A Meta-Analysis of Attention Deficit/Hyperactivity Disorder Interventions: An Empirical Road to Pragmatic Solutions

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(Abstract)

To continue to meet the benchmarks for success across all subgroup populations as defined by the No Child Left Behind Act (NCLB), educators need to look continuously upon the latest research regarding best educational practice. Attention deficit hyperactivity disorder (ADHD) affects 3% - 7% of the school-age population. NCLB mandates that educators demonstrate student success across all subgroups. This includes children identified with ADHD who may be receiving services under the Individuals with Disabilities Education Act (IDEA) or Section 504 of the 1973 Rehabilitation Act.

Given these charges, this meta-analysis examined 18 studies to determine how three intervening variables such as behavior intervention, medication, and a combination of behavior intervention and medication, effected the functioning of students diagnosed with ADHD under the DSM III or DSM IV definition. Effect sizes were calculated for each qualified, independent sample. Effect sizes were calculated for combinations of the 9 outcome variables with each of the 3 interventions of behavior intervention, medication, or a combination of behavior intervention and medication. The outcome variables were: (a) academics, (b) aggression, (c) attention, (d) externalizing behaviors, (e) hyperactivity/impulsivity, (f) inattention, (g) internalizing behaviors, (h) social skills, and (i) social problems.

Twenty-four effect sizes were calculated where data were available and homogeneity tests indicated. Although sample homogeneity presented technical issues for some outcome and intervening variable combinations, effect size calculations were appropriate. Behavior interventions had a range of effects on social skills (ES = .81), academics (ES = .22), and aggression (ES = .37) outcomes. The combination of behavior interventions and medication had a range of effects on inattention (ES = 1.67) and social skills (ES = .90) outcomes. The findings in this meta-analysis are intended to be used as a guide for educational discussions that link research to policy at the local educational agency level or that link research to individualized education programs at the student level.

DEDICATION

This is to Nancy whose unconditional love, support, and family guidance make all ventures possible. Likewise, to Macy and Bailey whose precious innocence and love remind me why I am an educator working for the good of all kids.

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The depth of my gratitude is immeasurable towards those who believed in me regarding this journey, both personal and professional acquaintances. I truly appreciate the commitment and dedication of my committee co-chairpersons, Dr. Jean Crockett and Dr. Lisa Driscoll. Your long hours of commitment and encouraging words allowed me to keep "chasing the data."

I want to thank my mom and dad, Mr. and Mrs. Clark Snead, who always had faith in my abilities. I can always remember the praise and encouragement you gave me. Specifically, you did a great job ignoring my faults and praising my strengths. Your support and spiritual guidance have always been unwavering and clear. Because of you, I know that God gives us strength to conquer any challenge as long as we follow His will. It was the transferring of this disciplined belief from you to me that I learned to find my way, but never to forget where I started. Thank you.

Finally, to my greatest blessings of all, I want to let my wife, Nancy, and my children, Macy and Bailey, know that their selfless support of me throughout this process is most appreciated. You have taught me to persevere. All three of you gave your time and energy, through a lot of your own milestones in life, to support me. I appreciate you, love you and look forward to relaxing on that front porch of life with you (to include both pastoral and oceanic settings, of course).

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CHAPTER 1

THE PROBLEM

Attention deficit/hyperactivity disorder (ADHD) affects about 3% - 7% of the school-age population (American Psychiatric Association, 2000). According to the *Diagnostic and Statistical Manual of Mental Disorders* (2000), in ADHD "the essential feature is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development" (p. 78). What knowledge must a teacher have to be successful with students and families who struggle with ADHD in the traditional K-12 educational setting? This is a question that has perplexed many educators, parents, and families over the years. I, too, have been challenged in the classroom to meet the needs of children with ADHD and have had the same question.

With the voluminous amounts of information available concerning how to educate a child with ADHD, one can become confused by the different interventions, thus becoming overwhelmed in the quest to help these children. The confusion is exacerbated by the many different interventions promoted in educational magazines and advanced by local educational and local medical experts. Further complications arise from the interpretation of outcomes of litigation surrounding ADHD. Heightened accountability for educators is also a factor with the pressure from such organizations as Children and Adults with Attention Deficit/Hyperactivity Disorder (CHADD) and newly enacted laws such as the No Child Left Behind Act (NCLB). As a current administrator, I have seen some students respond successfully to interventions, while others remain unaffected.

Without the support of appropriate and effective interventions, many years of schooling could be wasted for children with ADHD who fail to experience success.

Context of the Study

As presented earlier, ADHD affects 3% - 7% of the school-age population according to most experts (American Psychiatric Association, 2000). This percentage represents about 2 million children when applied to school systems across the United States. Within these numbers, students may be identified under the Individuals with Disabilities Education Act (IDEA), §504 of the Rehabilitation Act of 1973, or they may not be identified formally at all. This wide spectrum of ADHD support tends to give the practicing educator much to consider. It is not enough to say that the child is challenged by ADHD and a simple prescribed intervention will help compensate. One must understand the severity of the symptoms posed by a child's ADHD. If the symptoms are severe, then the child may be served under the IDEA umbrella and require specially designed programming or service supports. Some students may only require modifications or accommodations to be successful, as under the umbrella of the §504 policy. Some students may not have a structured plan at all, but take only medication. With all of the various approaches to ADHD and the wide spectrum of behaviors that children exhibit with ADHD, it is imperative that educators understand what successful interventions are available to address the student need.

Heightened accountability for educators may come in the form of litigation. In *Collinsgru v. Palmyra Bd. of Educ*., the 3rd Circuit Court ordered the school district to pay all attorney fees totaling $53,050 incurred by the parents of a student (Johnny) with ADHD. The district settled out of court by paying tuition for Johnny to attend a private

school until graduation. The litigation centered on the school district's identification of the child under the §504 guidelines rather than under the Individuals with Disabilities Education Act (IDEA). Specifically, the dispute was about the level of accommodations and modifications Johnny should receive; a §504 accommodation plan is less intensive than the specially designed instruction ensured under the IDEA. This case represents another dimension to the already complex circumstances of serving students with ADHD. Specifically at dispute were the accommodations provided under a §504 plan. This mis-step in the decision making process further stresses the need for the educator to understand ADHD and how it affects students in the classroom. .

Another factor that contributes to the urgency of understanding successful intervention strategies, for students with ADHD, is found in the NCLB. Unlike his predecessors who signed major educational reform acts, President George W. Bush appears to endorse the newest reauthorization of the Elementary and Secondary Education Act (ESEA) known as public law 107-110. This is more popularly called the "No Child Left Behind Act of 2001" signed by President Bush on January 8, 2002. NCLB is a wide-sweeping reform that involves four basic principles of concentration: (1) stronger accountability for results; (2) increased flexibility and local control; (3) expanded options for parents; and (4) an emphasis on teaching methods that have been proven to work (20 U.S.C. 6301, §1001). The fourth principle is the impetus for this study in the sense that teaching methods are being interpreted to include intervention strategies for students. For the purpose of this study, emphasis will be on intervention strategies for students with ADHD.

Educators are not the only ones confused about how to serve the needs of the students with ADHD. Parents are, too. Parents are becoming increasingly empowered as ADHD becomes trendy in the popular culture. Television programs continue to embrace an audience of parents who are trying to understand why their child is not successful in their local public school. Similar needs for empowerment are evidenced by the membership of Children and Adults with Attention Deficit/Hyperactivity Disorder (CHADD).

> CHADD was founded in 1987 by a small group of parents of children with AD/HD and two treating psychologists in Plantation, Florida (near Miami). These parents came together because they felt frustrated and isolated, and there were few places to turn for support and information about AD/HD. (http://www.chadd.org/webpage.cfm?cat_id=2&subcat_id=1)

Add the tenets of CHADD to the requirements of the NCLB and the message is clear: Educators must meet the needs of all children, inclusive of those with ADHD.

Statement of the Problem

The challenge facing educational leaders is two-fold when ADHD is present. First, there is the challenge of learning for the students, and second, the challenge of teaching for the educators. The challenge is made manageable by introducing research-based interventions to provide a conducive learning environment that will result in student academic achievement. Some possible challenges to the student caused by ADHD include difficulties in cognition, memory, behavior, impulsiveness, hyperactivity, aggression, on-task behavior, compliance, depression, self-esteem, efficacy, and anxiety (Purdie, Hattie, & Carroll, 2002). Some possible challenges for the teacher when

working with students with ADHD are classroom management, student success, and determining which intervention is useful (DuPaul & Eckert, 1997). Researchers have proceeded with the hypothesis that once interventions can be successfully matched to the student, then the student's achievement might increase (Ottenbacher & Cooper, 1983). The concept model in Figure 1 illustrates this process.

Concept Model

As illustrated in Figure 1, the challenge to students is learning. Literature shows that the learning for the individual with ADHD is a challenge, but sometimes the extroverted behaviors in class make learning a challenge for all of the students in the environment. Many factors inhibit the pathway to learning for students with ADHD. Those factors are discussed in detail in Chapter 2 within the theory of behavioral disinhibition by R. A. Barkley (1997), along with findings from other meta-analyses regarding ADHD and related interventions.

The challenge to educators is teaching. Educators, as well as students, are accountable under the NCLB. Because 3% - 7% of child-age students are diagnosed with ADHD (American Psychiatric Association, 2000), research-based interventions with a record for successfully quieting the disruptions posed by this disorder have the potential to be valuable to teachers, students, and their parents.

Research Purpose

The purpose of this study is to determine the effectiveness of different interventions for students with ADHD served in the preK-12 educational setting. The measures of interest are student behavior, social skills, and academic achievement.

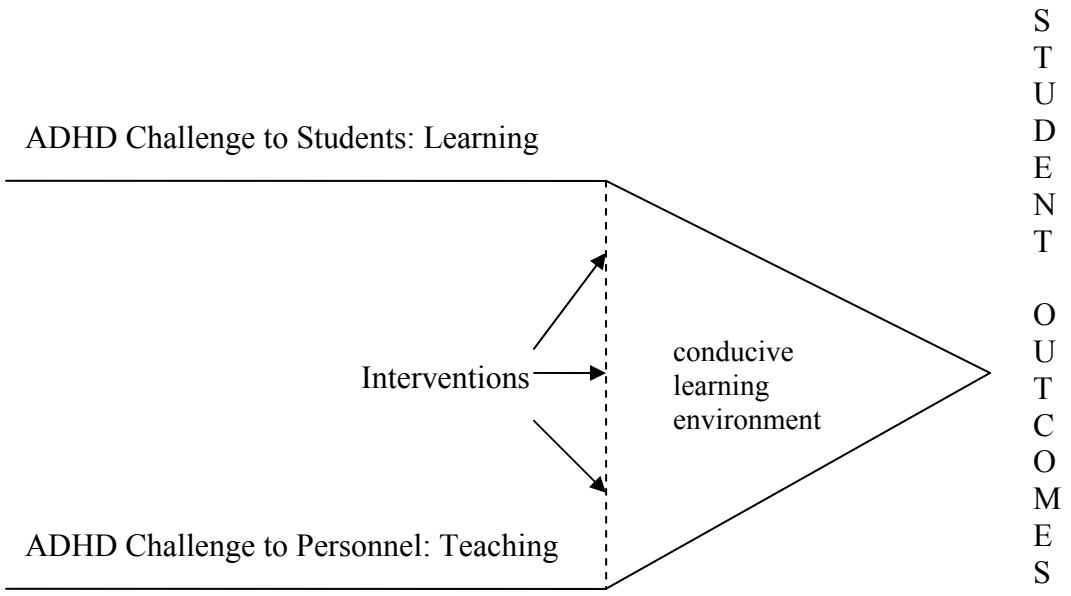

Figure 1 Concept model illustrating how interventions can be used to reduce the challenge of ADHD support a conducive learning environment to address student outcomes.

The intent of this analysis is to determine the effect sizes of interventions that decrease negative behaviors of students with ADHD that interfere with their academic achievement and social success.

Research Questions and Hypotheses

The central question addressed in this study is this: Based upon available research evidence, which behavior interventions, medication interventions, or combination interventions (behavior and medication) are effective for students with ADHD regarding academic achievement, aggression, attention, externalizing behaviors, hyperactivity/impulsivity, inattention, internalizing behaviors, social skills and social problems? A quantitative meta-analysis was performed on 18 studies conducted from 1990 to 2004 that addressed interventions for students with ADHD related to behavioral or academic performance. Twenty-seven intervention/outcome variable combinations were derived from the central question. A null hypothesis was analyzed for each intervention/outcome variable combination. The null hypothesis for each intervention/outcome variable combination is reviewed in chapter 3 and statistically analyzed in chapter 4.

Operational Definitions

The nomenclature used to describe interventions is vast and sometimes overlapping (Purdie et al., 2002). The categorization of interventions also varies in the literature. Therefore, definitions are a critical piece to understanding the intent and rationale of the study. The operative definitions as they relate to the central research question and null hypothesis testing statements are shown in Table 1.

Table 1

Operational Definitions

Term	Operational Definition
Intervention	A treatment applied to a subject to ascertain a particular outcome.
Outcome	A particular measurement of a result of the applied treatment.
Behavior Intervention	A category of interventions applied to subjects in this meta-analysis to include, but not limited to, counseling, redirecting behaviors, or token economies.
Medication	A category of interventions applied to subjects in this meta-analysis to include methylphenidate, selegiline, or a highly unsaturated fatty acid supplement.
Behavior Intervention and Medication (Combination)	A category of interventions applied to subjects in this meta-analysis to include a combination of behavior interventions and medications.

Interventions. Interventions are treatments applied to a subject to ascertain an outcome. This study will include 3 interventions: (a) behavior interventions, (b) medication, and (c) a combination of behavior interventions and medication.

Outcomes. Outcomes are a particular measurement of a result of the applied treatment. This study will include 9 measurements of outcome variables.

Behavior Interventions. Behavior interventions include those treatments where child training involved using token economies and redirecting behaviors. Also parent training was included in this category where the purpose of the parent training was to reinforce the child training component. Student counseling and specialty treatment classrooms were also categorized under this intervention.

Medication. Medication is a category of treatment intervention applied to subjects in this meta-analysis to include methylphenidate, selegiline, or a highly fatty unsaturated acid (HUFA).

Combination Intervention (Behavior Intervention and Medication). Combination intervention is a category of intervention applied in this meta-analysis to include a combination of behavior intervention with medication treatment. An example of this combination would include a subject treatment of student counseling while taking methylphenidate.

Theoretical Framework

Critics have noted that ADHD must be a fabrication of the American popular culture but recent studies suggest that ADHD is also prevalent in other cultures and foreign countries (Barkley, 2000). Japan recognizes 7% of its children as having ADHD, China recognizes 6% - 8%, and New Zealand reports up to 7% of its children are

diagnosed with ADHD (Barkley, 2000). This research is grounded in Barkley's (1997) hybrid model of executive functions and the relationship of the executive functions to the behavioral inhibition and the motor control systems. This model provides a useful framework for understanding ADHD interventions that are successful with school aged youth. Barkley revised the hybrid model to embrace the vantage point of behavior disinhibition, as opposed to behavior inhibition, in order to correlate more positively with the challenges posed by ADHD. Barkley's model is supported by the work of other behavioral theorists such as Fuster, Bronowski, Skinner, and Dawkins. Barkley's theoretical model is presented with more detailed explanations in Chapter 2.

Limitations of the Study

Meta-analyses represent synthesized results from more than one study. The synthesized results are called an effect size. Limitations that can affect the integrity of meta-analyses include (a) using data too dissimilar throughout the studies, (b) obtaining uninterpretable results because poorly designed studies are mixed with good studies, (c) not including insignificant studies, and (d) using results of samples more than once (Glass et al. as cited in Wolf, 1986). Meta-analysis, in general, has been criticized as oversimplifying results or not giving enough credence to mediation or interactive affects (Wolf, 1986). However, meta-analysis is an efficient way to summarize large bodies of literature and an effective tool for reaching stronger conclusions than the often impressionistic literary review (Green & Hall, 1984).

Delimitations of the Study

Delimitations were set by the researcher to address the limitations of meta-analysis research. To address the concern regarding the use of data too dissimilar the

researcher should be "coding apples as apples and oranges as oranges" (Wolf, p. 54) by choosing studies with similar outcome measures. Another delimitation to address the use of poor data should include only well designed studies such as randomized-control studies or pre/post control studies.

To address selection bias, all studies should be included regardless of their outcome significance as long as they meet the design criteria of being a randomized-control study or a pre/post control study. The data derived from independent samples should be used only once in the effect size calculation to maintain a reliable effect size and not create false effect size results.

If these delimitations can be carefully addressed, meta-analytic studies can offer strengths to the body of knowledge. Effects can be brought into sharper focus through meta-analysis (Wolf, 1986). Furthermore, Wolf indicated that the identification of outliers can lead to increased understanding and new hypotheses. It is the hope of this researcher to carefully address the limitations in this meta-analysis of ADHD intervention studies, so that effects can be more sharply focused and the body of knowledge extended to help the process of supporting the successful schooling of students challenged by ADHD.

Significance of the Study

This study is intended to contribute to the body of knowledge concerning interventions that are successful, or unsuccessful, for students with ADHD. The study is also intended to provide guidance for educators regarding the relative power of interventions available to meet the needs of students with ADHD. Quite simply, the

findings in the study should help educators understand how these interventions address the behavior needs of students and create opportunities for teaching and learning.

Outline of the Study

The need for this study was presented in Chapter 1and research addressing ADHD and various approaches to conducting meta-analyses are discussed in Chapter 2. The methodology used in the present meta-analysis is presented in Chapter 3 and the results of the analysis are presented in Chapter 4. The results are discussed in Chapter 5 along with implications for policy, practice, and future research.

CHAPTER 2

LITERATURE REVIEW

ADHD is notable by such behaviors as inattentiveness, hyperactivity, and impulsiveness exhibited by the child (APA, 1994). These behaviors have been noted by some experts to be typical behavior, but the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV)* stresses that the abnormal behavior must be "more frequent and severe than is typically observed in individuals at a comparable level of development" (1994, p. 78). If the behavior falls into a pattern meeting these criteria, then the child may be diagnosed with ADHD.

Content and Scope of the Review

This chapter addresses three major areas of review. The first area addresses ADHD classification, the scope of ADHD, and Barkley's (1997) theory of behavioral disinhibition as it relates to the current research. The second area of this literature review addresses the characteristics of meta-analysis to familiarize the reader with the process. The third area of concentration discusses two meta-analyses of ADHD interventions in order to examine the process and structure utilized in this form of analysis. The research methodology for the present study was guided by elements used in both of the meta-analyses reviewed in the third section.

Characteristics of Attention Deficit Hyperactivity Disorder

ADHD is characterized by developmentally inappropriate levels of inattention, hyperactivity, and impulsivity (APA, 1994). The three empirically derived subtypes of ADHD as classified by the *DSM-IV* are: (a) combined type, (b) the predominantly inattentive type, and (c) predominantly hyperactive-impulsive type (APA, 1994). If a

child is contending with any of the subtypes of ADHD, then traditional classroom instruction can become challenging for that student, and for others in the classroom. The child with ADHD may also exhibit academic and social deficits throughout the elementary and secondary grades persisting into adulthood, as compared to the normal population (Mannuzza & Klein, 2000). ADHD does not preclude attaining higher education and vocational goals (Mannuzza & Klein, 2000), but is particularly problematic in developing children and youth. Characteristics and examples of behaviors that pose challenges in an educational setting are listed in the DSM-IV (APA, 1994). The following description provides an example of the kinds of behaviors associated with ADHD.

> Individuals diagnosed with this disorder may begin a task, move on to another, then turn to yet something else, prior to completing any one task. They often do not follow through on requests or instructions and fail to complete schoolwork, chores, or other duties. Failure to complete tasks should be considered in making this diagnosis only if it is due to inattention as opposed to other possible reasons. (p. 78)

Hyperactivity may be manifested by excessive fidgeting or squirming and difficulty sitting still in leisure activities. Impulsivity manifests itself by impatience, difficulty in delaying responses, blurting out answers before questions have been completed, difficulty in waiting one's turn, and frequently interrupting or intruding on others to the point of causing difficulties in social, academic, or occupational settings (APA, 1994).

Of the total population of school-aged children in America, approximately 3%-7% (or 2 million children) are affected with the challenges of ADHD (Barkley, 2000). Children with ADHD are reported to lag behind their peers academically (Barkley, 1990). Furthermore, Cantwell and Baker (1991) stated that up to 80% of children with ADHD have been found to exhibit achievement problems and learning problems.

Students, with ADHD, risk achievement and learning problems in the short term (i.e. their current academic year), but there also exist long term risks. "When studied across time, children diagnosed with ADHD are at higher risk for continuing to have learning, behavioral, and emotional problems throughout childhood and adolescence." (Kollins, Barkley, & DuPaul, 2001, p. 1). Mannuzza, Klein, Bessler, Malloy, and LaPadula (1998) indicated that the long term effects for some students with ADHD include (a) attending fewer years of school, (b) achieving lower overall occupational status, and (c) experiencing a greater range of psychiatric problems as adults, such as antisocial personality disorder and non-alcohol substance abuse.

Because ADHD has such negative potential to affect the academic and social status of those who are diagnosed with it, it is essential to determine effective treatments for those with ADHD. There are three general approaches to treating ADHD that have surfaced in the research literature since 1960: (a) pharmacological approaches, (b) behavioral and psychosocial approaches, and (c) a combination of behavioral and pharmacological approaches (Kollins et al., 2001).

It is important for educators, parents, and students to have a better understanding of the characteristics of ADHD and the interventions considered to be more effective in addressing those characteristics so that the perceived confusion of how to address

behavior challenges does not waste valuable learning time for the student. There is an urgency induced by the accountability measures of the federal No Child Left Behind Act (NCLB). Public schools are becoming increasingly accountable at the same time that diagnoses of students with ADHD are on the increase.

Some students with ADHD are eligible to receive special education services under the OHI category of the Individuals with Disabilities Education Act (IDEA). The increase in students with ADHD served in special education was noted by the President's Commission on Excellence in Special Education (2002):

> In the past 10 years, the largest increases in students identified for IDEA services were for the other health impairment (OHI) category (319 percent), the orthopedic impairment category (45 percent) and the specific learning disabilities category (36 percent). Some of the growth in the OHI category is the result of the growth in children identified as having ADHD. (President's Commission on Excellence in Special Education, 2002, p.24)

The sharp increase of students served in the OHI category is due mainly to the number of newly identified students with ADHD. Zirkel (2001) reported an increase of 315% from 1987-1997 in students receiving special education under the Other Health Impaired (OHI) category of the IDEA. These figures do not include those students with ADHD who are served under §504 of the 1973 Rehabilitation Act.

In the current educational climate, educators are held accountable for the research-based education of all children. The mandates of federal legislation and the moral obligation to serve all students well are why educators must strive to seek research-based solutions to the learning problems posed by ADHD.

Barkley's Theory of Behavior Disinhibition

Russell A. Barkley, PhD combined the research of several theorists to develop a theory of ADHD. This theory, as illustrated in figure 2, includes components that describe the concept of behavioral disinhibition. In proposing this theory of ADHD, Barkley (1997) emphasized the following points with regard to helping individuals address their social and academic problems:

> Understanding the nature of self-control, the process of developmental internalization of behavior, and the process of directing behavior toward the future are absolutely critical to achieving a more complete understanding of the nature of the cognitive and social impairments created by ADHD and to treating those with this disorder. (p. *x*)

The top oval of Barkley's (1997) revised hybrid model contains the behavioral disinhibitions which are subdivided into three areas: (a) the disinhibited prepotent response, (b) preservation of ongoing responses, and (c) poor interference control. "The prepotent response is defined as that response for which immediate reinforcement (positive or negative) is available or with which reinforcement has been previously associated." (p. 48) In other words, prepotency refers to the consequences of one's actions. The interruption of an ongoing response is defined as "stopping an ongoing response or response pattern, thereby permitting a delay in the decision to respond." (p. 47) Therefore preserving ongoing responses would be to respond without delays or decisions.

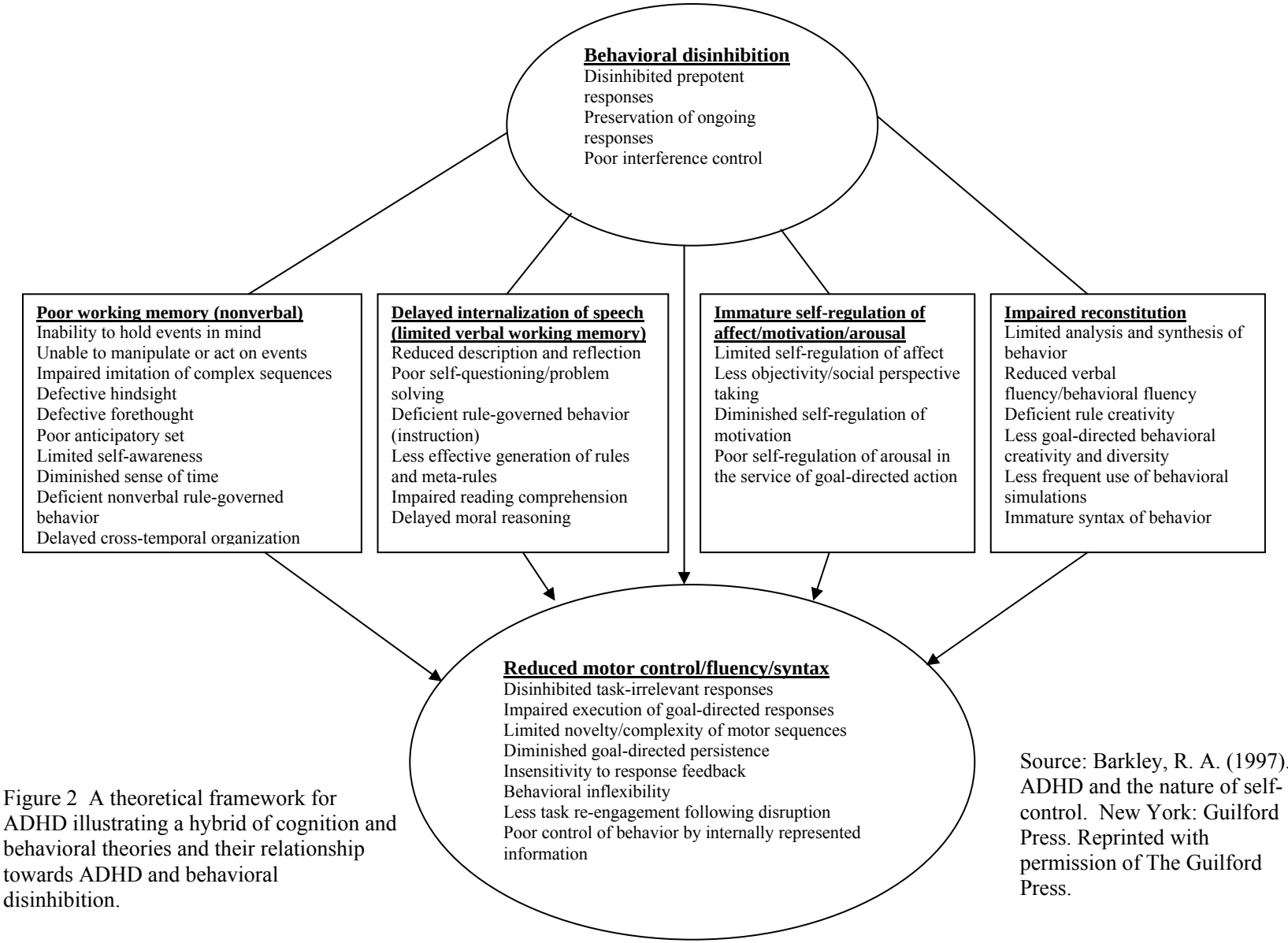

Figure 2 A theoretical framework for ADHD illustrating a hybrid of cognition and behavioral theories and their relationship towards ADHD and behavioral disinhibition.

Source: Barkley, R. A. (1997). ADHD and the nature of self-control. New York: Guilford Press. Reprinted with permission of The Guilford Press.

The interference control is defined simply as resistance to distractions (Barkley, 1997). Therefore, poor interference control would refer to the inability to resist distractions. Research suggests that all three of these behavioral inhibition factors are impaired for students with ADHD (Barkley, 1997). In other words, the behavioral disinhibition factors are typical of students with ADHD.

Barkley (1997) stated that four executive functions (represented by the boxes in the model) and their subfunctions are fundamental beneficiaries of behavioral inhibition. When behaviors are inhibited: working memory improves, the verbalizing working memory improves, self-regulation improves, and the ability to synthesize and analyze one's behavior improves. Conversely, when there exists behavioral disinhibition, then the executive functions and their subfunctions manifest themselves as deficits. When behaviors are disinhibited: working memory is poor, verbalizing working memory is limited, self-regulation is immature, and the analysis and synthesis of one's behavior is inhibited.

The bottom oval in the model represents motor control, fluency, and syntax. Likewise when the behaviors are disinhibited this oval is represented by terms pertaining to deficiencies for optimal behavior. These deficits are more closely aligned to the behaviors of the ADHD student than to the typically developing child. Another distinguishing characteristic of this oval is that it contains the observable effects of behavioral disinhibition and deficient executive functions. For example, disinhibited task-irrelevant responses (contained within the lower oval) are observable by a teacher in the classroom and may be a product of the behavioral disinhibition, or one of the executive functions as represented in the model.

The theory of behavioral disinhibition suggests that if educators can help students improve their working memory (nonverbal and verbal) and help them to self-regulate, then educators can decrease the observable effects of ADHD in their students, thus improving the ability for the child to cope within themselves and help improve the learning environment for all. In the section that follows, the technique of meta-analysis is discussed as an important tool to use in determining which interventions are most effective to use in addressing the behavioral disinhibitions associated with ADHD.

Characteristics of Meta-analysis

"Scientists have known for centuries that a single study will not resolve a major issue. Indeed, a small sample study will not even resolve a minor issue. Thus, the foundation of science is the accumulation of knowledge from the results of many studies." (Hunter, Schmidt, & Jackson, 1982, p. 10) Meta-analysis has been described as the "statistical analysis of the summary findings of many empirical studies." (Glass, McGaw, & Smith, 1981, p. 21) Glass et al. emphasized that meta-analysis leads to generalization and practical simplicity, not to be confused by its critics as merely averaging effect sizes. Glass et al. (1981) likened the analogy of averaging effect sizes to describing analysis of variance as adding and multiplying. In other words, describing the methodology as mere computations leaves out the power behind the methodology to describe the phenomena the researcher is attempting to describe.

Selecting Studies

In conducting meta-analytic research, included studies must be comparable and combinable before they can be used in the same meta-analysis. The researcher is challenged to select studies of similar design and studies in which between-studies

differences can be adjusted so that evidence can be combined (Cook et al., 1992). Meta-analysts are encouraged to follow three specific steps for the overall search: (a) use computerized databases, (b) examine lists of references at the end of key reports, and (c) contact scholars around the country (Cook et al.). After the studies have been searched on a broad scale, only 5% - 7% of the studies are typically used in the meta-analysis. Elements such as non-published studies, descriptive studies, dated studies, different research designs, and between-studies variability that cannot be adjusted provide examples explaining why the number of studies drops dramatically from the original number originally identified.

Coding Studies

In meta-analytic research, coding is the accumulation of descriptive statistics across studies (Hunter, Schmidt, & Jackson, 1982). Other characteristics should be included in the process of coding such as the date of the study and the number of threats to internal validity. The regression of study outcomes onto the coded characteristics should also be determined (Hunter et al.). Depending upon the type of meta-analysis, individual researchers have coded their own studies. Larger volume meta-analyses require outside support from research assistants to help break down the work load.

Meaning of Effect Size

Effect size is the fundamental unit of analysis for a meta-analytic study (Purdie et al., 2002). Effect size is simply the difference between the mean of outcome measures at the end of a program and the mean prior to beginning the intervention. According to Purdie et al., this difference between the means is divided by the appropriate pooled group standard deviation in all cases and is positive when treatment has a positive effect.

"Some effect sizes are meaningful without comparison to anything else." (Glass et al., 1981) For example, an effect size of zero has clearly no effect. Glass et al. also purported that a way to understand the magnitude of an effect size is to compare it with effects of familiar interventions, to include traditional classroom instruction. Glass et al. used an example where computer aided instruction (CAI) was compared with tutoring to determine the effects of CAI on mathematics learning. The familiarity of traditional classroom instruction was introduced to link the tutoring to the CAI. Therefore, the effect size of the CAI intervention was compared with the effects of traditional classroom instruction, thus making the outcomes of the study more meaningful to readers.

Calculating Effect Size

The effect size calculation must be applied correctly to the studies to maintain the integrity and accuracy of the outcome of the meta-analysis. Hunter et al. (1982) suggested considering dichotomous cases for simplicity (i.e. experimental group versus control group). Statistics measuring effect size, such as "*d*," are the most commonly used by researchers and are calculated by the difference between the group means divided by the standard deviation.

Consideration should also be given to studies with different sample sizes. Some studies used in the research may have a sample size of 35, but another study may have a sample size of 450. The formula to determine weight, *w,* for a sample where *d* is the unweighted effect size and *N* is the total sample size (for the control and experimental groups) is: $w = \frac{2N}{8 + d^2}$.

Another procedure used to minimize error for different sample sizes of studies used in a meta-analysis is to weight each effect size inversely by its variance (Hedges & Olkin, 1985).

Reducing Bias for the Final Analysis

The researcher should be cognizant of ways to inform the reader of potential bias in the meta-analysis. Resiliency of the meta-analysis can be strengthened by calculating the number of studies needed to confirm the null hypothesis that would be needed to reverse a conclusion of significance (Wolf, 1986). This is the fail-safe *N* where *N* represents the number of studies. Because it is unlikely that the literature review of studies would discover all studies supporting the hypothesis, the fail-safe *N* method is needed. Those studies not found were coined by Rosenthal (1979) to be in a file drawer. This file drawer caveat can be corrected by the fail-safe *N*.

Wolf (1986) suggested that the researcher stay cognizant of weighting studies to account for sample size and to stay cognizant of tests of homogeneity to account for common estimates of the population effect size. Before calculating effect size, Wolf (1986) suggested having knowledge of three different tests for the purpose of historical reference: (a) Fisher combined test, (b) Winer combined test, and (c) the Stouffer combined test. These tests are termed "combined" because they test the results of independent tests of the same hypothesis. The Fisher test is a method based upon the product of probabilities from different trials. The Winer test is a method for combining independent tests sampled of independent t-statistics. The Stouffer test is a method similar to the Winer test, but the *p*-values are converted to *z*'s not *t*'s, then summed. Wolf suggested the use of the Stouffer test because fewer calculations are needed (the

Fisher test uses log transformations and the Winer test makes adjustments to the degrees of freedom). Wolf noted that these combined tests do not provide insight in the strength of the effect. Hence, effect sizes become the measure of choice to be tested.

There is much to consider when conducting a meta-analysis. The true work begins in the process used to select the studies for analysis. If the inclusion criteria applied in the selection process are sloppy, then much work is needed to maintain the integrity of the study. Correct coding of characteristics can be as much as 99% of the work in a meta-analysis (Hunter et al., 1982).

Examples of ADHD Meta-analytic Studies

Purdie et al. (2002) researched 74 studies spanning a range of years from 1990-1998 in which there was a goal to improve the behavior, cognitive, or social functioning of children with ADHD. Larger effects were found with behavioral outcomes (ES = .56) and medical interventions were found to be most effective for those behavioral outcomes.

In addition to the studies selected for their review, Purdie et al. (2002) identified seven worthwhile meta-analyses addressing attention deficit/hyperactivity disorder interventions that contain results of pharmacological and behavior/cognitive interventions on ADHD. However, none of these meta-analyses reported effects for both types of interventions. Results of the ADHD-intervention meta-analytic studies support medication as being the most effective intervention for changing behavior (DuPaul & Eckert, 1997). Medication is also the most frequently reported form of intervention (Purdie et al.). The seven meta-analyses to which Purdie et al. refer vary in number of studies researched and the scope of time over which the original studies were conducted.

The DuPaul and Eckert (1997) study used 63 studies published between 1966 and 1995. This study used only non-pharmacological approaches to interventions. The findings lead to the conclusion that significant behavior effects were caused by school-based interventions as opposed to cognitive behavioral procedures for improving classroom behavior.

Kavale (1982), Ottenbacher and Cooper (1983), Thurber and Walker (1983), Silva, Munoz, and Alpert (1996), and Losier, McGrath, and Klein (1996) conducted meta-analyses that used only medication intervention studies in the research. Kavale researched 135 studies based on medication interventions. He found that medication was more effective for behavior outcomes with an ES of .80 than on cognitive outcomes with an ES of .50. He also found that achievement garnered an ES of .38 when medications were used. Ottenbacher and Cooper reviewed 61 studies. An effect size of .90 was found for behavior and .47 for academic performance. Thurber and Walker reviewed 20 studies where effect sizes were found to be .75 for attention and distractibility and .23 for achievement. Silva et al. reviewed 7 studies using Carbamazphione (the newer antidepressant of the time) and found an effect size range of .60 to 2.2 on behavior. Losier et al. reviewed 15 studies in which the Continuous Performance Test (CPT) was used to measure omission and commission errors of children taking methylphenidate. An effect size for omission was found to be 1.59 and for commission .80. Simply stated, methylphenidate was effective in reducing these errors of omission and commission. All of these medication studies support the finding that medication has a large effect on behavior, but a smaller effect on achievement.

Baer and Nietzel (1991) used 36 studies researching behavioral and cognitive interventions. These interventions had an effect size of .77 on impulsivity. There was a large variability in the number of studies used in this meta-analytic research. The number of studies ranged from 7 in the Silva et al. (1996)meta-analysis to 135 in the Kavale (1982) meta-analysis. All of the meta-analyses reported larger effect sizes on the interventions addressing behavior, but smaller effect sizes addressing achievement. Cohen's (1988) benchmarks for effect size are used to interpret effect size magnitude and mean that .20 is a small effect, .50 is a medium effect, and .80 is a large effect.

A Breakdown of Two Meta-Analyses

The methodologies of two meta-analyses are discussed in detail in this chapter. The first study discussed was conducted by Purdie et al. (2002) and this study was chosen based on its complexity and because it referenced seven other meta-analytical studies. These seven meta-analytical studies were not included in the present meta-analysis for effect size as would be found in a mega-meta-analysis. They were simply referenced to show the reader what other findings were available in the intervention research. Out of those seven meta-analyses surfaced the second study to be discussed in detail, Baer and Nietzel (1991). This study was chosen because of the straightforward nature of the calculations and to give the reader an understanding of the broad spectrum (when discussed in tandem with Purdie et al., 2002) of approaches researchers can apply to meta-analytic methodologies. Throughout the remaining sections of this chapter, Cohen's (1988) benchmarks for effect size are used to interpret effect size magnitude.

Studies can be included in the meta-analysis if they do not contain a control group, but only contain comparison groups. Purdie et al. (2002) did not discard any

studies based on the absence of a control group. They, instead, used the Becker (1988) method opting to include the studies without control groups. Examples of studies without control groups would be those that compare the effects of two types of practice. Becker cited the example of comparing skill improvement for groups experiencing mental-practice to that of groups experiencing actual physical practice. Such groups, according to Becker, cannot be compared to control groups, which do not practice the same skill. Becker's methodology would then compare the effects of the two groups using the two different types of practice. That is, this methodology uses comparison groups for effect size calculations.

Studies using the pre-test and post-test control group designs, as suggested by Glass, McGaw, and Smith (1981), produce two standardized mean changes, one for the experimental group and one for the control group. More precisely, "the effect size is the mean difference between experimental and control groups divided by the within-group standard deviation." (p. 102). The difference between these changes provides the estimate of the treatment effect. Becker's method is similar except she modified the difference in mean changes to enable estimation of a treatment effect for studies using pre-test—post-test designs without control groups. The sample standardized mean change is defined as: $g_{ij} = \frac{\overline{Y}_{ij} - \overline{X}_{ij}}{S_{ij}}$, where $\overline{X}_{ij}$ and $\overline{Y}_{ij}$ are the sample pre-test and post-test means and S_{ij} is the pre-test (or post-test) standard deviation for sample *j* in study *i*. Becker (1988) noted that the standardized mean-change measure represents average change from pre-test to post-test in standard-deviation units and that it is not identical to

Glass's effect size. Becker used the assumption that the variances of *X* and *Y* are equal and that either standard deviation of *X* or *Y* may be used as S_{ij}.

Purdie, Hattie, and Carroll (2002)

Purdie et al. (2002) researched 74 studies in which there was a goal to improve the behavior, cognitive, or social functioning of children with ADHD. Purdie and colleagues searched electronic databases including Dissertation Abstracts, Medline, PsycLIT, and ERIC using the keyword acronyms "ADHD" and "ADD" and the keyword terms "attention deficit disorder" and "attention deficit hyperactivity disorder" for studies published from 1990 to 1998. The number of citations was culled down from 4361 hits to 74 studies in order to focus on educational outcomes and interventions that would support positive educational outcomes. Sixty-eight of the studies were published journal articles and 6 were theses.

Methods Used in Determining Effect Sizes

Purdie et al. calculated effect sizes by using the following formula: $\frac{(X_t - X_c)}{SD_c}$, where X_t is the posttest mean of the treatment group, X_c is the posttest mean of the control group, and SD_c is the standard deviation of the control group. For studies without control groups, Purdie et al. used Becker's (1988) estimates for synthesizing mean changes. Hedge's correction (Hedges & Olkin, 1985) was used to correct for bias where overestimation in the population effect size occurred in small samples. The statistic $\bar{d} = \frac{\sum wd}{\sum w}$ was used where *d* was the unweighted effect size and *w* was the reciprocal of the estimated variance of *d* in each of the studies in the meta-analysis. However, where

the sample size was greater than or equal to 10, the following was used as a calculation of w: $w = \frac{2N}{8 + d^2}$ where d was the unweighted effect size and N represented the total sample size in the study both the experimental and control groups (Wolf, 1986).

Tests of homogeneity were employed so that it could be determined if the overall effect sizes shared a common effect size. Purdie et al. (2002) used the chi-square test: $\chi^2 = \sum (w(d - \bar{d})^2)$ with k-1 degrees of freedom where k is the number of studies. If a level of significance was found, then it was reasonable to start with the study (or studies) that was inconsistent with the overall direction of the other results (Wolf, 1986).

Most of the meta-analyses tested for methodological effects. For example, in Purdie et al. (2002) the researchers determined there was no correlation (r = .04) between the number of subjects in the study and the effect size. Other correlations were calculated utilizing variables such as length of treatment and effect size.

Interventions Used with Students with ADHD

There were 1,497 effect sizes derived from 74 studies based on 2,193 persons (Purdie et al., 2002). Effect sizes were determined for the attributes of the studies, attributes of the samples, attributes of the diagnosis, attributes of treatments, and attributes of outcomes. For the interest of the proposed study, attributes of the outcomes as related to the treatments will be discussed. Purdie et al. identified treatment interventions that clustered into five types: (a) pharmacological interventions including stimulants, anti-depressants, antipsychotic drugs, and a combination of stimulants and anti-depressants; (b) school-based psychological/educational interventions including cognitive self-regulation, behavioral training, educational, and other; (c) non-school-based psychological interventions including cognitive self-regulation, social skills

training, behavioral training, biofeedback, and other; (d) parent training interventions; and (e) multimodal interventions.

The important pharmacological interventions were antidepressants and stimulants (specifically, methylphenidate). The important school-based educational and psychological interventions under the subcategory of cognitive/self-regulation included self-instruction, self-monitoring, self-evaluation, and self-reinforcement. The interventions included under the subcategory of behavioral training were reinforcement and punishment. The interventions included under the subcategory of educational interventions were the seating of ADHD children in front seats, providing frequent breaks, creating service plans, promoting family involvement, and implementing continuous assessment. The subcategory labeled "other" was not defined.

The important non-school-based psychological interventions included self-instruction, self-monitoring, self-evaluation, and self-reinforcement under the category of cognitive/self-regulation. The interventions included in the subcategory of social skills training included a skills training program. The interventions included in the subcategory of behavioral training included reinforcement and punishment. The interventions included in the subcategory of biofeedback and other were not defined. Parent training interventions were defined as including those programs that were developed to assist parents in the development of appropriated skills to manage ADHD-type behaviors. Multimodal interventions were defined as the interventions that included a combination of stimulant medication used with cognitive behavioral interventions.

Outcomes Affected By These Interventions

Purdie et al. (2002) defined outcomes as being cognitive, physical, behavioral, social, and personal/emotional. The cognitive outcomes included general cognition, language/reading, math, IQ measures, and memory measures. The physical outcomes included blood pressure, heart rate, and weight loss, effects on fine motor skills, effects on sleep patterns, and nausea.

The behavioral outcomes were defined as better behavior, impulsivity, hyperactivity, and attention. Impulsivity was further broken down into categories such as lower impulsivity and lower disruption. Hyperactivity was further broken down into categories such as less hyperactivity and less aggression. Attention was further broken down into categories such as greater attention, more on-task seatwork, and greater compliance.

The social outcomes were measured by peer acceptance, peer interaction, and demonstration of pro-social skills. The personal/emotional outcomes were categorized as lower depression, general emotion, and higher self-esteem.

The least squares method was used to minimize the sum of the squares of the residuals, where residuals are the differences between the observations and the model. The least squares for all of the effect sizes across the studies are not weighted.

Interpretation of the Educational ADHD Interventions

Further understanding of educational outcomes can be introduced using the following categories of interventions: (a) pharmacological, (b) school-based psychological/educational, (c) non-school-based psychological, (d) parent training, and

(e) multimodal. Mathematics and language arts were noted as outcomes relative to these interventions for students with ADHD.

Effectiveness of the Interventions

Behavioral outcomes were affected the most by all treatment interventions in general (ES = .56). Where all treatments were averaged, social outcomes had an ES of .38, cognitive (ES = .28), personal/emotional (ES = .22), and physical effects (ES = -.03). Of all the treatment interventions, behavioral outcomes were influenced mostly by pharmacological interventions. For example, antidepressants had a positive effect on behavioral outcomes (ES = 1.58) but a negative effect on physical outcomes (ES = -.44). The 1.58 effect size suggests that antidepressants improved the behavioral outcomes (improved behavior, reduced impulsivity and hyperactivity, more on-task seatwork, and greater compliance) by approximately 1.58 standard deviation units over those students representative of the same population without this treatment. The -.44 effect size suggests that antidepressants negatively impacted physical outcomes (heart rate, blood pressure, and weight loss) by approximately .44 standard deviations under those students representative of the same population without this treatment.

School-based psychological treatments had the largest effects on general cognition skills with an effect size of .58, however this strength did not follow with language arts (ES = .02) and mathematics (ES = .04). Parent training interventions had an overall effect size of .53 on general cognition. Parent training had an effect size of .12 in language arts and an effect size of .12 in mathematics.

School based psychological interventions applied to cognition skills have a medium effect (ES = .58) as does parent training interventions (ES = .53) applied to

general cognition. However, these results of ES = .58 and ES = .53 do not translate to academic achievement as the effect sizes using the same interventions are comparatively small for language arts (ES = .02 and ES = .12) and mathematics (ES = .04 and ES = .12). When measured by Cohen's standard (ES = .20 is small, ES = .50 is medium, and ES $\geq$ .80 is large), these effect sizes are regarded as negligible.

Discussion of the Findings

Interpretations of the findings should be done with caution because some effect sizes were derived from many samples while others may have only been derived from one sample. Academic outcomes for mathematics were affected the most by non-school-based psychological interventions (ES = .17), however, this is not a strong assessment because this statistic was derived from only one study represented by one effect size. Language arts outcomes were affected mostly by pharmacological interventions (ES = .24) where seven studies involving 60 effect sizes were averaged. The language arts example represents a stronger and more reliable use of effect size because more studies were represented across more effect size measurements.

Pharmacological interventions may be warranted as a first step to assisting students who are diagnosed with ADHD, however care should be given to the physical effects. The problem with relying solely upon pharmacological intervention is that this intervention provides a short term solution and does not provide the students with skills necessary to compensate for challenges posed by ADHD. Further analysis needs to be done in the area of educational outcomes and educational interventions. Perhaps educational interventions, coupled with the pharmacological interventions, could provide students with ADHD with the necessary compensatory techniques needed to be

successful in the educational setting. Up to and including this study, educational outcomes are typically residual due to the behavioral interventions and pharmacological interventions.

Baer and Nietzel (1991)

The purpose of the Baer and Nietzel (1991) study was to examine the clinical utility of cognitive and/or behavioral treatment approaches for impulsivity. Baer and Nietzel began with a computer search using keywords such as impulsivity, cognitive, behavioral, or cognitive-behavioral treatment. Thirty six studies with subject age ranges of 4 years-18 years were included. Sample sizes ranged from 10 subjects to 275 subjects for a total *N* of 1550 children. The number of subjects per treatment condition ranged from 5 to 55. Over half of the studies used control groups, four used combined data from no-treatment and placebo groups, the remainder used no-treatment control groups. All studies were the same design, within-subjects design. Baer and Nietzel presented the outcome measures relative to their effect sizes and the methodological variables relative to their effect sizes in tables.

Methods Used in Determining Effect Sizes

Effect sizes were calculated by the following formula: $\frac{(X_t - X_c)}{SD_c}$, where X_t is the posttest mean of the treatment group, X_c is the posttest mean of the control group, and SD_c is the standard deviation of the control group. When means or standard deviations were not available, the effect size was derived from other reported statistics, such as *F*, *t*, chi-square, or from the significance level following methods by Smith,

Glass, and Miller (1980) and Rosenthal (1984). Zero was used for the effect size if a result was reported as insignificant.

Interventions Used with Students with ADHD

There were 187 effect sizes derived for 36 studies calculated separately for each treatment group and each measure (Baer & Nietzel, 1991). Effect sizes were determined for the year of study (1968-1979 and 1980-1989), mode of treatment (group or individual), type of control (placebo or no treatment), diagnosis (normal, ADHD, conduct disorder, or aggressive), and types of treatments (SSM, SSM plus, operant, modeling, specific strategy, strategy + operant, or other). For the interest of the proposed study, treatments will be discussed.

Baer and Nietzel (1991) defined the treatments. Self-statement modification (SSM) refers to the repeat phrases a child makes to himself such as, "Go slow; be careful." SSM plus refers to treatments where self-statements were combined with one or more additional treatments such as problem-solving training, reinforcement or response cost contingencies. The Meichenbaum and Goodman (as cited in Baer & Nietzel) approach was used for the SSM.

Operant treatments include only reinforcement and response cost contingencies. Modeling treatments refer to the subjects watching a model self-instruct, scan systematically, or delay in response. A specific strategy treatment refers to treatments in which children were taught to scan systematically, respond slowly, or both with no self-instructions or reinforcement. Strategy + operant refers to the treatment in which children were taught a specific strategy and exposed to reinforcement contingencies. The

other category included (one study) relaxation and reading for children silently to themselves with no training.

Outcome Measures

Direct observation was defined as the frequency of behaviors defined as impulsive. Teacher ratings included use of standardized measures such as the Self-Control Rating Scale (SCRS). Parent ratings used the Conner's Parent Rating Scale. The Matching Familiar Figures test (MFF) measured reflection-impulsivity. In the MFF test; the subject selects 12 items from an array of drawings of familiar objects and matches these to a sample drawing. The MFF was used as an outcome measure of errors represented by the variable MFF errors. The MFF was also an outcome measure of latency (response time) represented by the variable MFF latency. The Porteus Q, Porteus Maze Qualitative Score, was used as an outcome variable but not defined.

Effectiveness of the Interventions

Strategy + operant was the most effective intervention with an effect size of 1.98 which suggests that these students' outcomes were 1.98 standard deviations above the norm when compared to those students in the same population who did not receive the intervention. However, as mentioned in the Purdie et al. (2002) analysis, the strategy + operant variable had only 3 effect size measurements. For example, SSM had 24 effect size measurements yielding an effect size of .47. The SSM outcome variable measurement is more reliable because of the number of effect size measurements.

The least effective treatment was "other" with an effect size of -.29. This category should have been discarded, not only because this category came out of one

study that had no relation to the other studies in the meta-analysis, but because each sub-category under "other" had only one effect size measurement.

Outcome variables such as the MFF error score and MFF latency scores were used but should have been discarded according to some researchers who claim that slow response times do not necessarily mean thoughtful accurate responses (see Baer & Nietzel, 1991). The effect size .83 for the outcome measure of direct observation is also suspect for the same reason as the treatment variable of strategy + operant. The variable "direct observation" had a large effect size of .83, but only had 3 effect size measurements. This low number of effect measurements makes the .83 less reliable when trying to utilize interventions that will help students with ADHD to be successful.

Discussion of the Findings

The lack of data in some domains such as having only 3 effect size measurements for the outcome variable "direct observation" and having only 3 effect size measurements for the treatment variable "strategy + operant" makes the data suspect and unreliable. Additionally, researching an instrument such as the MFF that is unreliable in itself makes the findings less resilient.

The outcome variable of parent rating had an effect size of -.10 with 8 effect size measurements. One explanation could be that the parents were more keenly aware of their children's behaviors than before, therefore, they tended to me more alert and notice more behaviors than before the treatment. That is, they were more educated, thus the parent rating scale could have been comparing an uneducated rating with an educated rating. The only interventions that appear to truly warrant further investigation due to

their promising effect sizes are the SSM and SSM plus with effect sizes of .47 and .70, respectively.

This review of the Purdie et al. (2002) and Baer and Nietzel (1991) studies is intended to allow the readers to review different approaches to meta-analysis. However, before a method is chosen, one must understand what type of research designs are involved in the collection of studies. Such experts as Glass, Becker, Cohen, Rosenthal, Wolf, Hunter, Hedges, and Olkin should be referenced to ascertain the methods most conducive to maintaining the integrity of the proposed study.

Summary

The literature review noted that behavior interventions, medication, and a combination of behavior interventions and medication are consistently applied as intervening variables believed to be effective on various outcomes. These outcomes that commonly surface in the literature related mainly to behaviors, social skills, and academic achievement. This information supports the rationale behind the research question guiding the present study: Based upon available research evidence, which behavior interventions, medication interventions, or combination interventions (behavior and medication) are effective for students with ADHD regarding academic achievement, aggression, attention, externalizing behaviors, hyperactivity/impulsivity, inattention, internalizing behaviors, social skills and social problems?

After a review of several approaches toward meta-analyses by experienced researchers, and the breakdown of two large meta-analyses, this researcher has decided to follow closely the methodology presented in the Purdie et al. (2002) study. See

Appendix A for a summary of the studies selected from the inclusion criteria. Specific discussion of the methodology to be used will be at issue in Chapter 3.

CHAPTER 3

METHODOLOGY

This chapter discusses the methodological tools that were used to develop the effect sizes for the meta-analysis. The chapter includes a discussion of the research question, data collection procedures, and the analytical procedures.

The Design of the Study

Barkley (1997) suggested that behavioral inhibition factors are impaired for students with ADHD. The purpose of this study is to determine the effectiveness of different interventions for students with ADHD served in the preK-12 educational setting. The measures of interest are student behavior, social skills and academic achievement. The following research question will guide this meta-analysis: Based upon available research evidence, which behavior interventions, medication interventions, or combination interventions (behavior and medication) are effective regarding academic achievement, aggression, attention, externalizing behaviors, hyperactivity/impulsivity, inattention, internalizing behaviors, social skills and social problems?

This investigation began with a review of literature regarding ADHD to determine the feasibility of performing a meta-analytic study. It was decided that a meta-analysis of approximately 20 empirical studies would be completed to provide practitioners with a pragmatic understanding of how to support the ADHD student in the school setting. The number (20) of studies comports with Cook et al.'s (1992) assessment that an average of 5% - 7% of the studies typically reviewed in a meta-analysis are used from an initial database search of studies. The timeline of the selected studies ranged from 1990-2004. This range was selected based upon the literature that there exists an increase in the

ADHD population in the 1990's. The Purdie et al. (2002) meta-analysis included the range 1990-1998. The current meta-analysis contains the same range plus 6 more years to include more recent studies.

Selected Studies

As determined through the literature review, studies with medication interventions, behavior interventions, and combination (behavior intervention and medication) interventions were sought to determine the effect size on the cognitive, physical, behavioral, social, and personal domains for students with ADHD.

Research designs utilized in the studies to be selected were identified as randomized-controlled, randomized trials, control pre/post, or randomized clinical trials. According to Cook et al. 1992, the designs between studies should be similar so that evidence can be combined. This research included only designs such as randomized controlled, randomized trial, control pre/post, or randomized clinical trial studies to provide as much consistency and validity across studies as possible.

Sample

The number of participants in the independent samples ranged from 4 to 145. To maintain independence across samples, effect sizes were calculated for the intervening variables associated with an outcome variable only once regarding a particular sample. "It would be wrong to regard them as independent estimates since these measures were all made on the same group of pupils." (Hedges et al., 1989. p. 37) To prevent selection of several effect sizes measuring the same variables from one sample, this researcher calculated an average effect size from each sample so that only one representation of a unique intervention/outcome variable combination was calculated for that sample

(Hedges, 1985). The samples across all studies contained children ranging in age from 3 years to 17 years. All but two studies included a range of ages for their sample. Those two studies sampled only children 3 years of age. The effect size data were weighted regarding the sample size to correct for biases. Some studies were supported by the National Institute of Mental Health or the United States Department of Education. Most studies were developed in accordance with research grants in medical schools or psychological research centers.

Study Nomenclature

For the purpose of organization and reference, each study included in this meta-analysis was assigned a unique number. For studies with more than one sample each independent sample was assigned the same number, as the corresponding study, with a subscript indicating an independent sample within the study. For example, if study one utilized three independent samples, then the samples would be represented as 1_a, 1_b, and 1_c. A list of all the studies, their samples, and the effect size of the intervention with the respective outcome variables can be found in Appendix B. Each study was assigned a number such that each is referenced as study 1 through study 21.

Data Collection Procedures

Data for this study were drawn from research studies containing interventions on the selected outcome variables. These research studies were gleaned from electronic databases and the studies included in the searches ranged from 1990 to 2004. The number of studies numbered 869 using the keywords ADHD and intervention. Another keyword *randomized* was added to narrow the scope of the search. This did narrow down the number of returned studies and made selecting the studies more manageable. For

example, the *PsychInfo* database was reduced from 413 studies to 3 studies after the keyword randomized was added. However, a quick review of the titles and abstracts of the 413 articles was also completed to ensure inclusion of any articles that met the criteria.

Four databases described in Table 2 were used to find research studies pertaining to interventions for students with ADHD. Dissertations, and databases solely referencing dissertations, were not included because dissertation studies are regarded as novice research. Enough studies existed from refereed journals and "experts" in the field to warrant the exclusion of dissertations. However, Glass et al. (1981) noted that using only the published studies is unrepresentative of the real research. Rosenthal (1979) countered this argument by referring to the file drawer correction. The file drawer correction tells the reader how many studies, refuting the tested hypothesis, must be added to the meta-analysis to reverse the findings (Wolf, 1986). Although not as voluminous as the Purdie et al. (2002) study, Rosenthal's study used the work by Purdie et al. as a methodological road map. The meta-analysis by Purdie and his colleagues employed the keyword ADHD solely throughout the Medline, PsychInfo, and ERIC databases from 1990-1998. These searches resulted in 1,379, 2,546, and 436 citations, respectively. Out of these citations, Purdie's research group chose 74 studies to include in the meta-analysis. Similarly for this proposal, the keyword ADHD was used but conjunctionally with the word intervention to address thoroughness in the search for studies. The addition of the word intervention was used in the search criteria to narrow down the number of hits that would be relative to this research. These results yielded similar quantities, but different studies

Table 2

Databases Searched for ADHD Intervention Studies

Data-base and Vendor	Description	Subject
Medline, PubMed Version	Includes 1966 forward and covers the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and the preclinical sciences.	Medicine Psychology
ERIC from Ovid	Journal articles and reports on all aspects of education, including counseling, tests, and measurement from 1966 to present with full-text of ERIC Document (items with ED numbers) from 1966 to present.	Education Special Education
ERIC from First Search	Journal articles and reports on all aspects of education, including counseling, tests, and measurement from 1966 to present with full-text of ERIC Document (items with ED numbers) from 1966 to present.	Education Special Education
PsycINFO	Online version of *Psychological Abstracts*, 1872 to present. Covers journal articles, book chapters, books, technical reports, and dissertations, in psychology and psychological aspects of related disciplines.	Education Human Development Social Deviance Sociology Special Education

in some cases. Studies included in the present meta-analysis had an additional inclusion requirement that they be based on the standards for ADHD as stipulated in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV). The DSM-III was allowed where studies met the inclusion criteria before the DSM-IV existed. Other studies were excluded because of vague criteria, study design, or the use of another standard such as the ICD-10 Classification of Mental and Behavioural Disorders Criteria (World Health Organization, 1993).

Searches were completed using the databases listed in Table 2. The keywords 'intervention' and 'ADHD' were used together to search each database. Database searches using interventions yielded different results and studies from which to choose from searches using the singular form of the word. Table 3 reveals the quantity of results from trial searches for the purpose of this meta-analysis.

Exclusion of Studies and Samples

Twenty one studies were originally selected for inclusion. However, only 18 studies were suitable for analysis. Three studies were excluded from the meta-analysis because the data reported in all three studies were insufficient to determine an effect size. The study by Ialongo et al. (1993) was eliminated because information needed to convert the *F* or *t* statistic to Cohen's *d* was insufficient. According to Wolf (1986), when converting the *F* statistic to Cohen's *d*, the *df* (error) is to be factored into the formula. This information was not reported in study 10. The study by Wacks and Gilman (1996) was eliminated, because the only means and standard deviations reported were those that measured the parents' beliefs and their

Table 3

Results of searches using keywords ADHD and intervention(s)

Data-base and Vendor	Keywords	Limiters	Number of Studies Returned	Included in Meta-Analysis
Medline, PubMed Version	Intervention and ADHD	1990-2004	185	9
	Interventions and ADHD	1990-2004	182	
ERIC from Ovid	Intervention and ADHD	1990-2004	133	1
	Interventions and ADHD	1990-2004	65	
ERIC from First Search	Intervention and ADHD	1990-2004	138	3
	Interventions and ADHD	1990-2004	67	
PsycINFO	Intervention and ADHD	1990-2004	413	8
	Interventions and ADHD	1990-2004	364	

children's beliefs about the children's impulsivity. The measures were not relative to the children as they were in the other studies selected for this meta-analysis. The measures were perceptions the children and parents had regarding conflict. The study by Sonuga-Barke, Thompson, Daley, and Laver-Bradbury (2004) was eliminated because the measures reported were raw data with their confidence intervals. There was no avenue or information available to convert the data required to determine effect size. Standard deviations and means were not reported in this study.

Validity

Threats to the validity of the meta-analysis can be addressed throughout the process of conducting the meta-analysis. Internal validity of this meta-analysis was controlled by carefully selecting studies containing samples derived from randomized controlled clinical trials, randomized control, randomized trials, or pretest/posttest controlled trials as outlined in the inclusion criteria discussed earlier in this chapter. Four common threats to the validity of a meta-analysis should be addressed to strengthen the results (Gersten, Schiller, & Vaughn, 2000). They are: (a) using non-independent samples, (b) not weighting effect sizes, (c) inferring too much about a characteristic, (d) and assuming too much from a probabilistic outcome.

Independent samples. All effects sizes were derived from independent samples and characteristics were not used in the effect size calculations more than once. Using non-independent samples would create possibly large false effect sizes that are unreliable.

Weighting effect sizes. Effect sizes were weighted to account for differences in sample sizes. When an effects size was calculated for a sample, it was weighted with that sample in regards to the size of that sample.

Inferring too much about a characteristic. Internal reliability in selecting the variables (i.e. inferring too much about a characteristic) was controlled by carefully referencing what the instruments measured in the original studies. For example when outcome variables were reported, such as cooperation, assertion, responsibility or self-control, they were categorized under the outcome variable social skills using the reference of the Social Skills Rating Scale (SSRS) as the authority for this classification. Likewise, other variables were classified under the outcome variables using standard scales like the SSRS or the Child Behavior Checklist (CBCL). This standard ensured that the classification of the outcome variables maintained consistency throughout the meta-analysis. The DuPaul's ADHD Rating Scale, Conner's Teacher Rating Scale (CTRS), and the Conner's Parent Rating Scale (CPRS) were also frequently used in the studies to measure outcome variables.

Assuming too much from a probabilistic outcome. To correct for this threat to validity, the non-meta-analytical researcher usually tests the robustness across a different set of assumptions or runs several tests (Gersten et al., 2000). However, since a meta-analyst cannot test a different set of assumptions, then more samples may be added or other test measures may be added. One such measure is the 95% confidence interval which, when zero is not included in the interval, shows that an intervention can expect to have an effect on a particular outcome within an interval of values 95% of the time. A 99% confidence interval indicates the same, except expectations rise to 99% certainty.

Analytical Procedures

A common metric, *d*, was calculated to determine effect sizes for each intervention associated with an outcome variable (Cohen as cited in Wolf, 1986). This

standardized mean difference statistic *d* was used for "expressing and combining the results of studies that assess the effectiveness of an experimental treatment." (Hedges & Olkin, 1985, p. 7) The outcome variables to be analyzed were: (a) academic achievement, (b) attention, (c) inattention, (d) social skills, (e) aggression, (f) internalizing behaviors, (g) externalizing behaviors, (h) hyperactivity/impulsivity, and (i) social problems. The intervening variables were: (a) behavior intervention, (b) medication, and (c) a combination of behavior intervention and medication.

The designations of interventions and outcome variables were selected based upon the review of the literature in Chapter 2. The intervening variables that have surfaced since the beginning of this research in 1960 are behavior intervention, medication, and a combination thereof. The outcome variables chosen for this study comport with Barkley's (1997) model of behavior disinhibition discussed in Chapter 2 of this study. The intervening variables and the relative outcome variables in this meta-analysis are shown in Table 4. These variables were synthesized from 18 studies that met rigorous selection criteria for this meta-analytical review. The outcome variables and intervening variables are listed and cross-referenced with their original studies in Table 5.

Calculating Effect Size and Its Significance

The process of determining an effect size, weighting the effect size statistic, and finding an average ($\bar{d}$) across several outcome variables was completed for each intervention associated with an outcome variable. When calculating the effect size of an

Table 4

Existing Intervening Variables Associated with Outcome Variables in the Studies

Outcome Variables	Intervening Variables		
	Behavior Intervention	Medication	Behavior Intervention and Medication
Academic	X	X	X
Aggression	X	X	X
Attention	X	X	----
Externalizing Behaviors	X	----	----
Hyperactivity/Impulsivity	X	X	X
Inattention	X	X	X
Internalizing Behaviors	X	X	X
Social Skills	X	X	X
Social Problems	X	X	X

Note. As indicative in the table, all three interventions were combined with each outcome except externalizing behaviors and attention. Where possible, aggression was isolated from the externalizing behaviors category to calculate effect sizes with other studies in which aggression was measured alone.

Table 5

Research Study Sources of Qualified Independent Samples Regarding the Intervening Variables and Outcome Variables

Outcome Variables	Intervening Variables		
	Behavior Intervention	Medication	Behavior Intervention and Medication
Academic	3, 5_a, 13_a	5_b, 13_b	5_c, 13_c, 14
Aggression	3, 5_a, 9	5_b	5_c, 8
Attention	1, 3, 7	11, 12	----
Externalizing Behaviors	3, 9	----	----
Hyperactivity/Impulsivity	5_a, 9	5_b, 6, 15, 20	5_c, 14
Inattention	2, 3, 5_a, 7, 13_a	5_b, 6, 13_b 15, 17, 20	5_c, 8, 13_c
Internalizing Behaviors	3, 5_a, 9	5_b, 20	5_c, 14
Social Skills	3, 4, 5_a, 9, 13_a, 16, 19	5_b, 6, 13_b	5_c, 8, 13_c
Social Problems	3, 9	20	8

Note. Each number indicates the unique assigned study number in which the variables have an effect size. For example 5_a, 5_b, and 5_c represent study number 5. The subscript a, b, and c represent independent samples within that study.

outcome variable, the standard deviation of the control group was used. Hedges, Shymansky, and Woodworth (1989) stated:

> The standard deviation of the control group has the advantage of being uncontaminated by any effects of the treatment. Consequently, it is often used to compute the effect size estimates. Others prefer to use the pooled standard deviation which is slightly more stable as an estimate of the common standard deviation. (p. 24)

Gersten, Schiller, and Vaughn (2000) supported the use of the control (or pretest) group standard deviation as the preferred statistic:

> The effect size is then a measure of the mean difference expressed in standard deviation units. The standardized mean differences used in this meta-analysis were computed as the ratio of the difference between the mean of the baseline data points and the mean of the treatment data points to the standard deviation of the data in the control or baseline phase. (p. 149)

After individual effect sizes were determined per independent sample, effect sizes for each intervening variable/outcome variable combination were calculated. Homogeneity calculations were used for determining $\bar{d}$ for each combination (Rosenthal & Rubin as cited in Wolf, 1986). The homogeneity statistic was calculated to ensure that each study was testing the same hypothesis when variables from those studies were combined (Wolf, 1986).

If the statistic was found to be non-homogeneous, then studies were eliminated for that calculation and the statistic was recalculated until the homogeneity reached an acceptable tolerance of $p \geq 0.05$. Finally, a 95% confidence interval was calculated for

each effect size to determine if the null hypothesis associated with the intervention/outcome combination should be rejected. The formulae (Wolf, 1986) used in this process, from calculating *d* to calculating the 95% confidence intervals, are outlined in Table 6.

There were 97 effect size measurements calculated from 30 qualified independent samples of students with ADHD across 18 studies. Some studies produced numerous effect sizes because they may have contained three independent samples in which each sample was measured on all three interventions associated with several outcome variables.

Cohen's suggestion for interpretation of effect sizes was used to make determinations if the effect sizes were large, medium, or small (see Howell, 2002). According to Cohen, an effect size of 0.20 is small, an effect size of 0.50 is medium, and an effect size of 0.80 or greater is large. Effect sizes much greater than 1.00 were viewed with skepticism because defects in the design of the study or defects in the execution of the study could exist (see Hedges et al., 1989). Consideration was given to those effect sizes where greater than 1.00 was found.

Homogeneity of Samples

Homogeneity is a major analysis that allows the researcher to discern disparities in sample statistics among the samples compared (Gersten et al., 2000). If disparities are found, then the effect size is not as reliable a measure as it would be if the samples were homogeneous. A popular statistic, *Q*, is used by some researchers to calculate heterogeneity using sampling error. The complement of that statistic is the one measuring for homogeneity, X^2, as it measures whether or not the samples are in fact

Table 6

Formulae Used in the Process of Determining Effect Sizes for This Study (Wolf, 1986)

Purpose	Formula	Explanation
Cohen's *d* calculation for effect size	$d = \frac{\lvert \bar{x}_1 - \bar{x}_2 \rvert}{Sd}$	Where x_1 and x_2 are the means between the treatment group and the control or pretest group, respectively. *Sd* is the control or pretest group's standard deviation.
Estimate weight, *w*, of the studies to calculate a more unbiased estimate	$w = \frac{2N}{8 + d^2}$	Where *N* is the sum of the control group participants and the treatment participants.
Find the average *d* across effect sizes	$\bar{d} = \frac{\sum wd}{\sum w}$	Where *w* is the unbiased weight estimator and *d* is the original effect size.
Homogeneity of effect size	$\chi^2 = \sum (w(d - \bar{d})^2)$	Where the X^2 Chi square. The degrees of freedom, *df*, were determined by $k - 1$ where k = number of samples calculated.

Purpose	Formula	Explanation
Confidence Interval (Howell, 2000)	$t = \frac{\overline{X} - \mu}{\frac{s}{\sqrt{n}}}$	Where *t* is the number from the *t* distribution table given *n* – 1 degrees of freedom (*df*). $\overline{X}$ is the average of the sample effect sizes, μ is the mean population (on which confident limits are set), *s* is the standard deviation of the sample, and *n* is the number in the sample.

homogeneous (referenced earlier in Table 6). The similarity between the Q and X^2 statistic is that both values are compared to a percentile of the chi-squared distribution with k-1 degrees of freedom, where k represents the number of samples in the original comparison (Hedges et al., 1989). If p is found to be less than or equal to 0.05 using the homogeneous statistic, then the samples tested were determined to be non-homogeneous.

For the purpose of this study the homogeneity statistic (X^2) was used. If the sample was determined to be homogeneous (p >.05), then the effect sizes represented that composite. If non-homogeneity was determined, then the researcher returned to the calculations and proceeded to extract sample groups until a reasonable X^2 distribution comparison could be made. The descriptions for the comparison of independent sample groups, with regard to homogeneity, with intervening variables across outcome variables is discussed in Chapter 4 for each outcome variable. If homogeneity was not found, then the confidence interval was not determined, because the confidence interval relies on the t distribution table (which in this case the assumption of homogeneity is applied).

The intervening variables of behavior intervention, medication, and combination (behavior intervention and medication) were clearly labeled throughout all the studies by the original researchers. Intervening variables including treatments (interventions) such as student training based upon token reinforcement and behavior redirection, parent training that supports and reinforces the student training, and counseling were defined in the studies as behavior interventions. Treatments such as the use of the pharmaceuticals methylphenidate or selegiline were defined in the studies as medication. Treatments such as a combination of student training and taking methylphenidate were defined as a combination of behavior intervention and medication. The only exception to this

approach regards the placement of the intervening variable highly unsaturated fatty acid (HUFA) supplement in the category of medication. The HUFA supplement was ingested at prescribed amounts and is believed to influence the signal transduction in the neuronal membrane structure. The HUFA supplement is referred to as a biochemical intervention much as methylphenidate or selegiline are considered chemical interventions that inhibit influences of the frontal cortical activity on subcortical structures (Pliszka & McCracken as in Akhondzadeh et al., 2003).

Procedure for Calculating the Confidence Interval Regarding the Null Hypothesis, H_0

All calculations and formulae used in this procedure can be referenced in Table 6. The mean data and standard deviation data representing the treatment group and control group for a particular outcome variable were used to calculate the effect size (Cohen's *d*) for an intervention. Calculating effect size was repeated for each unique intervention/outcome combination for each sample.

Once all of the effect sizes were calculated, they were weighted and an average effect size was determined within its intervention/outcome combination. This weighted effect size was used to calculate the homogeneity. If homogeneity was determined, then the unweighted effect size was used to calculate confidence intervals (Howell, 2000). The *t* distribution table was used to calculate 95% confidence intervals. Within this process, the degrees of freedom (*df*) were cross referenced with the two-tailed $\alpha = .05$ in the *t* distribution table to find the *t* value for the confidence interval calculation. If the confidence interval limits were found not to include zero, then the effect size's distribution for that intervention/outcome combination was determined to be significant (Hedges & Olkin, 1985). If the confidence intervals were calculated and found to be

significant (i.e. they did not include zero), then the tested null hypothesis (H_0) was rejected (Wolf, 1986). If the interval included zero, then uncertainty regarding the confidence in rejecting the null hypothesis (H_0) existed, thus the null hypothesis was not rejected.

Testing the Null Hypothesis H_0

In this study the null hypothesis (H_0) was that the intervening variables of behavior intervention, medication, or a combination of behavior intervention and medication would have no significant effect on the outcome variables of: (a) academic achievement, (b) attention, (c) inattention, (d) social skills, (e) aggression, (f) internalizing behaviors, (g) externalizing behaviors, (h) hyperactivity/impulsivity, or (i) social problems. The null hypothesis was rejected 7 times out of 24 in this study. There was a possibility of 3 intervening variable x 9 outcome variable combinations (i.e. 3 x 9 = 27), however, 3 combinations were non-existent due to lack of data, leaving 24 combinations to be tested.

All 27 intervention/outcome combinations and their null hypotheses were tested. Each null hypothesis that was tested was structured like the following: the intervening variable will have no effect on the outcome variable. This null hypothesis models the intent of all of the combinations. This generality was used as the model which resulted in the 27 specific null hypotheses to be tested. One example of a null hypothesis that was tested: The intervening variable behavior will have no effect on the outcome variable academic achievement.

Procedures for Communicating the Meaning of Effect Size

For effect sizes where a 95% CI could be calculated not to include zero, *z*-values were used to communicate the meaning of the effect size. For example, given an ES = .32 suggests that the intervention x outcome had a positive effect of approximately .32 standard deviations above those student outcomes representative of the same population without treatment. Referencing .32 on the *z*-table, one finds that the "mean to *z*" reading is .1255 or ≈12.6%. This suggests that the average change to the outcome when the intervention is applied is approximately 12.6% in the positive direction. When .32 is referenced on the *z*-table, another statistic regarding the larger portion under the curve is .6255 meaning that the treatment effect on the outcome would place the subject in approximately the 63rd percentile.

Calculations, as presented in this chapter, will be done for all 24 combinations. Discussion of the results for all 24 combinations will be completed in Chapter 4. The results of the meta-analysis are reported in three sections in Chapter 4: (1) introduction, (2) hypothesis testing, and (3) summary.

CHAPTER FOUR

RESULTS OF THE STUDY

The purpose of this study was to determine the effectiveness of interventions on outcome variables for children who are diagnosed with attention deficit hyperactivity disorder (ADHD). This chapter presents the findings of the meta-analysis as referenced in Table 7.

Hypothesis Testing

Discussion for each intervening variable x outcome variable will proceed throughout this section. The effect size (unweighted), results of the null hypothesis test for each effect size, and confidence interval will be discussed for each of the 27 possible intervening x outcome combinations. An alpha level of .05 was used for all the following statistical tests: (a) the X^2 distribution for homogeneity and (b) the 95% confidence interval. The X^2 statistic tests for homogeneity, which is rejected at $p \leq .05$. Therefore, finding the statistic not significant at $p \leq .05$ is the desirable statistic to ensure homogeneity. If the samples were found to have non-homogeneity, then the confidence interval was not determined, because the confidence interval relied on the *t* distribution table, which assumes homogeneity among samples.

When medication was involved in the intervention, a 99% confidence interval was calculated if homogeneity existed and if a 95% confidence interval confidence interval did not include zero. The rationale behind a 99% confidence interval regarding medication lies within the fact that certainty must be close as possible to 100% regarding known effects for medication for children with ADHD. Medication contains possible side

TABLE 7
Mean Effect Sizes for ADHD Interventions

Outcome Variable	Intervention	Effect Size *d* Weighted	Effect Size *d* Unweighted	95% Confidence Interval for Unweighted Effect Sizes		Homogeneity (X^2)
				Lower	Upper	
Academic Achievement	Behavior Int	0.23	0.22	0.12	0.33	0.24[a]
	Medication	0.17	0.18	-0.40	0.75	0.28[a]
	Beh Int/Med	0.19	0.45	-0.74	1.64	1.50[a]
Aggression	Behavior Int	0.42	0.37	0.06	0.68	1.31[a]
	Medication	0.78	0.78	----[b]	----[b]	----[b]
	Beh Int/Med	0.82	0.84	-1.07	2.75	0.01[a]
Attention	Behavior Int	0.27	0.44	-0.83	1.71	5.21[a]
	Medication	----[c]	----[c]	----[c]	----[c]	46.15[c]
	Beh Int/Med	----[d]	----[d]	----[d]	----[d]	----[d]
Externalizing Behaviors	Behavior Int	0.27	0.28	-0.36	0.92	0.15[a]
	Medication	----[d]	----[d]	----[d]	----[d]	----[d]
	Beh Int/Med	----[d]	----[d]	----[d]	----[d]	----[d]
Hyperactivity/ Impulsivity	Behavior Int	----[c]	----[c]	----[c]	----[c]	9.09
	Medication	----[c]	----[c]	----[c]	----[c]	60.83
	Beh Int/Med	0.90	1.36	-4.87	7.59	1.62[a]

Inattention	Behavior Int	0.47	0.52	-0.06	1.10	3.43[a]
	Medication	----[c]	----[c]	----[c]	----[c]	99.50
	Beh Int/Med	1.58	1.67	1.19	2.15	1.04[a]
				0.56[e]	2.78[e]	
Internalizing Behaviors	Behavior Int	0.34	0.31	0.01	0.61	1.48[a]
	Medication	0.51	0.42	-1.80	2.64	1.93[a]
	Beh Int/Med	0.49	0.45	-0.12	1.02	0.02[a]
Social Skills	Behavior Int	0.64	0.81	0.44	1.18	11.46[a]
	Medication	----[c]	----[c]	----[c]	----[c]	28.56
	Beh Int/Med	0.90	0.90	0.71	1.09	0.73[a]
				0.46[e]	1.34[e]	
Social Problems	Behavior Int	0.29	0.30	0.24	0.36	0.001[a]
	Medication	0.33	0.33	----	----	----[b]
	Beh Int/Med	0.92	0.92	----	----	----[b]

[a] Indicates that the homogeneity statistic X^2 is not significant at $p \leq .05$, thus not rejecting homogeneity.

[b] Only one sample represented, therefore, the homogeneity statistic and confidence interval are not relevant.

[c] This statistic shows non-homogeneity, therefore, either an effect size or a confidence interval was not calculated as appropriate.

[d] No data available for calculations.

[e] This statistic represents a 99% confidence interval.

effects and its use must be left solely to the decision of trained medical personnel. The findings of this meta-analysis do not suggest that the reader make recommendations concerning medication. The findings are intended to provide data that will aid in better informed discussions surround children with ADHD in the educational setting.

Behavior Intervention x Academic Achievement

The following null hypothesis was tested in determining the effect of behavior intervention on academic achievement for students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, academic achievement.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 116, 145, and 138. The homogeneity statistic of 0.24 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x academic achievement resulted in an effect size of .22 within a 95% confidence interval of (.12, .33); thus, rejecting the null hypothesis (H_0). This finding suggests that behavior interventions positively affected academic outcomes (mathematics, English, and academic skills). The academic outcomes for students with ADHD who received the treatment were approximately .22 standard deviations above the outcomes for those students representative of the same population without this treatment.

Medication x Academic Achievement

The following null hypothesis was tested in determining the effect of medication on academic achievement for students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, academic achievement.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 144 and 128. The homogeneity statistic of .28 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of medication x academic achievement resulted in an effect size of .18 within a 95% confidence interval of (-.40, .75); thus, this effect size magnitude is inconclusive. This finding suggests that the medication intervention effects on academic achievement outcomes (mathematics, English, and academic skills) are inconclusive.

Behavior Intervention and Medication x Academic Achievement

The following null hypothesis was tested in determining the effect of behavior intervention and medication on academic achievement for students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, academic achievement.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 144, 139, and 5. The homogeneity statistic of 1.50 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x academic achievement resulted in an effect size of .45 within a 95% confidence interval of (-.74, 1.64); thus, this effect size magnitude is inconclusive. This finding suggests that the behavior intervention and medication intervention effects on academic achievement outcomes (mathematics, English, and academic skills) are inconclusive.

Behavior Intervention x Aggression

The following null hypothesis was tested in determining the effect of behavior intervention on aggression in students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, aggression.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 116, 145, and 60. The homogeneity statistic of 1.31 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x aggression resulted in an effect size of .37 within a 95% confidence interval of (.06, .68); thus rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention positively affected aggression outcomes. The outcomes regarding reduced aggression for students with ADHD who received the treatment were approximately .37 standard deviations above the outcomes for those students representative of the same population without this treatment.

Medication x Aggression

The following null hypothesis was tested in determining the effect of medication on aggression in students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, aggression.

This intervention/outcome combination was tested involving 1 study including 1 independent sample with an *n* of 144. The homogeneity statistic was found to be irrelevant regarding one sample. The effect of medication x aggression resulted in an effect size of .78. The confidence interval was found to be irrelevant because the effect size (ES = .78) was representative of only one sample.

Behavior Intervention and Medication x Aggression

The following null hypothesis was tested in determining the effect of behavior intervention and medication on aggression in students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, aggression.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 144 and 16. The homogeneity statistic of .01 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x aggression resulted in an effect size of .84 within a 95% confidence interval of (-1.07, 2.75); thus, this effect size magnitude is inconclusive. This finding suggests that the behavior intervention and medication intervention effects on aggression outcomes are inconclusive.

Behavior Intervention x Attention

The following null hypothesis was tested in determining the effect of behavior intervention on attention in students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, attention.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 21, 116, and 59. The homogeneity statistic of 5.21 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x attention resulted in an effect size of .44 within a 95% confidence interval of (-.83, 1.71); thus, this

effect size magnitude is inconclusive. This finding suggests that the behavior intervention effects on attention outcomes are inconclusive.

Medication x Attention

The following null hypothesis was tested in determining the effect of medication on attention in students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, attention.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 29 and 26. The homogeneity statistic of 46.15 was found to be significant at the level of $p \leq .05$ on the X^2 distribution table. Therefore, rejecting homogeneity and indicating non-homogeneity exists. The effect size was not calculated. This finding suggests that the medication intervention effects on attention outcomes are inconclusive.

Behavior Intervention and Medication x Attention

The following null hypothesis was tested in determining the effect of behavior intervention and medication on attention in students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, attention.

No data were available from any studies regarding this composite. Therefore, the behavior intervention and medication effects on attention outcomes are inconclusive.

Behavior Intervention x Externalizing Behaviors

The following null hypothesis was tested in determining the effect of behavior intervention on the externalizing behaviors of students with ADHD. Null hypothesis: The

intervening variable, behavior intervention, will have no effect on the outcome, externalizing behaviors.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 116 and 60. The homogeneity statistic of .15 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x externalizing behaviors resulted in an effect size of .28 within a 95% confidence interval of (-.36, .92); thus, this effect size magnitude is inconclusive. This finding suggests that the behavior intervention effects on externalizing behavior outcomes are inconclusive.

Medication x Externalizing Behaviors

The following null hypothesis was tested in determining the effect of medication on the externalizing behaviors of students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, externalizing behaviors.

No data were available from any studies regarding this composite. Therefore the medication intervention effect on externalizing behavior outcomes is inconclusive.

Behavior Intervention and Medication x Externalizing Behaviors

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the externalizing behaviors of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, externalizing behaviors.

No data were available from any studies regarding this composite. Therefore, the behavior intervention and medication intervention effect on externalizing behavior outcomes is inconclusive

Behavior Intervention x Hyperactivity/Impulsivity

The following null hypothesis was tested in determining the effect of behavior intervention on the hyperactivity/impulsivity of students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, hyperactivity/impulsivity.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 145 and 60. The homogeneity statistic of 9.09 was found to be significant at the level of $p \leq .05$ on the X^2 distribution table. Therefore, rejecting homogeneity and indicating non-homogeneity exists. The effect size was not calculated. This finding suggests that the medication intervention effects on hyperactivity/impulsivity outcomes are inconclusive for this study.

Medication x Hyperactivity/Impulsivity

The following null hypothesis was tested in determining the effect of medication on the hyperactivity/impulsivity of students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, hyperactivity/impulsivity.

This intervention/outcome combination was tested involving 4 studies including 4 independent samples with *n*s of 144, 46, 228, and 41. The homogeneity statistic of 60.83 was found to be significant at the level of $p \leq .05$ on the X^2distribution table. Therefore, rejecting homogeneity and indicating non-homogeneity exists. The effect size was not

calculated. This finding suggests that the medication intervention effects on hyperactivity/impulsivity outcomes are inconclusive for this study.

Behavior Intervention and Medication x Hyperactivity/Impulsivity

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the hyperactivity/impulsivity of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome, hyperactivity/impulsivity.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 144 and 5. The homogeneity statistic of 1.62 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x hyperactivity/impulsivity resulted in an effect size of 1.36 within a 95% confidence interval of (-4.87, 7.59); thus, this effect size magnitude is inconclusive. This finding suggests that the behavior intervention effects on externalizing behavior outcomes are inconclusive.

Behavior Intervention x Inattention

The following null hypothesis was tested in determining the effect of behavior intervention on the inattention of students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome, inattention.

This intervention/outcome combination was tested involving 5 studies including 5 independent samples with *n*s of 58, 116, 145, 59, and 138. The homogeneity statistic of 3.43 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x

inattention resulted in an effect size of .52 within a 95% confidence interval of (-.06, 1.10); thus, this effect magnitude is inconclusive. This finding suggests that the behavior intervention effects on inattention outcomes are inconclusive.

Medication x Inattention

The following null hypothesis was tested in determining the effect of medication on the inattention of students with ADHD. Null hypothesis: The intervening variable medication, will have no effect on the outcome variable, inattention.

This intervention/outcome combination was tested involving 6 studies including 6 independent samples with *n*s of 144, 46, 128, 228, 14, and 41. The homogeneity statistic of 99.50 was found to be significant at the level of $p \leq .05$ on the X^2distribution table. Therefore, rejecting homogeneity and indicating non-homogeneity exists. The effect size was not calculated. This finding suggests that the medication intervention effects on inattention outcomes are inconclusive for this study.

Behavior Intervention and Medication x Inattention

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the inattention of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, inattention.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 144, 16, and 139. The homogeneity statistic of 1.04 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x inattention resulted in an effect size of 1.67 within a 95% confidence

interval of (1.19, 2.15); thus rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention and medication intervention positively affected inattention outcomes. The outcomes for reducing inattention for students with ADHD who received the treatment were approximately 1.67 standard deviations above the outcomes for those students representative of the same population without this treatment.

A 99% confidence interval was calculated, in addition to a 95% confidence interval, because medication interventions were used. The effect of behavior intervention and medication x inattention resulted in an effect size of 1.67 within a 99% confidence interval of (.56, 2.78); thus rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention and medication intervention positively affected inattention outcomes. The outcomes for reducing inattention for students with ADHD who received the treatment were approximately 1.67 standard deviations above the outcomes for those students representative of the same population without this treatment.

Behavior Intervention x Internalizing Behaviors

The following null hypothesis was tested in determining the effect of behavior intervention on the internalizing behaviors of students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, internalizing behaviors.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 116, 145, and 60. The homogeneity statistic of 1.48 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x internalizing behaviors resulted in an effect size of .31 within a 95% confidence interval

of (.01, .61); thus, rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention positively affected internalizing behavior outcomes. The outcomes for reducing internalizing behaviors for students with ADHD who received the treatment were approximately .31 standard deviations above the outcomes for those students representative of the same population without this treatment.

Medication x Internalizing Behaviors

The following null hypothesis was tested in determining the effect of medication on the internalizing behaviors of students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome, internalizing behaviors.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 144 and 41. The homogeneity statistic of 1.93 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of medication x internalizing behaviors resulted in an effect size of .42 within a 95% confidence interval of (-1.80, 2.64); thus, this effect size magnitude is inconclusive. This finding suggests that the medication intervention effects on internalizing behavior outcomes are inconclusive.

Behavior Intervention and Medication x Internalizing Behaviors

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the internalizing behaviors of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome, internalizing behaviors.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 144 and 5. The homogeneity statistic of 0.02 was found

to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x internalizing behaviors resulted in an effect size of .45 within a 95% confidence interval of (-.12, 1.02); thus, this effect size magnitude is inconclusive. This finding suggests that the medication intervention effects on internalizing behavior outcomes are inconclusive.

Behavior Intervention x Social Skills

The following null hypothesis was tested in determining the effect of behavior intervention on the social skills of students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, social skills.

This intervention/outcome combination was tested involving 7 studies including 7 independent samples with *n*s of 116, 59, 145, 60, 138, 4, and 23. The homogeneity statistic of 11.46 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogenous. The effect of behavior intervention x social skills resulted in an effect size of .81 within a 95% confidence interval of (.44, 1.18); thus rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention positively affected social skills outcomes. Social skills outcomes for students with ADHD who received the treatment, were approximately .81 standard deviations above the outcomes for those students representative of the same population without this treatment.

Medication x Social Skills

The following null hypothesis was tested in determining the effect of medication

on the social skills of students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, social skills.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 144, 46, and 128. The homogeneity statistic of 28.56 was found to be significant at the level of $p \leq .05$ on the X^2distribution table. Therefore, rejecting homogeneity and indicating non-homogeneity. The effect size was not calculated. This finding suggests that the medication intervention effects on social skills outcomes are inconclusive for this study.

Behavior Intervention and Medication x Social Skills

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the social skills of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, social skills.

This intervention/outcome combination was tested involving 3 studies including 3 independent samples with *n*s of 144, 16, and 139. The homogeneity statistic of .73 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention and medication x social skills resulted in an effect size of .90 within a 95% confidence interval of (.71, 1.09); thus, rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention and medication intervention positively affected social skills outcomes. The social skills outcomes for students with ADHD who received the treatment were approximately .90 standard deviations above the outcomes for those students representative of the same population without this treatment.

A 99% confidence interval was calculated, in addition to a 95% confidence interval, because medication interventions were used. The effect of behavior intervention and medication x social skills resulted in an effect size of .90 within a 99% confidence interval of (.46, 1.34); thus, rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention and medication intervention positively affected social skills outcomes. The social skills outcomes for students with ADHD who received the treatment were approximately .90 standard deviations above the outcomes for those students representative of the same population without this treatment.

Behavior Intervention x Social Problems

The following null hypothesis was tested in determining the effect of behavior intervention on the social problems of students with ADHD. Null hypothesis: The intervening variable, behavior intervention, will have no effect on the outcome variable, social problems.

This intervention/outcome combination was tested involving 2 studies including 2 independent samples with *n*s of 116 and 60. The homogeneity statistic of .001 was found to be not significant at the level of $p \leq .05$ on the X^2distribution table. Thus, the independent samples were homogeneous. The effect of behavior intervention x social problems resulted in an effect size of .30 within a 95% confidence interval of (.24, .36); thus rejecting the null hypothesis (H_0). This finding suggests that the behavior intervention positively affected social problems outcomes. The outcomes for reducing social problems for students with ADHD who received the treatment were approximately .30 standard deviations above those students representative of the same population without this treatment.

Medication x Social Problems

The following null hypothesis was tested in determining the effect of medication on the social problems of students with ADHD. Null hypothesis: The intervening variable, medication, will have no effect on the outcome variable, social problems.

This intervention/outcome combination was tested involving 1 study including 1 independent sample with an *n* of 41. The homogeneity statistic was found to be irrelevant regarding one sample. The effect of medication x social problems resulted in an effect size of .33. The confidence interval was found to be irrelevant because the effect size was representative of only one sample.

Behavior Intervention and Medication x Social Problems

The following null hypothesis was tested in determining the effect of behavior intervention and medication on the social problems of students with ADHD. Null hypothesis: The intervening variable, behavior intervention and medication, will have no effect on the outcome variable, social problems.

This intervention/outcome combination was tested involving 1 study including 1 independent sample with an *n* of 16. The homogeneity statistic was found to be irrelevant regarding one sample. The effect of behavior intervention and medication x social problems resulted in an effect size of .92. The confidence interval was found to be irrelevant because the effect size was representative of only one sample.

Summary

Of the possible 27 intervention v. outcome variable combinations, 7 met the homogeneity test and 95% confidence interval rejecting the null hypothesis that the intervention would have not effect on the outcome. The 2 intervention/outcome

combinations using medication interventions also met the 99% confidence interval criteria, thus, rejecting the null hypothesis. Of the remaining 20 intervention v. outcome variable combinations, 9 met the homogeneity criteria, but had inconclusive 95% confidence interval results. Of the remaining 11 intervention v. outcome variable combinations, 5 were found to be non-homogeneous, thus nullifying the need to calculate a confidence interval. Of the 6 remaining intervention v. outcome combinations, 3 of them represented only one sample from one study and the other 3 had no data represented in any study. Within Chapter 5, the implications of the results are discussed and suggestions are made for future research.

CHAPTER FIVE

DISCUSSION, IMPLICATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH

This study was conducted to assist educators with the task of meeting the needs of students with ADHD The four preceding chapters addressed the research problem, relevant research literature, the methodology used to conduct the study, and the results of the analysis. In Chapter 5 the results are discussed and implications for practice are presented. Chapter 5 is divided into three sections. In the first section an overview of the study is presented. In the second section the results are discussed and interpreted. In the final section implications for practice are presented and recommendations for future research regarding this area of study are made.

Overview of the Study

As stated in Chapter 1, the purpose of this study was to evaluate the effectiveness of different interventions for students with ADHD in the preK-12 educational setting. Barkley's (1997) Hybrid Model of Behavior Disinhibition was introduced in Chapter 2 to illustrate cognitive and behavioral theories and their relationship towards ADHD and behavioral disinhibition. Guided by the theoretical framework of Barkley's model and the observation of Kollins et al. (2001) that the typical interventions are categorized as (a) pharmacological, (b) behavioral/psychosocial, and (c) a combination of behavioral and pharmacological approaches, the researcher designed a meta-analysis and categorized intervening variables into similar categories. These interventions were applied to sample populations that provided outcome data. The statistical analysis of the data for effect size measures was based, in part, on the work of Purdie et al. (2002) and is explained in Chapter 3. The null hypotheses of the 27 combinations of intervening x outcome variable

combinations and their effect size significance were listed in chapter 4. This, the final chapter, will discuss the results based on the research question: Based upon available research evidence, which behavior interventions, medication interventions, or combination interventions (behavior and medication) are effective regarding academic achievement, aggression, attention, externalizing behaviors, hyperactivity/impulsivity, inattention, internalizing behaviors, social skills and social problems?

Discussion and Interpretation of the Results

Of the 27 possible combinations of intervention x outcome variable effect sizes, 7 of them met the homogeneity test and did not include zero within the 95% confidence interval. These seven items are included in Table 8, Summary of Practical Findings. An effect size is considered small at .20, medium at .50, and large at .80 or greater (Cohen as cited in Howell, 2000). While regarding effect size as small, medium, or large using Cohen's criteria, Howell warned that this standard should not take the place of analyses to include confidence interval inspection. In addition to confidence interval inspection, these 7 effect sizes will also be described with regard to their meaning in terms of percent gain for an outcome as compared with an average student with ADHD who did not receive that particular treatment. The other 20 possible combinations failed to calculate: (a) 3 combinations had no reported data, (b) 3 combinations had only one sample, (c) 4 combinations involved non-homogeneous samples, and (d) 10 combinations included zero within the 95% CI, thus, no conclusions could be drawn regarding the rejection of the null hypotheses for these 10 combinations. This chapter will discuss these findings in the following subsections: (a) intervention x outcome data that met homogeneity and was

TABLE 8

Summary of Practical Findings

Outcome	Intervention	Treatment Intensity and Duration	Expected Effects
Academic Achievement (English, mathematics, academic skills)	Behavior	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day	.22
Aggression	Behavior	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day	.37

Outcome	Intervention	Treatment Intensity and Duration	Expected Effects
		Parent Training – 10 weekly, 1.5 hour sessions Child Training – 10 weekly, 1.5 hour sessions Parent Consultation – 4-6 sessions	
Inattention	Behavior and Medication	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day Methylphenidate – average 31.4 mg per day during the study for 14 months Methylphenidate – 2 doses (.3 mg/kg) per day for 8 weeks Methylphenidate – 2 doses (.6 mg/kg) per day for 8 weeks	1.67

Outcome	Intervention	Treatment Intensity and Duration	Expected Effects
Internalizing Behaviors	Behavior	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day Parent Training – 8 weekly, 1hour sessions Parent Counseling – 8 weekly, 1 hours sessions Behavioral Social Skills Training – 8 weeks	.31
Social Skills	Behavior	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day	.81

Outcome	Intervention	Treatment Intensity and Duration	Expected Effects
		Social Skills Training – 8 weekly, 1.5 hour sessions Student Training – 12 full school days Parent Training – 3 1.5 hour sessions per week for 2 weeks	
Social Skills	Behavior and Medication	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Summer Treatment Classroom – 8 weeks, 5 days per week, 9 hours per day Methylphenidate – average 31.4 mg per day during the study for 14 months Methylphenidate – 2 doses (.3 mg/kg) per day for 8 weeks Methylphenidate – 2 doses (.6 mg/kg) per day for 8 weeks	.90

Outcome	Intervention	Treatment Intensity and Duration	Expected Effects
Social Problems	Behavior	Barkley's parent training program - 10 weekly sessions plus monthly booster sessions Special Treatment Classroom – full school year Parent Training – 10 weekly, 1.5 hour sessions Child Training – 10 weekly, 1.5 hour sessions Parent Consultation – 4-6 sessions	.30

within a 95% CI, (b) intervention x outcome data that met homogeneity but was not within a 95% CI, (c) intervention x outcome data found to be non-homogeneous, (d) intervention x outcome data where only one sample was measured, and (e) intervention x outcome data that were non-existent.

Intervention x Outcome Data That Passed Homogeneity and Was Within a 95% CI

Behavior Intervention X Academic Achievement

The behavior intervention x academic achievement combination produced an effect size of .22 within a 95% confidence interval (.12, .33). The ES of .22 indicates that an average student with ADHD will perform .22 standard deviations over an untreated student. The 95% CI (.12, .33) indicates that one can expect the effect size will fall within this interval with 95% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of 4.8% to 12.9% improvement over an untreated student from the population mean, with an average of a 9.1% improvement over an untreated student from the population mean.

Although academic outcomes were not directly targeted through any of the behavior interventions in the samples contributing to the .22 effect size, it appears that academic achievement enjoyed residual benefits for the students who ranged in age from 5 years to 9.9 years.

The behavior intervention for one sample involved 10 weekly sessions of parent training consisting of rewards and praise to support a full school year of the sample being treated in a special treatment classroom. The special treatment classroom offered an intensive token system, response costs, group cognitive behavioral self-control training, social skills, and a daily report card sent home to the parents (Barkley et al., 2000). The

other samples contributing to this effect size also had parent training, child-focused treatment, and a school-based program that was ongoing for 12 weeks (MTA Cooperative Group, 1999). Descriptions of these interventions are helpful in conveying the intensity and the resources needed to be successful with children diagnosed with ADHD.

Behavior Intervention X Aggression

The behavior intervention x aggression combination produced an effect size of .37 within a 95% confidence interval (.06, .68). The ES of .37 indicates that an average student with ADHD will perform .37 standard deviations over an untreated student. The 95% CI (.06, .68) indicates that one can expect the effect size will fall within this interval with 95% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of 2.4% to 25.2% improvement over an untreated student from the population mean, with an average of a 12.6% improvement over an untreated student from the population mean.

The behavior intervention programs used with the samples contributing to the ES = .37 were the same as those used in the behavior intervention x academic achievement combination, plus an additional program: Barkley's Parent Training Curriculum (Reddy et al., 2002). Barkley's Parent Training Curriculum was implemented in study 9 over a period of 10 weeks and focused on social interactions at home, school, and public settings. The child training portion for the samples in study 9 included 10 weekly sessions focusing on social skills, self-control, and anger management. Token reinforcement was also used in the child training portion. School and home behavior consultation was afforded to members in the sample averaged 6.25 years of age.

Behavior Intervention X Internalizing Behaviors

The behavior intervention x internalizing behaviors combination produced an ES of .31 within a 95% confidence interval of (.01, .61). The ES of .31 also indicates that an average student with ADHD will perform .31 standard deviations over an untreated student. The 95% CI (.01, .61) indicates that one can expect the effect size will fall within this interval with 95% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of .4% to 22.9% improvement over an untreated student from the population mean, with an average of an 11.8% improvement over an untreated student from the population mean.

These samples were treated by the same behavior intervention interventions as in the behavior intervention x aggression category. Anger management and self-control were addressed in the treatments for all samples making up this effect size. Having success with anger management and self-control aligns with the need for self-regulation as noted in Barkley's (1997) Hybrid Model of Behavior Disinhibition. Anger management and self-control are beneficiaries of behavioral disinhibition according to this model. In other words, when behavioral disinhibition was controlled, whether by medication or behavioral interventions, self-control and anger management were improved. This information is relevant regarding decisions to be made involving students with ADHD and how they interact with the learning environment.

Behavior Intervention X Social Skills

This behavior intervention x social skills combination produced an ES of .81 within a 95% confidence interval of (.44, 1.18). The ES of .81 indicates that an average student with ADHD will perform .81 standard deviations over an untreated student. The

95% CI (.44, 1.18) indicates that one can expect the effect size will fall within this interval with 95% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of 17% to 38.1% improvement over an untreated student from the population mean, with an average of a 29.1% improvement over an untreated student from the population mean.

There were seven samples comprising this effect size. Behavior interventions included the same programs as applied to the behavior intervention x aggression category. Additionally, a social skills training program that lasted for 8 weeks was applied to study 4's sample. This training program was referred to as a modified version of the Milich program (Antshel & Remer, 2003). This intervention addressed cooperation with peers, problem solving, anger control, assertiveness, how to give compliments, and accepting consequences. Study 16 addressed talking-out-behaviors by targeting those behaviors, using a checklist to record frequency of talking out, and using peer pressure to reduce the behavior (Davies & White, 2000). Study 19 used a simple behavior contract approach where consequences were established and children were reminded of the consequences before they made their decision (Kapalka, 2002). Measurements were taken in out-of-home settings.

One recurring theme across all the behavioral interventions regarding social skills is that they address self-control. Self-control is also a component of Barkley's (1997) Hybrid Theory of Behavioral Disinhibition. According to the graphic construct of this model presented in Chapter 2, self-control is categorized under self-regulation. It is also categorized with the item "less social perspective." Since self-regulation encompasses the social perspective in the model, it is easier to understand why this particular behavior

intervention yielded the large effect size of .81, as these behavior interventions specifically addressed self-control and self-regulation.

Behavior Intervention X Social Problems

The behavior intervention x social problems combination produced an ES of .30 within a 95% confidence interval of (.24, .36). The ES of .30 indicates that an average student with ADHD will perform .30 standard deviations over an untreated student. The 95% CI (.24, .36) indicates that one can expect the effect size will fall within this interval with a 95% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of 9.5% to 14.1% improvement over an untreated student from the population mean, with an average of 11.8% improvement over an untreated student from the population mean.

The samples involved in this intervention x outcome combination received the treatments of parent training, a special treatment classroom throughout the school year (Barkley et al., 2000), and child training with parent and teacher consultation (Reddy et al., 2002). Only two samples were measured with this combination. One sample included a 5-year old group and the other sample included a group averaging 6.25 years in age with *n*s of 158 and 60, respectively. Not as many variables were measured for the outcome variable social problems as for the outcome variable social skills. Therefore, the amount of data available for researching outcomes related to reducing social problems was limited when compared to the voluminous amount of data and measurements found for the outcome variable related to increasing social skills.

Behavior Intervention and Medication X Inattention

The behavior intervention and medication x inattention combination produced an ES of 1.67 within a 99% confidence interval of (.56, 2.78). The 99% CI was applied because medication was involved in this intervention. Rationale for using a 99% CI lies within the fact that error with medication can cause more serious side effects; therefore, more certainty must exist that an effect will occur when such risks are at stake. The ES of 1.67 indicates that an average student with ADHD will perform 1.67 standard deviations over an untreated student. Specifically, the mean effect size can be expected to fall within an interval of 21.2% to 49.7% improvement over an untreated student from the population mean, with an average of a 45.3% improvement over an untreated student from the population mean. Regarding the review of literature in Chapter 2, medication usually yields larger effect sizes like this one. This behavior intervention effect with added medication appears to be beneficial in reducing inattention.

Two of the studies had parent training programs, a summer treatment child-focus program, and biweekly teacher consultation (MTA Cooperative Group, 1999). Another study placed the students in a Summer Treatment and Enrichment Program (STEP) where skills groups, classroom enrichment, time out, reinforcement, and set targets on social behavior took place 5 days per week, for 8 weeks for 7 hours per day (Kolko, Bukstein & Barron, 1998). All three studies issued methylphenidate as the medication to be combined with the behavior intervention. Methylphenidate is known to block dopamine reuptake. Dopamine is a neurotransmitter involved with executive control processing and has many receptors in an area known for working memory, the prefrontal cortex and basal ganglia (Bedard, Martinussen, Ickowicz & Tannock, 2003). Again, Barkley's

(1997) Hybrid Model of Behavior Disinhibition comports with the large effect size. The constant reinforcement of these intense programs coupled with the pharmacological intervention of methylphenidate appears to increase self-regulation and working memory. The 99% CI indicates that one can expect a 21.2% gain.

Medication alone yielded high effect sizes in this meta-analysis but not within a 99% confidence interval (as will be explained in future sections). However, adding medication to an already successful behavior intervention program (with some outcome variables) appears to enlarge the effect size. All of the behavior interventions are quite similar in practice, length, and intensity which indicates that these types of programs may be needed to assist students with ADHD meet success in the classroom, at home, and in social settings.

Behavior Intervention and Medication X Social Skills

The behavior intervention and medication x social skills combination produced an ES of .90 within a 99% confidence interval of (.46, 1.34). The effect size of .90 indicates that an average student with ADHD will perform .90 standard deviations over an untreated student. The 99% CI (.46, 1.34) indicates that one can expect the effect size will fall within this interval with 99% probability regarding the population mean. Specifically, the mean effect size can be expected to fall within an interval of 17.8% to 41.0% improvement over an untreated student from the population mean.

The behavior intervention programs implemented for this combination intervention x outcome are the same as implemented for the intervention behavior intervention and medication composite with the outcome variable inattention. Methylphenidate was issued as the medication to parallel with the behavior intervention.

Methylphenidate's affect on working memory appears to aid in increasing the effect size for social skills development since this effect size is slightly larger than that with just behavior interventions alone. According to the 99% CI, one can expect to gain 17.8% in improvement over those not receiving the treatment.

Intervention x Outcome Data That Met Homogeneity but Not Within a 95% CI

Medication x Academic Achievement

The combination of intervention x outcome for medication x academic achievement produced an ES of .18 within a 95% confidence interval of (-.40, .75). This is considered a negligible effect size. Given the 95% confidence interval of (-.40, .75), a positive effect cannot be concluded because the interval includes zero.

Behavior Intervention and Medication x Academic Achievement

The combination of intervention x outcome for behavior intervention and medication x academic achievement produced an ES of .45 within a 95% confidence interval of (-.74, 1.64). This is considered a small effect size. Given the 95% confidence interval of (-.74, 1.64), a positive effect cannot be concluded because the interval includes zero.

Behavior Intervention and Medication x Aggression

The combination of intervention x outcome for behavior intervention and medication x aggression produced an ES of .84 within a 95% confidence interval of (-1.07, 2.75). This is considered a large effect size. Given the 95% confidence interval of (-1.07, 2.75), a positive effect cannot be concluded because the interval includes zero.

Behavior Intervention x Attention

The combination of intervention x outcome for behavior intervention x attention produced an ES of .44 within a 95% confidence interval of (-.83, 1.71). This is considered a small effect size. Given the 95% confidence interval of (-.83, 1.71), a positive effect cannot be concluded because the interval includes zero.

Two of the three samples involved intense behavior intervention programs. For example, a parent training and a special treatment classroom was implemented in study 3 (Barkley et al., 2000) as described in the section regarding behavior intervention x academic achievement. A Behavioral Social Skills (BSS) program was implemented in study 7 (Tutty, Gephart & Wurzbacher, 2003). The BSS program was similar in theory to that in study 3 by providing each subject in the sample with 8 weeks of sessions and using Barkley's "What Do We Know" video. However, the intensity of the intervention was deliberately decreased, as stated in study 7, from that of study 3 due to the costs that were incurred in study 3 by providing special treatment programs throughout the year. A visual and auditory training was implemented in study 1 (Semrud-Clikeman, Nielsen, Clinton, Sylvester, Parle & Connor, 1999). As noted in the interval, this confidence interval included zero suggesting that a positive effect is inconclusive.

Behavior Intervention x Externalizing Behaviors

The combination of intervention x outcome for behavior intervention x externalizing behaviors produced an ES of .28 within a 95% confidence interval of (-.36, .92). This is considered a small effect size. Given the 95% confidence interval of (-.36, .92), a positive effect cannot be concluded because the interval includes zero.

Behavior Intervention and Medication x Hyperactivity/Impulsivity

The combination of intervention x outcome for behavior intervention and medication x hyperactivity/impulsivity produced an ES of .1.36 within a 95% confidence interval of (-4.87, 7.59). This is considered a large ES at 1.36. Given the 95% confidence interval of (-4.87, 7.59), a positive effect cannot be concluded because the interval includes zero.

Behavior Intervention x Inattention

The combination of intervention x outcome for behavior intervention x inattention produced an ES of .52 within a 95% confidence interval of (-.06, 1.10). This is considered a medium ES at .52. Given the 95% confidence interval of (-.06, 1.10), it cannot be suggested that a positive effect exists because the interval includes zero. This particular combination originally had five samples comprising the effect size, but the homogeneity test could not be met. The samples were extracted systematically until homogeneity was met among these three samples. However, after bringing the data down to three samples, the confidence interval was calculated and included zero.

Medication x Internalizing Behaviors

The combination of intervention x outcome for medication x internalizing behaviors produced an ES of .42 within a 95% confidence interval of (-1.8, 2.64). This is considered a small effect size. Given the 95% confidence interval of (-1.8, 2.64). A positive effect cannot be concluded because the interval includes zero.

Behavior Intervention and Medication x Internalizing Behaviors

The combination of intervention x outcome for behavior intervention and medication x internalizing behaviors produced an ES of .45 within a 95% confidence

interval of (-.12, 1.02). This is considered a small effect size. Given the 95% confidence interval of (-.12, 1.02). A positive effect cannot be concluded because the interval includes zero.

Intervention x Outcome Data Found to be Non-homogeneous

There were five combinations of intervention x outcome samples that failed the X^2 homogeneity test. If studies produce varying results, an investigation to find out why must occur (Rosenthal, 1991). Rejection of homogeneity implies that the effect sizes from these samples may not measure the same population parameter (Cook et al., 1992). Sometimes the measures of the dependent variable may be an issue. An approach can begin with homogeneity tests. Rosenthal (1991) suggests the descriptions of the instruments measuring the dependent variables may be included to provide more information that may be useful in the rationale as to why homogeneity was not met for these particular comparisons.

Medication x Attention

Only two samples contributed to the attempt of calculating an effect size for the intervention x outcome combination of medication x attention. To measure attention outcomes one sample used the Swanson, Kotkin, Agler, M-Flynn, and Pelham (SKAMP) Attention Scale. The SKAMP measured items such as: (1) getting started, (2) sticking with tasks, (3) attending to a topic, (4) stopping for transition, (5) remaining quiet, and (6) and remaining seated (Swanson, Wigal, Greenhill, Browne, Waslik, Lerner, Williams, Flynn, Agler, Crowley, Fineberg, Baren & Cantwell, 1998). The other sample used the Cambridge Neuropsychological Testing Automated Battery (CANTAB). This measured psychomotor speed and accuracy, visual-spatial processing, and visual-spatial working

memory (Bedard, Martinussen, Ickowicz & Tannock, 2003). The data compared between the two samples from different studies included 10 mg of methylphenidate applied. The researcher for this meta-analysis did not compare varying levels of methylphenidate.

Behavior Intervention x Hyperactivity/Impulsivity

Only two samples contributed to the attempt of calculating an effect size for this intervention x outcome combination. In study 9, measures of the dependent variable came from Conner's' Parent Rating Scale and the Conner's' Teacher Rating Scale (Reddy et al., 2002). In study 5, measures of the dependent variable came from Swanson, Nolan, and Pelham (SNAP) scale (MTA Cooperative Group, 1999). See Appendix C for a sample of a SNAP scale.

Medication x Hyperactivity/Impulsivity

There were four samples measured for this combination but no combination yielded an homogeneous group. The measurement of the dependent outcomes included the SNAP (MTA Cooperative Group, 1999); the IOWA Conner's Rating Scale (Smith, Pehlham, Evans, Gnagy, Molina, Bukstein, Greiner, Myak, Presnell & Willoughby, 1998); the ADHD Disorder Rating Scale-IV (See Appendix C for a sample) and Conner's Parent Rating Scale – Revised (Kratochvil, Heiligenstein, Dittman, Spencer, Biederman, Wernicke, Newcorn, Casat, Milton & Michelson, 2002); and Conner's Parent Rating Scale (Richardson & Puri, 2002). The Richardson & Puri (2002) study measured the outcomes of the highly unsaturated fatty acid supplement (HUFA). While gains were recognized, the effect sizes were significantly lower than the other effect sizes in the other studies. They were greater than 1.00.

Medication x Inattention

Six samples contributed to this attempt at trying to meet homogeneity. No combination of the six samples could meet the homogeneity test. Rationale for this failure can be attributed to the fact that most of the individual effect sizes from each sample were largely greater than 1.00 (Hedges et al., 1989). The measures for dependent variables resulted from: (1) the SNAP (MTA Cooperative Group, 1999), (2) IOWA Conner's Rating Scale (Smith et al., 1998), (3) the ADHD Rating Scale – IV (Kratochvil et al., 2002), (4) the DuPaul ADHD Rating Scale (Akhondzadeh, Tavakolian, Davari-Ashtiani, Arabgol & Amini, 2003), and (5) the Conner's' Parent and Teacher Rating Scales (Richardson & Puri, 2002).

Medication x Social Skills

The three samples involved in this comparison were not homogeneous samples and were measured by the SNAP (MTA Cooperative Group, 1999) and the IOWA Conner's Rating Scale (Smith et al., 1998). Again, effect sizes larger than 1.00 were computed for each sample. More samples being introduced for comparison may have contributed to more favorable results.

Intervention x Outcome Data Where Only One Sample Was Measured

The following intervention x outcome combinations resulted in only one effect size from one sample, thus nullifying an effort to compare samples for homogeneity or offer any 95% confidence data: (1) medication x aggression (ES = .78), (2) medication x social problems (ES = .33), and behavior intervention and medication x social problems (ES = .92). These effect sizes range from small (ES = .33) to large (ES = .92). However,

more samples are needed to align with the integrity of the meta-analysis when more than one sample is included.

Intervention x Outcome Data That Were Non-Existent

The following intervention x outcome combinations resulted in no measurable data for comparisons of outcomes: (1) behavior intervention and medication x attention, (2) medication x externalizing behaviors, and (3) behavior intervention and medication x externalizing behaviors.

Implications and Recommendations for Future Research

Barkley's Model Revisited

> Understanding the nature of self-control, the process of developmental internalization of behavior, and the process of directing behavior toward the future are absolutely critical to achieving a more complete understanding of the nature of the cognitive and social impairments created by ADHD and to treating those with this disorder. (Barkley, 1997, p. *x*)

With these words, Barkley (1997) clarified from a behaviorist perspective the kinds of interventions needed to be practiced to address successful outcomes for students diagnosed with ADHD. Some of the effect sizes resulting from this meta-analysis support Barkley's Theory. The large effect size of .81 (ES = .81) within the confidence interval of (.44, 1.18) involving seven samples for behavior interventions x social skills is very important to the contribution of ADHD research literature in that a lack of social skills impede learning for the student as well as those around him. The interventions used in this particular domain were very intense such as the Summer Treatment Program, the Specialized Treatment Classroom and the Parental Training Group. The constant

reinforcement from the across educational settings, home settings, and the Specialized Treatment Classroom has implications for treating students for ADHD.

The problem statement in Chapter 1 noted that often interventions for students involve only medication. The research literature indicates high effect sizes for medication in treating the externalizing factors and other ADHD symptoms. So many times parents and teacher have said, "Johnny did not take his medicine today, we will try again tomorrow." This implies that medication is relied upon heavily as being the sole cure. The research indicates that medication has a strong effect, but so do behavior interventions offer a valuable contribution as reported regarding their outcome measurements on: social skills (ES = .81), aggression (ES = .37), academic achievement (ES = .22), internalizing behaviors (ES = .31), and social problems (ES = .30). When medication was added to the behavior interventions, the reported outcome measurements were: inattention (ES = 1.67) and social skills (ES = .90).

If students are to meet success, as noted in this research, then attention must be paid to the fact that behavior interventions play an important role. This is evident because the behavior interventions were successful with five outcomes and they were successful when combined with medication for two outcomes. This finding has implications for policy at the government level and has implications for Individualized Educational Programs (IEP) at the student level. This research implies that these students who are in the 3% - 7% segment of the school age population with ADHD would benefit from behavior intervention. A majority of the success was noted with children ranging in age from 3 years old to 9.9 years old. Implications for funding regarding the No Child Left Behind Act, Section 504 of the 1973 Rehabilitation Act or the Individuals with

Disabilities Education Act (IDEA) are evident if school districts have no means to fund such interventions. Future studies could investigate the rationale for providing funding for intense behavior intervention treatment programs like those successful models found in this meta-analysis (child training, parent training to reinforce the child training, specialty treatment classrooms, or summer treatment programs). Having accessibility to programs like this would add another choice for those diagnosed with ADHD.

If funding becomes too burdensome, the study by Tutty et al. (2003) offers a solution purposefully designed to be less expensive by using the Behavior Social Skills treatment. This study involved 59 subjects who were exposed to the Behavior Social Skills treatment. This treatment also involved viewing Barkley's video, "What Do We Know." The outcome variable of attention was measured within the DuPaul's ADHD Parent Rating Scale (Tutty et al., 2003) and provided an ES of .35 for this sample when the treatment was applied. After three months (only a few weeks after the treatment), an effect size of .71 (ES = .71) was calculated.

Future Research

This meta-analysis suggests that future research should focus on gathering more studies involving the intervention combination of behavior intervention with medication. There were only two interventions of this nature to discuss from this meta-analysis, but both effect sizes were larger than that where behavior intervention was the sole intervention. Consideration should also be given to reviewing cost saving measures for those behavior interventions where the intensity was comparable, but the cost was prohibitive for implementation. Treatments implemented such as those in study 3, 5, or 9 may be cost prohibitive at the local district level without additional funding. For

example, study 7 introduced the Behavior Social Skills (BSS) program as an answer to the cost implications implied by study number 3, number 5 and number 9 that were done by clinical research facilities and cooperative groups. This would give the average local educational agency an alternate opportunity to meet success with children if less costly options were available. If no less costly options are available, then perhaps policy should be revisited at all levels: (a) federal, (b) state, and (c) local.

As for the outcome of academic achievement, it would be interesting to gather more studies and combine them where possible regarding the impact of various interventions. It is clear from the literature that medication has large effects on behavior and that behavior interventions have large effects on social behaviors. It is also clear that medication increases the magnitude of the effects in most cases. What is still not as clear are the interventions consistently needed to increase academic achievement. This meta-analysis contributes an ES of .22 for behavior interventions x academic outcomes. Other studies also contribute similarly to these findings: (a) medication x academic achievement (ES = .47) (Ottenbacher & Cooper, 1983), (b) medication x academic achievement (ES = .38) (Kavale, 1982), and (c) medication x academic achievement (ES = .23) (Thurber & Walker, 1983). Studies regarding behavior interventions combined with medication would be suggested to add to this body of knowledge regarding ADHD interventions and academic achievement.

Some other studies that were discovered in the original large search, but were not included in this meta-analysis, referenced the use of hypnosis and neurotherapy to treat ADHD (Barabasz & Barabasz, 2000). Barabasz and Barabasz reported that 40 to 80 sessions of Instant Alert Hypnosis, while measuring EEG event related responses, are

needed to recognize lasting effects for the patient. This study was found to be interesting as pioneer research, but because the primary authors supporting this approach were the researchers themselves, the study was excluded in anticipation of more studies supporting this treatment approach in the future.

Research is prevalent regarding ADHD interventions; how educators use this knowledge will affect many students. Understanding what interventions can assist students in the classroom is beneficial to all stakeholders involved: (a) students, (b) parents, (c) educators, (d) physicians, and e) policy developers at the local, state, and federal levels. For example, although an educator cannot prescribe medication, it is beneficial to the student for those involved to know that medication can be beneficial to social skills when combined with behavior interventions. The interventions within the control of a team of educators, such as behavioral interventions, can be utilized while a recommendation to the child's doctor can be simultaneously made. The doctor's opinion will add more data and credibility to the team's decisions regarding the child's interventions. Another recurring pattern from the Summary of Practical Findings in Table 8 is that those behavior interventions focusing on self-regulation, such as self-control and anger management, produced significant effect sizes on the outcome variables of social skills and social problems. This implies that children in the educational environment with students with ADHD may enjoy a more productive educational experience regarding the classroom environment.

Since the age ranges of the children regarding these interventions ranged from 3-9 years of age, it appears that the earlier the intervention is applied, the more successful educational experiences will be for the child. The data from this meta-analysis will

hopefully guide present and future stakeholders in making better decisions about children, affected by ADHD, and their education.

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* Indicates studies used for this meta analysis.

APPENDIX A

Appendix A

Included Studies for the Meta-Analysis – Demographic Breakdown
All from journals – No dissertations included

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
Akhondzadeh, Tavakolian, Davari-Ashtiani, Arabgol, & Amini (2003)	Selegeline in the Treatment of ADHD in Children: A Double Blind and Randomized Trial	14	Avg. 7.36	Medication	ADHD Rating Scale (See Appendix C)
Antshel & Remer (2003)	Social Skills Training in Children with ADHD: A Randomized-Controlled Trial	120	8-12	Behavior Interventions	Social Skills Rating Scale (SSRS)
Barkley, Shelton, Crosswait, Moorehouse, Fletcher, Barrett, Jenkins, & Metevia (2000)	Multi-method psycho-educational intervention for preschool children with disruptive behavior: Preliminary results at post-treatment	158	5	Behavior Interventions	Child Behavior Checklist (CBCL) See Appendix C. Home Situation Questionnaire (HSQ)
Bedard, Martinussen, Ickowicz, & Tannock (2004)	Methylphenidate Improves Visual-Spatial Memory in Children with	26	Avg. 8.6	Medication	Cambridge Neuropsychological

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
	ADHD				Testing Automated Battery (CANTAB)
Davis & Witte (2000)	Self-Management and Peer-Monitoring within a Group Contingency to Decrease Uncontrolled Verbalizations of Children with ADHD	4	9	Behavior	Frequency of talking-out behaviors
Kapalka (2002)	Reducing ADHD Children's Management Problems in Out-of-Home Settings	44	5-10	Behavior	Barkley's Home Situations Questionnaire
Kolko, Bukstein, Barron (1999)	Methylphenidate and behavior intervention in children with ADHD and comorbid ODD or CD: Main and incremental effects across	16	7-13	Behavior and medication	Overt Aggression Scale (OAS)

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
	settings				
Kratochvil, Heilgenstein, Dittmann, Spencer, Biederman, Wernicke, Newcorn, Casat, Milton, & Michelson (2002)	Atomoxetine and Methylphenidate Treatment in Children with ADHD: A Prospective, Randomized, Open-Label Trial	228	7-15	Medication	ADHD Rating Scale IV
MTA Cooperative Group (1999)	A 14-month randomized clinical trial of treatment strategies for ADHD	579	7-9.9	Behavior, Medication, and Combined B/M	SNAP, Social Skills Rating Scale (SSRS)
MTA Cooperative Group (2004)	A 24-month National Institute of Mental Health Multimodal Treatment of ADHD	526	7-10	Behavior, Medication, and Combined	SNAP, SSRS, & WIAT

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
				B/M	
Reddy, Braunstein, Springer, Bartik, Hauch, Hall, Benisz, and Gioia (2002)	Randomized Trial of Three Child/Parent Training Groups for ADHD Children	60	Avg. 6.25	Behavior	Child Behavior Checklist (CBCL), Conner's Rating Scale, Social Skills Rating Scale (SSRS)
Richardson & Puri (2002)	A Randomized Double-Blind, Placebo-Controlled Study of the Effects of Supplementation with Highly Unsaturated Fatty Acids on ADHD-Related Symptoms in Children with Specific Learning Difficulties	41	8-12	Medication	Conner's Parent Rating Scale, ADHD Rating Scale
Semrud-Clikeman, Nielsen, Clinton, Sylvester, Parle, &	An intervention approach for children with teacher and parent	33	Avg. 10	Behavior and Combined	Visual and auditory test

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
Connor (1999)	identified attention difficulties			B/M	
Sheridan, Dee, & Morgan (1996)	A Multimethod Intervention for Social Skills Deficits in Children with ADHD and Their Parents	5	9	Behavior and Combined B/M	SSRS and Conner's Rating Scale
Smith, Pelham, Evans, Gnagy, Molina, Bukstein, Greiner, Myak, Presnell, & Willoughby (1998)	Dosage Effects of Methylphenidate on the Social Behavior of Adolescents Diagnosed with ADHD (1998)	46	Avg. 13.8	Behavior, Medication	IOWA Conner's Rating Scale
Sonuga-Barke, Thompson, Daley, & Laver-Bradbury (2004)	Parent Training for ADHD: Is It Effective When Delivered as Routine Rather Than Specialist Care	89	3	Behavior	Parental Account of Childhood Symptoms (PAC), Behavior Checklist (BCL), and Werry-Weiss-Peters Activity Scale (WWP)

Author(s)	Title	N	Age (years)	Interventions	Dependent Variables (or inventory used)
Swanson, Wigal, Greenhill, Browne, Waslik, Lerner, Williams, Flynn, Agler, Crowley, Fineberg, Baren, & Cantwell (1998)	Analog Classroom Assessment of Adderall in Children with ADHD	29	7-14	Medication	SKAMP Attention Scale
Tutty, Gephart, & Wurzbacher (2003)	Enhancing Behavioral and Social Skill Functioning in Children Newly Diagnosed with ADHD Disorder in A Pediatric Setting	100	5-12	Behavior, Medication	DuPaul's ADHD PRS (18 items) and Child Attention Profile (12 items)

APPENDIX B

APPENDIX B

Descriptive Information on ADHD Studies and Independent Samples Included in the Meta-Analysis

Study #	Reference	*n* Students in Treatment Group	*n* Students in Comparison Group	Outcome Variables Measured	*n* of Effect Sizes	Mean Effect Size ($\bar{d}$)
1	Semrud-Clikeman, Nielsen, Clinton, Sylvester, Parle, & Connor (1999)	21	12	attention	1	1.02 (beh)
2	Sonuga-Barke, Edmund, Daley, Thompson, Laver-Bradbury, & Weeks (2001)	30_a	20	inattention	2	0.67 (beh)
		28_b	20			
3	Barkley, Shelton, Crosswait, Moorehouse, Fletcher, Barrett, Jenkins, & Metevia (2000)	37_a	42	social skills	3	0.37 (beh)
		39_b	42	aggression	3	0.25 (beh)
		40_c	42	attention	3	0.22 (beh)
				inattention	3	0.25 (beh)
				internalizing	3	0.21 (beh)
				externalizing	3	0.23 (beh
				academic	3	0.21 (beh)
				social problems	3	0.29 (beh)
4	Antshel & Remer (2003)	59	61	social skills	1	0.36 (beh)
5	MTA Cooperative Group (1999)	145_a	145	academic	3	0.17 (b/m)
		144_b	144			0.13 (med)
		144_c	144			0.27 (beh)
				social skills	3	0.97 (b/m)
						0.76 (med)
						0.78 (beh)
				internalizing	3	0.49 (b/m)
						0.59 (med)
						0.44 (beh)
				aggression	3	0.82 (b/m)

Study #	Reference	*n* Students in Treatment Group	*n* Students in Comparison Group	Outcome Variables Measured	*n* of Effect Sizes	Mean Effect Size ($\bar{d}$)
						0.72 (med)
						0.50 (beh)
				inattention	3	1.63 (b/m)
						1.88 (med)
						1.08 (beh)
				hyperactivity/		
				impulsivity	3	0.87 (b/m)
						1.67 (med)
						1.14 (beh)
6	Smith, Pelham, Evans, Gnagy, Molina,	46	46	impulsivity/		2.82 (med)
	Bukstein, Greiner, Myak, Presnell, &			hyperactivity	1	2.50 (med)
	Willoughby (1998)			inattention	1	2.19 (med)
				social skills	1	
7	Tutty, Gephart, Wurzbacher (2003)	59	41	inattention	1	0.63 (beh)
				attention	1	0.07 (beh)
8	Kolko, Bukstein, Oscar, & Barron (1999)	16	16	aggression	1	0.85 (b/m)
				inattention	1	1.88 (b/m)
				social problems	1	-0.45 (b/m)
				social skills	1	0.92 (b/m)
9	Reddy, Braunstein, Springer, Bartik, Hauch,	18_a	18	externalizing	3	0.33 (beh)
	Hall, Benisz, & Gioia (2002)	14_b	14	internalizing	3	0.27 (beh)
		18_c	18	aggression	3	0.37 (beh)
				social skills	3	0.67 (beh)
				hyperactivity/		
				impulsivity	3	0.42 (beh)
				social problems	3	0.30 (beh)
10	Ialongo, Horn, Pascoe, Greenberg, Packard,	96	96	externalizing	1	n/a

Study #	Reference	*n* Students in Treatment Group	*n* Students in Comparison Group	Outcome Variables Measured	*n* of Effect Sizes	Mean Effect Size ($\bar{d}$)
	Lopez, Wagner, & Puttler (1993)			aggression	1	n/a
				inattention	1	n/a
11	Swanson, Wigal, Greenhill, Browne, Waslik, Lerner, Williams, Flynn, Agler, Crowley, Fineberg, Baren, & Cantwell (1998)	29	29	attention	1	3.53 (med)
12	Bedard, Martinussen, Ickowicz, & Tannock (2004)	26	26	attention	1	0.71 (med)
13	MTA Cooperative Group (2004)	138_a	138	academic	3	0.17 (b/m)
		128_b	128			0.22 (med)
		139_c	139			0.19 (beh)
				social skills	3	0.82 (b/m)
						0.66 (med)
						0.69 (beh)
				inattention	3	1.5 (b/m)
						1.6 (med)
						1.19 (beh)
14	Sheridan, Dee, & Morgan (1996)	5	5	social skills	1	1.23 (b/m)
				academic	1	1.00 (b/m)
				internalizing	1	
				impulsive/		0.40 (b/m)
				hyperactivity	1	1.85 (b/m)
15	Kratochvil, Heilgenstein, Dittmann,	184	184	impulsivity/		
	Spencer, Biederman, Wernicke, Newcorn,	44	44	hyperactivity	1	1.31 (med)
	Casat, Milton, & Michelson (2002)			inattention	1	2.27 (med)
16	Davies & Witte (2000)	4	4	social skills	1	0.44 (beh)
17	Akhondzadeh, Tavakolian, Davari-Ashtiani,	14	14	inattention	2	0.11 (med)

Study #	Reference	*n* Students in Treatment Group	*n* Students in Comparison Group	Outcome Variables Measured	*n* of Effect Sizes	Mean Effect Size ($\bar{d}$)
	Arabgol, & Amini (2003)	14	14			
18	Wacks & Gilman (1996)	10	10	n/a	n/a	n/a
19	Kapalka (2002)	23	21	social skills	1	1.37 (beh)
20	Richardson & Puri (2002)	41	41	impulsivity/ hyperactivity	1	0.13 (HUFA)
				inattention	1	0.45 (HUFA)
				social problems	1	0.33 (HUFA)
				internalizing	1	0.24 (HUFA)
21	Sonuga-Barke, Thompson, Daley, & Laver-Bradbury (2004)	59	30	hyperactivity	n/a	n/a

Note. HUFA in study 20 represents Highly Unsaturated Fatty Acid supplement.

APPENDIX C

Examples of Checklists in the Public Domain

Sample SNAP Scale (ADHD.net)

Name: _____ Gender:_____ Age:_____ Grade:_____

Ethnicity: African-American _____ Asian _____ Caucasian _____ Hispanic _____ Other_____

For teacher: Completed by: _____ Type of Class:_____ Class size: _____

Telephone # at school: _____ Recommended times for follow-up call: _____

For parent: Completed by: _____ # Parents Living in Home: _____ Family Size: _____

Period of Time Covered by Rating: Past Week _____ Past Month _____ Past Year _____ Lifetime _____ Other _____

For each item, check the column that best describes this child:	Not At All	Just A Little	Quite A Bit	Very Much
1. Often fails to give close attention to details or makes careless mistakes in schoolwork or tasks	_____	_____	_____	_____
2. Often has difficulty sustaining attention in tasks or play activities	_____	_____	_____	_____
3. Often does not seem to listen when spoken to directly	_____	_____	_____	_____
4. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties	_____	_____	_____	_____
5. Often has difficulty organizing tasks and activities	_____	_____	_____	_____
6. Often avoids, dislikes, or reluctantly engages in tasks requiring sustained mental effort _____	_____	_____	_____	
7. Often loses things necessary for activities (e.g., toys, school assignments, pencils, or books)	_____	_____	_____	_____
8. Often is distracted by extraneous stimuli	_____	_____	_____	_____
9. Often is forgetful in daily activities	_____	_____	_____	_____
10. Often fidgets with hands or feet or squirms in seat	_____	_____	_____	_____
11. Often leaves seat in classroom or in other situations in which remaining seated is expected	_____	_____	_____	_____
12. Often runs about or climbs excessively in situations in which it is inappropriate	_____	_____	_____	_____
13. Often has difficulty playing or engaging in leisure activities quietly	_____	_____	_____	_____
14. Often is "on the go" or often acts as if "driven by a motor"	_____	_____	_____	_____
15. Often talks excessively	_____	_____	_____	_____
16. Often blurts out answers before questions have been completed	_____	_____	_____	_____
17. Often has difficulty awaiting turn	_____	_____	_____	_____
18. Often interrupts or intrudes on others (e.g., butts into conversations/games)	_____	_____	_____	_____
	_____	_____	_____	_____

ADHD-In		ADHD-H/Im	
# 1	_____	#10	_____
# 2	_____	#11	_____
# 3	_____	#12	_____
# 4	_____	#13	_____
# 5	_____	#14	_____
# 6	_____	#15	_____
# 7	_____	#16	_____
# 8	_____	#17	_____
# 9	_____	#18	_____
Total =	_____	=	_____
Average =	_____	=	_____

The 4-point response is scored 0- 3 (Not at All = 0, Just A Little = 1, Quite A Bit = 2, and Very Much = 3). Subscale scores on the SNAP-IV are calculated by summing the scores on the items in the specific subset (eg., Inattention) and dividing by the number of items in the subset (eg., 9). The score for any subset is expressed as the Average Rating-Per-Item.

Sample ADHD Rating Scales – Home & School Versions
(elcaminopediatrics.com/documents)

To print: Select **File** and then **Print** from your browser's menu

El Camino Pediatrics: ADHD Rating Scale-IV -- Home Version

Child's Name _____

Child's Age _____ Sex: M F Grade_____ Child's Race_____

Completed by: Mother Father Guardian Grandparent

Circle the number that best describes your child's home behavior over the last 6 months

		never or rarely	sometimes	often	very often
1.	Fails to give close attention to details or makes careless mistakes in schoolwork.	0	1	2	3
2.	Fidgets with hands or feet or squirms in seat.	0	1	2	3
3.	Has difficulty sustaining attention in tasks or play activities.	0	1	2	3
4.	Leaves seat in classroom or in other situations in which remaining seated is expected.	0	1	2	3
5.	Does not seem to listen when spoken to directly.	0	1	2	3
6.	Runs about or climbs excessively in situations in which it is inappropriate.	0	1	2	3
7.	Does not follow through on instructions and fails to finish work.	0	1	2	3
8.	Has difficulty playing or engaging in leisure activities quietly.	0	1	2	3
9.	Has difficulty organizing tasks and activities.	0	1	2	3
10.	Is "on the go" or acts as if "driven by a motor."	0	1	2	3
11.	Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort.	0	1	2	3
12.	Talks excessively	0	1	2	3
13.	Loses things necessary for tasks or activities.	0	1	2	3
14.	Blurts out answers before questions have been completed.	0	1	2	3
15.	Is easily distracted.	0	1	2	3
16.	Has difficulty awaiting turn.	0	1	2	3
17.	Is forgetful in daily activities.	0	1	2	3
18.	Interrupts or intrudes on others.	0	1	2	3

To print: Select **File** and then **Print** from your browser's menu

El Camino Pediatrics: ADHD Rating Scale-IV -- School Version

Child's Name _____

Child's Age _____ Sex: M F Grade_____ Child's Race_____

Circle the number that best describes this student's school behavior over the past 6 months (or since the beginning of the school year).

		never or rarely	sometimes	often	very often
1.	Fails to give close attention to details or makes careless mistakes in schoolwork.	0	1	2	3
2.	Fidgets with hands or feet or squirms in seat.	0	1	2	3
3.	Has difficulty sustaining attention in tasks or play activities.	0	1	2	3
4.	Leaves seat in classroom or in other situations in which remaining seated is expected.	0	1	2	3
5.	Does not seem to listen when spoken to directly.	0	1	2	3
6.	Runs about or climbs excessively in situations in which it is inappropriate.	0	1	2	3
7.	Does not follow through on instructions and fails to finish work.	0	1	2	3
8.	Has difficulty playing or engaging in leisure activities quietly.	0	1	2	3
9.	Has difficulty organizing tasks and activities.	0	1	2	3
10.	Is "on the go" or acts as if "driven by a motor."	0	1	2	3
11.	Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort.	0	1	2	3
12.	Talks excessively	0	1	2	3
13.	Loses things necessary for tasks or activities.	0	1	2	3
14.	Blurts out answers before questions have been completed.	0	1	2	3
15.	Is easily distracted.	0	1	2	3
16.	Has difficulty awaiting turn.	0	1	2	3
17.	Is forgetful in daily activities.	0	1	2	3
18.	Interrupts or intrudes on others.	0	1	2	3

Please print **TEACHER'S REPORT FORM FOR AGES 6-18**

For office use only
ID #

Your answers will be used to compare the pupil with other pupils whose teachers have completed similar forms. The information from this form will also be used for comparison with other information about this pupil. Please answer as well as you can, even if you lack full information. Scores on individual items will be combined to identify general patterns of behavior. Feel free to print additional comments beside each item and in the spaces provided on page 2. ***Please print, and answer all items.***

PUPIL'S FULL NAME First Middle Last

PUPIL'S GENDER ☐ Boy ☐ Girl

PUPIL'S AGE

PUPIL'S ETHNIC GROUP OR RACE

TODAY'S DATE Mo. ____ Day ____ Year ____

PUPIL'S BIRTHDATE (if known) Mo. ____ Day ____ Year ____

GRADE IN SCHOOL

NAME AND ADDRESS OF SCHOOL

PARENTS' USUAL TYPE OF WORK, even if not working now.
(Please be specific — for example, auto mechanic, high school teacher, homemaker, laborer, lathe operator, shoe salesman, army sergeant.)
FATHER'S TYPE OF WORK ____
MOTHER'S TYPE OF WORK ____

THIS FORM FILLED OUT BY: (print your full name) ____

Your gender: ☐ Male ☐ Female

Your role at the school:
☐ Classroom Teacher ☐ Counselor ☐ Teacher's Aide
☐ Special Educator ☐ Administrator ☐ Other (specify)

I. For how many months have you known this pupil? _____ months

II. How well do you know him/her? 1. ☐ Not Well 2. ☐ Moderately Well 3. ☐ Very Well

III. How much time does he/she spend in your class or service per week?

IV. What kind of class or service is it? (Please be specific, e.g., regular 5th grade, 7th grade math, learning disability, counseling, etc.)

V. Has he/she ever been referred for special class placement, services, or tutoring?
☐ Don't know 0. ☐ No 1. ☐ Yes — what kind and when?

VI. Has he/she ever repeated any grades? ☐ Don't Know 0. ☐ No 1. ☐ Yes – grades and reasons:

VII. Current academic performance — list academic subjects and check box that indicates pupil's performance for each subject:

Academic subject	1. Far below grade	2. Somewhat below grade	3. At grade level	4. Somewhat above grade	5. Far above grade
1. _____	☐	☐	☐	☐	☐
2. _____	☐	☐	☐	☐	☐
3. _____	☐	☐	☐	☐	☐
4. _____	☐	☐	☐	☐	☐
5. _____	☐	☐	☐	☐	☐
6. _____	☐	☐	☐	☐	☐

Be sure you answered all items. Then see other side.

Please print. Be sure to answer all items.

VIII. Compared to typical pupils of the same age:	1. Much less	2. Somewhat less	3. Slightly less	4. About average	5. Slightly more	6. Somewhat more	7. Much more
1. How hard is he/she working?	☐	☐	☐	☐	☐	☐	☐
2. How appropriately is he/she behaving?	☐	☐	☐	☐	☐	☐	☐
3. How much is he/she learning?	☐	☐	☐	☐	☐	☐	☐
4. How happy is he/she?	☐	☐	☐	☐	☐	☐	☐

IX. Most recent achievement test scores (optional):

Name of test	Subject	Date	Percentile or grade level obtained

X. IQ, readiness, or aptitude tests (optional):

Name of test	Date	IQ or equivalent scores

Does this pupil have any illness or disability (either physical or mental)? ☐ No ☐ Yes — please describe:

What concerns you most about this pupil?

Please describe the best things about this pupil:

Please feel free to write any comments about this pupil's work, behavior, or potential, using extra pages if necessary.

Please print. Be sure to answer all items.

Below is a list of items that describe pupils. For each item that describes the pupil *now or within the past 2 months*, please circle the *2* if the item is *very true or often true* of the pupil. Circle the *1* if the item is *somewhat or sometimes true* of the pupil. If the item is *not true* of the pupil, circle the *0*. Please answer all items as well as you can, even if some do not seem to apply to this pupil.

0 = Not True (as far as you know) **1 = Somewhat or Sometimes True** **2 = Very True or Often True**

0 1 2 1. Acts too young for his/her age
0 1 2 2. Hums or makes other odd noises in class
0 1 2 3. Argues a lot
0 1 2 4. Fails to finish things he/she starts
0 1 2 5. There is very little he/she enjoys
0 1 2 6. Defiant, talks back to staff
0 1 2 7. Bragging, boasting
0 1 2 8. Can't concentrate, can't pay attention for long
0 1 2 9. Can't get his/her mind off certain thoughts; obsessions (describe): _____
_____
0 1 2 10. Can't sit still, restless, or hyperactive
0 1 2 11. Clings to adults or too dependent
0 1 2 12. Complains of loneliness
0 1 2 13. Confused or seems to be in a fog
0 1 2 14. Cries a lot
0 1 2 15. Fidgets
0 1 2 16. Cruelty, bullying, or meanness to others
0 1 2 17. Daydreams or gets lost in his/her thoughts
0 1 2 18. Deliberately harms self or attempts suicide
0 1 2 19. Demands a lot of attention
0 1 2 20. Destroys his/her own things
0 1 2 21. Destroys property belonging to others
0 1 2 22. Difficulty following directions
0 1 2 23. Disobedient at school
0 1 2 24. Disturbs other pupils
0 1 2 25. Doesn't get along with other pupils
0 1 2 26. Doesn't seem to feel guilty after misbehaving
0 1 2 27. Easily jealous
0 1 2 28. Breaks school rules
0 1 2 29. Fears certain animals, situations, or places, other than school (describe): _____
_____
0 1 2 30. Fears going to school
0 1 2 31. Fears he/she might think or do something bad
0 1 2 32. Feels he/she has to be perfect
0 1 2 33. Feels or complains that no one loves him/her
0 1 2 34. Feels others are out to get him/her
0 1 2 35. Feels worthless or inferior
0 1 2 36. Gets hurt a lot, accident-prone
0 1 2 37. Gets in many fights
0 1 2 38. Gets teased a lot
0 1 2 39. Hangs around with others who get in trouble
0 1 2 40. Hears sound or voices that aren't there (describe): _____
_____
0 1 2 41. Impulsive or acts without thinking
0 1 2 42. Would rather be alone than with others
0 1 2 43. Lying or cheating
0 1 2 44. Bites fingernails
0 1 2 45. Nervous, highstrung, or tense
0 1 2 46. Nervous movements or twitching (describe): _____
_____
0 1 2 47. Overconforms to rules
0 1 2 48. Not liked by other pupils
0 1 2 49. Has difficulty learning
0 1 2 50. Too fearful or anxious
0 1 2 51. Feels dizzy or lightheaded
0 1 2 52. Feels too guilty
0 1 2 53. Talks out of turn
0 1 2 54. Overtired without good reason
0 1 2 55. Overweight

56. Physical problems *without known medical cause:*
0 1 2 a. Aches or pains (*not* stomach or headaches)
0 1 2 b. Headaches
0 1 2 c. Nausea, feels sick
0 1 2 d. Eye problems (*not* if corrected by glasses) (describe): _____
_____
0 1 2 e. Rashes or other skin problems
0 1 2 f. Stomachaches
0 1 2 g. Vomiting, throwing up
0 1 2 h. Other (describe): _____
_____
_____

Be sure you answered all items. Then see other side.

Please print. Be sure to answer all items.

0 = Not True (as far as you know) 1 = Somewhat or Sometimes True 2 = Very True or Often True

0 1 2 57. Physically attacks people
0 1 2 58. Picks nose, skin, or other parts of body (describe): _____
_____
0 1 2 59. Sleeps in class
0 1 2 60. Apathetic or unmotivated
0 1 2 61. Poor school work
0 1 2 62. Poorly coordinated or clumsy
0 1 2 63. Prefers being with older children or youths
0 1 2 64. Prefers being with younger children
0 1 2 65. Refuses to talk
0 1 2 66. Repeats certain acts over and over; compulsions (describe): _____
_____
0 1 2 67. Disrupts class discipline
0 1 2 68. Screams a lot
0 1 2 69. Secretive, keeps things to self
0 1 2 70. Sees things that aren't there (describe):
_____
_____
0 1 2 71. Self-conscious or easily embarrassed
0 1 2 72. Messy work
0 1 2 73. Behaves irresponsibly (describe): _____
_____
_____
0 1 2 74. Showing off or clowning
0 1 2 75. Too shy or timid
0 1 2 76. Explosive or unpredictable behavior
0 1 2 77. Demands must be met immediately, easily frustrated
0 1 2 78. Inattentive or easily distracted
0 1 2 79. Speech problem (describe): _____
_____
0 1 2 80. Stares blankly
0 1 2 81. Feels hurt when criticized
0 1 2 82. Steals
0 1 2 83. Stores up too many things he/she doesn't need (describe): _____
_____
_____
0 1 2 84. Strange behavior (describe): _____
_____
0 1 2 85. Strange ideas (describe): _____
_____
0 1 2 86. Stubborn, sullen, or irritable
0 1 2 87. Sudden changes in mood or feelings
0 1 2 88. Sulks a lot
0 1 2 89. Suspicious
0 1 2 90. Swearing or obscene language
0 1 2 91. Talks about killing self
0 1 2 92. Underachieving, not working up to potential
0 1 2 93. Talks too much
0 1 2 94. Teases a lot
0 1 2 95. Temper tantrums or hot temper
0 1 2 96. Seems preoccupied with sex
0 1 2 97. Threatens people
0 1 2 98. Tardy to school or class
0 1 2 99. Smokes, chews, or sniffs tobacco
0 1 2 100. Fails to carry out assigned tasks
0 1 2 101. Truancy or unexplained absence
0 1 2 102. Underactive, slow moving, or lacks energy
0 1 2 103. Unhappy, sad, or depressed
0 1 2 104. Unusually loud
0 1 2 105. Uses drugs for nonmedical purposes (*don't* include tobacco) (describe): _____
_____
_____
0 1 2 106. Overly anxious to please
0 1 2 107. Dislikes school
0 1 2 108. Is afraid of making mistakes
0 1 2 109. Whining
0 1 2 110. Unclean personal appearance
0 1 2 111. Withdrawn, doesn't get involved with others
0 1 2 112. Worries
113. Please write in any problems the pupil has that were not listed above:
0 1 2 _____
0 1 2 _____
0 1 2 _____

Please be sure you answered all items.

APPENDIX D

Assignment Protocol
Raw Variables Sorted Out of Studies Via Index Cards – First Glance

Outcome Category	Descriptor	Study ID Number(s)
Social Problems	Opposition	6, 8, 8, 9, 9, 13, 20
Social Skills	Assertion	4, 4, 5
Social Skills	Social skills	1, 3, 4, 5, 5, 5, 9, 9, 13
Aggression	Aggression	3, 3, 3, 5, 5, 5, 8, 8, 9, 9
Attention	Attention	1, 3, 3, 7
Social Problems	Problem behavior	6, 9, 9
Inattention	Inattention	5, 5, 6, 8, 8, 11, 15, 20,
Social problems	Social problems	3, 3, 9, 9, 9, 9, 20
Internalizing	Internalizing	1, 3, 5, 5, 5, 9, 9
Social Problems	Anxiety	3, 3, 3, 9, 9, 9, 9, 20
Not related to sample	Efficacy	2, 3
Externalizing	Externalizing	1, 3, 9, 9
Inattention or Hyperactive	ADHD	2, 3, 7, 13, 15, 17, 17, 20, 21
Hyperactivity/Impulsivity	Hyperactive	9, 9, 15, 20, 21
Hyperactivity/Impulsivity	Impulsivity	6, 20
Hyperactivity/Impulsivity	Hyperactivity/impulsivity	5, 5, 5, 11, 13, 15, 20
Social Skills	Behavior and conduct	2, 3, 3, 6
Discarded	Cognitive problem	12, 15, 20
Social problems	Peer conflicts and teasing	6, 8, 8
Academic	Reading score	5, 13
Internalizing	Psychosomatic	9, 20
Discarded	Severity	3, 3, 15
Discarded	Delinquent	3, 3
Social Skills	Positive mood/behavior	8, 8
Academic	Academic skills	3, 3, 5
Social Skills	Cooperation	4, 4
Internalizing	Satisfaction	2, 3
Internalizing	Withdrawn	3, 3
Attention	Free play	3, 3
Social Skills	Self control	4, 4
Attention	Fidgets	3, 3
Attention	Out-of-seat	3, 3
Inattention	Off-task	3, 3
Social Skills	Vocal	3, 3
Attention	Task-setting	3, 3
Attention	Visual	12, 12, 12, 12, 12
Discarded	Global total	20, 20
Discarded	No. settings	3, 3
Attention	Latency	12
Discarded	Commissions	3
Discarded	Stress	3
Attention	Auditory	1
Attention	No. sorted	3
Academic	Applied problems	3
Not related to sample	Personal consensus	5
Discarded	Total correct	3
Discarded	Practices	3
Not related to sample	Well-being	2
Discarded	Parent-discipline	7
Academic	Letter id.	3
Academic	Broad knowledge	3
Internalizing	Perfection	20
Academic	Humanities	3

Academic	Science	3
Academic	Social studies	3
Academic	Dictation	3
Social Skills	Responsibility	4
Discarded	Job performance	6
Academic	Spelling	5
Social skills	Empathy	4
Academic	Mathematics	5
Discarded	Negative/ineffective discipline	13
Discarded	Success rating (summary of negative behaviors)	6

VITA

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Education:

2005 **Candidate for Ed.D. Educational Leadership and Policy Studies**
Virginia Tech, Blacksburg, VA
1996 **M.S. Educational Administration**
Radford University, Radford, VA
1989 **B.A. Mathematics Education**
Virginia Tech, Blacksburg, VA

Professional Experience:

2001 – present - **Principal, Northside Middle School**
Roanoke County Schools
Roanoke, VA
1998-2001 – **Assistant Principal, Cave Spring High School**
Roanoke County Schools
Roanoke, VA
1996–1998 – **Math Coordinator, Montgomery County Public Schools**
Christiansburg, VA
1993-1996 – **Adjunct Math Teacher, New River Community College**
Dublin, VA
1990-1996 – **Math Teacher, Auburn Middle/High School**
Montgomery County Public Schools
Riner, VA
1989-1990 – **Math Teacher, Floyd County High School**
Floyd County Public Schools
Floyd, VA

Conferences:

Virginia Association of Supervision and Curriculum Development Conference, Williamsburg, VA
December 2004
Virginia Middle Schools Conference, Norfolk, VA
March 2004
Instructional Strategies Workshop, Roanoke, VA
October 2004
Virginia Association of Supervision and Curriculum Development Conference, Williamsburg, VA
December 2003

Virginia Middle Schools Conference, Norfolk, VA
March 2003
Virginia Middle Schools Conference, Norfolk, VA
March 2001
CSA Training, Roanoke, VA
August 2 & 3, 2000
STAR-BASE User Conference, Eatontown, NJ
May, 2000
HSTW Conference, Richmond, VA
January, 2000
AEL QUEST Conference, Bristol, VA
January, 2000
HSTW Conference, Roanoke, VA
August, 1999
Interdisciplinary Team Instruction (ITI) Workshop, Lexington, KY
July, 1999
STAR-BASE User Conference, Eatontown, NJ
May, 1999
VCTM Conference, Roanoke, VA
March, 1999
AEL QUEST Conference, Roanoke, VA
February, 1999
VCTM Board Meeting, Longwood College
January, 1999
AEL QUEST Conference, Glade Springs, WV
November, 1998
HSTW Conference, Roanoke, VA
August, 1998
NCTM Regional Conference, Cleveland, OH
November, 1997
NCTM Regional Conference, Baltimore, MD
October, 1996
Hands-On Equations Train-the-Trainer, Alexandria, VA
October, 1996
Project Adventure Workshop, Ipswich, MS
May, 1995
Curriculum Writers Workshop, Richmond, VA
March, 1995
Project Adventure Workshop, Brattleboro, VT
January 1995
NCTM Regional Conference, Charleston, WV
November, 1994
AP Computer Science Conference, Winston-Salem, NC
November, 1994

NCTM Regional Conference, Richmond, VA
April, 1994
Tech Prep Convention, Atlanta, GA
September, 1993
AP Workshop (Computer Science), Manhattan College,
New York, NY
July, 1993 (1 week)
Project Adventure Workshop, Radford University, Radford, VA
February, 1993 (2days)
AP Workshop (Calculus), LaSalle University,
Philadelphia, PA
July, 1992 (1 week)
CORD Train-the-Trainer, Waco, TX
June, 1992 (5 days)

Presentations:

SOL Expo, Hotel Roanoke
February, 2004
T/TAC Collaboration Workshop, VA Tech
October, 1999
Interdisciplinary Team Instruction Workshop, CSHS
September, 1999
T/TAC Collaboration Workshop, VA Tech
March, 1999
504 and Special Education IEP Workshop, Roanoke, VA
September, 1998
Hands-On Equations Trainer, Montgomery County, VA
10/96 - 3/98
Virginia Educational Research Association, Abingdon, VA
October, 1996
World Wide Web Workshop (co-presenter), VA Tech
February, 1996
World Wide Web Workshop, Riner, VA
February, 1996
Integrade Workshops (2), Montgomery County Public Schools
1995-1996 School Year
SVCTM Conference, Clinch Valley College
April, 1995
Integrade Workshops (3), Montgomery County Public Schools
Spring 95
Integrade Workshop, Blacksburg, VA
January, 1995
TI Graphics Calculator Workshop, Christiansburg, VA
August, 1994
Applied Mathematics Conference, Big Stone Gap, VA
July, 1994

DOS Training, Auburn High School
February, 1994

Professional Service:

2001 – present, Treasurer, Roanoke Area Chapter of Phi Delta Kappa
1996-1997 President, Blue Ridge Council of Teachers of Mathematics

Professional Affiliations:

Phi Delta Kappa
National Association of Secondary School Principals
Association of Supervision and Curriculum Development
Virginia Middle School Association
National Education Association