Is There a Relationship Between the Play Attention Program and Improved Student Achievement?

Jenny Ann Webber

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IS THERE A RELATIONSHIP BETWEEN THE PLAY ATTENTION PROGRAM AND IMPROVED STUDENT ACHIEVEMENT?

by

Jenny Ann Webber

Abstract of a Dissertation Submitted to the Graduate School of the University of Southern Mississippi in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

August 2011
ABSTRACT

IS THERE A RELATIONSHIP BETWEEN THE PLAY ATTENTION PROGRAM AND IMPROVED STUDENT ACHIEVEMENT?

by Jenny Ann Webber

August 2011

Attention Deficit/Hyperactivity Disorder (ADHD) and its effects on student academic achievement have been researched for many years. There have been many interventions that have been used in treating ADHD that have been found successful when implemented consistently. Some of the interventions that have been researched in the past are behavior modification, pharmacotherapy with stimulants, educational interventions, and a combination of these. Play Attention is an intervention that incorporates aspects of behavior modification through computerized cognitive-training, which utilizes feedback-based technology. Through Play Attention, students wear a helmet or armband embedded with sensors. These sensors read students’ brain activity in order to monitor their levels of focus. It helps students develop skills in attention stamina, short-term memory, hand-eye coordination, discriminatory processing, and time on task, thereby altering their inattentive behavior. Play Attention allows students to create their own knowledge and meaning of inattentiveness by making inattention visible through the different games of the program, thereby allowing students to improve on these weak skills. This new knowledge is analyzed through a journal that students complete after each session of play.
Furthermore, it allows students to work in their own zone of proximal development by differentiating the games and levels that are controlled by a coach who works with students during game play.

This study did not show significant results in the use of *Play Attention* to help students with ADHD increase their academic achievement. Although there were some interesting results in terms of achievement on gender that were unexpected, these results were not significant in terms of boys being affected more than girls in increased achievement. The limitation of time hindered the analysis of the results of this study, and further research would need to be conducted during a longer time period to understand if this program can give significant results.
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Jenny Ann Webber

A Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

Approved:

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August 2011
DEDICATION

First and foremost, I dedicate this dissertation to my husband, Christopher Daniel Webber. Without his loving support and encouragement throughout this process, I would have never made it. Next, I want to dedicate it to my daughter, Genevieve Webber, who I hope will grow up into an intelligent, strong, and independent woman. Also, I would like to dedicate this to my parents, Don and Judy Gavin; my late grandparents, Ray and Genevieve Warthen; and to my grandmother Mrs. Leila Hebert, who have always instilled in me the importance of a good education. I could not have completed this process without your love and support. Finally, I would like to dedicate this dissertation to all my colleagues and administrators of the Long Beach School District. You have always supported me and encouraged me throughout my years of teaching. You all made me feel like I could accomplish anything I set my mind to. Thank you all!
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# TABLE OF CONTENTS

ABSTRACT...........................................................................................................ii  
DEDICATION........................................................................................................iv  
ACKNOWLEDGMENTS..............................................................................................v  
LIST OF TABLES.....................................................................................................viii  
LIST OF ILLUSTRATIONS.......................................................................................ix  

CHAPTER

I. INTRODUCTION......................................................................................................1  
   Setting  
   Statement of the Problem  
   Purpose of the Study  
   Research Questions and Hypotheses  
   Definition of Terms  
   Delimitations  
   Assumptions  
   Justification  
   Summary  

II. REVIEW OF RELATED LITERATURE...............................................................8  
   Introduction  
   Theoretical Framework  
   School Accreditation  
   Differentiated Instruction  
   Attention Deficit/Hyperactivity Disorder  
   Academic Achievement  
   ADHD Interventions  
   Play Attention  
   Summary  

III. METHODOLOGY................................................................................................42  
   Introduction  
   Research Design  
   Participants
Procedures
Data Analysis
Summary

IV. DATA ANALYSIS ................................................................. 51

Introduction
Data
Summary

V. SUMMARY, DISCUSSION, CONCLUSIONS, AND
RECOMMENDATIONS ......................................................... 61

Introduction
Overview
Conclusions
Discussion
Limitations
Recommendations for Policy and Practice
Recommendations for Future Research
Summary

APPENDIXES ........................................................................... 75

REFERENCES ........................................................................... 86
LIST OF TABLES

Table

1. Reading Pretest/Post-Test Scores .................................................................52
2. Math Pretest/Post-Test Scores .................................................................53
3. Reading Pretest/Post-Test Scores by Gender ...........................................53
4. Math Pretest/Post-Test Scores by Gender .................................................54
5. Amount of Fidgets at Beginning and End of Intervention .........................57
6. Perceptions Survey Results .................................................................58
LIST OF ILLUSTRATIONS

Figure

1. Reading Achievement .................................................................55
2. Math Achievement ...........................................................................56
3. Sample Behavior Graph from Play Attention Program...................56
4. Behavior Graph from Play Attention Program...............................62
CHAPTER I

INTRODUCTION

Constructivist theory suggests that learners create or reform their own knowledge through their experiences and interactions in the world. It also suggest that learners are more motivated when they are being challenged, not frustrated. To ensure all children are being effectively challenged, the U.S. government passed the No Child Left Behind Act in 2001. It has provided a system of accountability, which has improved student achievement. However, it has also contributed to homogeneous groups in classrooms with students at heterogeneous ability levels and teachers who feel frustrated. Some of the students in the classes also have disabilities, such as ADHD, that may not be addressed in these classrooms due to time constraints and pressure arising from high-stakes testing. Differentiated instruction allows for general education teachers to meet the needs of all these students while at the same time accommodating the learning needs of students with ADHD through classroom interventions.

ADHD is a specific disability to address in the classroom because its symptoms (inattentiveness, impulsivity, and hyperactivity) affect a variety of students through social, behavioral, and academic situations. Although these students’ academic achievement is lower than the academic achievement of students without ADHD, their intelligence levels are at a normal range. Therefore, if educators can implement effective interventions for these students, their academic achievement should increase. The most promising interventions for students with ADHD are pharmacotherapy, behavior therapy, peer tutoring, computer-assisted instruction, task and/or instructional modifications, self-monitoring, strategy training, functional assessment, and cognitive training. Furthermore,
research has shown that these interventions are most effective when used in conjunction
with each other, not singularly.

*Play Attention*, developed by a master teacher, is a computerized cognitive-
training program. It uses feedback-based technology to differentiate instruction by
analyzing brain activity and data from a coach working with students. Initial data from
research done by the company who distributes *Play Attention* states that their program
will help ADHD symptoms decrease and academic achievement increase.

**Setting**

This study took place in a 4th through 6th grade upper elementary on the
Mississippi Gulf Coast. Students participated in the *Play Attention* computer program in
the drop-in computer lab within the school in order to control distractibility levels during
the intervention. The goal was for students to complete between 30 and 40 hours of the
intervention.

**Statement of the Problem**

Research has shown that students with Attention Deficit/Hyperactivity Disorder
(ADHD) typically underachieve academically compared to their peers without ADHD.
With today’s educational accountability system described in No Child Left Behind
(2008), many classrooms have reverted to whole group instruction. This set back in
classroom pedagogy is due to the perception that differentiated instruction will take too
much time thereby not allowing all objectives to be taught despite the educational
knowledge that differentiation is best (Nowacek & Mamlin, 2007). Although many
interventions have been proven effective for students affected by ADHD, many teachers
do not incorporate these interventions into their classrooms. *Play Attention* is a
computer-based, cognitive training program. It was developed by a master teacher in
order to help students with ADHD learn to accommodate their disability through the
development of strategies to help them control their symptoms.

Purpose of the Study

The purpose of this study was to identify if *Play Attention* is a reliable and
efficient intervention strategy in schools for students with ADHD. It is hoped that Play
Attention will increase these students’ academic achievement in reading and/or math by
decreasing symptoms of ADHD. This decrease in symptoms will be due to the *Play
Attention* components, which incorporate aspects of behavior therapy, computer-assisted
instruction, self-monitoring, strategy training, and cognitive training.

Another purpose of the study was to identify teacher and administrator
perceptions on the effectiveness of the *Play Attention* system when it comes to symptom
improvement and academic gains.

Research Questions and Hypotheses

Research Questions

1. Did *Play Attention* reduce the symptoms of ADHD?

2. Did *Play Attention* increase academic achievement of ADHD students in reading
   and/or math compared to controls?

3. Was academic impact more significant for boys than girls due to the type of
   intervention (computer game format)?

4. Did the perceptions of the principal and teachers about *Play Attention* compare
   accurately to the efficacy of the program?

Statistical Hypotheses

1. *Play Attention* lessens the severity of ADHD symptoms.
2. *Play Attention* increases the academic achievement of ADHD students in reading and/or math compared to controls.

3. The academic impact was more significant for boys than girls due to the type of intervention (computer game format).

*Null Hypotheses*

1. There was no difference in the severity of ADHD symptoms after the *Play Attention* intervention.

2. There was no difference in the academic achievement of ADHD students in reading and/or math after the *Play Attention* intervention.

3. There was no significant difference in the academic impact in boys versus girls with *Play Attention* program.

*Definitions of Terms*

**Constructivist Theory** - a theory about knowledge, which argues that humans create their own knowledge and meaning from an interaction between their ideas and experiences.

**Play Attention** - a computerized cognitive-training program using feedback-based technology that helps students assimilate new skills specific to their ADHD symptomology into their everyday life so they may learn to control some of the symptoms of their disability.

Neurofeedback technology - helps users assimilate new skills specific to their ADHD symptomology into their everyday life so they may learn to control some of the symptoms of their disability using EEG readings to identify changes in brain waves.
Attention Deficit-Hyperactivity Disorder (ADHD) - a persistent pattern of inattention and/or hyperactivity-impulsivity that is displayed more frequently and is more severe than typically seen in peers.

Pharmacotherapy - the use of central nervous system stimulant medication to improve ADHD symptoms.

Behavior therapy - utilizes the manipulation of positive and negative consequences that are conditional on the child’s behavior.

Peer tutoring - two students are paired together, one being the tutee and the other being the tutor. They help each other in learning academic objectives through active response while providing each other with frequent and immediate feedback.

Computer-assisted instruction - utilizing the computer to present specific instructional objectives using multiple learning styles. It allows information to be presented in small chunks with repetition and provides immediate feedback.

Task or instructional modifications - the implementation of procedures that reduce task length, increasing time allotment for activities, increasing structure to activities, and delivering instruction through different avenues of learning styles.

Self-monitoring - goal setting for the completion and accuracy of classwork and on-task behavior.

Strategy training - teaching a specific skill in which students can implement on their own to improve their academic performance, i.e., note taking.

Cognitive training - trains the brain to increase a certain skill or to improve a weak area of the brain (i.e., attention and short-term memory).
Delimitations

Due to convenience sampling, this research study only focused on students affected by Attention Deficit/Hyperactivity Disorder. This is because *Play Attention* is a program specifically designed for people affected by this disability. Also, the sample for this study was in grades four through six from one upper elementary on the Mississippi Gulf Coast. This is because the researcher felt this study would be more pertinent if it was done in the school setting opposed to a clinic setting. Lastly, state practice tests were used to assess academic improvement. Since all states do not use the same state assessment at this time, it is not appropriate to compare assessment scores across states.

Assumptions

The biggest assumption made was that the *Play Attention* program was implemented accurately and effectively. The second assumption is that all responses on the administrator/teacher perception survey were completed honestly.

Justification

This study is important because, although teachers understand the symptomology of ADHD, interventions within schools for students affected by ADHD are minimal and inconsistent. If this study proved that *Play Attention* is effective, it will be a relatively inexpensive and efficient tool, which can be easily implemented in schools.

Summary

The *Play Attention* computer program combines research-based intervention strategies for students with ADHD in order to help them control the symptoms of their disability. Through this research study, the researcher hoped to identify if there was a relationship between Play Attention and increased academic achievement in an upper elementary school on the Mississippi Gulf Coast. Furthermore, the researcher hoped to
identify if this intervention is more helpful for boys versus girls. Lastly, the researcher
hoped to learn more about the perceptions of principals and teachers on the *Play
Attention* program.
CHAPTER II
REVIEW OF RELATED LITERATURE

Introduction

Discussed within this review of literature is the Theory of Constructivism, which describes how learners derive knowledge from their experience by assimilating that knowledge into what they already know or by accommodating their existing knowledge base to incorporate new knowledge. Also discussed are the new accreditation standards within the United States and how schools are ensuring that no child is left behind due to lack of identification of academic underachievement or learning disability.

The symptoms of ADHD are discussed along with educational implications and research-based interventions for this disorder such as medication, behavior therapy, peer tutoring, computer-assisted instruction, task and/or instructional modifications, self-monitoring, strategy training, functional assessment, and cognitive training. Finally, Play Attention, a computer program for children and adults with ADHD, is discussed along with the implications for its use for the purpose of increasing academic achievement of students with ADHD.

Theoretical Framework

The Constructivist Theory has been developed and popularized over many years by several historic contributors to the field of education: Jerome S. Bruner, Jean Piaget, L.S. Vygotsky, John Dewey, and Maria Montessori (Bruner, 1966; Dewey, 1910/1997; Montessori, 1948/2004; Vygotsky, 1978). It is a theory about knowledge, which argues that humans create their own knowledge and meaning from an interaction between their ideas and experiences. Jean Piaget (1950) published one of the leading theories of
constructivism. It had a long-range impact on learning theories and teaching methods within education and is the underlying theme of many educational reform movements.

The basic premise of constructivism is that learners, through two processes, internalize knowledge: accommodation and assimilation. Accommodation happens when the learner reforms his old ideas to fit new experiences. Assimilation is when the learner adds to his existing body of knowledge without changing his basic knowledge framework. Therefore, this theory suggests that learners construct knowledge out of their experiences. Maria Montessori encouraged teachers to become facilitators (i.e., consultants or coaches): people who help learners get to their own understanding of content. As a facilitator, the teacher’s goal is to support the learner in becoming an effective thinker (Montessori, 1948/2004).

Vygotsky (1978) described a person’s zone of proximal development, or the distance between their actual developmental level and the level of their potential development. Learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. By utilizing this zone, teachers can secure learners’ motivation and build on their previous successes to enhance their confidence. To ensure full engagement by the learner and to ensure the learner is being challenged, tasks and the learning environment should reflect the rigor and challenge of the environment they will be required to function in at the end of the learning process.

School Accreditation

The No Child Left Behind Act of 2001 (NCLB, 2008) changed U.S. education forever. At the center of this important legislation was the idea of helping ALL students achieve success in school, and schools were held accountable for their students’ progress (NCLB, 2008). The basics of this law are:
• All states must annually test students in grades 3-8 in language arts and math, and these tests must be aligned to state standards.

• Students must be tested once in elementary, middle, and high school in the area of science, and these tests must be aligned to state standards.

• By the school year 2013-2014, ALL students must test at the proficient level on state tests, and individual schools must make AYP toward this goal as a whole and for certain demographic subgroups.

• States must provide an annual report card showing student achievement data by subgroup and on individual school districts.

• Every core content teacher must be highly qualified in the subjects he/she teaches, and paraprofessionals hired with Title One money must have completed two years of college or passed a test demonstrating their knowledge and teaching ability.

NCLB (2008) also provides states with greater flexibility in how they spend some federal money as long as they can prove the need for that money and how it relates to state curriculum and school improvement.

How has NCLB affected schools? Many studies have shown that NCLB and its accountability system are important because it has had a positive impact on student achievement (Hanushek & Raymond, 2005). The reason behind this positive impact is the main reason schools feel so much pressure behind NCLB: consequences for underachievement. Furthermore, “many state and local officials have identified testing and accountability requirements for students with disabilities as troublesome” (Jennings & Rentner, 2006, p. 113). These students must take the same tests as their general education counterparts with minimal accommodations. The effect of these high standards of testing has been that many students with disabilities are mainstreamed into the general
education classroom, which has been proven effective for student achievement in all ability groups (George, 2005). However, these classrooms cannot be successful without differentiated curriculum.

With increased expectations resulting from high-stakes testing and accountability programs, teachers feel that individualized instruction is too time consuming (Nowacek & Mamlin, 2007). Tomlinson and Doubet (2005) agree that teachers are under constant pressure to prepare students for high stakes tests. In order to meet the needs of such a diverse group, these same heterogeneous classrooms are pressured by the amount of content to be covered while at the same time moving forward rapidly in the successful implementation of classroom strategies that provide differentiated curriculum, instruction, and assessment (George, 2005; Tomlinson & Doubet, 2005). Students, teachers, parents, and administrators are often left feeling frustrated with all these demands.

Many administrators are scurrying to find interventions that will help them meet the needs of all these students; however they must look at testing data to find out if these interventions are working. One strategy educators can use to help all their students be successful on homogeneous state assessments to a level of proficiency is by differentiating instruction. When teachers embed the required state curriculum into their instruction (which is differentiated), students feel they are being taught, not just having material covered (Tomlinson & Doubet, 2005).

Differentiated Instruction

One of the most troublesome issues facing today’s educators is the competing ideas of meeting accountability standards while at the same time addressing the individual needs and strengths of diverse learners (McTighe & Brown, 2005). Carol Ann
Tomlinson defines differentiation as a “pedagogical change in education to accommodate a wide range of students’ readiness levels, interests, and modes of learning” (Tomlinson, 2003, p. 6). Sondergeld and Schultz (2008, p. 35) define differentiation as “working to address the abilities, interests, and needs (both perceived and real) of individuals.” Differentiated instruction (DI) makes learning challenging for students and relevant for their world, and DI varies the pace, difficulty level, and type of instruction. DI provides a variety of ways for all students to feel affirmed, challenged, and successful despite limitations one might have: learning disability (including ADHD), behavior disability, gifted, etc. (George, 2005). Teachers must use many resources to teach everyone in their classrooms including: interventions for disabilities, multiple intelligences, learning styles, achievement scores, student attitudes, teacher assistants, resource/inclusion teachers, etc.

One of the important aspects of DI is feedback. Feedback is an essential element in learning, but it has become a limited resource in many of today’s classrooms due to time constraints and the pressure to move along quickly (McTighe & Brown, 2005). Another key component of differentiated instruction, which is frequently overlooked, is that students need to become self-evaluative and self-regulating in their efforts to succeed in school (McTighe & Brown, 2005). This is also a key component in constructivist theory.

The No Child Left Behind Act of 2001 (2008) states that all students must make Adequate Yearly Progress (AYP) in a school year despite the differences in all children, such as background, readiness, and attitudes toward school. Such pressure has encouraged whole group instruction to get everyone ready, even though research shows this to be a hindrance in the learning process (George, 2005; Subban, 2006). Nowacek and Mamlin (2007) found that many learning disabilities, such as Attention
Deficit/Hyperactivity Disorder, still do not always qualify by themselves as an eligibility criterion for special education services. Educational services may be provided to students with ADHD who do not meet the Individuals with Disabilities Education Act of 1990 (IDEA) eligibility requirements under section 504 of the Vocational Rehabilitation Act of 1973 if the condition is substantially limiting to a major life activity, such as learning (Loe & Feldman, 2007). These requirements limit the resources available to general education teachers because these students are the sole responsibility of the general education teacher.

Because general education teachers are so busy with classroom administrative tasks and planning, the majority of teachers make few individual modifications for students with ADHD. When educators do incorporate modifications into their classrooms, these modifications tend to be those that require the least amount of time to implement and were less likely to separate students with disabilities from those without disabilities. When Nowacek and Mamlin (2007) interviewed elementary and middle-school teachers, these teachers said that they did attempt to meet the needs of their students with ADHD; however, these modifications were ones that could be performed “without advanced planning, that did not require differentiated instructions or behavioral intervention, or that could be addressed by another professional or support person” (Nowacek & Mamlin, p. 34). In Mastropieri et al.’s 2006 study, differentiating science instruction increased students’ knowledge and achievement. So, for students with ADHD who suffer from underachievement due to their disability, it is important for teachers to differentiate their instruction.
Attention-Deficit Hyperactivity Disorder

Attention-Deficit Hyperactivity Disorder (ADHD) has been studied by many researchers for many years, dating all the way back to middle 1800s (Barkley, 1996). It is considered a life-long disorder (DuPaul, 2007). Only 30% to 40% of children effected with ADHD “grow out of it” by late adolescence or early adult years (Fox, Tharp, & Fox, 2005, p. 368). Currently the DSM IV-TR states that “the essential feature of Attention-Deficit/Hyperactivity Disorder is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequently displayed and more severe than is typically observed in individuals at a comparable level of development” (American Psychiatric Association, 2000, p. 85). For ADHD to be problematic there must be proof of it interfering with a person’s academic or occupational life.

The DSM IV-TR (American Psychiatric Association, 2000) categorizes ADHD into three subtypes: ADHD combined, ADHD-predominantly hyperactive, and ADHD-predominantly impulsive. Research has shown that these subtypes do have relevance when it comes to academic achievement (Barry, Lyman, Klinger, 2002; Diamond, 2005; Marshall, Hynd, Handwerk, & Hall, 1997; Massetti, Lahey, Pelham, Loney, Ehrhardt, Lee, & Kip, 2008).

Inattentiveness may be evident in more structured environments such as the classroom or one’s job. People with this subtype may be less attentive to details and make careless mistakes in their work. Tasks are untidy and without thought to neatness. Individuals with this subtype cannot attend to prolonged tasks and find it hard to complete any given task. They do not listen to or follow through with instructions or chores, and immaterial distracters get these individuals off task easily while these insignificant noises or movements do not influence their counterparts. In the classroom,
rates of on-task behavior are particularly low when passive classroom activities are required (DuPaul, 2007).

Impulsivity may show up as impatience, blurting out answers in class or in meetings, inability to wait one’s turn, and frequent interrupting. These symptoms lead to difficulties in “social, academic, or occupational settings” due to others’ perceived notion that the impulsivity is, instead, rudeness (American Psychiatric Association, 2000, p. 85).

Hyperactivity is a more commonly seen subtype due to its visual aspect. Individuals with this symptom may exhibit fidgetiness or squirming (otherwise known as “ants in the pants”), excessive talking, inability to be quiet during leisure activities, or running and/or climbing at inappropriate times. These individuals are always moving as if unstoppable. They are unable to stay in their seat at appropriate times such as while eating, watching television, or doing homework.

These symptoms are not new with this disorder. However, through the years research has shown how these symptoms relate to academic achievement. The symptoms of ADHD have been found to be significant predictors of coexisting and future academic difficulties (DuPaul, 2007). According to Diamond (2005), individuals with Attention Deficit Disorder (ADD) are not so much distractible as they are more easily bored and under-aroused. Individuals with Attention Deficit/Hyperactivity Disorder (ADHD) have trouble keeping track of multiple things held in the mind, which can make mathematical calculations, reading, or abstract problem solving difficult. They also have a hard time sustaining focused attention on a task or activity. Reading and language deficits are more commonly co-morbid with ADD than with ADHD as are challenges with mental math calculations.
Academic Achievement

According to the DSM-IV-TR (American Psychiatric Association, 2000), academic achievement is marred for individuals with ADHD. Approximately 3% to 5% of elementary age students in the United States are diagnosed with ADHD (Harris, Friedlander, Saddler, Frizzelle & Graham, 2005). Longitudinal studies show that the academic underachievement and poor educational outcomes associated with ADHD are persistent throughout schooling (DuPaul, 2007; Loe & Feldman, 2007). In a study of 66 children, age 8-14, to assess the negative impact of symptom severity on school performance, the outcome exhibited that the ADHD group scored “below prediction in all academic areas” (Barry, Lyman, Klinger, 2002, p. 273) when being compared to peers of the same age or the same grade-level. These discrepancies showed “significant impairment by both clinical standards and when compared to the control group” (p. 278). Furthermore, this study found a discrepancy between predicted and actual achievement in that the non-ADHD control group had significantly greater achievement in all subject areas compared to the ADHD group. Within their study they found that the more severe the ADHD symptoms, the more severe underachievement was. Finally, the students within the ADHD group had been more likely to be placed in special education services at some point during their school career than the non-ADHD group (4% were identified with specific learning disabilities; 65.8% other health impaired; 57.9% emotional disturbance; 4.5% speech-language impairments; DuPaul, 2007).

Barkley (1998) found that ADHD children score 10 to 30 standard score points lower than their non-ADHD peers on various achievement tests in the areas of reading, spelling, and math. According to the DSM-IV-TR (American Psychiatry Association, 2000), these academic problems are more distinct in individuals with inattention because
this subtype affects classroom work and performance. Furthermore, this disorder is more frequent in males than females according to the DSM-IV-TR (American Psychiatry Association, 2000) and Hoza, Owens, and Pelham, Jr. (1999) by a range of 2:1 to 9:1.

In a study by Faraone et al. (1993), two groups of children were studied (140 ADHD and 120 controls). The ADHD group had significantly more school failures than the control group, more than half of these students had been required to attend tutoring, and one-third had repeated a grade. Furthermore, among the ADHD group, reading and math disabilities were significantly more common. Loe and Feldman (2007) confirmed these results in a meta-analysis. An important aspect of Faraone et al.’s study (1993) showed that the ADHD group had significantly lower scores on the WISC-R subtests (Weschler Intelligence Scale for Children -Revised), while at the same time, their mean levels of intelligence was within normal range. This data substantiates that students with ADHD have average to above average intelligence, and yet they still perform poorly in school. Also despite this discrepancy, children with ADHD were more likely to have histories of learning disabilities, grade retention, placement in special education, suspension or expulsion, and academic tutoring when compared to the control group (Faraone et al., 1993; Loe & Feldman, 2007; Raggi & Chronis, 2006; Trout et al., 2007).

Marshall, Hynd, Handwerk, and Hall (1997) completed a study of 182 children, ages 6 to 12 years old. The purpose of the study was to see if there was a noticeable difference in academic achievement related to ADHD subtypes. This study found that individuals with ADD/noH have “cognitive deficits” which motivates learning disabilities. This is a problem for education today. Currently the academic arena is concerned with students learning to use their cognitive abilities to interpret and infer data and to comprehend literary works at a higher depth of knowledge than in the past.
However, the educational system is requesting these students to use their primary deficit to triumph over their academic disabilities (Marshall et al., 1997). As Marshall et al. (1997) states, “If attention-based working memory deficits are causing academic difficulties, it seems unlikely that the same deficits would serve as the solution to these students’ academic problems” (p. 642). Furthermore, these academic problems are not limited to school situations. Many parents ask for help from teachers and clinicians in the area of homework responsibility, including, but not limited to, completion and accuracy (Hoza, Owens, & Pelham, 1999).

Another research study, which looked at ADHD subtypes, was by Massetti et al. (2008). This was a longitudinal study of 255 children aged 3 to 7. The findings in this study showed that only children with ADHD-predominantly inattentive showed problems with academic underachievement (intelligence was controlled). Overtime, children with ADHD-combined subtypes and ADHD-predominately hyperactive did not have lower academic test scores at age 4-6 than their peers. This was an important study because it highlighted the importance of merging targeted academic interventions and ADHD treatment. Barry, Lyman, and Klinger (2002) also found that children who were underachieving academically benefited from educational interventions that not only addressed school achievement but also their symptoms of ADHD. These students need to be taught behavioral strategies that will help them reach their potential in the classroom and when they join the work force. Symptoms of ADHD are present in adolescent and young adulthood, although they may decrease in severity, they are still persistent (Loe & Feldman, 2007).
ADHD Interventions

Many children with ADHD go undiagnosed or are treated using a multitude of methods. These methods include behavior modification, pharmacotherapy with stimulants (Hoza et al., 1999), educational interventions, and the combination of these. A more recent intervention that is beginning to be seen is cognitive therapy; however, according to Hoza et al. (1999), this intervention should only be performed in conjunction with the other standard treatments. In school students are treated with behavior management approaches that parents and educators hope will calm these students down enough so that teaching and learning can take place. Researchers have searched for answers on how to help children with ADHD by combining stimulant medication, behavior management, and interventions to help students’ academic successes. It is important to emphasis that using one of these strategies alone has not been found to adequately affect students’ academic performance (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006; Hoza et al., 1999; Swanson, McBurnett, Christian, & Wigal, 1995).

Pharmacotherapy involves the use of central nervous system stimulant medication such as Ritalin and Dexedrine, which are the most commonly prescribed medications for ADHD. Medications such as Ritalin, known as methylphenidate or MPH, have been the most widely studied, and have been shown to improve academic performance and on-task behavior in the classroom (Hoza et al., 1999). There have also been studies that show that while stimulants and other medications improve academic productivity, “long term outcome studies indicate that these drugs have minimal impact on educational achievement” (DuPaul et al., 2006, p. 636). Furthermore, there have been no medications that have been found to create long-term improvement in children with ADHD (Fox,
Tharp, & Fox, 2005). It has also been estimated that medication has no effect on 25% to 40% of children with this disorder (Fox et al., 2005).

In a 2009 study conducted by the National Survey and Nutrition Examination Survey, 8.7% of children meet the criteria for ADHD, only 47.9% had been diagnosed, and only 32% were consistently treated with medication. These statistics can be attributed to many reasons (Whalen & Henker, 1991). First of all, many parents are against giving their children medication for behavioral problems. Second, not all children can be given medications due to extenuating circumstances. Lastly, not all children who take the medication show improvement or benefit from it. Another important aspect of pharmacotherapy is that there is a chance that some people with ADHD would have to be on this medication indefinitely (Thompson & Thompson, 1998).

Behavior therapy has been shown to be effective with less severe problem behaviors. They reduce the core symptoms (although less effectively than medication), and behavior therapy is equivalent or better than medication in improving behavior (Loe & Feldman, 2007). It utilizes the manipulation of positive and negative consequences that are conditional on the child’s behavior. Behavior therapy involves praise, token reinforcement, picking your battles, lose of privileges for bad behavior, response cost, and reprimanding inappropriate behavior (Barkley, 2007; DuPaul, 2007; Hoza et al., 1999). For problem behaviors seen at school, daily behavior logs have been found to be effective as well (Hoza et al., 1999).

Some behavior therapy includes consultation with a school psychologist or other mental health caregiver. With this type of behavior therapy, classroom teachers work with these consultants to develop individualized interventions based on data on the student’s strengths and weaknesses in the classroom. The consultant monitors treatment
implementation and the teacher is provided feedback. In a study by DuPaul et al. (2006), results show limited support for the effectiveness of this type of behavioral intervention in its ability to improve the academic functioning in children with ADHD.

Some of the academic interventions that have shown promising results are peer tutoring, computer-assisted instruction, task and/or instructional modifications, self-monitoring, strategy training, and functional assessment (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006; Raggi & Chronis, 2006). Academic interventions not only have positive effects for students’ academia, they also have been shown to be positive treatments for students with ADHD because they often act as preventative measures for behavior management. Therefore, they alter problematic behaviors. These academic interventions also involve “mediators” such as a computer, peers, parents, etc., so the interventions are not completely contingent on an overburdened teacher (DuPaul, 2007).

Peer tutoring is an intervention where two students are paired together, one being the tutee and the other being the tutor. They help each other in learning academic objectives through active response while providing each other with frequent and immediate feedback. Peer tutoring allows learners to obtain individualized instruction at their own pace with one student providing instruction and assistance to the other under a teacher’s direct supervision. Another form of peer tutoring, which has been found to be effective, is classwide peer tutoring (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006; Raggi & Chronis, 2006). Studies have found that this form of peer tutoring improves classroom behavior in ADHD students and their academic performance by improving their on-task behavior. It also allows teachers to implement interventions without singling out students with ADHD and allows them to work on their social skills with their
peers who may not usually interact with them in other social situations (Raggi & Chronis, 2006).

Computer-assisted instruction involves utilizing the computer to present specific instructional objectives using multiple learning styles. It allows information to be presented in small chunks with opportunities to review and practice material independently and provides immediate feedback (Jitendra, DuPaul, Someki, & Tresco, 2008). According to Raggi and Chronis (2006), this intervention has been hypothesized to sustain the attention and work performance of students with ADHD.

Ota and DuPaul (2002) did a study involving three male Caucasian students in grades four, five, and six exhibiting ADHD behaviors and who had been privately diagnosed by either a pediatrician or by a child psychologist. The researchers used a commercial math software package with an arcade-style game format with six activities and six different difficulty levels that adjusted to a child’s ability. Reinforcement was provided in the form of points, and all participants showed varied improvement in math performance. Furthermore, results showed an increase in active engagement time and a decrease in off-task behaviors compared to seatwork activities.

Clarfield and Stoner (2005) completed a study involving three Caucasian males in kindergarten and 1st grade. Students worked on an Internet-based reading program called Headsprout Reading Basics for thirty minutes per day. Headsprout incorporates individualized lessons adapted to child’s pace, and it incorporates positive reinforcement through rewards. Results add to those of initial studies indicating computer-assisted instruction holds promise as an intervention strategy for students with ADHD who are experiencing academic difficulties. The study also showed direct positive effects on
academic skill development and indirect improvements on classroom behavior for students with ADHD.

In spite of the lack of research on academic outcomes, computer-assisted instruction does parallel peer tutoring in that it provides immediate feedback to the student and calls for active responding on the part of the student. It also improves work completion for some students with ADHD (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006). Computer-assisted instruction appears to be advantageous and unique in its ability to provide individualized, engaging instruction with frequent opportunities for response (Clarfield & Stoner, 2005). It also shows high rates for success and reinforcement. Finally, this type of intervention facilitates differentiated instruction if the programs are built with individualization as a feature (Clarfield & Stoner, 2005). Both peer tutoring and CAI have been found to be promising interventions in helping students with ADHD effectively learn academic content. However, it is important that these students first receive instruction in the critical academic areas, such as reading and math, from experts or teachers in order to maximize the significance of both of these intervention types (Jitendra et al., 2008).

Task or instructional modifications are the most widely used in the general education setting; however, according to the literature review by Raggi and Chronis (2006) it remains largely untested for its effectiveness with ADHD students. This strategy involves the implementation of procedures that reduce task length, increasing time allotment for activities, increasing structure to activities, and delivering instruction through different avenues of learning styles. These strategies strive to sustain the attention of the ADHD student, reduce their frustration levels by making tasks seem more manageable, and increasing their organizational skills.
Two specific forms of instructional modifications that have received a lot of research attention in the past have been choice making (Newton, Ard, & Horner, 1993; Powell & Nelson, 1997; Raggi & Chronis, 2006) and task stimulation with the use of color (Zentall, 1975). Choice making gives the student autonomy in the classroom, allowing him to choose a task from a selection of appropriate alternatives. According to Raggi and Chronis (2006), choice making is helpful in managing the behavior of ADHD students in the general education classroom. Task stimulation by color is an older theory still in use today. Data suggests that for simple tasks, if color is added early or midway through, behavior and performance of ADHD students is normalized when compared to non-ADHD students because it gives stimulation and allows the students to give closer attention to the task at hand (Zentall, 1975). For more complex tasks where students are acquiring new knowledge, color added too early reduces performance of ADHD students because it is too much stimuli, disrupting the student’s focus. For these tasks, color needs to be added later to regain attention lost due to the length of the task (Zentall, 1975).

A final task modification intervention that is being utilized more and more in the educational setting is functional assessment (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006; Raggi & Chronis, 2006). It allows the professional to individualize academic interventions based on the identification and analysis of areas that are problematic for the student. Thanks to technology this intervention is becoming easier to administer and therefore used more prevalently in the general education classroom.

Self-monitoring is an intervention more appropriate for older students and adolescents with ADHD but may also be modified for younger students. It entails goal setting for the completion and accuracy of classwork and on-task behavior (Raggi & Chronis, 2006). Students monitor their own work and behavior and “self-administer”
their own rewards at the successful completion of their goals. This intervention is most successful when combined with other interventions. “Self-monitoring has resulted in large effect sizes for on-task behavior, disruptive behavior, academic output, and academic accuracy” (Raggi & Chronis, 2006, p. 104). In a study by Shimabukuro, Prates, Jenkins, and Edelen-Smith (1999), three male students in grades 6 and 7 with ADD and ADHD who had a history of academic underachievement were taught self-monitoring strategies. These self-monitoring strategies were implemented during reading, math, and writing instruction in order to assess the effects these strategies have on academic accuracy, academic productivity, and on-task behavior. Self-monitoring resulted in greater positive effects for productivity than for accuracy in reading comprehension and math. Furthermore, students completed more of their assignments during independent practice when the self-monitoring strategies were being implemented. All of the students in the study consistently improved in the area of on-task behavior during reading, and the smallest gains for on-task behavior were seen during whole-class writing instruction. The highest levels of attention were seen during math. Harris and colleagues (2005) also found that self-monitoring interventions resulted in considerable gains in on-task behavior. It is important to note that with this strategy the teacher reported that the intervention was easy to implement within the classroom setting and was easily incorporated into the existing curriculum. The ease of intervention implementation has been shown to aid in its significance in improvement (Hoza et al., 1999).

Strategy training involves teaching a specific skill in which students can implement on their own to improve their academic performance, i.e., note taking (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006). It gives added responsibility and ownership
over the intervention to the student; however, there is limited research on the validity of its effectiveness on the improvement of academic performance for ADHD students. Strategy training is also a form of direct intervention, which is a “process-specific approach” applied to treatment of ADHD in which attention can be improved by providing “structured opportunities for exercising particular aspects of attention” (Kerns, Eso, & Thomson, 1999, p. 275). In a study by Kerns et al. (1999), 14 children (seven ADHD and seven control) were seen individually twice weekly for 30 minutes sessions each for eight weeks. These children worked on tasks that directly focused on their attention skills. Results showed significant improvement in the performance levels of “sustained, selective, and higher levels of attention” (Kerns et al., 1999, p. 288). Improvements were also seen in academic efficiency and in a trend for improvement in teacher’s ratings for inattentive-impulsive classroom behaviors.

Another intervention worth mentioning despite the lack of research for its efficacy for ADHD populations is homework completion and accuracy, as this is an area of great concern for teachers and parents. For this intervention, parents and teachers must become partners in structuring the homework process, setting goals, and consulting with each other on a daily basis. These interventions have been proven effective for general populations of students (Raggi & Chronis, 2006). Some homework intervention strategies addressed by Stormont-Spurgin (1997) relate to object organization, idea organization, and task completion planning. Examples of object organization interventions are cooperative homework teams, positive reinforcement and contracts, routines and lists, assignment folders and daily planners, and collaboration. The purpose of these interventions are to help ADHD students (a) get their homework home, (b) get their homework completed, and (c) get their homework back to school and turned in.
Examples of idea organization are highlighting key terms in passages and/or directions, story mapping, and story webs. Examples of task completion planning is developing routines, student pacing strategies, lists, and planning of homework and future planning projects.

There are many obstacles for these interventions. The most serious threat to these interventions is the failure of adults to follow through with implementation of the treatment program prescribed for the ADHD child. This failure could be a result of family trouble, change in the family dynamics, the family’s busy schedules, and the reluctance of school personnel to cooperate with outside consultants. It is important for educators and researchers to know that studies have shown that aiming interventions at academic improvement is necessary to bring about change. However, ADHD students with disruptive behavior need more than just academic interventions (Hoza et al., 1999). They need behavioral targets as well. Another important factor in the implementation of any intervention is the multiple contacts between teacher and therapist and/or interventionist (Hoza et al., 1999). Furthermore, according to Hoza et al. (1999), having multiple teachers can compound the many difficulties of implementing interventions in the school setting. Hoza et al. (1999) found it worthwhile to meet with every teacher of the ADHD child to discuss the implementation of interventions and to reward teacher efforts in the beginning of implementation until they begin to see improvement in the child (intrinsic motivation to keep the intervention going will take over at that point).

After listing all these interventions, it is important to note that with the many aspects of ADHD and the three subtypes, one intervention alone has not been found to improve symptomology or academic underachievement in children with ADHD (Whalen & Henker, 1991). Professionals need to use a combination of interventions in order to
help these children. Furthermore, these interventions can be used in a variety of ways to be incorporated into differentiated instruction within the classroom.

**Cognitive Training**

Cognitive training is a relatively new form of intervention for students with ADHD. It trains the brain to increase a certain skill or to improve a weak area of the brain such as attention and short-term memory. Many researchers are involved in the investigation of this method in conjunction with other treatment methods. Many do not believe it is appropriate as an intervention that can stand alone in its treatment of ADHD (Abikoff, 1991; Abikoff, 2001; Hoza et al., 1999). In fact, Abikoff’s (1991) literature review on cognitive training from 1976-1988 revealed small gains in academic improvement for ADHD students.

Many forms of computerized cognitive training utilize elements of video/computer games. Studies have shown that computer games improve spatial visualization, the ability to read images, and improved visual attention. On the other hand, “there is no research that actually documents a link between video game playing, attentional skills, and success in academic performance” (Subrahmanyam, Greenfield, Kraut, & Gross, 2001, p. 15). Furthermore, according to Subrahmanyam et al. (2001), the main audience in which computer games appeals to is and always has been boys between the ages of 8 and 14. Therefore, one question to be answered is if this type of intervention will be effective in helping girls with ADHD.

Cognitive training began with neurofeedback training which is a “neurobehavioral treatment aimed at acquiring self-control over certain brain activity patterns and implementing skills in daily-life situations” (Gevensleben et al., 2009p. 780). Neurofeedback training utilizes the use of electroencephalography displays, or EEG
readings, to identify changes in brain waves. These readings help the participant modify brainwave activity to improve attention, reduce impulsivity, control hyperactivity, and produce long-term change (Fox et al., 2005). In a study by Gevensleben et al. (2009), children were given either neurofeedback training or attention skills training. Both groups had to practice the strategies they were learning in a specific situation for 10 minutes each day. The specific situation was embedded in their daily life. To identify the strategies to be practiced, the children had to identify situations in which the strategies they were learning would be the most useful. The purpose of the self-appointment of strategies was to increase the children’s responsibility in their interventions.

The neurofeedback system used in the Gevensleben et al.’s study (2009) was called SAM (Self-regulation and Attention Management). It contained animation and feedback components to keep the children of their study interested in the program. The children played a computer game during training, which required them to regulate their brain activity. After training sessions, the children were required to practice the focused state they learned to control in the training room while at home in different situations. The attention skills training used in the Gevensleben et al., study (2009) was based on Skillies, an award-winning German learning software. The software’s primary goals are to exercise “visual and auditory perception, vigilance, sustained attention, and reactivity” (Gevensleben et al., 2009, p. 783). This group also had to practice one of the strategies they had to learn in order to solve the computer games’ tasks while in their daily life.

Behavior ratings by both parents and teachers revealed that the neurofeedback training was superior to the attention skills training in reducing symptoms of ADHD. According to Fox et al. (2005), neurofeedback training would require up to 60 sessions or
6 months of treatment for sustained, long-term change to happen. Therefore, neurofeedback training may be difficult in the school setting. In addition, the sample size for Gevensleben et al.’s study in 2009 was small, so it may not show the same results when applied to a larger population within a school. Other studies on neurofeedback found that when an individual without ADHD is presented with a task that involves a lot of attention, such as reading, simple arithmetic, or listening to a story, his EEG usually shifts to the beta frequency band with an increase in the right frontal lobe. Individuals diagnosed with ADHD shift down into a slow frequency (theta) without significant increase in frontal activity. This slow frequency activity is related to the mental wandering and unfocused thought characteristics of ADHD (Fox et al., 2005).

From neurofeedback came other computerized cognitive training programs. Studies have shown that these training programs reduce the symptoms of ADHD by increasing the attention of ADHD children and providing them strategies for impulse control (Solomonidou, Garagouni-Areou, & Zaferopoulou, 2004). Xu, Reid, and Steckelburg (2008) found that some of the advantages of computerized cognitive training was the ability to individualize interventions for specific children, the ability for generalizability in order to transfer knowledge gained in training to other situations, and the automatic recording of data from training sessions which can be retrieved for later analysis. Another important aspect of cognitive training, especially for self-control to reduce excitability, is that skills that were learned in training can be generalized to situations in the child’s everyday life. Also when feedback is given, results show more improvement than when these aspects are left out (Henrich, Gevesleben, & Strehl, 2007).

Shalev, Tsal, and Mevorach (2007) designed a study with the sole purpose of determining if computerized attentional training can improve academic achievement.
They used a “computerized progressive attentional training (CPAT) program” which was developed using major theories and methodologies of visual attention literature (Shalev et al., 2007, p. 383). It was developed for children age 6 and above who deal with attention difficulties. It focused on extensive training in one of the four networks of attention: “sustained attention, selective attention, orienting attention, and executive attention” (Shalev et al., 2007, p.383):

- Sustained attention is the ability to focus on a task for a sustained amount of time.
- Selective attention is the ability to focus on a select task despite distractions around you.
- Orienting attention is the ability to control the selection of information your brain receives from different sensory areas.
- Finally, executive attention is responsible for problem solving and the ability to choose one response over another.

The results of their study showed that in a relatively short amount of training using the CPAT significant improvements were made on both academic tests and parental behavioral ratings. Another study (Posner & Rothbart, 2005) found that attention training and working memory training for children with ADHD can create improvements in their ability to concentrate, which in turn increases their performance level on general intelligence tests.

One computerized cognitive-training system is Captain’s Log. It contains five components with 33 separate exercises in cognitive training that have been designed to help develop attention, concentration, memory, eye-hand coordination, basic numeric concepts, and problem-solving/reasoning skills (Kotwal, Burns, & Montgomery, 1996; Slate, Meyer, Burns, & Montgomery, 1998). Eight of the exercises were specifically
designed for the purpose of boosting attention and concentration skills. With this computer system, children must successfully complete tasks, which are multilevel, in order to move on to the next level. As the child gets better in moving from one level to the next the program requires them to concentrate more and to be less impulsive.

Slate et al.’s study (1998) included a very small sample size of four children age 7-11. However, their results did show improvement in mathematics and knowledge of vocabulary for three out of the four children. Furthermore, the child who was most successful with the Captain’s Log program showed the most improvement on most measures within the study. This result supported their hypothesis that the children who are most successful with the cognitive training will show the most improvement academically and behaviorally due to the greater generalizability of the skills they have learned while in training (Slate et al., 1998).

A study by Kotwal, Burns, and Montgomery (1996) also used the Captain’s Log system in a one-subject study in a clinical setting. The subject was a 13-year-old who sat for 35 sessions during a three-month period. Their study was successful in that the informal verbal report from the child’s teachers and parents showed substantial improvement in the child’s behavior. In class, his teacher reported that he was on task for longer periods of time and was less disruptive. Due to these changes in behavior, “his grades improved from Ds and Fs to Bs and Cs” (Kotwal et al., 1996, p.91). Kotwal et al. (1996) chose the Captain’s Log computer-based training program because they felt that it was more useful in classroom situations because of the availability of computers in classrooms now. However, it is important to reiterate that their study was completed in a clinical setting.
Play Attention

Peter Freer developed *Play Attention*. He is a master teacher with 16 years classroom experience and CEO and founder of Unique Logic + Technology, Inc. It is a computerized cognitive-training program using feedback-based technology, which has been field-tested for approximately the last 16 years. Play Attention incorporates many of the aspects of the constructivist theory because it helps students assimilate new skills specific to their ADHD symptomology into their everyday life so they may learn to control some of the symptoms of their disability.

*Play Attention* is similar to neurofeedback technology and strategy training because it helps students acquire self-control over their inattentive brain activity. It also helps students learn and transfer specific skills to implement in academic situations through the monitoring of brain activity by way of sensors embedded in the helmet or armband worn during play. Nevertheless, it is neither neurofeedback technology nor strategy training (Gevensleben et al., 2009; Raggi & Chronis, 2006). Like the CPAT (Shalev et al., 2007) and *Captain’s Log* (Kotwal et al., 1996; Slate et al., 1998), *Play Attention* was designed for students with inattention that causes academic or behavioral problems.

Mr. Freer designed the program after a NASA flight training simulator program because, like many teachers, he had students in his classroom with attention problems, and the academic interventions in which he used in his classroom provided inconsistent results. It is based on neurofeedback and biofeedback technologies and incorporates aspects of differentiated instruction. Neurofeedback utilizes real-time EEG (electroencephalography) displays to illustrate brain activity in order to change unwanted behavior. Biofeedback technology is similar to neurofeedback in that it monitors a
person’s physical and mental algorithms. However, it is used more for training people to control unwanted functions in order to improve their life. *Play Attention* also combines several of the interventions discussed earlier: computer-assisted technology, choice making, strategy training, self-monitoring, functional assessment, and cognitive training while focusing on improving weak skills of ADHD or low attention students. It also incorporates the teaching of organizational skills, finishing tasks, filtering out distractions, watching the teacher, and memory.

*Play Attention* was created to help students “see” their focus so they can learn to transform their attention span. There are no joysticks or game controllers. Students wear a bicycle helmet or armband lined with sensors to monitor their brainwaves. It allows for self-monitoring (Barry et al., 2002; Raggi & Chronis, 2006) by the student to help them identify what it means to be unfocused so they can eventually learn to correct the behavior by themselves.

Children or adults who want to improve their attention span or short-term memory can benefit from using *Play Attention*. It can be used by a parent in their home or by schools to help students with attention difficulties. Each session is conducted with a trained coach who provides ongoing feedback and correction throughout training for the ADHD child. This coach may be a teacher or parent. Support for the coach is ongoing through the company so the program can evolve with the student. Also, the intervention can be consistent because the coach is provided support through the company that is needed to effectively implement the intervention (Hoza et al., 1999). Psychologists and masters-level operators who are friendly provide this support, which is by telephone or email (Siglin, 2000).
Every session begins with setting an objective to focus on improvement. By setting this objective it helps the student focus on their weakest skill so they may make improvement on it. This is similar to functional assessment, which allows the professional to individualize the intervention for the specific child (Raggi & Chronis, 2006). Then, with the coach’s assistance, the student completes leveled, skill activities designed to help them strengthen their weakest areas: attention stamina, visual tracking, time on task, short-term memory sequencing, discriminatory auditory and visual processing, visual working memory, and processing auditory instructions.

The program allows students to choose from three different games within the same skill set. This aspect of the game utilizes choice making, an instructional and task modification strategy that has been found to be beneficial in conjunction with other interventions for children with ADHD (Newton, Ard, & Horner, 1993; Powell & Nelson, 1997; Raggi & Chronis, 2006). *Play Attention* may be considered a form of direct intervention. Research findings for direct interventions have supported the hypothesis that a systematic approach to practicing attention and attention-demanding tasks can result in improved attention (Kerns et al., 1999). All of these components of *Play Attention* are similar to the tested components of CPAT, which focused on the different levels of attention (Shalev et al., 2007) and *Captain’s Log*, which focused on developing attention, concentration, short-term memory, hand-eye coordination, problem solving/reasoning skills, and basic numeric skills (Kotwal et al., 1996; Slate et al., 1998). Both of these computerized cognitive-training programs provided significant gains in academic achievement and behavior of the studies’ subjects.

The short-term memory component in all of these programs has been found to be beneficial in increasing the amount of information students can keep in working memory,
which is bound to be beneficial Academically (Klingberg, Forssberg, & Westerberg, 2005). In a study by Klingberg et al. (2005) of 50 participants, the treatment program entailed performing working memory tasks implemented by a computer program. Treatment was performed either at home or at school, and an adult viewed data every two days. Participants worked for approximately 40 minutes each day for 25 days. This working memory training had strong effects on parent ratings of attention but not teacher ratings. However, this discrepancy could be due to the lack of feedback by an adult while training was being completed.

ADHD children play by wearing a bicycle helmet or armband that is embedded with sensors. These sensors pick up the student’s brain activity, an adaptation from biofeedback and neurofeedback technology. When the student is focused, they are able to complete the objectives of the game. If they are unfocused or fidgety, the game stops working until the coach gets them back on track or until the student self-corrects. While the student is playing the game, they must remain still with no talking – out of control talking or talking at inappropriate times is a symptom of ADHD (American Psychiatric Association, 2000). The coach is the only one allowed to talk when redirecting inappropriate behavior such as fidgeting or loss of attention to the game. The coach records any observations of distractive behavior onto a wipe-off board. At the end of the session, the coach transcribes the behaviors into the computer for tracking data and helps the student analyze their behavior, the effects of that behavior and how to improve their behavior.

This program requires active engagement on the part of the student for it to even work. According to Raggi and Chronis (2006), active engagement by the student in academic interventions “typically result in better performance than those with passive
attentional requirements” (p. 104). The coach encourages students to replicate the skills they have learned through the training in real-life situations at home and at school for the generalizability of skills being practiced. According to the company, students should complete 40-60 hours of use in a school year in order for the game to be effective; however, this has not been scientifically supported yet (Play Attention, 2010).

Reward and reinforcement to help students increase their weak skill sets are key elements to the Play Attention program. This use of positive consequences is consistent with behavior therapy interventions, which have been tested and found to be successful when implemented with other interventions (Hoza et al., 1999). If students lose their focus on the objective of the game, the game stops working. For example, on one of the games students must focus their attention on a whale. If the student remains focused and still, the whale will dive to the bottom of the ocean to pick up treasure. However, if the student loses their focus, the whale will go to the top of the ocean. Another example is the forklift game. Students must remain focused on the forklift in order for the driver to load palettes from a dock to a truck. If they lose focus, the forklift stops moving. This game format has been found to be beneficial to attention and performance (Raggi & Chronis, 2006).

Play Attention does not utilize extravagant graphics or intricate story lines to keep the player’s attention like other video game systems. Players must work for their attention. Students must learn to focus their attention on ordinary things. This is consistent with computer-assisted instruction research, which found some evidence that computer animation may damage progress made in interventions because it provides too much stimulation (Raggi & Chronis, 2006).
Play Attention also uses utilizes aspects of functional assessment. The program is tailored toward the individual needs of the students through the setting of objectives important to each student. Through the game and support from the company, the coach can help the students with their specific weak skills. Furthermore, games go from beginner to intermediate to advanced, and distracters are added as the student progresses through the program. This is similar to the format of Captain’s Log, only allowing the student to move to the next level when the previous level has been mastered (Slate et al., 1998). For example, when students are starting the program, they should be in the quietest environment possible. However, as they advance, distracters should be added, such as students moving through the hallway, background music or noise playing, others talking behind them, etc. Finally, Play Attention may be used during homework completion so students can see when they are becoming unfocused and self-correct this behavior.

Studies on Play Attention and a Similar Intervention

In its 16-year history, Play Attention has been researched; however, no empirical, independent studies have been published (Walker & Bardos, 2008). According to the Play Attention Learning System: Clinical Research Case Studies and Qualitative Data (2006) provided by the company, they are waiting on the publication of a research study by SUNY Plattsburg Research, and Tufts University Medical School is in the progress of researching Play Attention. They also show data from a 2004-2006 study of students enrolled in the Focus through Fun Learning Center in which 71 out of 72 students were diagnosed with or met the criteria for ADHD. According to this information from Unique Logic + Technologies, Inc., the average student in the program had 25 sessions on Play Attention and “85.9% reduced attention problems, 77.5% reduced hyperactivity,
76.1% reduced internalizing problems, and 49.3% increased adaptive skills” (personal communication, July 10, 2009). In a pamphlet from the company, they also documented one case study by Dr. Jeffery Coffey of Sylva Clinical Associates P.A. in which 2 males, ages 6 and 10 respectively, logged in 40+ hours on Play Attention. The purpose of his study was to see if \textit{Play Attention} increased attention and to see if this increase transferred to the classroom. His data showed significant gains in attention and response control (personal communication, July 10, 2009).

Another study that incorporated an intervention similar to \textit{Play Attention} was by Thompson and Thompson (1998). It must be stated up front that this was not a controlled study; however, it did reveal some encouraging results. It was a study performed at an educational center with 88 children, age 5-16, and the ratio of males to females was 3:1. It utilized a combination of neurofeedback training, behavior training (reward system), and metacognition (increasing the awareness of one’s thinking processes). The metacognitive strategies specifically used in this study focused on the subjects remaining alert while listening or studying and their ability to organize and synthesize material to aid in recall (working memory). Results from this study utilizing the WRAT 3 showed significant improvements ($p<.0001$). Arithmetic scores rose 10 standard score points, word recognition scores rose 12 standard score points, and spelling scores rose 20 standard score points. One child, who read on a 2\textsuperscript{nd} grade reading level in the 6\textsuperscript{th} grade, was reading on grade level after 85 sessions. This was an important aspect of the study because the prescribed amount of sessions was 40; however, if a child is showing progress, do not stop at 40. This study showed that a training program incorporating neurofeedback and metacognitive instruction strategies can produce significant outcomes in an educational center not set up for research purposes.
So, the following questions remain:

1. Will *Play Attention* reduce the symptoms of ADHD?

2. Does *Play Attention* increase academic achievement of ADHD students in reading and math compared to controls?

3. Will academic impact be more significant for boys than girls due to the type of intervention (computer game format)?

**Summary**

Constructivist theory suggests that learners create or reform knowledge through their experiences and interactions in the world. It also suggest that learners are more motivated when they are being challenged, not frustrated.

No Child Left Behind (2008) has provided a system of accountability, which has improved student achievement. However, it has also contributed to homogeneous groups in classrooms with students at heterogeneous ability levels. Some of these students also have disabilities, such as ADHD, that may not be addressed in these classrooms due to time constraints and pressure arising from high-stakes testing. Differentiated instruction allows for general education teachers to meet the needs of all these students while at the same time accommodating the learning needs of students with ADHD through classroom interventions.

ADHD is a specific disability to address in the classroom because its symptoms (inattentiveness, impulsivity, and hyperactivity) affect a variety of students through social, behavioral, and academic situations. ADHD affects males more often than females, and although these students’ academic achievement is lower than the academic achievement of students without ADHD, their intelligence levels are at a normal range.
Therefore, if educators can implement effective interventions for these students, their academic achievement should increase.

The most promising interventions for students with ADHD are pharmacotherapy, behavior therapy, peer tutoring, computer-assisted instruction, task and/or instructional modifications, self-monitoring, strategy training, functional assessment, and cognitive training. Furthermore, research has shown that these interventions are most effective when used in conjunction with each other, not singularly.

*Play Attention*, developed by a master teacher, is a computerized cognitive-training program using feedback-based technology to differentiate instruction by analyzing brain activity and data from a coach working with students. Initial data from research done by the company who distributes *Play Attention* states that their program will help ADHD symptoms decrease and academic achievement will increase.
CHAPTER III

METHODOLOGY

Introduction

After approval from IRB (see Appendix A), data for this research was obtained through the graphing and analysis of ADHD symptomology through the Play Attention program. Students’ academic achievement data was obtained through practice MCT 2 pretest and post-test data analyzed through a one-way ANOVA. Teachers’ and principal’s perceptions of the Play Attention program were gathered through a descriptive survey.

Research Design

The design of this study was quantitative in looking for a direct relationship between the Play Attention program and the academic achievement of students with ADHD in reading and math. The dependent variable was the MCT 2 practice pretest and post-test scores. These were used to measure academic achievement. The first independent variable was the severity of ADHD symptomology from pre-program to post-program. The other independent variable was gender in order to assess if the Play Attention program affects boys and girls with ADHD differently. Finally a survey was used descriptively in order to assess the perceptions of teachers and the principal within the school on the program Play Attention.

Participants

This study took place in a city of 17,320 people made up of 8,349 males and 8,971 females on the Gulf Coast of Mississippi. The median age in the city is 35.7 years. The race makeup is as follows:

- 15,154 White, non-Hispanic
• 1,275 Black, non-Hispanic
• 445 Asian
• 397 Hispanic
• 67 American Indian
• 12 Native Hawaiian or Pacific Islander

The majority of the population (86.3%) is reported as having a high school diploma or higher, and 24.3% of the population is reported as having a bachelors degree or higher.

The school in which this study took place was a 4th-6th grade upper elementary with a total of approximately 691 students: 215 4th Graders, 243 5th Graders, and 233 6th Graders. Fifty-two percent of the student population qualifies for free or reduced lunch.

The school had approximately 120 students diagnosed with ADHD. The race makeup of the school was:

• 18 Asian
• 93 African American
• 22 Hispanic
• 4 American Indian
• 554 Caucasian.

Upon approval from IRB (see Appendix A), permission was obtained from the superintendent (see Appendix B) and principal (see Appendix C). Students’ homeroom teachers, due to academic underachievement, recommended students who have been diagnosed with ADHD by their physician participation. The control group for the study was ADHD students who did not participate in the Play Attention program. The researcher obtained parental consent (see Appendix D) and student assent after calling parents to describe the study (see Appendix E).
Instrumentation

Research question number one (ADHD symptom severity) was assessed through data and graphs produced through the *Play Attention* program. There were two types of graphs and data:

- **Behavioral graphs (shown in Figures 3 and 4):** The coach observes and records repetitive self-distracting behaviors during each game and enters them into the software. The program graphs the culmination of the coach’s observations in order to see an increase of the ability to control a behavior or to see if more work is needed.

- **Share ratings (see Appendix F):** These were sent out before the start of training and again the end of the intervention. This will allow assessment of behaviors that are observed in classroom and home environments prior to training and after training. These scales are entered into the system in order to see a full, picture of each student’s behavior at home and at school.

By comparing MCT 2 practice pretest and post-test scores, research question number two (academic achievement) was assessed. The pretest data was archival data, as it was taken in the August of the 2010-2011 school year. The post-test was given the week of March 14-18, 2011. The *Play Attention* data and MCT 2 practice test data was used to assess research question number 3 (affects on gender).

Finally, the descriptive survey (see Appendix G) was used to identify perceptions of the principal and teachers. This survey was modified from its original format after a letter (see Appendix H) obtained by Dr. Douglas M. Arnold was obtained. This letter gave the researcher permission to use and make modifications to his survey, which he created for his dissertation. His dissertation was completed in 1998 at the University of
Cincinnati entitled “A Descriptive Study of Principals’ and Teachers’ Perceptions of the Value of Technology for Schools.” The original survey had a Cronbach Alpha of .9420 and a standardized item alpha of .9442. Therefore, the original survey was deemed reliable.

Dr. Arnold obtained validity by gathering a focus group that read and modified his original draft. The panel of reviewers was made up of professionals who had “completed research and written in the areas of educational change and technology.”

Since *Play Attention* is a relatively new program in the world of education, a pilot study cannot be performed to validate the minor modifications made by the current researcher to the survey due to no other available people to participate in a pilot study that have experience with *Play Attention*. This survey was handed directly to the teachers and administrator by the researcher.

**Procedures**

Students who had been diagnosed as having Attention-Deficit/Hyperactivity Disorder by their physicians and/or psychologists were chosen for this intervention. Their teachers requested they participate in the *Play Attention* program as part of the Response to Intervention program because of poor academic achievement.

Peter Freer developed the *Play Attention* program. He is a master teacher with 16 years classroom experience and CEO and founder of Unique Logic + Technology, Inc. It is a computerized cognitive-training program using feedback-based technology, which has been field-tested for approximately the last 16 years. *Play Attention* incorporates many of the aspects of the constructivist theory because it helps students assimilate new skills specific to their ADHD symptomology into their everyday life so they may learn to control some of the symptoms of their disability. *Play Attention* was designed for
students with inattention that causes academic or behavioral problems. It also combines several of the interventions discussed earlier: computer-assisted technology, choice making, strategy training, self-monitoring, functional assessment, and cognitive training while focusing on improving weak skills of ADHD or low attention students. It incorporates the teaching of organizational skills, finishing tasks, filtering out distractions, watching the teacher, and memory.

*Play Attention* was created to help students “see” their focus so they can learn to transform their attention span. There are no joysticks or game controllers. Students wear a bicycle helmet or armband lined with sensors to monitor their brainwaves. Each session was conducted with a trained coach who provided ongoing feedback and correction throughout training for the ADHD child. This coach was the instructional coach of the school. Each session focuses on whichever behavior was exhibited the most during the previous session.

With the coach’s assistance, the students completed leveled, skill activities designed to help them strengthen their weakest areas: attention stamina, visual tracking, time on task, short-term memory sequencing, discriminatory auditory and visual processing, visual working memory, and processing auditory instructions (personal communication, July 10, 2009). The sensors in the helmet or armband pick up the students brain activity, an adaptation from biofeedback and neurofeedback technology. When the student is focused they are able to complete the objectives of the game. If they are unfocused or fidgety, the game stops working until the coach gets them back on track or until the student self-corrects.

While the student was playing the game, they had to remain still with no talking – out of control talking or talking at inappropriate times is a symptom of ADHD (American
Psychiatric Association, 2000). The coach was the only one allowed to talk when redirecting inappropriate behavior such as fidgeting or loss of attention to the game. The coach recorded any observations of distractive behavior onto a wipe-off board. At the end of the session, the coach transcribed the behaviors into the computer for tracking data and in order to help students analyze their behavior, the effects of that behavior, and how to improve their behavior. The coach encouraged students to replicate the skills they learned through the training in real-life situations at home and at school for the generalizability of skills being practiced. According to the company, students must complete 40-60 hours of use in a school year in order for the game to be affective; however, this has not been scientifically supported yet (Play Attention, 2010)

Reward and reinforcement to help students increase their weak skill sets are key elements to the Play Attention program. If students lost their focus on the objective of the game, the game stopped working. For example, on one of the games, students had to focus their attention on a whale. If the student remained focused and still, the whale dove to the bottom of the ocean to pick up treasure. However, if the student lost their focus, the whale would go to the top of the ocean. Another example is the forklift game. Students had to remain focused on the forklift in order for the driver to load palettes from a dock to a truck. If they lost their focus, the forklift stopped moving. This game format has been found to be beneficial to attention and performance (Raggi & Chronis, 2006).

Play Attention does not utilize extravagant graphics or intricate story lines to keep the player’s attention like other video game systems. On the other hand, players must work for their attention. Students must learn to focus their attention on ordinary things. Play Attention also uses utilizes aspects of functional assessment. The program is tailored toward the individual needs of the students through the pretest taken at the
beginning of each session. Through the game and support from the company, the coach can help the students with their specific weak skills. Furthermore, games go from beginner to intermediate to advanced, and distracters are added as the student progresses through the program. For example, when students are starting the program, they should be in the quietest environment possible. However, as they advance, distracters should be added, such as students moving through the hallway, background music or noise playing, others talking behind them, etc. Finally, *Play Attention* may be used during homework completion so students can see when they are becoming unfocused and self-correct this behavior.

Two students at a time participated in the program with the researcher as their program coach. The intervention was conducted in a computer lab that is empty except for the two students and coach in order to reduce distractions. Before beginning training, a Share Rating pre-survey was given to teachers of the students so data could be entered into the system. The coach used the “Coach’s Rating Scale” (see Appendix I) to observe the students during game play, and that data was entered into the program.

Students began playing games in the program that addressed their specific needs. The length of time it took the student to complete most games was five minutes; however, the coach may have decided to end the game early if the student had played as long as possible. The six types of games are:

- **Attention Stamina** – The goal is to progressively teach the student to prolong attention up to a full five minutes without rest.
- **Visual Tracking** – The goal is to progressively teach the student to prolong attention to objects that randomly appear in a visual field.
• Time on Task – The goal is to progressively teach the student to start a project quickly and stay focused on the project to complete it in a timely manner.

• Short-term Memory – The goal is to progressively teach the student to prolong attention to objects and remember the sequence in which they are displayed.

• Discriminatory Processing – The goal is to progressively teach the student to only pay attention to specified targets while excluding distractions.

• Academic Bridge – The student may read, practice spelling, math, etc. while connected to Play Attention in order to transfer or generalize new attention skills in the classroom. The student or coach will divide homework into a section that may be completed in five minutes. This feature is recommended after 15 sessions have been completed.

Sessions lasted up to 30 minutes. At the end of each session, a journal was completed by the coach and student in order to reflect on progress and to set new goals. This journal was also sent to the teacher after each session in order to aid in generalizability or transfer of skills into the classroom. It was hoped that students would complete between 30-40 hours of Play Attention.

In order to protect student confidentiality, achievement data was stored in Achievement Series, an Internet-based database. Data was only accessible to the researcher, teacher, and parents upon request. Play Attention data was kept in the Play Attention program. It was only accessible to the researcher, who would provide the teacher with daily journal reports and share rating reports at the middle and end of the training.

During data analysis, all students participating in the study were randomly assigned a number. These number assignments were kept in a metal file box, which
remained locked and held in the school vault. The only person with a key was the researcher. At the end of the study, results were disseminated to the teacher, and parents through a pamphlet and a copy of the completed study was given to the principal and superintendent in its entirety. The number assignments were shredded and thrown away.

Data Analysis

Research question number 1 (ADHD symptoms) was analyzed using a repeated measure ANOVA. Research question 2 (academic achievement) was analyzed using a mixed model ANOVA. The independent variable was the two sample groups: ADHD group and control group. The control group was made up of ADHD students who were not participating in the *Play Attention* program. The dependent variable was a continuous variable of MCT 2 practice pretest and post-test scores for both the control group and ADHD group. Research question 3 (effects on gender) was analyzed using a mixed model ANOVA. The independent variable was the control group and ADHD group. The dependent variable was pretest and post-test scores. Research question 4 (perceptions) was only analyzed for descriptive data.

Summary

Data was gathered through multiple data sources: MCT 2 practice tests, *Play Attention* symptomology graph analyses, and a descriptive perception survey. Data was gathered and analyzed in a confidential manner in order to keep participants’ names anonymous. After completion of the study results were disseminated to interested stakeholders, and student data was shredded and thrown away.
CHAPTER IV
DATA ANALYSIS

Introduction

In this chapter, data from an MCT 2 pretest and post-test are analyzed in order to identify if the Play Attention program increased the academic achievement of ADHD students who participated in the program when compared to ADHD students who did not participate in the program. Also, data are analyzed to assess if the Play Attention program had a greater effect on boys than girls due to its computer game format. Next, results from a perception survey given to teachers and one principal are discussed. The researcher received 100% return rate on these surveys. Finally, the effect Play Attention had on ADHD symptomology are qualitatively discussed.

Data

This study was conducted in a fourth through sixth grade upper-elementary school. It involved twelve ADHD students in the experimental group. This group, who participated in the Play Attention program, was made up of one sixth grader, six fifth graders, and five fourth graders, all of which were struggling academically. The genders in this group were seven males and five females. These students participated from the end of October to mid-March.

The control group consisted of twelve ADHD students. The makeup of this group was one sixth grader, five fifth graders, and six fourth graders. Their genders were seven boys and five girls. The perception survey was given to one principal with over 26 years experience in education and eight teachers with experience ranging from 0-5 years to 21-25 years.
Hypothesis one is discussed later on in this chapter. First, hypothesis two stated, “Play Attention increases the academic achievement of ADHD students in reading and/or math compared to controls.” As shown in Table 1, both groups did make improvement. The mean scores of the control group were higher during the reading pretest (control = 38.99 with std. deviation of 15.84, experimental = 34.88 with std. deviation of 10.04) and continued to be higher after the reading post-test (control = 50.70 with std. deviation of 14.97, experimental = 43.31 with std. deviation of 10.8222). So, although reading improvement over time, F(1, 22) = 9.65, p=.005, is significant; improvement of the experimental group over the control group, F(1, 22) = .252, p=.618, was not significant.

Table 1

<table>
<thead>
<tr>
<th>Academic Achievement in Reading</th>
<th>Group</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reading Pretest</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 experimental</td>
<td>34.88</td>
<td>10.04</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2 control</td>
<td>38.99</td>
<td>15.84</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36.94</td>
<td>13.14</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td><strong>Reading Post-Test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 experimental</td>
<td>43.31</td>
<td>10.82</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2 control</td>
<td>50.70</td>
<td>14.97</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47.00</td>
<td>13.32</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

This same effect was seen with math, as shown in Table 2. Both groups’ improvement was significant, F(1, 22) = 12.822, p=.002. However, the math performance mean scores of the control group over the experimental group during the pretest were higher (control group = 48.72, with std. deviation of 12.21; experimental group = 39.07, with std. deviation of 10.44), and this effect did not change after the post-test (control group = 61.17, with std. deviation of 18.64; experimental group = 49.69, with std. deviation of
Therefore, the improvement of the experimental group over the control group, F(1, 22) = .080, p=.781, was not significant.

Table 2

Math Pretest/Post-Test Scores

<table>
<thead>
<tr>
<th>Academic Achievement in Math</th>
<th>Group</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math Pretest</td>
<td>1 experimental</td>
<td>39.07</td>
<td>10.44</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2 control</td>
<td>48.73</td>
<td>12.21</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>43.90</td>
<td>12.16</td>
<td>24</td>
</tr>
<tr>
<td>Math Post-Test</td>
<td>1 experimental</td>
<td>49.69</td>
<td>12.40</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2 control</td>
<td>61.17</td>
<td>18.64</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>55.43</td>
<td>16.56</td>
<td>24</td>
</tr>
</tbody>
</table>

Hypothesis three stated, “The academic impact was more significant for boys than girls due to the type of intervention.” Table 3 shows the mean scores and standard deviations in reading for the pretest and post-test. Males scored higher than the girls during the reading pretest for both the experimental and control groups. However, during the post-test the girls in the experimental group had caught up to the achievement of the boys.

Table 3

Reading Pretest/Post-Test Scores By Gender

<table>
<thead>
<tr>
<th>Academic Achievement in Reading By Gender</th>
<th>Group</th>
<th>Gender</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Pretest</td>
<td>1 experimental</td>
<td>1 male</td>
<td>35.64</td>
<td>11.50</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>2 female</td>
<td>33.82</td>
<td>8.75</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>34.88</td>
<td>10.04</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2 control</td>
<td>1 male</td>
<td>42.44</td>
<td>15.48</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 female</td>
<td>34.16</td>
<td>16.76</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>38.99</td>
<td>15.84</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Although improvement over time was significant, $F(1,20) = 8.86$, $p=.007$, improvement over time by gender, $F(1, 20) = .090$, $p=.767$, was not significant and improvement over time by group, $F(1, 20) = .218$, $p=.646$, was not significant. For math, similar results were seen. Table 4 shows the mean scores and standard deviations.

Table 4

Math Pretest/Post-Test Scores By Gender
### Table 4 (continued).

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 male</td>
<td>49.74</td>
<td>12.64</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>2 female</td>
<td>49.62</td>
<td>13.54</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>49.69</td>
<td>12.40</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>1 male</td>
<td>61.39</td>
<td>20.81</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>2 female</td>
<td>60.86</td>
<td>17.49</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>61.17</td>
<td>18.64</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>1 male</td>
<td>55.56</td>
<td>17.61</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>2 female</td>
<td>55.24</td>
<td>15.89</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>55.43</td>
<td>16.56</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

Improvement over time, $F(1, 20) = 12.557$, $p=.002$, was significant. However, improvement by group, $F(1, 20) = .055$, $p=.816$, was not significant, and improvement by gender, $F(1, 20) = .572$, $p=.458$, was not significant. Interestingly, as with reading, for the math pretest girls in both groups scored lower than the boys. However, for the post-test, girls seemed to catch up to the boys. Figures 1 and 2 show these results. Whether or not these results were caused by Play Attention will be discussed later in Chapter V.

![Graph](image_url)

**Figure 1.** Reading achievement.
Hypothesis one stated, “Play Attention lessons the severity of ADHD symptoms.” This hypothesis was analyzed qualitatively through two tools: a behavior rating scale completed by the experimental groups’ classroom teachers and data from the Play Attention program that graphed the occurrences of fidgets for each member of the control group (see sample graph in Figure 3).

(Fidgets was chosen because that was the most frequently and consistently seen behavior amongst everyone in the experimental group.) The behavior rating scale, which was
completed by students’ classroom teachers, was inconclusive because there was not a consistent pattern seen that showed improvement in ADHD behavior. However, in analyzing the graphs that tracked each student’s amount of fidgets, a well-defined pattern was observed in that all but four students had a considerable decrease in the amount of fidgets observed by the researcher throughout the participation in the *Play Attention* program. Many of the students who did not have a decrease had issues with medication and excessive absenteeism. Table 5 shows the mean amount of fidgets per session for each student at the beginning of the intervention and how many they had at the end.

Table 5

*Amount of Fidgets at Beginning and End of Intervention*

<table>
<thead>
<tr>
<th>Student I.D.</th>
<th>Beginning Number of Fidgets</th>
<th>Ending Number of Fidgets</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6S1</td>
<td>11 fidgets</td>
<td>2 fidgets</td>
</tr>
<tr>
<td>R5S2</td>
<td>7 fidgets</td>
<td>1 fidget</td>
</tr>
<tr>
<td>R5S3</td>
<td>9 fidgets</td>
<td>2 fidgets</td>
</tr>
<tr>
<td>R5S4</td>
<td>12 fidgets</td>
<td>3 fidgets</td>
</tr>
<tr>
<td>R5S5</td>
<td>8 fidgets</td>
<td>1 fidget</td>
</tr>
<tr>
<td>R5S6</td>
<td>1 fidget</td>
<td>1 fidget</td>
</tr>
<tr>
<td>R5S7</td>
<td>7 fidgets</td>
<td>51 fidgets*</td>
</tr>
<tr>
<td>R4S8</td>
<td>21 fidgets</td>
<td>7 fidgets</td>
</tr>
<tr>
<td>R4S9</td>
<td>8 fidgets</td>
<td>8 fidgets</td>
</tr>
<tr>
<td>R4S10</td>
<td>27 fidgets</td>
<td>2 fidgets</td>
</tr>
<tr>
<td>R4S11</td>
<td>13 fidgets</td>
<td>0 fidgets</td>
</tr>
<tr>
<td>R4S12</td>
<td>3 fidgets</td>
<td>5 fidgets</td>
</tr>
</tbody>
</table>

*Note. *This student was taken off his medication during the intervention and had excessive absences during the intervention.*
The fourth research question was assessed through a survey designed to understand the perceptions of the principal and teachers about the efficacy of the Play Attention program. The survey utilized a Likert Scale, 1 = strongly agree and 5 = strongly disagree. Table 6 describes this data.

Table 6

Perceptions Survey Results

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q6 - Useful source for students and teachers?</td>
<td>9</td>
<td>3.78</td>
<td>1.09</td>
</tr>
<tr>
<td>Q7 – Assists in reaching “lost” students</td>
<td>9</td>
<td>3.89</td>
<td>.78</td>
</tr>
<tr>
<td>Q8 – Caps higher-order thinking skills</td>
<td>9</td>
<td>3.78</td>
<td>.44</td>
</tr>
<tr>
<td>Q9 – Addresses a variety of learning styles</td>
<td>9</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Q10 – Increases students’ control over self-learning</td>
<td>9</td>
<td>4.11</td>
<td>.93</td>
</tr>
<tr>
<td>Q11 – Allows for and encourages lifelong learning</td>
<td>9</td>
<td>3.44</td>
<td>.88</td>
</tr>
<tr>
<td>Q12 – Individualizes learning</td>
<td>9</td>
<td>3.78</td>
<td>1.20</td>
</tr>
<tr>
<td>Q13 – Students receive immediate feedback</td>
<td>9</td>
<td>4.33</td>
<td>.87</td>
</tr>
<tr>
<td>Q14 – Students aren’t threatened by program</td>
<td>9</td>
<td>4.33</td>
<td>1.00</td>
</tr>
<tr>
<td>Q15 – Allows completion of quality work</td>
<td>9</td>
<td>3.89</td>
<td>1.17</td>
</tr>
<tr>
<td>Q16 – Encourages risk taking</td>
<td>9</td>
<td>3.67</td>
<td>.87</td>
</tr>
<tr>
<td>Q17 – Useful in preparing students for standardized tests</td>
<td>9</td>
<td>3.89</td>
<td>.78</td>
</tr>
</tbody>
</table>
Table 6 (continued).

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>n</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q18 – Helps students perform at an equal level as traditional students</td>
<td>9</td>
<td>3.56</td>
<td>.88</td>
</tr>
<tr>
<td>Q19 – Reports a variety of student performance data</td>
<td>9</td>
<td>3.89</td>
<td>.78</td>
</tr>
<tr>
<td>Q20 – Information can be stored and retrieved as needed</td>
<td>9</td>
<td>4.11</td>
<td>.78</td>
</tr>
<tr>
<td>Q21 – Openness to change is necessary for this program to be successfully implemented in schools</td>
<td>9</td>
<td>3.89</td>
<td>.93</td>
</tr>
</tbody>
</table>

The components that the majority of those surveyed agreed with were that:

- *Play Attention* addresses a variety of learning styles (Q9 - 44% agreed).
- *Play Attention* increases students’ control over their own learning (Q10 - 44% strongly agreed).
- Students receive immediate feedback to their performance (Q13 - 56% strongly agreed).
- Students do not feel threatened by the *Play Attention* program (Q14 - 56% strongly agreed).
- Information can be stored and retrieved as needed (Q20 - 44% agreed).

The component that received the lowest score (44% had neutral feelings) was that *Play Attention* encourages life-long learning (Question 11).

Summary

In this chapter, data was discussed which showed that *Play Attention* did not increase the academic achievement of ADHD students for reading and math in the
experimental group any more than the growth that was naturally occurring in the control group. Furthermore, it did not improve the achievement of boys over girls through its computer game format. On the other hand, whether by the program or not, a more pronounced rate of improvement in achievement was seen in girls over boys in the experimental group. *Play Attention* did seem to increase students control over their own fidgeting, and the perceptions of teachers and the principal were positive about the effectiveness of the program.
CHAPTER V
SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

In this chapter the study is reviewed as well as the conclusions to this study. A connection is also made between this study and current research. Next, recommendations for practitioners and school policy makers are made. Limitations to this study are acknowledged, and recommendations for policy makers, practitioners, and future research are suggested.

Overview

This study was conducted in a 4th-6th grade upper elementary school. The subjects had been diagnosed with ADHD at some time during their school career. They were divided into two groups: experimental and control. The experimental group participated in a program called Play Attention, a computerized-cognitive training program designed specifically for students with ADHD to assist them with accommodating their symptomology through learned behaviors. Twelve students participated in the program for 19 weeks. In the end, their MCT 2 pretest from August was compared to their post-test in March. These results were also compared to those of the control group, ADHD students who had not participated in Play Attention. Finally, data from the Play Attention system were analyze to decide how effective the program was in helping decrease the symptomology of students’ ADHD.

Conclusions

Research question one asked, “Did Play Attention reduce the symptoms of ADHD?” After analyzing the data, this study found that Play Attention did not significantly decrease ADHD symptoms. The program did help students reduce the
amount of fidgeting they exhibited as shown by the program’s behavior graph (see Figure 4), and as the coach for the control group, the researcher does believe it helped make their attention more concrete, thereby helping them focus more.

![Behavior graph from Play Attention program.](image)

*Figure 4. Behavior graph from Play Attention program.*

Xu, Reid, & Steckelburg (2006) found that computerized cognitive training did help with individualizing interventions, which was consistent with the findings from the *Play Attention* program. However, these traits did not seem to generalize to the classroom, which was inconsistent to the computerized cognitive training in Xu, Reid, & Steckelburg’s study. These findings were also inconsistent with a similar computerized cognitive training program called CPAT in a study by Shalev et al. (2007), which showed significant improvements in ADHD symptomology through behavior ratings by parents.
Studies (Clarfield & Stoner, 2005; Fox et al., 2005; Kerns et al., 1999; Loe & Feldman, 2007; Ota & DuPaul, 2002; Solomonidou, Garagorini-Areau, & Zaferopoulou, 2004) have shown that:

- behavior therapy reduces core symptoms and improves behavior;
- computer-assisted instruction increases active engagement time as well as decreases off-task behaviors, provides individualized, engaging instruction with frequent opportunities for response and high rates of success and reinforcement, and facilitates differentiated instruction;
- strategy training significantly improves the performance levels in attention;
- computerized cognitive training programs reduced the symptoms of ADHD by increasing the attention of ADHD children and providing them with strategies for impulse control; and
- neurofeedback technology modifies brainwave activity to improve attention, reduce impulsivity, control hyperactivity, and produce long-term change.

*Play Attention* incorporates aspects of all of these interventions: behavior therapy, computer-assisted instruction, strategy training, computerized cognitive training, and neurofeedback technology, but this study did not show consistent results in ADHD symptomology.

The second research question asked, “Did *Play Attention* increase academic achievement of ADHD students in reading and/or math compared to controls?” Both groups’ academic achievement increased as the year progressed at the same rate for each subject area. However, the experimental group who participated in *Play Attention* did not make significantly greater gains than the control group. This is consistent with studies by Abikoff in 1991 and 2001, which showed small gains in academic
improvement for ADHD students with cognitive training (an aspect of *Play Attention*).

Furthermore, it was consistent with a study by DuPaul and Weyandt (2006), which discussed the limited research on the validity of strategy training (another aspect of *Play Attention*) with its effectiveness on the improvement of academic performance for ADHD students.

In a study by Barry, Lyman, and Klinger in 2002, it was found that children who were underachieving academically benefited from educational interventions that not only addressed school achievement but also their symptoms of ADHD. In this study, the *Play Attention* group’s pretest and post-test remained lower than the control groups throughout the year, which is inconsistent with the Barry, Lyman, and Klinger (2002) study. It is believed by the researcher that this effect is most likely due to the fact that the students who participated in *Play Attention* were struggling more academically at the beginning of the year than the control group, and even though they made significant improvements (as did the control group), they remained at a lower academic range at the post-test.

The third research question asked, “Was academic impact more significant for boys than girls due to the type of intervention (computer game format)?” Boys achieving greater results than girls were not found to be significant in this study. Consequently, it was interesting that the girls’ achievement levels in the experimental group were lower than the boys at the pretest for both reading and math, but by the post-test, the girls caught up to the boys in both of these subject areas. This was seen in the experimental group and not in the control group, which would be interesting to further investigate in future research. Although this was an interesting result, their improvement was not enough to show significance in academic improvement.
Subrahmanyam et al.’s study in 2001 found that computer games appeal to boys between the ages of 8 and 14 more so than girls. However, they also found in their study that no research actually documents a link between video game playing, attention skills, and increased academic performance; this is consistent with the current study.

Finally, research question four asked, “Did the perceptions of the principal and teachers about Play Attention compare accurately to the efficacy of the program?” One principal and eight teachers were surveyed. These teachers were chosen because they had students participating in the Play Attention program. The principal and teachers did not feel like Play Attention encouraged life-long learning. However, these individuals all agreed that Play Attention addressed a variety of learning styles while increasing students’ control over their own learning through immediate feedback in a nonthreatening fashion. They also perceived the system to be effective in storing and retrieving information as needed. This perception is consistent with Xu, Reid, & Steckelburg’s findings in their 2006 study that included findings which confirmed the benefit of computerized cognitive training programs due to their ability to automatically record data from training sessions which can be retrieved for later analysis.

Discussion

Constructivist Theory states that humans construct knowledge from experiences. Play Attention embraces this theory by trying to assist participants in constructing new knowledge about their attention by allowing them to see their focus. Play Attention incorporates a coach to assist students, which is a component to Maria Montessori’s ideals (teacher as facilitator). It also helps students work within their Zone of Proximal Development in relation to their attention and readiness to move forward with more challenging games. Furthermore, Play Attention is a tailored intervention that was
designed for its use in conjunction with other interventions. This practice is consistent with previous research (DuPaul & Eckert, 1998; DuPaul & Weyandt, 2006; Hoza et al., 1999; Swanson, McBurnett, Christian, & Wigal, 1995; Whalen & Hanker, 1991). One intervention alone is not sufficient to help students with ADHD. No Child Left Behind helped educators push for ALL students to achieve success, and through its flexibility in spending Play Attention allows for schools and districts to purchase programs to help all students make improvements.

The data from the perception survey did show that educators believed that *Play Attention* accommodated a wide range of learning styles through this intervention, which is a key component to Differentiated Instruction. It also was a relevant intervention for the students’ world in its efforts to help them accommodate their ADHD symptoms. It provided important feedback to the students and helped them become self-evaluative through its journaling process.

ADHD has been found to be a life-long disorder with only 30-40% of all children growing out of it. Many interventions for this disorder fail due to the lack of follow-through by the adults providing the accommodations. No one intervention for ADHD works by itself. Many students who participated in this study were on medication, and as the research says, sometimes their parents would take them off and put them back on from time to time. This lack of consistency in medication did have an effect on the results of this study.

*Play Attention* was a mixture of behavior therapy, computer-assisted instruction, and computerized cognitive training. Its purpose was to reduce core symptoms of ADHD through positive and negative consequences, it helped sustain attention and gave immediate feedback, and it tried to train the brain to improve weak areas of learning (i.e.,
short-term memory, attention stamina). But like many other interventions, Play Attention fell into the trap of inconsistent implementation due to conflicting scheduling issues.

Although research has found computerized cognitive training to be less effective for girls, in this study the girls’ academic achievement increased at a faster rate than the boys. It is hard to tell if this result was a true effect of the Play Attention program due to the age range of students in the study and lack of implementation time, but with a longer implementation time and greater range of age participation, there may be more significant data in order to analyze if Play Attention caused this effect. Furthermore, the training done during Play Attention sessions did not seem to transfer to other situations such as the classroom. By having more contact with the students’ teachers and parents, the generalizability may increase.

Time was a significant factor in the outcome of this research study. It is important for schools that wish to use Play Attention or other programs like it to begin the intervention at the beginning of the school year. Make sure your purchase orders are completed and approved, order the program, and get it installed before the year begins.

Limitations

As predicted in Chapter one, convenience sampling was a limitation to this study. This program is specifically designed for students with ADHD, and due to budget constraints and the price of the program, this study was conducted in one elementary school. One of the biggest limitations not predicted was time. According to a study by Fox, Tharp, & Fox in 2005, neurofeedback technology was most effective and produced long-term change after 60 sessions or 6 months of implementation. This amount of time is difficult in a school setting. Furthermore, according to Play Attention (2010), students should complete 40-60 hours of use in order for the game to be effective. However, for
this study the intervention did not get started until the end of October due to purchasing issues (i.e., completing purchase order, getting order approved, faxing order, etc.). Then the researcher had to wait for the technology department to install the program. To add to the time issue, this program was implemented in an upper elementary; therefore, with holidays out of school, scheduling around testing, special school events, etc., this intervention time was not protected, so many times students missed their scheduled time.

A second limitation was inclusion of students in the experimental and control groups. The experimental group was comprised of students who were struggling academically, and while the control group had a few students who met this criterion, the majority of the control group was not struggling with their academics. It is believed that this was a major reason why improvement of the experimental group over the control group was not seen. Both groups made improvement but the control group was performing at a higher level than the experimental group from the beginning.

A third limitation that was not predicted was location. The program was installed in the school’s computer lab. The school had two labs: one for interventions and one for classrooms to sign up and use. Because this intervention began late into the 2nd 9 weeks, the program had to be installed in the classroom drop-in lab instead of the intervention lab. Classes would run late, sign up over others’ times, use the lab for testing requirements, etc., which also affected the amount of time spent utilizing the intervention. It was hoped that students would complete between 30-40 hours of playtime; however, the longest logged amount of hours was eight. Although no significant results were seen in this study, the results may have been different if the implementation time had been longer. Furthermore, the effect of girls catching up to the boys in the experimental group
only when comparing the pretest to the post-test may have been more significant allowing for better analysis of the phenomena.

Finally, the failure of adult follow through was a fourth limitation. According to Hoza et al. (1999), the most common threats to interventions for students with ADHD are the failure of adults to follow through with implementation as well as multiple contacts between teacher and interventionists not being consistently completed. Many of the students in the experimental group are on medication for their ADHD, and many times throughout this study, their parents would alter their medication by changing the dosage or stopping it all together without conferring with their child’s doctor. These changes in medication were a part of the first threat of the lack of adult follow through.

Also throughout this intervention, the students kept a journal after each session for them to reflect on their progress. Many of the teachers would read these journals and provide encouragement as well as reinforcement of the skills we were working on through Play Attention. Other teachers never opened the Play Attention journal or discussed the program with their students. The researcher provided graphs to the homeroom teachers and principal updating them at the middle and end of the program. Some teachers reviewed the graphs and asked questions, while others ignored the graphs.

Recommendations for Policy and Practice

Although the findings of this study were limited in their significance, it is still believed that Play Attention can be an effective program for ADHD interventions in schools. This hypothesis is based on the comparison of Play Attention to the many interventions that have been proven effective in the treatment of ADHD. Based on the findings from this study, the most important recommendations for practitioners would be to begin the intervention at the beginning of the year. Schools should work with
community business members and grant programs to buy enough units to meet your school’s population needs.

Next, this would be an excellent intervention for the Response to Intervention process with No Child Left Behind as a Tier 2 or Tier 3 behavior intervention within schools. This is a more targeted intervention program, and by doing this the intervention would be a priority and less likely to be susceptible to scheduling changes. It would also be an excellent program to incorporate into schools using Positive Behavior Intervention Strategies (PBIS) because it uses positive reinforcement to help students understand their lack of focus in order to improve their symptomology.

Teachers could use the results of this study to internalize the importance of consistency in the implementation of interventions for students with Attention Deficit/Hyperactivity Disorder. As a master teacher knows, it is tough to remember the behavior interventions because of the seemingly lack of priority they have in these times of academic accountability. However, Hoza et al. found in their 1999 study that ADHD students need more than just academic interventions. *Play Attention* is one of these behavioral interventions that can be implemented relatively easily within the school setting. Furthermore, it is advised that teachers make these implementations a priority. Don’t push them aside for something else. Without good behavior and improvements in the inattentive behavior common in students with ADHD, their academic achievement will not improve.

Principals should strive to find the money within their budgets to purchase programs and interventions to help students with ADHD. These students represent a growing population within our schools, and these students need our help just as much as the students who need academic interventions. Principals could write grant proposals,
use Title 1 funds, etc. to purchase programs like *Play Attention* or other programs that are similar which will utilize technology to help students with ADHD learn to accommodate their disorder. Principals need to be leaders in making it a priority within their schools to implement these behavior interventions so that teachers will also make it a priority.

School boards need to be supportive of their schools’ efforts to purchase programs to address the needs of students with ADHD and other behavior problems. In the current educational environment of high-stakes accountability, these members of school districts often loose focus of the other aspects of education besides academia, as the majority of school board members have never worked in education. It is important for them to remember that without positive behavior and focus in the classroom students will not learn. Therefore, they should make policies that support the teachers and other school staff in their efforts to help students become responsible citizens in society.

After the school board makes the policies, superintendents need to be well informed about what programs are current in their ability to help students with ADHD and other behavior issues. They need to begin by looking at the current research and being skeptical of salespersons whose only agenda is to sell their product. They need to listen to the principals and teachers within their schools to identify what needs are immediate. Finally they can be an integral part of the grant writing process and provide money within their budgets for the purchase of these programs, as well as encouraging the teachers and students who are implementing these programs.

**Recommendations for Future Research**

It is highly recommended that *Play Attention* be researched again in a school setting. The company provided outstanding research results of their own within a clinical setting. However, for practitioners in general education, results need to be seen within
the real world. For future research, it is recommended that the intervention start at the beginning of the school year. This will help the interventionist get closer to 40 hours of implementation time. School personal need to ensure that the program is purchased and installed by the beginning of the school year.

Also for future research, the experimental group’s academic achievement levels should be comparable to the control groups, so that educators can see if *Play Attention* improves the academic achievement levels of the experimental group. If students are on medication and are suddenly taken off, they need to be taken out of the study. *Play Attention* and other program like it have been designed to be completed in conjunction with other interventions. When a student is taken off their medication or if it is adjusted, this will affect the data in the study.

Schools are busy places, but this intervention needs to be conducted in a room that the distractibility levels can be controlled as well as the amount of interruptions. If a school has a lab dedicated to academic interventions, it is recommended that *Play Attention*, or some other program that is similar, be placed in that location.

Additionally, for future research, interventionists who are implementing the program should have a lot of contact with each student’s teacher so that generalizability into the classroom is more effective. They must keep the teachers informed of student progress as well as tips for integration of new skills into the classroom environment. This would be consistent with Hoza et al.’s 1999 study which found that multiple contacts between teacher and interventionist are a necessary component in contributing to the significance in academic increases and behavioral changes.

Due to the results from this study of girls versus boys’ achievement levels, it is finally recommended that more research be done incorporating gender as a variable. This
study was conducted in an upper elementary where girls mature faster than boys. *Play Attention* is recommended for ages 5 through adult, so by placing the intervention at a lower elementary and completing the intervention for the recommended amount of time, researchers may be able to see a true difference between gender achievement levels.

**Summary**

This study took place in an upper elementary school made up of grades four, five, and six. It was conducted under the supervision of the researcher. The purpose of this study was to identify if *Play Attention* is a reliable and efficient intervention strategy in a school setting for students with Attention Deficit/Hyperactivity Disorder by decreasing their symptomology thereby increasing their academic achievement. The results of the study were hoped to address the problem of students with ADHD having more pronounced academic underachievement when compared to their peers with ADHD. It was also hoped that it would help educators and administrators identify an intervention that would help them meet the accountability standards within the United States today. These standards will not allow teachers or administrators to ignore the growing number of behavior challenges seen in our schools and classrooms today.

*Play Attention* is a computer program based on aspects of the Constructivist Theory. It also incorporates aspects of behavior therapy, strategy training, computer-assisted instruction, neurofeedback technology, and cognitive training (all of which are well researched interventions). *Play Attention* incorporates differentiated instruction, allowing the coach to assign tasks to students, which will help them work on their own areas of weakness.
Although this research study did not find significant results, future research can address the limitations of this study to give educators a better picture of the full potential of this program.
APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board
118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 10110805
PROJECT TITLE: Is There a Relationship Between the Play Attention Program and Improved Student Achievement
PROPOSED PROJECT DATES: 11/02/2010 to 11/01/2011
PROJECT TYPE: Dissertation
PRINCIPAL INVESTIGATORS: Jenny Ann Webber
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Educational Leadership & School Counseling
FUNDING AGENCY: N/A
HSPRC COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 01/03/2011 to 01/02/2012

[Signature]
Lawrence A. Hosman, Ph.D.
HSPRC Chair

[Date]
1-26-2011
APPENDIX B
PERMISSION REQUEST FORM (SUPERINTENDENT)

Dear [Name],

As you know, I am in the process of completing my doctorate at The University of Southern Mississippi. I am completing my dissertation on the use of the Play Attention program in order to assess how this intervention affects student achievement in reading and math for students with ADHD. I would like to ask your permission to obtain data from our school for this study, as we are the only known school on the coast to use this intervention.

I have gained approval through the university’s Institutional Review Board. Their job is to ensure the rights of human subjects in research are being protected. After gaining yours and [Name] approval, I will send a letter to all parents whose child is enrolled in the program in order to gain their approval for the use of their child’s MCT 2 practice pretest and post-test data. I will also ask each child for his/her assent to participate in my study. Finally I will send a letter to students’ parents who have not used the Play Attention program to ask their permission to use their children’s MCT 2 practice pretest and post-test data.

Student names will be kept anonymous throughout the study through a numbering system, and the only data that will be used will be the data from the Play Attention program and the children’s MCT 2 practice pretests and post-tests. This information will also be shared with the teachers and parents of each child when the study is complete. However, no names will be used in my data analysis. The study will be completed by May 2011. At the end of the study, a copy of my dissertation will be given to you and all student data will be shredded.

If you agree with my using our school and student data in my study, please sign below. I appreciate your support.

Sincerely,

Jenny Webber
Instructional Coach

I, ________________________, give Jenny Webber permission to use Harper McCaughan School as the data source for her study on the Play Attention program.
APPENDIX C

PERMISSION REQUEST FORM (PRINCIPAL)

Dear [Principal's Name],

As you know, I am in the process of completing my doctorate at The University of Southern Mississippi. I am completing my dissertation on the use of the Play Attention program in order to assess how this intervention affects student achievement in reading and math for students with ADHD. I would like to ask your permission to obtain data from our school for this study, as we are the only known school on the coast to use this intervention.

I have gained approval through the university’s Institutional Review Board. Their job is to ensure the rights of human subjects in research are being protected. After gaining yours and [Mrs. Hamilton’s] approval, I will send a letter to all parents whose child is enrolled in the program in order to gain their approval for the use of their child’s MCT 2 practice pretest and post-test data. I will also ask each child for his/her assent to participate in my study. Finally I will send a letter to students’ parents who have not used the Play Attention program to ask their permission to use their children’s MCT 2 practice pretest and post-test data.

Student names will be kept anonymous throughout the study through a numbering system, and the only data that will be used will be the data from the Play Attention program and the children’s MCT 2 practice pretests and post-tests. This information will also be shared with the teachers and parents of each child when the study is complete. However, no names will be used in my data analysis. The study will be completed by May 2011. At the end of the study, a copy of my dissertation will be given to you and all student data will be shredded.

If you agree with my using our school and student data in my study, please sign below. I appreciate your support.

Sincerely,

Jenny Webber
Instructional Coach

I, ______________________, give Jenny Webber permission to use Harper McCaughan School as the data source for her study on the Play Attention program.
APPENDIX D

PARENTAL CONSENT FORMS

Dear Parent of ________________,

As you know, your child has been participating in an intervention at school in order to help them learn to control their ADHD symptoms in class and at home. I, Jenny Webber, am the instructional coach at Harper McCaughan Elementary School, and I have been working with your child twice to three times a week on this program. I am very encouraged by their progress.

I also happen to be working on my Doctorate Degree from the University of Southern Mississippi. My dissertation is on Play Attention. My goal for this study is to assess whether or not Play Attention increases students’ academic achievement in reading and math, whether or not it decreases their ADHD symptoms, and whether or not it affects boys and girls differently. Therefore, I would like to ask your permission to use your child’s data, NOT THEIR NAME OR PERSONAL INFORMATION, in my dissertation to complete the requirements for my Doctorate. The only data I would use would be their MCT 2 practice test they took in August and which they will take again in March. It is very important for us to learn if this program is an effective program for our students at Harper McCaughan so we know if it is a worthwhile program in the coming years.

I have gained approval through the university’s Institutional Review Board. Their job is to ensure the rights of human subjects in research are being protected. I have also gained approval from Mrs. Hamilton, our superintendent, and Mr. Sims, our principal, to conduct this study.

Student names will be kept anonymous throughout the study through a numbering system, and the only data that will be used will be the data from the Play Attention program and the children’s MCT 2 practice pretests and post-tests. This information is normally shared with the teacher and parents of each child. However, no names will be used in my data analysis. The study will be completed by August 2011. At the end of the study, a copy of my dissertation will be available to you upon request, and it will be available at the school district’s central office.

If you agree with my using your child’s data in my study, please sign below. I appreciate your support.

Sincerely,

Jenny Webber
Instructional Coach

I, ________________________, give Jenny Webber permission to use my child’s Play Attention data and MCT 2 practice test scores as the data source for her study on the Play Attention program.
Dear Parent of __________________,

My name is Jenny Webber. I am the instructional coach at Harper McCaughan Elementary School. I have been working with ADHD children all year to see if a new program we are piloting improves their ADHD symptoms and their academic achievement. The program is called Play Attention, and you may read about the program at www.playattention.com.

I also happen to be working on my Doctorate Degree from the University of Southern Mississippi. My dissertation is on Play Attention. My goal for this study is to assess whether or not Play Attention increases students’ academic achievement in reading and math, whether or not it decreases their ADHD symptoms, and whether or not it affects boys and girls differently. Your child has been chosen to be a part of the control group for my study. However, I must have your permission to use some of their test scores. Therefore, I would like to ask your permission to use your child’s data, NOT THEIR NAME OR PERSONAL INFORMATION, in my dissertation to complete the requirements for my Doctorate. The only data I would use would be their MCT 2 practice test they took in August and which they will take again in March. It is very important for us to learn if this program is an effective program for our students at Harper McCaughan so we know if it is a worthwhile program in the coming years.

I have gained approval through the university’s Institutional Review Board. Their job is to ensure the rights of human subjects in research are being protected. I have also gained approval from Mrs. Hamilton, our superintendent, and Mr. Sims, our principal, to conduct this study.

Student names will be kept anonymous throughout the study through a numbering system, and the only data that will be used will be the data from the Play Attention program and the children’s MCT 2 practice pretests and post-tests. This information is normally shared with the teacher and parents of each child. However, no names will be used in my data analysis. The study will be completed by August 2011. At the end of the study, a copy of my dissertation will be available to you upon request, and it will be available at the school district’s central office.

If you agree with my using your child’s data in my study, please sign below. I appreciate your support.

Sincerely,

Jenny Webber
Instructional Coach

I, ______________________, give Jenny Webber permission to use my child’s MCT 2 practice test scores as a part of the data source for the control group for her study on the Play Attention program.
APPENDIX E

DESCRIPTION OF STUDY SCRIPT

Researcher Says: Hello, Mrs. or Mr. ______________. This is Jenny Webber. I am the teacher who is helping your child with the Play Attention program. We are very excited about this new program for our school, and its potential for helping your child. I am also a doctoral student at The University of Southern Mississippi and am in the process of completing my dissertation. I am writing that dissertation about Play Attention and how it influences student achievement and symptoms of ADHD. The university’s Institutional Review Board has approved my study. That is a group of professors who ensure research studies are safe for human subjects. I wanted to ask your permission to use your child’s data from their MCT 2 practice tests and from the Play Attention program. Your child’s name will not be used, and at the end of my study I will send my results home with your child so you can see what I have discovered. Do you have any questions for me?

Parent Replies:

Researcher Says: Thank you for your time. (If the answer is yes for permission, the letter in appendix C will go home.)
APPENDIX F
SHARE RATINGS

Play Attention Behavior Ratings for

Rate user on various behaviors to use as a guide for comparing overtime.

0=Never 1=Sometimes 2=Often 3=Always

RATED BY: ____________________________

CONTACT: ______________________________

DATE: _________________________________

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Engages in nervous habits (e.g. twists-hair, bite nails, chew objects)</td>
<td>______</td>
</tr>
<tr>
<td>(2) Off task (e.g. eyes moving off target)</td>
<td>______</td>
</tr>
<tr>
<td>(3) Cannot adjust behavior to expectations of situation</td>
<td>______</td>
</tr>
<tr>
<td>(4) Calls out</td>
<td>______</td>
</tr>
<tr>
<td>(5) Fidgets</td>
<td>______</td>
</tr>
<tr>
<td>(6) Hum</td>
<td>______</td>
</tr>
<tr>
<td>(7) Easily frustrated</td>
<td>______</td>
</tr>
<tr>
<td>(8) Cries</td>
<td>______</td>
</tr>
<tr>
<td>(9) Outbursts</td>
<td>______</td>
</tr>
<tr>
<td>(10) Excitable, impulsive</td>
<td>______</td>
</tr>
<tr>
<td>(11) Does not want to complete task (verbal argument)</td>
<td>______</td>
</tr>
<tr>
<td>(12) Does not follow verbal instructions</td>
<td>______</td>
</tr>
<tr>
<td>(13) Needs instructions repeated</td>
<td>______</td>
</tr>
<tr>
<td>(14) Fails to remember short instructions</td>
<td>______</td>
</tr>
<tr>
<td>(15) Does not complete assignments independently</td>
<td>______</td>
</tr>
<tr>
<td>(16) Attempts to begin without full instructions</td>
<td>______</td>
</tr>
<tr>
<td>(17) Makes unnecessary banter or noises (e.g. burping, chatting to self)</td>
<td>______</td>
</tr>
<tr>
<td>(18) Attempts inappropriate behaviors (e.g. tips desk, tips chair)</td>
<td>______</td>
</tr>
</tbody>
</table>

Please return this form to: ________________________________
APPENDIX G

DESCRIPTIVE SURVEY

Survey Instrument for Principals and Teachers on Their Perceptions of the Value of Play Attention for Schools

Directions: Share your perceptions of the value of Play Attention for schools by identifying your level of agreement or disagreement with the following statements.

For data collection purposes, please identify your personal demographic data.

1. Gender  
   _____ Male  _____ Female

2. Racial/Ethnic  
   _____ Asian or Pacific Islander  
   _____ Black, non-Hispanic  
   _____ Hispanic  
   _____ American Indian or Alaskan Native  
   _____ White, non-Hispanic

3. Job Classification  
   _____ Principal  _____ Teacher

4. For teacher respondents,  
   grade level currently teaching  
   _____ 4th  
   _____ 5th  
   _____ 6th

5. Years in education  
   _____ 0-5 years  
   _____ 6-10 years  
   _____ 11-15 years  
   _____ 16-20 years  
   _____ 21-25 years  
   _____ higher than 26 years

Use the following scale to best describe your level of agreement or disagreement with items 6 – 23.

1=strongly agree  2=agree  3=neither agree nor disagree  4=disagree  5=strongly disagree

6. Play Attention has been a useful resource for students  
   1  2  3  4  5  
   and teachers.
7. Play Attention assists in reaching “lost” students. 1 2 3 4 5
8. Play Attention can cap such higher-order thinking skills as synthesis, analysis, and adaptability. 1 2 3 4 5
9. Play Attention address a variety of learning styles. 1 2 3 4 5
10. Play Attention increases students’ control over their own learning. 1 2 3 4 5
11. Play Attention allows for and encourages life-long learning. 1 2 3 4 5
12. Play Attention individualizes learning. 1 2 3 4 5
13. Through Play Attention students receive immediate feedback to their responses. 1 2 3 4 5
14. Students are not threatened by Play Attention. 1 2 3 4 5
15. Play Attention allows students to complete quality work in an environment of personal control and autonomy. 1 2 3 4 5
16. Play Attention encourages students to take risks. 1 2 3 4 5
17. Play Attention is a useful tool in preparing students to take standardized tests. 1 2 3 4 5
18. Students using Play Attention perform at an equal level as students in traditional classes by the end of the program. 1 2 3 4 5
19. Play Attention makes it possible to report a variety of student performance data. 1 2 3 4 5
20. It is important that through Play Attention information can be stored and retrieved as needed. 1 2 3 4 5
21. Openness to change is necessary if Play Attention is to be successfully implemented in schools. 1 2 3 4 5

Thank you for completing this survey.
APPENDIX H

LETTER OF PERMISSION FOR SURVEY MODIFICATION

MACONAQUAH SCHOOL CORPORATION

Dr. Douglas M. Arnold
Superintendent
Ext. 1000

Dr. James M. Callane
Assistant Superintendent
Ext. 1050

September 24, 2010

Ms. Jenny Weber
14958 East Shadow Creek Drive
Biloxi, Mississippi 39532

Dear Ms. Weber,

Please use this letter as an acknowledgement of my granting you permission to use my Survey Instrument for Principals and Teachers on Their Perceptions of the Value of Technology for Schools. You may make any modifications that you wish.

Best of luck with your research and I would appreciate the opportunity to review your finished dissertation.

Sincerely,

Douglas M. Arnold, Ed.D.
Superintendent
APPENDIX I
COACH'S RATING SCALE

DO NOT USE PERMANENT MARKERS

[Table with columns for Coach, Player, Age, Sex, Date, Distraction (None, Low, Medium, High)]

Play®
Attention

Our Stated Educational Objective Is:

Coaches Session Rating Scale

Instructions: Read each item below. Tally the number of occurrences during each game and place the total number in the unit to the left of each item. Mark non-occurrences as 0.

☐ 1. Engages in nervous habits (e.g., twists hair, bites nails, chews objects, etc.)
☐ 2. Off task (e.g., eyes moving off target)
☐ 3. Cannot adjust behavior to expectations of situation
☐ 4. Calls out
☐ 5. Fidgets
☐ 6. Hum
☐ 7. Easily frustrated
☐ 8. Cries
☐ 9. Outbursts
☐ 10. Excitable, impulsive
☐ 11. Does not want to complete task (verbal argument)
☐ 12. Does not follow verbal instructions
☐ 13. Needs instructions repeated
☐ 14. Fails to remember software operation (after three sessions)
☐ 15. Attempts to change software programs without completing current application
☐ 16. Attempts to begin without coach's instructions
☐ 17. Makes unnecessary banter or noises (e.g., burping, chatting to self)
☐ 18. Attempts inappropriate behaviors (e.g., kicks desk, tips chair, etc.)
☐ 19. Other: __________________
REFERENCES


Captiain’s Log [Computer Software]. Richmond, VA: Brain Train.


Play Attention (Version 5.1) [Computer Software]. Asheville, NC: Unique Logic & Technology.


