForWord. *American Journal of Speech-Language Pathology, 10-3,* 203-216.

Gillam, R.B., Loeb, D.F., & Friel-Patti, S. (2001). Looking back: A summary of five exploratory studies of Fast ForWord. *American Journal of Speech-Language Pathology, 10-3,* 2-7.

Greenwald, J. (1999). Retraing your brain. *Time, 153-26,* 22-24.

Hutchinson, K. M., & Mauer, D.M. (1999). Targeting academic success: An interdisciplinary assessment program for children with central auditory processing deficits. *Volta Review, 100-4,* 235-260.

Johnson, K., Ph.D. (2000) Do computers in the classroom boost academic achievement? *The Heritage Foundation, 00-08.* Retrieved on March 12, 2002 from http://www.heritage.org/library/cda/cda00-08

Kleifgen, J. (1989). Computers and opportunities for literacy development. *ERIC/CUE Digest, 54,* ED311120.

Konde, S. (2001) Central Auditory Processing Disorder. *Kids Health,* Retrieved on January 29, 2002 from http://www.kidshealth.org/pagemanager.jsp?dn

Loeb, D.F., Stoke, C., & Fey, M.E. (2001). Language changes associated with Fast Forword-language: Evidence from case studies. *American Journal of Speech-Language Pathology, 10-3,* 216-229.

MacArthur, C.A. & Malouf, D.B. (1991). Teachers' beliefs, plans, and decisions about computer-based instruction. *Journal of Special Education, 25-1*, 44-73.

Marler, J.A., Champlin, C.A., & Gillam, R.B. (2001) Backward and simultaneous masking measured in children with language-learning impairments who received intervention with Fast ForWord or Laureate Learning Systems software. *American Journal of Speech-Language Pathology, 10-3,* 28-37.

McCormick, A. (1998). Dyslexia. *Curriculum Quarterly, 7-2,* Retrieved on November 3, 2001 from http://www.ascd.org/readingroom/ctq/vol07/1spring

Payton, T. (1998) Integrating technology in the elementary classroom. *ICE,* Retrieved on March 12, 2002 from http://www.siec.k12.in.us/~west/article/integrate

Semel, E., Ed.D, Wiig, E.H., Ph.D., & Secord, W.A., Ph.D. (1995) Clinical Evaluations of Language Fundamentals 3. *The Psychological Corporation, San Antonio TX.*

Smith, F. (1999). When irresistible technology meets irreplaceable teachers. *Language Arts, 76-5,* 414-421.

Tallal, P. & Rice, M. (1997). Evaluating new training programs for language impariments. *ASHA, 39-3,* 12-14.

Turner, S. & Pearson, D.W. (1999). Fast ForWord language intervention program: Four case studies. *Journal of Auditory and Speech Pathology, 13,* Retrieved on January 22, 2002 from http://www.scilearn.com/scie/index

Wise, B.W., Ring, J. & Olson, R.K. (2000). Individual differences in gains from computer-assisted remedial reading. *Journal of Experimental Child Psychology, 77-3,* 197-235.

Zhang, Y. (2000). Technology and the writing skills of students with learning disabilities. *Journal of Research on Computing in Education, 32-4,* 467-479.