1998

A Brief Method for Evaluating the Effects of Stimulant Medication and Behavioral Interventions on the Classroom Performance of Children With Attention Deficit Hyperactivity Disorder (ADHD).

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A BRIEF METHOD FOR EVALUATING THE EFFECTS OF STIMULANT MEDICATION AND BEHAVIORAL INTERVENTIONS ON THE CLASSROOM PERFORMANCE OF CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy in

The Department of Psychology

by

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B. S., Louisiana State University, 1992
M. A., Louisiana State University, 1996
December, 1998
ACKNOWLEDGEMENTS

I wish to thank my supervisor, Dr. John Northup, for his never-ending support, encouragement and guidance. I also want to thank my mom for teaching me how to reach for the stars, my dad for reminding me to stop along the way and smell the roses, and my grandmother, my guardian angel, for always making sure I got there okay. I am eternally grateful to all of my family and friends (you know who you are) for helping me to recognize the important things in life and without whom none of this would have been possible. I especially would like to thank my husband, Charles Douglas Gulley, III, for his endless patience, understanding, and for being my best friend.
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ABSTRACT

This study examined the separate and combined effects of varying dosages of methylphenidate (MPH) and behavioral interventions of varying strengths on the disruptive behavior and academic performance of 5 students with attention deficit hyperactivity disorder (ADHD). Overall results indicated the behavioral interventions at some level were comparable to previously prescribed dosages of MPH for decreasing disruptive classroom behavior for 4 of 5 participants. However, the "strength" of behavioral intervention necessary to achieve maximum improvements was idiosyncratic. For a fifth participant, results indicated that MPH was not necessary. Results also demonstrated that the combination of the behavioral interventions at some level and MPH was more effective than MPH alone for increasing academic performance for 3 students. Overall, results indicated that for 2 of the 5 participants, their previous dose of MPH was inaccurately prescribed. Results illustrate idiosyncratic differential effects both stimulant medication and behavioral interventions may have on student academic and behavioral performance at varying levels of dosage or strength.
CHAPTER 1

REVIEW OF THE LITERATURE

Overview

Current estimates from the American Psychiatric Association state that 3% to 9% of children in the United States are diagnosed with ADHD (American Psychiatric Association, 1994). This percentage accounts for one third to one half of all referrals for child mental health services (Richters et al., 1995). The disorder is more common in males with male to female ratios ranging from 4:1 to 9:1. The major problems these children experience include short attention span, low impulse control, excessive motor behavior, below average academic performance, poor peer relations, and a variety of classroom behavior problems (e.g., excessive talking, out of seat, noncompliance). Not all children display all of these behaviors and symptoms are often child and task specific.

Treatment

A wide variety of treatments for children with ADHD exist. Some of which include parent and teacher training, counseling, behavioral and cognitive-behavioral interventions, and stimulant medication (Barkley, 1990). The most common of these treatments is stimulant medication (Pelham, Jr., 1993). It is estimated that between 2 - 2¼% of all elementary school-aged children in North America are receiving some type of pharmacological treatment for hyperactivity (Richters et al., 1995). Methylphenidate (Ritalin), the most commonly used medication, is
currently prescribed to approximately one and a half million children (Safer, 1996). Other stimulants less frequently prescribed include dextroamphetamine (Dexedrine), pemoline (Cylert), and more recently Adderall®. All best practice guidelines suggest that the initial step in treating ADHD should be a behavioral intervention that directly addresses the presenting problem. A stimulant medication evaluation is the next appropriate step if behavioral treatment has failed to show sufficient improvement in child performance (Pelham, Jr., 1993). It has been suggested that the combination of behavior modification and medication treatment often shows positive effects when combined. Therefore, current best practice suggests the initial use of behavior modification and the subsequent use of combined medication treatment if necessary (Pelham, Schnedler, Bologna, & Contreras, 1980; Rapport, Murphy, & Bailey, 1982; Abramowitz, Eckstrand, O’Leary, & Dulcan, 1992; Hoza, Pelham, Jr., Sams, & Carlson, 1992; Carlson, Pelham, Jr., Milich, & Dixon, 1992; Johnson, Handen, Lubetsky, & Sacco, 1994; Pelham, Jr., 1993).

**Behavioral Treatments**

Behavior modification is an integral part of interventions designed for many children with ADHD. Most behavior modification programs involve setting clear rules and limits and the use reinforcement and mild punishment (e.g., time-out) in the child’s home and school environment. The effectiveness of different behavior modification strategies is dependent on each individual child and these procedures do not often generalize
outside of the setting in which they are implemented (Barkley, 1990). It has also been suggested that positive reinforcement alone is often insufficient for maintaining appropriate classroom behavior and must be combined with a mild punishment technique to be effective (DuPaul, Eckert, & McGoey, 1997). The following section briefly reviews the most common behavioral approaches to treatment.

**Parent training.** Parent training is commonly used to help parents acquire the skills needed to help them in implementing various behavior management strategies, primarily involving contingency management techniques. A number of studies have been published that evaluate the effects of parent training/counseling for children with ADHD (Anastopoulos, Shelton, DuPaul, & Guevremont, 1993; Barkley, Guevremont, Anastopoulos, and Fletcher, 1992; Pisterman et al., 1992; Barkley, 1990; Pisterman et al., 1989; Pollard, Ward, & Barkley, 1983; Dubey, O'Leary, & Kaufman, 1983; Eyberg & Robinson, 1982; Firestone, Kelly, Goodman & Davey, 1981; Baum & Forehand, 1981; Forehand, Wells, & Griest, 1980). Most studies were consistent in finding that parent training, in general, helped to improve child behavior. However, most of these studies varied methodologically regarding the different types of parent training examined, outcome measures, definition of ADHD, and sample sizes (Barkley, 1990).

Barkley, Guevremont, Anastopoulos, and Fletcher (1992) compared three family therapy programs for treating family conflicts in adolescents...
with ADHD. These authors compared behavior management training (BMT), problem-solving and communication training (PSCT), and structural family therapy (SFT) to determine the effectiveness of each in treating the parent-adolescent conflicts seen in adolescents with ADHD. Families were assessed at pre- and post treatment and at a 3 month follow-up. It is important to note that the majority of the participants were also diagnosed with Oppositional Defiant Disorder (ODD).

Several rating scales evaluating parent and adolescent interactions, direct observations of parents and adolescents engaged in neutral and conflictual discussions, therapist ratings of family cooperation and a consumer satisfaction survey were used to evaluate the effectiveness of all three programs. Results suggested that all three approaches produced significant group improvements in parent-adolescent communication, number of conflicts, and anger intensity during discussions at home based on reports from rating scales at post treatment and 3 month follow-up. In addition, families in all three treatments reported high satisfaction ratings equally across groups. However, when examining the degree of clinically significant change (i.e., magnitude of actual change) and clinical recovery (i.e., degree of normalization) for individuals (Jacobson & Truax, 1991), the percentage of subjects displaying clinical improvement ranged from 5 - 30%, and similarly only 5 - 20% were considered clinically recovered across groups. In addition, results from direct observations did not indicate positive changes as did self-report measures.
Anastopoulos, Shelton, DuPaul, and Guevremont (1993) examined the effects of behavioral parent training (PT; Barkley 1990) for school-aged children with ADHD. Changes in parenting self-esteem, parenting stress, marital satisfaction, and perceived severity of child symptoms were evaluated. Results suggested that compared to wait list controls, parents in the PT group reported less parenting stress, higher levels of parenting self-esteem, and significantly less severe ADHD symptomatology. These results remained stable over the 2 month follow-up period. In addition, when considering clinical significance, 26% to 64% of the PT subjects displayed reliable change and/or recovery. One major limitation of this study is the exclusion of direct observations of parent-child interactions as an outcome measure. Other studies have indicated a lack of correspondence between what parents are reporting as change, and actual changes in parenting styles and parent-child interactions (Barkley et al., 1992).

Pisterman et al. (1992) evaluated the effectiveness of parent training for increasing compliance and time on task in preschool children with ADHD. A behavioral assessment consisting of a 20 minute free play condition, a compliance task, and a parent supervised and unsupervised attention task (10 minutes each) were used to assess change in parent and child behaviors. Child compliance was measured in several ways. A percentage of compliance score measured child compliance relative to the total number of parent commands. Frequency of child compliance, frequency of parent appropriate (alpha) and inappropriate (beta)
commands, and time to complete the compliance task were also used as outcome measures. Child attention was measured by mean time on task during free play, parent supervised and unsupervised attention tasks. Parent skills were measured by figuring the percentage of alpha commands and percentage of child compliance which was reinforced during the compliance task, and frequency of commands, questions and negative feedback during the attention task. Parental interactions were coded as directive (commands or questions), positive, and negative. Parents were also asked to complete child behavior rating scales and self-report measures. Assessments were conducted during pre- and post treatment and a three month follow-up.

The parent training intervention consisted of a 12-session attention training program which was an extension of a parent training program for compliance (Pisterman et al., 1989). Compliance training involved instruction in reinforcing compliance and implementing time out procedures for noncompliance. Attention training extended these same strategies to teach parents to reinforce their children's on-task behavior. Parents were also taught to focus their praise specifically on their child's on-task behavior, and to avoid asking questions, issuing commands that were not related to getting back on task, and giving negative feedback. All instruction was provided through modeling, role-playing, and individual instruction sessions where parents received feedback from trainers.
Results suggested that this parent training program was effective for improving compliance in preschoolers with ADHD. A significant increase in the percentage of compliance, in addition to a significant decrease in the time taken to complete the compliance task was demonstrated. However, results did not demonstrate any positive effects of the parent training on any of the attention measures. Parents were found to issue more appropriate commands and more consistently reinforce compliance. In addition, overall parent-child interactions improved as parents gave less directive statements and delivered more positive feedback to their children.

Parent training is commonly recommended as a part of treatment for children with ADHD. However, despite its widespread use, there are not many studies demonstrating the efficacy of individual parent training programs. Future research should focus on continuing to evaluate specific standardized programs with various age groups using behavioral (i.e., direct observation) rather than self-report (i.e., rating scale) outcome measures.

**Differential reinforcement.** The most typical contingency management procedure for children with ADHD is differential reinforcement. Reinforcement is provided contingent on appropriate, or alternative behavior and taken away, or prevented from occurring following inappropriate behavior (DuPaul, Guevremont, & Barkley, 1992). Differential reinforcement of other behavior (DRO) involves the administration of reinforcement based on the absence of the inappropriate behavior for a specified period of time. It has been demonstrated that DRO
is more effective when reinforcement is based on the absence of inappropriate behavior during the entire time period, rather than only the last interval of the time period (Repp, Barton, & Brulle, 1983).

Differential reinforcement of incompatible behavior (DRI) and differential reinforcement of alternative behavior (DRA) involve reinforcement of appropriate behaviors rather than the absence of inappropriate behaviors. Some classroom studies have used these procedures with the typical reinforcer being praise and positive attention from the teacher. As with most interventions, the success of these procedures often depends on the consistency of implementation.

**Token economies.** Token economies allow the child to earn points or tokens for appropriate behavior which can then be exchanged for preferred items or activities. Token economies have been used to increase academic productivity and appropriate social behaviors. Several studies have demonstrated these programs to be an effective form of treatment for some children with ADHD (Piffner & O'Leary, 1993). Most studies that have evaluated the effectiveness of token economies for children with ADHD have included a response cost procedure for inappropriate behavior, in addition to time out for severe disruptive behavior. Most also include a daily school home note (Hoza, Pelham, Sams, & Carlson, 1992).

**Response cost.** Response cost is a procedure that involves contingent loss or withdrawal of reinforcers following inappropriate behavior. Response cost has been shown to improve on-task behavior and academic
assignment completion for some children (Rapport, Murphy, & Bailey, 1982). DuPaul et al. (1992) demonstrated that a recently developed Attention Training System (ATS; Gordon Systems, Inc., 1987), based on a response-cost procedure, was effective in improving on-task behavior and work completion in the classroom for two children with ADHD. In addition, the ATS reduced the frequency of associated problem behaviors for both children.

Kelley and McCain (1995) demonstrated the efficacy of adding response cost to school home notes for improving on-task behavior in inattentive children. It was demonstrated that the addition of response cost was necessary to produce maximum benefits for all children.

**Time-out.** Time-out from positive reinforcement has been demonstrated to be an effective technique for decreasing inappropriate classroom behavior. Time-out procedures can range from minimal (i.e., brief non-exclusionary) to restrictive (e.g., exclusionary). Time-out is more difficult to implement than other forms of punishment procedures, and therefore has a high potential for misuse (Abramowitz & O'Leary, 1991). Additionally, in order for time-out procedures to be effective, the “time-in” environment must be considered reinforcing by the child.

**Functional Analysis**

Recent research has emphasized the importance of conducting a functional analysis for the purpose of developing behavioral treatments. The primary purpose of functional analysis is to identify possible
maintaining variables of problem behavior in an attempt to design more appropriate and effective interventions. In 1977, Carr discussed three environmental events that could influence problem behaviors: positive reinforcement, negative reinforcement, and automatic reinforcement or self stimulation. Iwata et al. (1982/1994) then presented a methodology to assess functional relationships between various environmental events and self-injurious behavior in developmentally disabled individuals. Four analogue conditions (i.e., demand, attention, play and alone) were presented in random order to each subject. The occurrence of self-injurious behavior was recorded during each 10 minute condition. During the demand condition, a difficult task was presented to the child, and removed contingent upon any occurrence of the target behavior. The attention condition consisted of issuing adult attention in the form of a reprimand contingent upon the occurrence of the target behavior. The play condition functioned as a control condition where noncontingent social attention was available, in addition to several preferred activities. Finally, during the alone condition, the child was not provided with any activities and no attention was available from the examiner. Results demonstrated that problem behaviors were related to specific environmental events and were idiosyncratic across individuals. Also, treatment recommendations were made based on the identified function of the problem behavior.

Since the Iwata et al. (1982/1994) study, there has been an extensive amount of research demonstrating the utility of functional analysis
methodology. Recently, functional analysis procedures have been extended
to other populations, behaviors, and settings. Northup, Wacker, Berg,
Kelly, Sasso, and DeRaad (1994) trained special education teachers to
implement functional analysis procedures within the classroom. Results
demonstrated that the subjects’ behaviors were maintained by different
functions. These results were then utilized to develop effective treatments
with effects that were durable over time.

Cooper, Wacker, Sasso, Reimers and Donn (1990) developed a brief
functional analysis procedure in an outpatient setting with children of
average intellectual abilities. Parent’s were trained to conduct 90-minute
assessments in an attempt to identify variables maintaining their child’s
behavior problem(s). Analogue conditions varied by level of task difficulty
and adult attention. Results indicated that appropriate behavior
corresponded to certain analogue conditions. Interventions based on results
of the functional analysis were rated as effective by parents at follow-up.

In another study, Cooper et al., (1992) compared the results of
functional analysis procedures conducted in an outpatient clinic and a
special education classroom. Brief functional analysis procedures were used
to assess behavior problems in children with average intelligence. Results
demonstrated that the children’s disruptive behaviors were related to levels
of academic demands and attention. In contrast to the previous study,
experimenters were conducting functional analysis procedures in the
classroom and not the teacher.
Broussard and Northup (1995) conducted functional analyses of three developmentally normal children in the regular education classroom setting. Parent and teacher interviews and direct observations were used to form hypotheses about maintaining variables for each child's problem behavior(s). Hypotheses were then tested through functional analysis procedures during ongoing instruction within the child's classroom. Although only one hypothesized variable was tested for each child, this study demonstrated the feasibility of conducting functional analysis within a regular classroom setting.

Northup, Broussard, Jones, George, Vollmer, and Herring (1995) utilized functional analysis methodology to identify maintaining variables for disruptive classroom behavior in developmentally normal children. The effects of contingent teacher attention, contingent peer attention, and contingent escape from academic tasks were investigated for children diagnosed with ADHD. Results indicated that contingent peer attention resulted in high levels of inappropriate behavior compared to teacher attention for all 3 subjects. Also, differential results occurred for one subject was she was on medication (Ritalin). This study suggested that functional analysis methodology may be useful for future research regarding ADHD.

Umbreit (1995) utilized a three-phase classroom-based functional analysis to develop an intervention for an 8 year old child with ADHD. During the first phase, a brief functional analysis was conducted that
presented teacher attention and escape from academic tasks contingent upon disruptive behavior. Results indicated that the child's behavior was maintained by escape from academic demands. In the second phase, curriculum based assessment was used to assess the effects of antecedent events on child behavior. Results indicated higher levels of disruptive behavior when the child was seated in specific areas of the classroom.

Phase three examined the effectiveness of an intervention based on the above assessment procedures. The intervention (which included modifying seating arrangements, functional communication training, and decreased teacher attention to disruptive behavior) resulted in a significant decrease in disruptive behavior. This study demonstrated the utility of classroom-based functional assessments for developing successful classroom interventions for children with ADHD.

Most recently, Ervin, DuPaul, Kern, and Friman (1998) conducted classroom-based functional assessment of problem behaviors for four adolescents with ADHD and ODD. Observations and interviews were used to develop hypotheses regarding the maintaining variables of problem behavior both by the consultant and teacher. Hypotheses were then tested within the child's classroom. Based on these results, interventions were implemented for two students. Interventions were effective for both students. Results further demonstrated the utility of classroom-based functional assessment procedures for developing successful school-based interventions for children diagnosed with ADHD.
**Reinforcer Assessment**

It has been repeatedly demonstrated that systematic reinforcer assessment procedure can enhance the effectiveness of behavioral treatments in the area of developmental disabilities (Fisher, et al., 1992; Pace et al, 1985). It is fundamental in behavior analysis that reinforcers differ across individuals (i.e., something that is reinforcing for one individual may not be reinforcing for another). Several specific methods have been developed to identify possible reinforcers for developmentally delayed children with limited verbal repertoires. However, very few studies have addressed developing systematic methods to assess reinforcer preference in verbal children. Most often reinforcers for verbal children are chosen by verbal nomination (i.e., "what do you like?") or sometimes by observing the activities a child engages in frequently (Northup, George, Jones, Broussard & Vollmer, 1996). The most common methods of reinforcer assessment across populations are based on direct observation procedures, verbal nomination, surveys and forced-choice stimulus preference assessments.

Pace, Ivancic, Edwards, Iwata, and Page (1985) used direct observation to identify preferences for individuals with profound mental retardation. Sixteen stimuli were presented to each individual at 5 second intervals. If the participant approached the stimuli within 5 seconds of it’s presentation, it was made available to them for 5 seconds. Therapists prompted participants to sample stimuli that they did not approach during
the initial 5 seconds. Preferences were found for each participant by calculating the percentage of trials during which approach to individual stimuli was observed. These preferred items were also shown to function as reinforcers for the participants.

Fisher et al. (1992) modified the Pace, Ivanic, Edwards, Iwata, and Page (1985) method of reinforcer assessment by presenting stimuli in a concurrent operant arrangement. All possible combinations of the 16 stimuli were presented simultaneously in pairs to each participant. A preference was identified by calculating the percent of trials that an item was chosen. This forced-choice procedure was demonstrated to be more effective for identifying stimuli that would function as reinforcers and thus maintain higher levels of responding.

Mason, McGee, Farmer-Dougan, and Risley (1989) identified preferred stimuli based on Pace et al. (1985) assessment procedures. These stimuli were then presented once daily in a mini-assessment. The experimenter presented only the two most preferred stimuli and the participant was given an instruction to pick only one. Results demonstrated that using an ongoing reinforcer assessment was effective for decreasing problem behaviors.

Northup, Jones, Broussard, and George (1995) evaluated the utility of a verbal forced choice questionnaire, child nomination, and direct observation to determine which method was best for identifying reinforcers for verbal children with ADHD. Child nomination consisted of showing
each child five toys and asking “Of all the toys, which one is your favorite?”

The forced-choice questionnaire involved verbally presenting all combinations of the five toys in pairs and asking “Would you rather play with Toy 1 or Toy 2?” The toys were then ranked based on how frequently they were chosen. Direct observation of the children during a 10-minute period of free play followed. All 5 toys were available and children were instructed to “do whatever they want and we will be back in a little bit.” Toys were then ranked based on the number of intervals in which the child was engaged with each toy. Results indicated that preference varied across assessment methods for 9 out of 10 subjects. In addition, by requiring children to complete academic tasks in order to gain access to their preferred reinforcers, it was demonstrated that children were more likely to work for the reinforcers that were identified through the forced-choice procedure and direct observation rather than those reinforcers identified by verbal nomination.

Northup et al. (1996) compared the treatment utility of a reinforcer survey, a verbal stimulus-choice questionnaire, and a pictorial stimulus-choice questionnaire. A modified child reinforcement survey was administered verbally to each child and ratings (0 = not at all; 1 = a little; 2 = a lot) were recorded for each of nine stimuli in 5 categories (i.e., activity, attention, edibles, escape, and tangibles). A verbal stimulus choice questionnaire was developed for the five categories of stimuli. Ten questions were constructed so that each category was compared at least
once with every other category. The questions were presented in the format, "Would you rather (e.g. get things to eat like candy, pretzels, and chips) or (get to do things like play on the computer, art projects, or go to the library)?" The same specific stimuli (e.g., candy, pretzels, and chips) were presented each time. Categories were ranked based on frequency of selection and a percentage was calculated by dividing the number of times a category was chosen by the number of times it was presented as an alternative. Categories with a score of 75% or greater were considered high preference. The pictorial stimulus choice was identical to the verbal stimulus choice only the coupons representing each category were presented in pairs, and the child was asked to pick one rather than providing a verbal response. Results indicated that the pictorial and verbal stimulus-choice assessments identified high and low preference categories for 3 of 4 participants. However, survey results were substantially less likely to identify high and low preference categories and were less likely to correspond with the results of a reinforcer assessment. Across all participants the accuracy of the survey did not exceed chance levels.

Along with functional analysis, the above studies suggest that the greater use of systematic reinforcer assessment procedures may be necessary to develop the most effective behavioral treatments.

Medication Treatment

Stimulant medication has been the most commonly used and recommended intervention for children diagnosed with ADHD. Research
has suggested that medication has been effective in the short-term management of classroom behavior and performance for about two thirds of the children for whom it is prescribed (Pelham, Jr., 1993; Stoner et al., 1994). Elia et al. (1991) suggested that these estimates may be too low due to (a) only evaluating the effects of one stimulant medication in a study, and (b) not titrating doses for individual children. These authors demonstrated in a controlled study that addressed these factors, that a much larger percentage (96% of a total of 48) of children with ADHD responded favorably to either MPH or dextroamphetamine. In addition, the most common reason for nonresponse was due to significant side effects.

**The Stimulants.** Stimulant medication currently prescribed for the treatment of children with ADHD include methylphenidate (MPH; Ritalin), dextroamphetamine (Dexedrine), pemoline (Cylert), and more recently, Adderall®. More children are prescribed MPH than the other three stimulants. These medications have a relatively brief half-life, therefore they take effect and wear off rather quickly. It has been repeatedly demonstrated that the behavioral effects of methylphenidate and dextroamphetamine peak approximately 1-3 hours after ingestion, and decrease gradually until they disappear approximately 2 (MPH) to 4 (dextroamphetamine) hours later. The effects of these medications can typically be observed on the first day they are administered. It is not necessary for the medication to build up in the child's system. The time-response curve of methylphenidate and dextroamphetamine indicates that
the behavioral effects increase for the first two hours after administration, and decrease in what is similar to a bell-shaped curve, with the offset somewhat more extended than the onset (Pelham, Jr., 1993). In contrast, the peak effects for pemoline are 4 - 6 hours post administration, and its effects last for a total of 8 - 10 hours. Also, pemoline must be administered for 2 consecutive days before maximum effects can be observed (Pelham et al., 1990). Less is known about Adderall®. It was initially approved in the 1960's for the treatment of obesity and ADHD. Swanson et al. (1998) was the first controlled, double-blind study to date evaluating the efficacy of Adderall® in the treatment of children diagnosed with ADHD.

Methylphenidate is manufactured in fixed doses of 5 mg, 10 mg, 20 mg, and sustained release-20 mg tablets. Short-acting doses rather than sustained-release are more commonly prescribed due to the fact that some studies suggest that sustained-release methylphenidate may be less effective in the first hours after administration and more variable from day to day (DuPaul et al., 1991), although others have demonstrated similar effects to standard preparations (Fitzpatrick et al, 1992). Dexedrine is manufactured in 5 mg tablets, and 5 mg, 10 mg, and 15 mg sustained release spansules. Pemoline is manufactured in 18.75 mg, 37.5 mg, 75 mg tablets and a chewable tablet of 37.5 mg. Adderall® is manufactured in 5 mg, 10 mg, 20 mg and 30 mg tablets.

**Limitations.** There are several limitations associated with the use of stimulant medication and it should be noted that no medication is 100%
safe. The use of any medication with children also requires special care. There are many children for whom stimulant medication is ineffective or contraindicated (e.g. those who have serious side effects). In addition, there are no child characteristics that have proven to be effective for predicting a positive response to medication, or in determining what particular medication is best for a particular child. Therefore, careful monitoring of the effects of medication is necessary, but assessment typically occurs by “trial and error” and errors are common. Also, minimum ages approved by the Food and Drug Administration (FDA) for stimulant medication use are not supported by research data (Dulcan et al., 1997). Stimulants are often used for populations outside of this age range (i.e., preschoolers), but there are very few studies demonstrating their efficacy.

Another limitation concerns parents and children’s acceptability of medication treatment. Although many studies have demonstrated the beneficial effects of stimulant medication, its use remains controversial for many parents and educators (Brown, Dingle, & Landau, 1994). This attitude regarding stimulant medication may help explain why many parents are inconsistently administering medication and sometimes discontinuing use without consulting their child’s physician (Cross-Calvert & Johnston, 1990). Other studies have suggested that mothers of both ADHD and non-referred children consistently rated behavioral interventions as most acceptable and stimulant medication as least acceptable (Liu, Robin, Brenner & Eastman, 1991).
Few studies have investigated peer and child attitudes regarding medication treatment. It has been suggested that children who receive medication treatment for ADHD will be more likely to attribute improvements in their behavior to external sources (i.e., medication) and that this could have negative effect on future learning (Whalen, Henker, Hinshaw, Heller, & Huber-Dressler, 1991). However, studies have shown that when children diagnosed with ADHD are exposed to success and failure conditions both on medication and placebo, they did not differ in their attributions following success on an easy task. However, when faced with a more difficult task, they made more external (i.e., task difficulty) and fewer internal (i.e., effort) attributions on medication versus placebo (Carlson, Pelham, Milich & Hoza, 1991; Milich, Carlson, Pelham, & Licht, 1991). Another study demonstrated that most children with ADHD reported to have more internal control while on medication, and two-thirds would choose to continue taking medication if given a choice (Cohen & Thompson, 1982).

As with most medications, there are also possible side effects. The most frequently reported side effects are appetite reduction and insomnia. Other possible side effects include irritability, nausea, dizziness, headaches, stomachaches, tachycardia, skin rashes, drowsiness, and in rare cases, motor and vocal tics (Barkley, 1990, Pelham, 1993). Also, with the administration of Pemoline, blood tests are required to check for abnormalities in liver function (Greenhill et al., 1996). In addition, most
research to date on the effects of stimulant medication for ADHD has assessed only the short-term efficacy of the treatment. There are very few studies that have evaluated the long term efficacy of medication treatment and those often have serious shortcomings (Barkley, 1990). The general conclusion is that there are no proven long-term benefits associated with the use of stimulant medication, and all benefits are usually lost if medication is discontinued (Pelham et al., 1991).

**Behavioral effects.** Research has demonstrated that stimulant medication can have an effect on a variety of children's behaviors. Several studies have shown that methylphenidate was effective in increasing on task behavior (Pelham et al., 1993; Pelham et al., 1991; Johnson et al., 1994; Rapport, DuPaul, Stoner, & Jones, 1986), rule following (Pelham et al., 1993; Pelham et al., 1991), and the percentage of assigned work completion and accuracy (Pelham et al., 1993; Pelham et al., 1991; Rapport et al., 1986). Methylphenidate has also been shown to be effective in decreasing disruptive behaviors in the classroom (Rapport, Denny, DuPaul, & Gardner, 1994; Pelham et al., 1993), in addition to improving teacher ratings of child behavior (Rapport et al., 1986) and compliance to teacher requests (Barkley, McMurray, Edelbrock, & Robbins, 1989; Pelham et al., 1980). Studies have also illustrated that methylphenidate decreased fidgetiness (Johnson et al., 1994) and improved laboratory measures of attention and impulsivity in some children (Rapport et al., 1986).
In contrast, the effects of MPH on academic performance remain equivocal. It has been demonstrated that only about half of children with ADHD exhibit positive changes in academic performance as a result of treatment with methylphenidate, and the other half either show no response or a deterioration in academic productivity (Rapport et al., 1994). Some studies have demonstrated immediate, short term improvements in academic performance (e.g., Stoner et al., 1994), however, long term studies have not shown improvement on standardized achievement measures (Barkley & Cunningham, 1978).

The above mentioned effects have been primarily demonstrated in the research with elementary-aged children and MPH. There are relatively few studies conducted with younger preschool-aged children (4 - 6 year old) and adolescents. Some studies have suggested that stimulant medication is less effective for preschool children as compared to elementary-aged children (Dulcan et al., 1997). In contrast, other studies have shown stimulant medication to increase on-task behavior, compliance, and the quality of play in preschool children with ADHD (Alessandri & Schram, 1991; Barkley, 1988; Cohen et al., 1981). Overall, current research suggests that stimulant medication response is more variable in preschool children, and the rate of side effects may be higher (Dulcan et al., 1997).

The few studies that have evaluated the effects of pemoline have shown it to be beneficial for increasing on-task behavior and academic performance, in addition to decreasing noncompliance for some children.
with ADHD. Results also illustrated improvements on laboratory measures of attention and impulsivity (i.e., Continuous Performance Task) and teacher ratings of child behavior (Pelham, Swanson, Furman, & Schwindt, 1995; Pelham, Greenslade, Vodde-Hamilton, et al. 1990; Stephens, Pelham, & Skinner, 1984; Conners & Taylor, 1980).

Swanson et al. (1998) conducted a double-blind, placebo-controlled study to determine the efficacy and safety of Adderall® for the treatment of children with ADHD. The time course effects of four doses of Adderall® (5, 10, 15, and 20 mg), a placebo, and a “clinical dose” of methylphenidate were evaluated for 30 children in a laboratory classroom setting. Assessments were conducted at 0, 1.5, 3.0, 4.5, 6.0, and 7.5 hours after medication administration. Dependent variables included: observer ratings of child attention (i.e., getting started, sticking with tasks, attending to topic, stopping for transitions) and deportment (i.e., interacting with students, interacting with staff, remaining quiet, staying seated) during independent seatwork and permanent products from math tasks (i.e., problems attempted and problems correct).

Significant overall effects were found for all dependent measures. Results demonstrated a dose-related improvement in measures of both deportment and attention in addition to permanent product scores. Results showed earlier peak effects for methylphenidate (average across measures = 1.88 hours) than for most of the Adderall® conditions (average across measures = 1.5, 2.6, 2.6, and 3.0 hours for 5 mg to 20 mg doses, respectively.)
However, methylphenidate had a shorter duration of action (average = 3.98 hours) than for the Adderall® conditions which increased with dose (average = 3.52, 4.83, 5.44, and 6.40 hours for 5 mg to 20 mg doses, respectively).

Several limitations were noted in this study. Students attended the laboratory school only one day per week (Saturdays) for 10 hours (7:00 a.m. to 5:00 p.m.), and therefore was a novel experience for the children. Also, this study was not designed to compare the effects of methylphenidate to Adderall®, however several conclusions were made concerning the onset and duration of behavioral effects of each. These comparisons should be interpreted with caution because it is not known which dosages of methylphenidate were compared to all four doses (5 - 20 mg) of Adderall®.

**Dose response.** Research shows highly idiosyncratic dose-response relationships for stimulant medication; that is, the relation between the dose and the magnitude of the behavioral effects, for children diagnosed with ADHD (DuPaul & Barkley, 1993). Studies have suggested that an idiosyncratic response exists across children, regardless of behavior. Typical methods for recommending dosage such as body weight (mg/kg) and blood levels have been demonstrated to be poor predictors of dose-response to stimulant medication. Likewise, there may be an idiosyncratic response across behaviors for the same child (Sprague & Sleator, 1977). Therefore, assessment of medication effects must have the ability to assess all of the
problem behaviors that a child exhibits in order to evaluate the effectiveness of a particular dose of medication (Rapport et al., 1994).

The fact that different doses of medication can effect separate classes of behavior (e.g., academic performance, compliance, attention, etc.) has broad implications for medication assessment. For example, which behavior is considered most problematic for a child with a diagnosis of ADHD may be quite different for different children. Thus, there may be both immediate and long-term implications for emphasizing one behavior over another and for deciding which behavior(s) should be targeted for intervention (Rapport & Kelly, 1993).

**Combined Treatment**

Most studies that assess behavioral treatments have evaluated the combined effects of behavior modification and stimulant medication. Overall, results are equivocal. Some combined studies have shown behavior modification alone to be most effective in reducing problem behaviors and increasing academic performance for some children with ADHD (Hoza, Pelham, Sams, & Carlson, 1992), while others have shown medication alone to be most effective, and yet others have demonstrated combined treatments were most effective (Hoza et al., 1992; Pelham, Vodde-Hamilton, Murphy, Greenstein, & Vallano, 1991). In general, the combined treatment studies are limited by the large variability in participants, procedures, and measures.
Other studies have shown the combined treatment to be most effective for improving classroom behavior, but only medication had a beneficial effect on academic performance (Carlson, Pelham, Jr., Milich, & Dixon, 1992; Pelham et al., 1993). In addition, Pelham, Jr. et al., (1993) concluded that the combination of the two treatments was more effective across measures of classroom behavior and academic performance than behavior modification alone. However, the addition of behavior modification to medication treatment resulted in a minimal improvement over medication treatment alone. It is important to note that some combination studies evaluated the effects of different doses of medication, but only one level of a behavioral intervention. This is a limitation as some children may require a more intense behavioral intervention to obtain maximum treatment effects (Hoza Pelham, Sams & Carlson, 1992).

Hoza et al. (1992) addressed this limitation by evaluating the effects of two doses of MPH and behavioral interventions at various strengths on the classroom performance of two boys diagnosed with ADHD. Assessments were conducted during an 8 week summer treatment program. Dependent variables included: percentage seatwork completed, percentage seatwork correct, and percentage disruptive behavior.

The standard behavior modification consisted of reward and response-cost procedures using a token system, time out for severe problem behaviors, a “star student” privilege system, and a daily school home note. For those children who were not responsive to this standard behavior
modification, the strength of the intervention was increased by adding a more potent consequence. Instead of losing points in the token system, children lost their afternoon swimming time. This intervention targeted both classroom disruptive behaviors and accuracy on academic seatwork.

Results for one child indicated that behavior therapy was comparable to treatment with a low dose of MPH for all dependent variables. However, the most potent consequences (i.e., loss of pool time) were necessary to obtain comparable effects for the disruptive behavior measure. The high dose of medication did not produce incremental effects for any of the dependent measures, however, the high dose of medication was more effective than placebo when there were no behavioral contingencies in place.

Results for the second child demonstrated that a potent behavioral intervention and a high dose of medication were necessary to achieve maximum change in academic productivity and disruptive classroom behavior. Behavior modification and medication alone did not have any significant effect for any of the dependent variables. In addition, medication administration time had to be modified (i.e., taking morning dose at home) in order for the child to achieve maximum benefits.

Interestingly for both children, when the pool contingency was applied only to academic performance, it did not increase their rate of disruptive behaviors. However, when the contingency was only applied to behavior, a decrease in academic performance resulted. These results suggest that to obtain improvements on academic productivity and
accuracy, behavioral treatments must directly target academic performance and not solely disruptive behavior. This is consistent with previous findings that suggest being on-task may not necessarily result in high rates of academic work production (Rapport et al., 1982).

Abramowitz, Eckstrand, O'Leary, and Dulcan (1992) also evaluated the effectiveness of two intensities of a behavioral intervention and MPH on the off task behavior of children with ADHD. Assessments took place within a classroom setting during an 8 week ADHD summer day treatment program. The behavioral intervention consisted of two types of teacher reprimands, immediate and delayed. During the immediate reprimand condition, reprimands were delivered as immediately as possible following off-task behavior. In the delayed reprimand condition, reprimands were delivered approximately 1 minute following off-task behavior. MPH was administered in two doses, .3 mg/kg and .6 mg, plus placebo.

Overall results indicated that for some children, the more intense form of the behavioral intervention (i.e., immediate reprimand) was equally effective as medication. For others delayed reprimands were effective when used in combination with medication treatment. It is important to note that teacher reprimands were given in the context of an ongoing response-cost classroom management system.

Carlson, Pelham, Milich, and Dixon (1992) evaluated the combined effects of two doses of MPH (.3 mg/kg and .6 mg/kg) and a classroom behavior management strategy for children with ADHD during a summer
treatment program. The behavioral intervention in the classroom consisted of a token economy system, time out for extreme disruptive behaviors, and a daily school home note. Dependent variables included: direct observations of disruptive and on-task behavior, academic work completion and accuracy, and self-ratings of performance.

Results suggested that both the behavioral intervention and MPH significantly improved classroom behavior, but only MPH had beneficial effects on academic performance. Separately, the behavioral intervention and .3 mg/kg MPH produced comparable improvements on classroom disruptive behavior. The combination of the two treatments resulted in maximum improvements which were comparable to improvements with .6 mg/kg MPH alone. These results illustrate that low doses of MPH are sufficient for improving behavior in many children when consistent behavior management techniques are used.

**Medication and Treatment Evaluation Procedures**

**Common Practices**

Current prescription procedures typically involve a physician prescribing the lowest dose and gradually increasing the medication based on subjective parent report (Gadow, Nolan, Paolicelli, & Sprafkin, 1991). Teacher report and behavior rating scales are sometimes used to evaluate a child's response to Ritalin, however, these measures are subject to informant bias and are often technically inadequate (Stoner, Carey, Ikeda, & Shinn, 1994; Shapiro & Kratochwill, 1988).
It is currently recommended that multiple outcome measures be utilized. Among these are teacher rating scale data, curriculum-based measures of academic performance, direct observation protocol, and side effects rating scales (Dulcan et al., 1997). Regardless of the measures used, the rationale for dosage selection is rarely operationalized in an objective manner (Gadow et al., 1991). Rather, the criteria of whether a specific dose level is “optimal” often relies on a subjective process of “clinical judgment” (DuPaul & Barkley, 1993). Considering recent research has illustrated the idiosyncratic nature of dose-response relationships among ADHD children, the use of behavioral assessment in medication evaluations is gaining recognition and importance (DuPaul & Barkley, 1993). As research suggests that behavioral assessment is currently the optimal way to evaluate medication response, collaboration between physicians prescribing the medication and school-based professionals who have expertise in behavioral assessment methodologies becomes essential.

**School-Based Medication Evaluations**

In an attempt to standardize the use of direct observation, and in order to address the ecological validity of medication assessment, Gadow et al. (1991) described a school-based medication evaluation (SBME) that encompasses both behavior rating scales and direct observations of child behavior in order to evaluate medication effects. The SBME begins after a diagnosis of ADHD has been made by a psychiatrist and the child’s family has received information and recommendations regarding medication
therapy. After parental request to participate in the SBME, the SBME “team” sends a member to the child’s school to explain procedures and the purpose of the evaluation and to receive approval to observe the child in the classroom.

The SBME involves the use of double-blind, placebo-controlled conditions in the school setting. Standard doses of methylphenidate (0.3 mg/kg, 0.6 mg/kg) and placebo are each administered 7 days a week for 2 weeks at each level. The purpose of administering the medication on the weekends is to allow the parents to observe the effect that the medication is having on their child in order to include them in the evaluation.

The SBME uses two parent and teacher rating scales. The first of two that are mentioned in Gadow et al. (1991) is an extended version of the Abbreviated Teacher Rating Scale (ATRS; Conners 1973). The SBME added five items to the original ATRS to measure the Inattention-Overactivity (I-O) and Aggression (A) subscales from the IOWA Conners Teacher’s Rating Scale (Loney & Milich, 1982). Teacher reports are completed two days a week, for the same time period in which direct observations are conducted. Parent reports are completed based on the child’s behavior over the weekend. The Stimulant Side Effects Checklist (SSEC; Gadow, 1986) is completed by parents and teachers to assess possible side effects as well as verbal reports from the parents.

The direct observation code developed for use in the SBME classroom observation is based on the Classroom Observation Code used by Abikoff
and Gittelman (1985). The code was originally proposed to assess hyperactivity and was discovered to be an indicator of stimulant drug-response. (Gadow et al., 1991). Interference, motor movement, noncompliance, nonphysical aggression, off-task, and physical aggression are recorded during 15-sec intervals. Direct observations of social behavior are conducted in the lunchroom and on the playground using the Code for Observing Social Activity (COSA; Sprafkin, Grayson, Gadow, Nolan, & Paolicelli, 1986). Appropriate social interaction, noncompliance, nonphysical aggression, physical aggression, and play aggression are recorded during 30-second intervals based on occurrence or nonoccurrence. The COSA was designed to assess aggressive and prosocial interactions in children, and also has been found to be sensitive to medication effects (Gadow, 1991).

Peer comparisons are used during direct observation for the purpose of having a standard comparison for what is "normal" behavior for the classroom. The SBME uses a "peer group" which consists of three same-gender children that preferably sit close to the target child. Direct observations for the peer group are made on the same days (and settings) as observations for the target child. The SBME defines the target child’s behavior as "normal" if the rate of behavior is within one standard deviation above or below the mean of the peer’s behavior.

The SBME seeks to establish a minimal effective dose (MED) of medication for a child. This is calculated by comparing the placebo and
each level of medication based on the rate of occurrence of the target behavior(s). Effectiveness is concluded if there is a 30% reduction in the rate of target behavior or if the behavior is reduced by one-half standard deviation of the peer mean. If it appears that both doses are effective, a comparison of improvement of child behavior is made between the placebo-low-dose and the low-moderate-dose. The superior dose, low or moderate, is determined by evaluating the difference between the magnitude of improvement for each comparison by the above mentioned criteria (one dose is 30% or one-half standard deviation greater than the other).

It is stated by Gadow et al. (1991) that the initial presentation of the SBME is specifically for the purpose of conducting future investigations and not for clinical practice at this time. The SBME offers somewhat of a comprehensive alternative to procedures that are currently used for medication evaluations. However, there are limitations that future research in this area should address. It is mentioned that academic performance has previously been shown to be negatively correlated with off-task and disruptive behavior (which the SBME assess). However, the SBME does not directly measure academic performance. In addition, none of the laboratory measures that have shown to be sensitive to medication effects, such as the CPT, are used in the SBME. Also, the SBME only evaluates the effects of two doses of medication (0.3 mg/kg, 0.6 mg/kg). Finally, the SBME fails to identify the specific problem behavior(s) of the target child. Thus, the "MED" is based on an average of combined
behaviors that may not reflect those that are most problematic for a particular child.

Fischer & Newby (1991) describe another multi-method approach to assessing stimulant drug-response for children with ADHD. This method is an extension of the protocol previously used by Barkley, Fischer, Newby, & Breen (1988). The initial study by Barkley et al. included 161 children diagnosed with ADHD. Each week questionnaires were distributed to teachers and parents in addition to 30-minutes of clinic testing conducted with each child. Each child completed one week on a low dose of Ritalin (0.2 mg/kg bid-i.e., twice daily), a high dose (0.4 mg/kg bid), and a placebo. The medication order was randomized and double-blind procedures were followed.

After an initial clinic evaluation, the following assessment measures were administered each week for three weeks: a) parent ratings of child behavior were measured by The Home Situations Questionnaire (HSQ; Barkley, 1981), and the Conner's Parent Rating Scale-Revised (Goyette, Conners, & Ulrich, 1978), b) assessment of teacher ratings of child behavior included The School Situations Questionnaire (SSQ; Barkley, 1981), and the Conner's Teacher Rating Scale-Revised (CTRS-R; Goyette et al., 1978), and c) the Side Effects Rating Scale was used to obtain information about possible side effects that can occur with the use of Ritalin. The Child Behavior Checklist (CBCL; Achenbach & Edelbrock) was administered to parents and teachers in the initial evaluation, but was not used in the drug
evaluations because it has not been shown to be sensitive to changes in behavior due to medication.

In addition, three laboratory measures were used each week to assess the child's reaction time, sustained attention, impulsivity, and a variety of child behaviors observed during a restricted academic situation. Reaction time was measured by instructing the student to press a button as soon as they saw a light appear. This was assessed with the Lafayette Instrument Company's Multi-Choice Reaction Timer. Each child completed 20 trials and received a total score that was derived from the mean score of the trials. The GDS vigilance task (Gordon, 1987) was used to assess attention and impulsivity. The number of correct responses, omissions, and commissions were recorded for each child. A restricted academic situation (Barkley, 1988) was used to observe ADHD behaviors. The child was instructed to work on sheets of math problems while left alone in a room. Through a one-way mirror observers recorded the occurrence of the following behaviors for a 10-minute period: off-task, fidgeting, vocalizing, playing with objects, and out of seat.

Drug effects were analyzed by using one-way, repeated-measures multivariate analyses of variance (MANOVA-s) on related sets of the dependent measures. Significant main effects were found on all parent rating measures, teacher measures, and laboratory measures. One-way (drug condition), repeated-measures analyses of variance (ANOVA's) were conducted on each dependent measure used in the assessment. Results of
these analyses indicated significant main effects for 23 of the 27 dependent measures. Most teacher, parent, and laboratory measures of attention and impulsivity showed improvement when the child was taking Ritalin as opposed to a placebo. Significant drug effects were not seen on the number or severity of side effects in the home or school setting, or on the percentage of math problems completed during the restricted academic condition. A significant dose effect was found on all measures from the CTRS-R and the percentage of intervals of observed behavior during the restricted academic condition. Both doses of Ritalin were effective in improving child behavior on these measures, however, the higher dose was most effective. The higher dose was also effective in improving reaction time and performance on the GDS.

Each child's results were reviewed with the prescribing physician and an optimal dose (if any) was chosen based on the child's best academic and behavioral performance, and least amount of side effects. Of the 161 subjects who participated in this study, 107 of them continued to take Ritalin, 36 on the lower dose, 56 on the higher dose, and 15 on a between dose. This between dose was a result of children who responded better to the higher dosage, but experienced a significant number of side effects with it.

Fischer and Newby (1991) described a multimethod clinical assessment for assessing medication effects with ADHD children. The results in this evaluation recommended the following regarding the children
who participated: 34% to receive no medication, 22% to receive the lower
dose, 34% the higher dose, and 10% the moderate (between) dose.
Limitations of this study include the fact that the children were only
exposed to two doses of medication. This assessment could indicate a
difference in performance between a low dose and a high dose, however,
results of the “between dose” that was recommended for some children
suggest that for a complete assessment, other dosages should be used rather
than just a low dose and a high dose. Other limitations include a) lack of
direct observations and measures of academic and social behavior, and b) a
lack of repeated measurements under standardized conditions.

Curriculum Based Measurement

Two recent studies have shown Curriculum Based Measurement
(CBM) to be a sensitive measure of stimulant medication effects on
academic performance (Gulley & Northup, 1997; Stoner et. al., 1994). CBM
was developed from a behavioral-assessment perspective to evaluate
academic performance in reading, math, spelling, and written expression
(Shinn, 1989). CBM measures are reported to have three main
characteristics: 1) they consist of direct assessments of a child academic
performance; 2) are designed to be used repeatedly, and 3) are treated as
time series data by graphing the results and using them to make ongoing
decisions (Marston & Magnusson, 1988). CBM has previously been used
for evaluating the effectiveness of various academic and behavioral
interventions using single-case designs. For example, Deno, Mirkin, &
Chiang (1982) conducted concurrent validity studies for the purpose of developing a system of continuous evaluation of student reading progress. It was assumed that close monitoring of academic progress would enable teachers to determine the effectiveness of interventions provided to each student. Results of the validity studies indicated that student performance on the CBM measures were closely related to standardized achievement test scores. CBM overcomes previous limitations of assessing academic performance during medication evaluations by using a standardized method of assessment that allows valid and frequent repeated administrations that are necessary during medication evaluations.

Recently, Stoner et al. (1994) conducted a study that investigated the utility of CBM math and reading probes for evaluating the effects of methylphenidate for two children diagnosed ADHD. A double-blind, placebo-controlled design was used to evaluate the subject's performance on curriculum-based measures at three levels (5 mg, 10 mg, and 15 mg) of methylphenidate. In addition, two standardized behavior rating scales, the Academic Performance Rating Scale (APRS; DuPaul, Rapport, & Perriello, 1991) and the Child Attention Problems scale (CAP; Barkley, 1990) were completed by the student's teacher. The Stimulant Drug Side Effects Rating Scale (SDERS; Barkley, 1990) was also administered to the subjects, their parents and teachers to detect possible side effects. Results of the first study indicated that student performance on curriculum-based measures were sensitive to various dosages of methylphenidate. By demonstrating a
clear relationship between reading and math performance at different doses of medication the child received, CBM was shown to be a useful measure of medication effects on academic performance (Stoner et al., 1994). The CBM data was also compared with the teacher ratings at each dose. The correspondence between the teacher’s reports and CBM data also suggested that CBM for reading and math may be sensitive to medication effects.

A second study in Stoner et al. (1994) replicated these findings by evaluating a follow-up dose of methylphenidate. After six weeks on the established recommended dose from the medication trial, CBM was readministered for a two week period. Academic performance continued to be improved over baseline. Results of this second study suggested that the use of CBM during a brief medication trial could also be an effective tool in selecting a dose of medication that may be beneficial for the child’s long term academic progress (Stoner et al., 1994).

Stoner et al. (1994) stated the following limitations of their study: a) there was not a no-medication day between trials and b) potential order and history effects as each subject was only exposed to each trial phase of medication once (Stoner et al., 1994). However, the most serious limitation may have been that a number of other important behaviors (social interactions, attention, compliance) were not assessed in addition to academic performance. Other behaviors that were assessed (impulse control), were only assessed by the administration of teacher rating scales.

In conclusion, CBM seems to be an effective measure of academic
performance, however, a more comprehensive assessment of how other behaviors are effected by methylphenidate may be necessary.

Gulley and Northup (1997) conducted school-based behavioral assessments of the effects of MPH for two children diagnosed with ADHD that included CBM of academic performance and direct observations of problem behavior. Following a baseline off of medication, three doses of methylphenidate (low, moderate, and high) were administered in a double-blind, placebo-controlled, design. Behavioral assessments were conducted within each child's classroom at each level of medication, for each of the following areas: academic performance, classroom behavior, social interactions, and teacher ratings of child behavior.

Results demonstrated that CBM and direct observation of behavior were sensitive to medication response for both students. Results also illustrated the differential effects that stimulant medication may have on student academic and behavioral performance both within and across dosages. In addition, results from teacher ratings of child behavior during the assessment suggested poor correspondence between teacher rating scales and direct observation of child behavior.

Purpose of the Present Study

The purpose of this study was to (a) develop a brief, practical method that will allow school psychologists to evaluate the effects of a currently prescribed dose of stimulant medication across academic and behavioral domains, (b) to develop a systematic procedure to evaluate dosage titration
that parallels actual prescription practices, (c) to simultaneously evaluate the relative effectiveness of an alternative behavioral intervention at varying levels of treatment strength, and (d) determine the utility of these procedures with preschool-aged children who are currently prescribed stimulant medication.

In conclusion, it was recommended that a “best practices” approach for medication evaluations should include at least (a) an experimental single case design, (b) the use of double-blind, placebo-controlled procedures, (c) an assessment across multiple domains of functioning, (e) an assessment of side effects, and (f) the use of reliable dependent measures that can be administered repeatedly without significant practice effects (Gulley & Northup, 1997).

Unfortunately, the best practices such as those recommended above are very time-consuming, expensive, and may not be feasible for most school-based practitioners. If these needed services are to be extended to the many children receiving stimulant medication, it will be necessary to develop brief and practical methods for use in typical school settings.
Participants in this study were five students between the ages of 4 and 7 who exhibited behavior problems at home and school. Inclusion criteria included: (a) the participant had a recent diagnosis of ADHD or met the criteria for ADHD according to the DSM-IV; (b) the participant was of average intellectual functioning; (c) the participant had been prescribed stimulant medication or the participant’s parents and physician agreed that an initial trial of medication was warranted; and (d) respective parents and physicians agreed that a medication evaluation may be beneficial for the participant. Written informed consent was obtained from the parents of each participant (Appendix A). Please refer to Table 1 for a summary of student characteristics.

A consulting psychiatrist provided confirmation that the participants met criteria for a DSM-IV diagnosis based on at least, parent interviews and scores at least 2 standard deviations above the mean on the attention problems domain on the Child Behavior Checklist (Achenbach & Edelbrock, 1991) and the ADHD Index on the Conner’s Parent Rating Scale - Revised, Short Form (CPRS - R:S; Conner’s, 1997). Additionally, parents completed the Social Skills Rating System (SSRS -Parent Form; Gresham & Elliott, 1990). Scores obtained on these instruments are presented in Table 2.
Max was a 4 year old white male who was entering pre-kindergarten. He was diagnosed with ADHD and Oppositional Defiant Disorder (ODD) and prescribed medication (MPH, 10 mg t.i.d., and Catapress, .025 mg b.i.d.) by his physician. Max was also classified with a severe expressive language disorder and was receiving speech therapy. According to Max's mother and father, referral problems included overactivity, impulsivity, verbal and physical disruption, and aggression. Parent ratings on the

<table>
<thead>
<tr>
<th>Student Characteristics</th>
<th>Age</th>
<th>Grade</th>
<th>Diagnosis</th>
<th>Medication</th>
<th>Referral Behaviors</th>
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<tbody>
<tr>
<td>Max</td>
<td>4</td>
<td>Pre-K</td>
<td>ADHD and ODD</td>
<td>MPH, 10 mg</td>
<td>Overactivity, impulsivity, verbal and physical disruption, aggression</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Catapress, .025 mg</td>
<td></td>
</tr>
<tr>
<td>Bryan</td>
<td>6</td>
<td>1</td>
<td>ADHD and ODD</td>
<td>MPH, 10 mg</td>
<td>Aggression, noncompliance, verbal and physical disruption</td>
</tr>
<tr>
<td>Betty</td>
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<td>K</td>
<td>ADHD</td>
<td>MPH, 10 mg</td>
<td>Overactivity, noncompliance, off task</td>
</tr>
<tr>
<td>Sally</td>
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<td>1</td>
<td>ADHD</td>
<td>MPH, 15 mg</td>
<td>Impulsivity and noncompliance</td>
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<tr>
<td>Ricky</td>
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<td>K</td>
<td>ADHD</td>
<td>MPH, 5 mg</td>
<td>Inattention, impulsivity, aggression and anxiety</td>
</tr>
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Table 2
Scores obtained from the CBCL, SSRS, and Conner’s Rating Scales

<table>
<thead>
<tr>
<th></th>
<th>Max</th>
<th>Bryan</th>
<th>Betty</th>
<th>Sally</th>
<th>Ricky</th>
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<tr>
<td><strong>CBCL (T-score)</strong></td>
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<td>Withdrawn</td>
<td>64</td>
<td>67</td>
<td>73*</td>
<td>50</td>
<td>84*</td>
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<td>50</td>
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<td>70*</td>
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* denotes a T-score that is significantly above average
CBCL indicated significant problems in the areas of attention, delinquent and aggressive behaviors. Ratings from the SSRS also indicated significant problem behaviors and minimal appropriate social skills. Significant ratings were also reported on the CPRS-R across all areas (i.e., Oppositional, Cognitive Problems, Hyperactivity, and ADHD Index). A brief assessment of academic skills showed that Max did not recite the alphabet and could only recognize the letters X and Y. Max recognized parts of the body and all basic colors except for orange. Max also counted aloud to ten, but did not recognize any numbers when presented randomly.

Bryan was a 6 year old white male entering the first grade. He was diagnosed with ADHD and ODD and prescribed MPH (10 mg t.i.d.) by his physician. According to Bryan's mother and father, referral problems included aggression, noncompliance, verbal and physical disruption. Parent ratings on the CBCL indicated significant problems in the areas of anxious/depressed, social problems, attention problems, delinquent and aggressive behaviors. Ratings on the SSRS also indicated significant problem behaviors and minimal appropriate social skills. Significant ratings on the CPRS-R were reported across all areas. A brief assessment of Bryan's academic skills showed that he could recite the alphabet but did not recognize the uppercase letters C, V, and I and lowercase letters v, u, q, and l when presented randomly. Bryan recognized all colors and the color words red, blue, yellow and green. He also recognized some shapes (i.e., triangle, circle and rectangle). Bryan read aloud some basic sight words (i.e., and, to,
will, look, he, up, Mr., going, big, go, and on). Bryan counted aloud to 19 and could recognize all numbers when presented randomly. He completed single digit addition problems (i.e., sums to 5) with 100% accuracy and sums to 10 with 86% accuracy.

Betty was a 7 year old white female who was repeating kindergarten. She was diagnosed with ADHD and was prescribed MPH (10 mg t.i.d.) by her physician. According to Betty's mother and father, referral problems included overactivity, noncompliance and off task behavior. Betty's parents indicated significant ratings across all areas on the CBCL except somatic complaints. Similarly, ratings on the SSRS also indicated significant behavior problems and minimal appropriate social skills. All areas on the CPRS-R were rated as significant. A brief academic assessment showed that Betty could recite the alphabet, recognize all letters, shapes, colors and color words. Betty could also read some basic sight words (i.e., and, to, will, look, up, Mr., going, big, go, let). She counted to 20 and recognized all numbers when presented randomly. She completed single digit addition problems that included pictures (i.e., sums to 9) with 83% accuracy.

Sally was a 6 year old white female entering the first grade. She had previously been retained in kindergarten. She was also diagnosed with ADHD and prescribed MPH (15 mg t.i.d.) by her physician. According to Sally's mother, referral problems included noncompliance and impulsivity. For Sally, parent ratings on the CBCL indicated significant problems in the areas of social and attention problems. Ratings from the SSRS also
indicated significant problem behaviors and below average appropriate social skills. Significant ratings were also reported on the CPRS-R in the areas of Cognitive Problems, Hyperactivity, and ADHD Index. A brief academic assessment showed that Sally recited the alphabet and omitted the letter n. She could recognize all upper case letters when presented randomly and all lowercase with the exception of the letter b. Sally also read some basic sight words (i.e., and, to, will, look, he, up, go). Sally recognized all basic colors and some shapes (i.e., square, circle, and oval). Sally also counted aloud to 14 and recognized all numbers when presented randomly. Sally completed simple math problems, (i.e., counting objects and circling the correct answer; sums to 7) with 80% accuracy.

Ricky was a 5 year old white male entering kindergarten. Ricky was diagnosed with ADHD and prescribed medication (MPH, 5 mg t.i.d.) by his physician. According to Ricky's mother and father, referral problems included inattention, impulsivity, aggression and anxiety. Ricky's parent ratings on the CBCL indicated significant problems in the areas of withdrawn, anxious/depressed, social problems, and attention problems. Ratings on the SSRS also indicated significant problem behaviors and minimal social skills. All areas on the CPRS-R were rated as significant. A brief academic assessment showed that Ricky could only recite the alphabet up to the letter g. He could recognize the upper and lowercase letters O, S, X, and R when presented randomly. Ricky also read the basic sight words “to” and “up”. Ricky recognized all basic colors and some shapes (i.e., circle,
triangle, and square). Ricky counted aloud to 13 and could recognize the numbers 1 through 6 when presented randomly. He completed simple math problems, (i.e., counting objects and circling the correct answer; sums to 7) with 70% accuracy.

**Materials and Setting**

Task materials for each session included instructional level math worksheets and a block stacking activity for Max. Each participant's instructional level in math was determined through the use of Curriculum Based Assessment probes (Deno & Mirkin, 1977). Probes on which participants completed between 70 and 90 percent correct were considered to be instructional level (Shapiro & Lentz, 1986). For Max, a block stacking activity was used during each session as CBA determined simple pencil to paper tasks (i.e., tracing or matching numbers) were frustrational level tasks.

This study was conducted within a classroom setting during a summer research program for children with a diagnosis of ADHD. The summer program was held in a university classroom each weekday morning between 8:30 and 11:30 for four weeks. A certified kindergarten teacher with over 20 years of classroom experience functioned as the classroom teacher. The class contained a total of 6 children. The daily classroom schedule included whole group and individual instruction, center activities, and free time.
Response Definitions

Student Disruptive Behaviors

Target behaviors during classroom observations included: (a) inappropriate vocalizations; (b) plays with objects; (c) out-of-seat; (d) off-task; and (e) fidgeting. Individualized target behaviors were also recorded and included aggression, destruction of materials, and throwing objects for Max and Bryan.

Inappropriate vocalizations was defined as any vocal noise or verbalization made by the participant that was not preceded by raising a hand or acknowledgment from an adult. Playing with objects was defined as touching any object that was not at the participant’s desk and associated with the assigned task. Out of seat was defined as the participant’s full body weight not being supported by a chair, and/or the participant’s buttocks removed from the chair for greater than three seconds. Off-task was defined as the participant looking away from instructional materials for greater than 3 sec. Fidgeting was defined as repetitive unnecessary movements of any part of the body that occur at least twice in succession (i.e., rocking back and forth, tapping a pencil on a desk).

Additional dependent variables included (a) digits correct on math worksheets during independent seatwork (number of blocks stacked for Max), (b) scores on teacher rating scales, and (c) scores on side effects rating scales.
Teacher and Peer Behavior

Teacher and peer attention was defined as any contingent or noncontingent vocalizations, gestures, or physical contact between the participant and the teacher (or examiner) and/or peer. Teacher and peer attention were recorded for the purpose of establishing procedural integrity.

Data Collection and Measurement

Classroom Observations of Behavior

During all conditions an observer recorded the above described behaviors using a 10-second partial interval recording procedure. During the 5-minute classroom observations, participants were working independently on math worksheets, or block stacking activities for Max. Percent of intervals for each behavior was calculated by dividing the number of intervals in which the behavior occurred by the total number of intervals and multiplying by 100.

Observations were conducted by trained graduate and undergraduate students from an unobtrusive location in the classroom. All observers participated in direct instruction and practice in observation procedures, and achieved at least an 85% agreement criterion before observing sessions for this study.

Two independent observers simultaneously but independently collected data for a minimum of 25% of sessions, which was approximately equally dispersed across all phases of the study. Reliability was calculated by dividing agreements by the sum of agreements and disagreements for
each interval for occurrence and nonoccurrence and multiplying by 100 (Kazdin, 1982). Overall agreement was 97% (range, 73% to 100%). Interobserver agreement across participants for each target behavior was as follows: off task (M = 97%; range 80% to 100%), vocalizations (M = 97%; range 83% to 100%), out of seat (M = 98%; range 80% to 100%), fidgeting (M = 97%; range 73% to 100%), and playing with objects (M = 99%; range 93% to 100%)

Math worksheets were selected to include, (a) a range of problems that represented the skills required by the participant's current curriculum (e.g. single- or double-digit addition, etc.), and (b) the correct proportion of problem type (e.g., 20% single-digit subtraction, 20% double-digit addition) as represented by the curriculum (Stoner et al., 1994). Participants were given 5 minutes to complete as many problems as possible and the number of correct digits was recorded. For Max, the number of blocks stacked during the 5 minute period was recorded by the observers.

Agreement for math worksheets was calculated by having a second observer score completed worksheets. Interscorer agreement was assessed for 30% of the sessions for all participants. Interscorer agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement was 100% for all participants.
Teacher Rating Scale

The Conners Teacher Rating Scale - Revised: Short Form (CTRS - R:S; Conners, 1997) was completed each day by the participants' teacher. Typically, rating scales are completed based on the participant's behavior across the entire school day. For this study, the teacher was instructed to complete this scale based on the participant's behavior only for the time period 1 - 3 hours following medication administration. The CTRS - R is a 28 - item rating scale that asks teachers to rate the participants' hyperactive and conduct problem symptoms based on a scale that ranges from 0 (= not true at all) to 3 (= very often true).

Side Effects Rating Scale

The Stimulant Drug Side Effects Rating Scale (SDSERS; Barkley, 1990) was completed at the end of each day by the participants' teacher. The SDSERS is a rating scale that ranges from 0 (=absent) to 9 (=serious) that is used to report whether the participant experienced common side effects (e.g., headaches, stomachaches, insomnia) associated with the use of stimulant medication.

Reinforcer Assessment

A reinforcer assessment was conducted in order to identify preferred items to develop subsequent behavioral treatments. The reinforcer assessment consisted of a reinforcer assessment survey (RAS) and a behavioral paired-choice procedure. A reinforcer assessment survey (RAS) was administered to identify preferred categories of reinforcers for each
participant, to identify which items within a category were preferred, and to
ensure that what they preferred could be provided in the classroom
(Appendix B). During the administration of the RAS, the participant was
given the following instructions, “I am going to name some things that kids
sometimes get in school. I want to know how much you like each of these
things. After I name each thing, you tell me if you like it a little, a lot, or
not at all” (Fantuzzo, et al., 1991). The participant’s verbal responses were
recorded by the examiner. Each response was given a ranking based on the
participant’s answer; not at all = 0; a little = 1; and a lot = 2. A percentage
score for each category was calculated by dividing the participant’s score for
the category by the total possible score and multiplying by 100. Categories
with a percentage score of 75 or greater were considered high preference
and below 75, low preference.

**Token coupons.** Token coupons represented reinforcers within each
category and each category of reinforcers was represented by a particular
color of coupon. Each participant was shown coupons of each color, and told
what category of reinforcers each color represented. Specific back-up
reinforcers associated with each category were verbally reviewed with the
participant until the participant could name each category and the
particular reinforcers associated with it. Back-up reinforcers were three
randomly selected items from each category (e.g., edibles) that the
participant indicated on the RAS that they liked “a lot”.
Behavioral paired-choice. The method for determining which reinforcers the participant was able to earn during the behavioral intervention was determined by a behavioral paired-choice procedure (Northup et al., 1996). A fourteen item questionnaire was constructed which presented all six categories of reinforcers verbally in pairs (Appendix C). The order in which the categories were presented was counterbalanced within the questionnaire. The same stimuli representing each category was presented each time. The following instructions were read to the participant, “I’d like to know what things you might like to earn by doing lots of hard work at school. I am going to read some statements to you. After each statement that I read, choose what you would like by picking up the coupon that goes with it, or if you don’t like either of the choices say “neither one or none.” For example, a participant was asked “would you rather . . . (e.g., get things to eat like snickers, chips or popcorn) or . . . (e.g., get things to have like folders, pens or pencils) or neither one.” A percentage score was calculated based on the number of times a participant chose each category by the number times it was presented in the questionnaire and multiplied by 100. A score of 75% was considered high preference and below 75%, low preference. The participant was given a choice of the top two coupons that they chose most often during the behavioral paired-choice procedure during the behavioral intervention conditions.
Treatment Acceptability

The degree to which teachers found the behavioral interventions acceptable was evaluated by administering the Intervention Rating Profile - 15 (IRP-15; Martens, Witt, Elliott, & Darveaux, 1985). The IRP-15 was designed to measure whether a teacher considers an intervention appropriate for the student prior to implementing it in the classroom (Appendix D). Items are rated on a 6-point Likert-type scale, with the lowest point (1) being “strongly disagree” and the highest point (6) being “strongly agree”.

Procedural Integrity

Teacher, peer, and examiner behaviors were observed to assess the degree to which intervention sessions were conducted as intended. Procedural integrity was calculated in two ways for every session for each participant. First, integrity was calculated as a percentage of target behaviors that were followed by the independent variable that was specified for each assessment condition, and the nonoccurrence of any other independent variable during the same or subsequent 10-s interval. Second, a percentage of intervals was calculated for the occurrence of independent variables that was not contingent upon a target behavior, in order to indicate experimental control. Average percentages are presented in Table 3.
<table>
<thead>
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**Design**

Medication status (i.e., MPH or placebo), behavioral intervention status (i.e., presence or absence), and a combined intervention (medication plus behavioral intervention) was alternated daily in a multielement design. A placebo condition was included during Phase 1 to demonstrate participant behavior in the absence of either treatment. All assessment procedures were completed each day until a minimum of three complete assessments were conducted at each level of intervention or until maximum possible benefits were achieved for both treatments.

**Procedures**

**Assessment Procedures**

The assessment procedures were designed to correspond with the current prescription practices of physicians regarding stimulant medication. Typically, physicians begin with the smallest dosage of medication thought to be effective (typically 5 mg or .3 mg/kg), and gradually increase this dose.
in 5 mg increments based on informal parent and teacher report and sometimes teacher rating scales. However, the following procedures provided a systematic way of reporting relevant direct observation and academic performance data to the consulting child psychiatrist and parents.

All assessment procedures were completed in phases at each prescribed dosage of medication and at progressively increased “strengths” of behavioral interventions. That is, in Phase 1, the current dose of medication and the least intensive behavioral intervention were evaluated. Assessments continued for subsequent dosages and behavioral interventions as indicated based on the assessment results of the previous phase. Phase changes were based on a comprehensive review across all outcome measures; specifically, (a) the magnitude, trend and stability of the reduction in participant disruptive behaviors, (b) teacher ratings of participant behavior, (c) participant academic performance, and (d) reported side effects.

**Medication Procedures**

Medication status alternated daily between placebo and the child’s current dose of MPH which was prescribed by the child’s physician prior to the beginning of this study. Max was prescribed 10 mg of MPH (.6 mg/kg), however, the consulting psychiatrist increased his dose to 15 mg (.9 mg/kg) during the course of this study. Bryan was prescribed 10 mg (.6 mg/kg), Betty was prescribed 10 mg (.5 mg/kg), Sally was prescribed 15 mg (.6 mg/kg), and Ricky was prescribed 5 mg (.2 mg/kg). Although a
commercially prepared placebo is considered to be standard practice in evaluating medication effects, one was not included based on time, expense and inconvenience of obtaining a commercially prepared placebo, and the goal of developing a brief and practical method for use in typical school settings. Instead, medication administration followed a standardized procedure in which parents were asked to place medication in a serving of food (e.g., chocolate pudding, peanut butter). These procedures are typically used for young children who have problems taking medication. Placing the medication in pudding provided a practical and economical placebo that effectively controlled for appearance, taste, and texture. This is also a procedure that would be feasible for school-based practitioners.

Parents were given a pill counter and instructed to place the child's current dose of MPH in each box for the week (Monday to Friday). Parents were provided written instructions each afternoon regarding medication administration for the following day. If parents were instructed to give the child medication, they used the medication in the appropriate box (i.e., Monday). If medication was not given, then the pills remained in the pill counter for that day. Parents were also asked to complete a drug administration checklist each morning.

The program director confirmed each morning with the parent that the child received medication as prescribed and the time of administration. Additionally, the program director checked pill counters and drug administration checklists at the end of each week to assess integrity.
assessment procedures were conducted within 1 to 3 hours following oral administration of medication.

**Phase 1**

During Phase 1 of the intervention procedures, the participant’s currently prescribed dose of MPH and a token coupon intervention were evaluated. If neither treatment demonstrated maximum benefits for the participant, a combination of the treatments was evaluated. In addition, the participant’s performance was evaluated in the absence of either treatment (i.e., placebo).

**Placebo.** During placebo conditions, classroom observations of participant behavior were conducted during the 5 minutes of independent seatwork when participants were working on instructional level math worksheets (block stacking activity for Max). The participant was given the following instructions, “I want you to sit in your seat and complete this work (stack these blocks) quietly. Do you have any questions? Okay, begin working.” On sessions following the implementation of the behavioral intervention, the participant was instructed that they could not earn any coupons for that session.

**Behavioral intervention 1 (Token Coupons).** A behavioral intervention was developed that used token coupons on a differential reinforcement schedule (Differential reinforcement of alternative behavior, DRA; Deitz & Repp, 1983) based on baseline levels of target behaviors for each participant. The behavioral intervention was implemented during the
5 minutes of independent seatwork during which participants were working on instructional level math worksheets (block stacking activity for Max). The participant was given the following instructions, "I want you to sit in your seat and complete this work quietly. For every "X" (time criterion) you are working, you can earn a coupon for... (e.g., tangibles or edibles). Do you have any questions? Okay, begin working." Reinforcement (i.e., token coupons) was delivered on a DRA schedule and withheld if any instance of off task or disruptive behavior (i.e., vocalizations, out of seat, and plays with objects) occurred during the reinforcement interval. Experimenters were cued by observers to deliver a choice of coupons. The experimenter then placed 2 coupons in front of the participant and instructed them to pick one and then to return to work. Each participant was given a choice of the two coupons that they chose most often during the behavioral paired-choice procedure and was allowed to exchange them for the appropriate reinforcers immediately following the session.

Medication intervention 1 (Current dose). The participant's current dose of MPH was evaluated. Again, an examiner observed the participant's behavior during 5 minutes of independent seatwork when participants were working on instructional level math worksheets (block stacking activity for Max). The participant was given the following instructions, "I want you to sit in your seat and complete this work quietly. There will be no coupons. Do you have any questions? OK, begin working."

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Combined intervention 1 (Current dose and token coupons). If neither MPH nor the token coupon intervention demonstrated maximum benefits for the participant, then a combined treatment of MPH and token coupons was evaluated. That is, the behavioral intervention was conducted as described above when the participant was taking their currently prescribed dose of MPH.

Following Phase 1, all results were reviewed with both the parents and the consulting psychiatrist. If the results from Phase 1 indicated either an unclear or no response to the current dose of MPH, it was a possibility that the dosage would be increased by the consulting psychiatrist. If an increase in dosage was made, then Phase 2 evaluated this increased dose of MPH using the same procedures. If the dosage was not increased, Phase 2 continued to evaluate the participant's previously prescribed dose. If the results from the token coupon intervention during Phase 1 did not indicate that maximum improvements were achieved, then a response cost procedure was added to the token coupon intervention and was evaluated during Phase 2.

Phase 2

Behavioral intervention 2 (Token coupons plus response cost). A token coupon intervention was implemented during the 5 minutes of independent seatwork as in Phase 1. In addition, a response cost procedure in which the participant lost one minute of free time for each occurrence of off task or disruptive behavior was also implemented. The participant had
a card placed on the desk with a row of smiley faces representing each minute of free time. Any occurrence of a target behavior resulted in the examiner walking over to the participant's desk and placing an “X” over one smiley face. Response cost was chosen because it is a mild and common form of punishment in the classroom, it has been supported in the literature, and is a procedure that most teachers can implement. The participant was given the following instructions, “I want you to sit in your seat and complete this work quietly. For every “X” (time criterion) you are working, you can earn a coupon for . . . (e.g., tangibles or edibles). However, each time you are not working, talking or getting out of your seat, you will lose one minute of your free time. I will let you know this by walking over to your desk and crossing out a smiley face. Do you have any questions? OK, begin working.” The participant was told at the end of the five minute period the total number of minutes they lost, if any, from free time that afternoon.

Medication intervention 2 (Increased or previous dose). Medication dosage was evaluated using the same assessment procedures described in Phase 1.

Combined intervention 2 (Increased or previous dose and token coupons plus response cost). If maximum benefits were not obtained by either of the above described interventions, then a combination of the two interventions was evaluated as in Phase 1.
Again, all results were reviewed with both the parents and consulting psychiatrist following Phase 2. If a change in dosage was made, then Phase 3 evaluated this dose of MPH using the same procedures as in Phases 1 and 2. If the results from the token coupon plus response cost intervention did not indicate that maximum improvements were achieved, then a time out procedure was added to the token coupon intervention and evaluated during Phase 3.

Phase 3

Behavioral intervention 3 (Token coupons plus time out). The token coupon procedures were implemented as in Phase 1. In addition, a time out procedure replaced response cost. Time out was chosen because it is generally considered to be more intensive than response cost and positive results are often reported. The participant was given the following instructions, “I want you to sit in your seat and complete this work quietly. For every “X” (time criterion) you are working, you can earn a coupon for . . . (e.g., tangibles or edibles). However, each time you are not working, talking or getting out of your seat, I will put you in time out. Do you have any questions? OK begin working.” If the participant engaged in disruptive or off task behavior, their chair was immediately turned away from their desk, work, and other students for 30 seconds. At the end of 30 seconds, the examiner turned the participant’s desk back to its original position and gave the participant instructions “Time out is over, return to work.” Prior to
the initial time out session, the time out procedures were described and demonstrated for each participant.

**Medication intervention 3 (Increased or previous dose).** Medication dosage was evaluated using the same assessment procedures described in Phase 1.

**Combined intervention 3 (Increased or previous dose and token coupons plus time out).** If maximum benefits were not obtained by either of the above described interventions then a combination of the two interventions was evaluated as in Phase 1.
CHAPTER 3

RESULTS

Figures 1 through 5 show the results for Max, Bryan, Betty, Sally, and Ricky, respectively. The behaviors out-of-seat, inappropriate vocalizations, and playing with objects were initially reviewed separately, but as the pattern of results for those behaviors were similar they were subsequently combined and are referred to as disruptive behavior (top panel). Individualized target behaviors for Max and Bryan (i.e., aggression, destruction of materials, throwing objects) were also included with the above mentioned behaviors and referred to as disruptive behavior. The figures also show the number of digits correct for math problems (bottom panel) for each student. For Max, the number of blocks stacked is presented. In addition, off task data were averaged across conditions for all participants, and are presented in Appendix E.

Max

Reinforcer Assessment

A reinforcer assessment survey (RAS) was not administered to Max as he appeared to have difficulty matching the token coupons with the back-up reinforcers. A modified version of the behavioral paired-choice procedure was used to identify potential reinforcers for the behavioral interventions for Max. The behavioral paired-choice procedure was modified by using actual items from the edible, tangible, and activity categories. Max was allowed to sample several items from each category.
Individual items were then presented in pairs and Max was asked "which one do you like best?". The ranking of categories by percentage score was as follows: edibles (100%), activities (100%) and tangibles (0%). The actual items were also used during the behavioral intervention rather than the token coupons. A mini-reinforcer assessment was conducted immediately prior to the first few intervention sessions to determine which items would be used during the session. During the mini-reinforcer assessment, Max's most preferred items were presented in pairs a minimum of three times and the item he chose most often was used. After Max consistently chose the same item over three sessions, that item was used for the remainder of the behavioral intervention sessions. Following session 9, gummy bears were always provided for Max to choose from during the behavioral intervention sessions. Max could earn a maximum of 12 edibles during each 5 minute session.

**Phase 1**

Based on initial classroom observations, Max's reinforcement schedule during the behavioral intervention (BI) was initially every 10-s for 2 intervals, 20-s for 2 intervals, and then 30-s for the remainder of the 5 minute session. After one 10-second interval without disruptive or off task behaviors, the observer cued the experimenter to deliver reinforcement. Max was then given his choice of reward (i.e., gummy bears) and allowed to consume the item immediately and instructed to "get back to work". This procedure was repeated once, then Max was required to go 20 seconds
without disruptive or off task behaviors. The same procedure continued until Max was required to go 30 seconds without disruptive or off task behaviors and the 30 second criterion was continued during the remainder of the 5 minute session.

During the placebo condition, Max engaged in high levels of disruptive classroom behavior across all sessions (M = 95% of intervals; range, 87% to 100%). During the behavioral intervention (BI) Max continued to engage in similarly high levels of disruptive behavior (M = 88% of intervals; range 83% to 97%). When Max received 10 mg of MPH his disruptive behavior occurred during a mean of 52% of intervals (range, 13% to 77%). The use of the behavioral intervention and 10 mg of MPH (combined) resulted in a slightly lower mean level of disruptive behavior (M = 42% of intervals; range, 10% to 53%). However, disruptive behavior occurred during approximately 50% of intervals for all but one session.

Max also engaged in high levels of off task behavior across all sessions during the placebo condition (M = 80% of intervals; range, 57% to 100%). During the behavioral intervention (BI) Max continued to engage in off task behavior during a mean of 59% of intervals (range, 10% to 87%). When Max received 10 mg of MPH his off task behavior occurred during a mean of 58% of intervals (range, 47% to 70%). The use of the behavioral intervention and 10 mg of MPH (combined) resulted in a similar mean level of off task behavior (M = 59% of intervals; range, 33% to 97%).
Figure 1. Max: Results of intervention procedures for percent of intervals with disruptive classroom behavior (top panel) and number of blocks stacked (bottom panel).
Max stacked a mean of 8 blocks (range, 1 to 15) during the placebo condition and a mean of 7 blocks stacked (range, 0 to 17) during the behavioral intervention condition. When Max received 10 mg of MPH, he stacked a mean of 14 blocks (range, 10 to 20) and when the behavioral intervention was combined with 10 mg of MPH he stacked a mean of 13 blocks (range, 1 to 15).

Overall, the results for Phase 1 show that the behavioral intervention was associated with little or no improvement in Max’s disruptive behavior or number of blocks stacked as compared to placebo. Ten mg of MPH resulted in a decrease in disruptive behavior as compared to placebo. However, levels of disruptive behavior still averaged over 50% of intervals. All three interventions resulted in similar decreases in off task behavior as compared to placebo, however, levels of off task behavior still averaged 59% of intervals. Max’s mean number of blocks stacked increased while taking 10 mg of MPH as compared to placebo, however his performance was somewhat variable. The combination of 10 mg and the behavioral intervention did not result in any clear improvements over medication alone when stability and trend are considered. Based on these results it was determined by Max’s parents and the consulting psychiatrist to evaluate an increased dose of medication of 15 mg of MPH and to add response cost to the behavioral intervention.
Phase 2

During the behavioral intervention plus response cost condition, Max began each session with 15 edibles (i.e., gummy bears) placed on his desk. When Max exhibited disruptive or off task behaviors during any interval, the observer cued the examiner to take one of the edibles away. The examiner told Max he had "lost one gummy bear for . . . (e.g., being out of his seat)." The same schedule of reinforcement for appropriate behavior was used as in Phase 1. In addition, Max was allowed to consume any edibles which remained on his desk at the end of each session.

During the behavioral intervention plus response cost condition, the results show that Max engaged in high levels of disruptive behavior ($M = 96\%$ of intervals; range, $89\%$ to $100\%$) across all sessions and were equivalent to or above placebo levels in Phase 1. When Max received 15 mg of MPH, his disruptive behavior occurred during a mean of $20\%$ of intervals (range, $0\%$ to $63\%$) with an apparent downward trend. The addition of the behavioral intervention plus response cost to 15 mg of MPH (combined) did not result in any clear decreases in disruptive behavior as compared to medication alone ($M = 18\%$ of intervals; range, $10\%$ to $53\%$).

Max engaged in off task behavior during 100\% of intervals across all sessions during the behavioral intervention plus response cost condition, which was above placebo levels in Phase 1. When Max received 15 mg of MPH, his off task behavior occurred during a mean of $53\%$ of intervals (range, $23\%$ to $73\%$) which was similar to results for 10 mg of MPH in Phase
1. The addition of the behavioral intervention plus response cost to 15 mg of MPH (combined) decreased Max's off task behavior as compared to 15 mg of MPH alone (M = 20% of intervals; range, 8% to 33%).

Max stacked 0 blocks across all sessions during the behavioral intervention plus response cost condition. However, while receiving 15 mg of MPH, Max's mean number of blocks stacked was 22 (range, 16 to 28) and slightly higher than when he received 10 mg in Phase 1. The combination of the behavioral intervention plus response cost and 15 mg of MPH increased Max's mean number of blocks stacked above that of medication alone (M = 28; range, 20 to 36).

Overall, results indicated that the behavioral intervention plus response cost did not decrease Max's disruptive behavior below placebo levels, but actually decreased the number of blocks stacked to zero. Additionally, Max's off task behavior increased as compared to both the placebo and behavioral intervention conditions in Phase 1. However, 15 mg of MPH resulted in a decrease in mean disruptive behavior and an increase in the mean number of blocks stacked as compared to both placebo and 10 mg of MPH in Phase 1. Fifteen mg of MPH did not result in lower levels of off task behavior as compared to the behavioral intervention and 10 mg of MPH in Phase 1. The combination of the behavioral intervention plus response cost and 15 mg of MPH resulted in minimal improvements over medication alone for disruptive behavior, but increased the mean number of blocks stacked above that of medication alone. In addition, the combination
intervention resulted in the lowest levels of off task behavior across all conditions during Phases 1 and 2. Based on these results it was determined by Max's parents and the consulting psychiatrist to continue to evaluate 15 mg of MPH and to replace response cost with time out during the behavioral intervention.

Phase 3

During the behavioral intervention plus time out condition, the observer again cued the experimenter when Max exhibited disruptive or off task behaviors during any interval. The examiner told Max “time out because you . . . (e.g., talked)” and then turned Max's chair away from his desk, work and other students for 30 seconds. A least to most prompt (i.e., fingers on shoulders to baskethold) procedure was used to keep Max seated in his chair during the time out period. At the end of 30 seconds, Max's chair was turned back the desk and the examiner told Max “time out is over, return to work”. The same schedule of reinforcement for appropriate behavior was used as in Phase 1.

During the behavioral intervention plus time out condition, Max engaged in low levels of disruptive classroom behavior (M = 10% of intervals; range, 0% to 27%) and the last 2 sessions were zero or near zero. Both the combination of the behavioral intervention plus time out and 15 mg and a replication of the medication alone condition resulted in zero levels of disruptive behavior.
During the behavioral intervention plus time out condition, Max also engaged in low levels of off task behavior ($M = 9\%$ of intervals; range, 0\% to 21\%) and the last 2 sessions were zero or near zero. When Max received 15 mg of MPH, off task occurred during 63\% of intervals which was higher than mean levels during Phase 2. The combination of the behavioral intervention plus time out and 15 mg resulted in near zero levels of off task behavior ($M = 2\%$ of intervals; range 0\% to 3\%).

Max stacked a mean of 20 blocks (range, 17 to 23) during the behavioral intervention plus time out condition which was approximately equivalent to the number of blocks stacked when he received 15 mg in Phase 2. Max stacked a mean of 45 blocks (range, 40 to 49) during the combination intervention (behavioral intervention plus time out & 15 mg of MPH). During the medication only condition, Max stacked 8 blocks which was fewer than during Phase 2.

Overall, results indicate that both the behavioral intervention plus time out and 15 mg of MPH alone, decreased Max's disruptive behavior to zero or near zero levels and increased the number of blocks stacked as compared to either the behavioral intervention alone or 10 mg of MPH. However, the combination of the behavioral intervention plus time out and 15 mg resulted in the lowest levels of off task behavior and the highest number of blocks stacked across all conditions.
Teacher Ratings

The average T-score on the CTRS - R is 50, and a T-score of 70 or greater represents significant deviations from the standardization sample. Teacher ratings were always lowest (better) when Max received medication as compared to placebo across all phases. (See Appendix F).

Side Effects

Teacher ratings on the Stimulant Drug Side Effects Rating Scale indicated no significant side effects. The behavior “talks less with others” was rated low to moderate (2 and 5) on two occasions when Max received 10 mg of MPH, but were zero ratings across all other days whether Max received medication or placebo.

Bryan

Reinforcer Assessment

On the Reinforcer Assessment Survey (RAS), Bryan’s highest percentage score was for tangibles and teacher attention. Percentage scores across categories were as follows: Tangibles and teacher attention (79%), peer attention and activities (71%), edibles (36%), and escape (7%).

The results of the behavioral - paired choice show that Bryan’s highest preference was tangibles, which was chosen in 100% of presentations. Edibles was chosen in 80% of presentations, escape and activities were chosen 40% of presentations, and teacher and peer attention was chosen in 20% of the presentations. As a result, Bryan was given a choice between tangible and edible token coupons during the behavioral interventions.
Phase 1

Based on the initial classroom observation, Bryan's reinforcement schedule during the token coupon condition was one minute. After 6 consecutive 10-second intervals without disruptive or off task behaviors, the observer cued the experimenter to deliver a choice of coupons. The experimenter placed 2 coupons (i.e., 1 tangible, 1 edible) in front of Bryan and he was instructed to pick one. The experimenter then prompted Bryan to return to work. Bryan could earn a maximum of 5 coupons for each session. Immediately following each session, Bryan was allowed to cash in coupons for specific back up reinforcers.

During the placebo condition, Bryan engaged in high levels of disruptive classroom behavior ($M = 87\%$ of intervals; range, $67\%$ to $100\%$). During the token coupon condition, Bryan’s disruptive behavior decreased to a mean of $20\%$ of intervals (range $0\%$ to $47\%$) as compared to placebo, but was highly variable. When Bryan received $10$ mg of MPH he engaged in low levels of disruptive behavior ($M = 4\%$ of intervals; range, $0\%$ to $27\%$). The addition of token coupons to $10$ mg of MPH (combined) resulted in zero levels of disruptive behavior.

Bryan also engaged in high levels of off task behavior ($M = 70\%$ of intervals; range, $10\%$ to $100\%$) during the placebo condition. During the token coupon condition, Bryan’s off task behavior decreased to a mean of $28\%$ of intervals (range $13\%$ to $40\%$) as compared to placebo, but again was highly variable. When Bryan received $10$ mg of MPH he engaged in low
Figure 2. Bryan: Results of intervention procedures for percent of intervals with disruptive classroom behavior (top panel) and number of digits correct (bottom panel)
levels of off task behavior (M = 13% of intervals; range, 0% to 47%). The addition of token coupons to 10 mg of MPH (combined) resulted in near zero levels of off task behavior (M = .8% of intervals; range 0% to 3%).

Bryan completed a mean of 8 digits correct (range, 0 to 16) during the placebo condition and a mean of 16 digits correct (range, 15 to 17) during the token coupon condition. When Bryan received 10 mg of MPH, he completed a mean of 36 digits correct (range, 33 to 39). However, the addition of token coupons to 10 mg of MPH (combined) resulted in a mean of 27 digits correct (range, 21 to 33).

Overall, the token coupon condition decreased Bryan's disruptive and off task behavior as compared to placebo but was highly variable. Additionally, during the token coupon condition, the number of digits Bryan completed correctly increased as compared to placebo. When Bryan received 10 mg of MPH, his disruptive behavior decreased to zero levels except for one session, and he completed more digits correct than in any of the other conditions. Bryan's off task behavior also decreased as compared to both placebo and the token coupon condition. The combined intervention resulted in zero levels of disruptive behavior and near zero levels of off task behavior. Based on these results it was determined by Bryan's parents and the consulting psychiatrist to continue to evaluate 10 mg of MPH but to add response cost to the behavioral intervention due to the variability associated with token coupons alone.
Phase 2

During the token coupon plus response cost condition, Bryan began each session with a card on his desk which contained a total of 15 smiley faces. Each smiley face represented one minute of free time. When Bryan exhibited disruptive or off task behaviors during any interval, the observer cued the examiner to place an “X” over one smiley face. For each “X”, Bryan lost one minute of free time. At the end of each session, Bryan was told how many minutes (if any) he had lost from free time. The same schedule of reinforcement for appropriate behavior was used as in Phase 1 (i.e., one minute).

During the token coupon plus response cost condition, Bryan engaged in disruptive classroom behavior a mean of 28% of intervals (range, 13% to 53%) which was both slightly higher and more stable than token coupons alone in Phase 1. When Bryan received 10 mg of MPH, his disruptive behavior occurred at low levels (M = 4% of intervals; range, 0% to 7%) which was similar to results during phase 1.

Bryan engaged in off task behavior a mean of 36% of intervals (range, 13% to 53%) during the token coupon plus response cost condition which again was both slightly higher and more stable than token coupons alone in Phase 1. When Bryan received 10 mg of MPH, his off task behavior occurred at low levels (M = 10% of intervals; range, 7% to 13%) which was similar to results during phase 1.
Bryan completed a mean of 18 digits correct (range, 6 to 32) during the token coupon plus response cost condition and a mean of 42 digits correct (range, 33 to 50) when he received 10 mg of MPH.

Overall, results indicated that token coupons plus response cost decreased Bryan's disruptive and off task behavior as compared to placebo. However, Bryan's level of disruptive and off task behavior increased as compared to the token coupon condition without response cost during Phase 1. Token coupons plus response cost did not result in any clear improvements for the mean number of digits completed correctly as compared to token coupons alone when stability and trend are considered. Ten mg of MPH continued to decrease Bryan's disruptive behavior to near zero levels, and increase the mean number of digits correct as compared to placebo. Similar to results in Phase 1, 10 mg of MPH resulted in low levels of off task behavior. Based on these results it was determined by Bryan's parents and the consulting psychiatrist to continue to evaluate 10 mg of MPH and to replace response cost with time out during the behavioral intervention.

Phase 3

During the token coupon plus time out condition, the observer again cued the experimenter when Bryan exhibited disruptive or off task behaviors during any interval. The examiner told Bryan "time out because you . . (e.g., talked)" and then walked Bryan to a corner of the classroom away from other student's for 30 seconds. At the end of 30 seconds, the
examiner told Bryan “time out is over, return to work” and used a 3-step guided compliance procedure if necessary to direct him back to his desk. The same schedule of reinforcement for appropriate behavior was used as in Phase 1.

During the token coupon plus time out condition, Bryan engaged in low levels of disruptive classroom behavior (M = 5% of intervals; range, 0% to 12%). When Bryan continued to receive 10 mg of MPH his disruptive behavior decreased to zero levels similar to results during Phases 1 and 2.

Bryan also engaged in low levels of off task behavior (M = 3% of intervals; range, 0% to 9%) during the token coupon plus time out condition. When Bryan continued to receive 10 mg of MPH his off task behavior decreased to zero levels similar to results during Phases 1 and 2.

Bryan completed a mean of 30 digits correct (range, 24 to 39) during the token coupon plus time out condition and a mean of 40 digits correct (range, 37 to 43) when he received 10 mg of MPH, however, the trend for the token coupon plus time out condition was very similar to the results for medication alone.

Overall, results indicated Bryan exhibited high levels of disruptive and off task behavior and low levels of work productivity when he received placebo. It is also important to note that during the placebo, token coupon and token coupon plus response cost conditions, Bryan’s disruptive behavior included qualitatively more severe behaviors such as throwing objects and property destruction (e.g., breaking objects, writing on desks).
Although disruptive levels decreased in frequency during the token coupon and token coupon plus response cost conditions as compared to placebo, the intensity of his disruptive behavior continued. Across all phases 10 mg of MPH was shown to decrease disruptive and off task behavior to zero or near zero levels and substantially increased the number of digits correct as compared to placebo when used alone. Overall, all three behavioral interventions were beneficial for Bryan’s classroom behavior as compared to placebo. However, time out was demonstrated to be most effective and was approximately equivalent to medication alone.

**Teacher Ratings**

Teacher ratings were always lowest when Bryan received medication as compared to placebo. (See Appendix F).

**Side Effects**

Teacher ratings on the Stimulant Drug Side Effects Rating Scale indicated no significant side effects.

**Betty**

**Reinforcer Assessment**

On the Reinforcer Assessment Survey (RAS), Betty indicated a high preference for all categories (100%) except for escape which was less preferred with a score of 79%. The results of the behavioral - paired choice showed that Betty’s highest preference was tangibles, which was chosen in 100% of presentations. Edibles and escape were chosen in 60% of presentations, activities and peer attention were chosen 40% of
presentations, and teacher attention was never chosen. As a result, Betty was given a choice between the tangible, edible and escape token coupons during the behavioral interventions.

**Phase 1**

Based on the initial classroom observation, Betty’s reinforcement schedule during the token coupon condition was one minute. After 6 consecutive 10-second intervals without disruptive or off task behaviors, the observer cued the experimenter to deliver a choice of coupons. The experimenter placed 3 coupons (i.e., 1 tangible, 1 edible, 1 escape) in front of Betty and she was instructed to pick one. The experimenter then prompted Betty to return to work. Betty could earn a maximum of 5 coupons for each session. Immediately following each session, Betty was allowed to cash in coupons for specific back up reinforcers.

During the placebo condition, Betty engaged in disruptive classroom behavior a mean of 37% of intervals (range, 0% to 77%) but was quite variable. Betty engaged in lower levels of disruptive behavior during the token coupon condition (M = 16% of intervals; range, 7% to 33%) with an apparent downward trend. When Betty received 10 mg of MPH, disruptive behavior occurred during a mean of 7% of intervals (range, 0% to 43%). The addition of token coupons to 10 mg of MPH (combined) resulted in the lowest levels of disruptive behavior (M = 2% of intervals; range, 0% to 7%).
Figure 3. Betty: Results of intervention procedures for percent of intervals with disruptive classroom behavior (top panel) and number of digits correct (bottom panel).
Betty engaged in off task behavior a mean of 52% of intervals (range, 30% to 70%) during the placebo condition. During the token coupon condition, Betty engaged in lower levels of off task behavior as compared to placebo (M = 32% of intervals; range, 10% to 77%) but was again variable. When Betty received 10 mg of MPH, off task behavior occurred during a mean of 12% of intervals (range, 0% to 47%). The addition of token coupons to 10 mg of MPH (combined) resulted in the lowest levels of off task behavior (M = 3% of intervals; range, 0% to 13%).

Betty completed a mean of 15 digits correct (range, 7 to 36) during the placebo condition and a mean of 28 digits correct (range, 7 to 43) during the token coupon condition. When Betty received 10 mg of MPH, she completed 43 digits correct (range, 28 to 58). The addition of token coupons to 10 mg of MPH (combined) resulted in a mean of 54 digits correct (range, 48 to 62).

Overall, the token coupon condition decreased Betty's levels of disruptive behavior as compared to placebo, but did not reach near zero levels. Additionally, during the token coupon condition, the mean number of digits completed correctly increased as compared to placebo. The token coupon condition also decreased Betty's off task behavior as compared to placebo, however, mean levels were still above 30%. Ten mg of MPH resulted in a decrease in disruptive and off task behavior to zero levels and an increase in the mean number of digits correct as compared to the placebo and token coupon condition. The combined intervention resulted in zero
levels of disruptive and off task behavior and the most digits completed
correctly compared to all other conditions. Based on these results it was
determined by Betty's parents and the consulting psychiatrist to continue to
evaluate 10 mg of MPH and to add response cost to the behavioral
intervention. Additionally, because Betty's disruptive and off task
behaviors showed a downward trend during the placebo condition, it was
continued during Phase 2.

Phase 2

During the token coupon plus response cost condition, Betty began
each session with a card on her desk which contained a total of 15 smiley
faces. Each smiley face represented one minute of free time. When Betty
exhibited disruptive or off task behaviors during any interval, the observer
cued the examiner to place an "X" over one smiley face. For each "X", Betty
lost one minute of free time. At the end of each session, Betty was told how
many minutes (if any) she had lost from free time. The same schedule of
reinforcement for appropriate behavior was used as in Phase 1 (i.e., one
minute).

During the placebo condition, Betty continued to engage in disruptive
behavior a mean of 23% of intervals (range, 3% to 43%). However,
disruptive behavior decreased to zero levels during the token coupon plus
response cost condition. Continued evaluation of 10 mg of MPH also
resulted in zero levels of disruptive behavior.
Betty engaged in off task behavior during a mean of 24% of intervals (range, 23% to 27) during the placebo condition and was highly stable. However, off task behavior decreased to near zero levels during the token coupon plus response cost condition (M = 3% of intervals; range, 0% to 7%). Continued evaluation of 10 mg of MPH resulted in zero levels of off task behavior.

Betty completed a mean of 23 digits correct (range, 11 to 37) during the placebo condition and a mean of 32 digits correct (range, 18 to 50) during the token coupon plus response cost condition. When Betty received 10 mg of MPH she completed a mean of 52 digits correct (range, 46 to 57) which was higher than the mean number completed during Phase 1.

Overall results indicate that both 10 mg of MPH and token coupons alone were effective interventions for decreasing Betty’s disruptive classroom behavior and increasing her academic performance as compared to placebo. Token coupons also decreased Betty’s off task behavior as compared to placebo, however off task levels remained over 30%. The combination of token coupons and 10 mg resulted in zero levels of disruptive and off task behavior and the highest number of digits correct across all sessions in Phase 1. Results also indicated that token coupons plus response cost, when used alone, decreased Betty’s disruptive and off task behavior to zero levels, which was more effective than token coupons alone and as effective as 10 mg of MPH in Phase 1.
Teacher Ratings

Teacher ratings were lowest when Betty received medication as compared to placebo in Phase 1. However, in Phase 2, teacher ratings were low for both medication and placebo (See Appendix F).

Side Effects

Teacher ratings on the Stimulant Drug Side Effects Rating Scale indicated no significant side effects.

Sally

Reinforcer Assessment

On the Reinforcer Assessment Survey (RAS), Sally indicated highest preferences for the tangible and teacher attention categories with percentage scores of 100%. Ranking of other categories by percentage score was in the following order: activities (93%), peer attention (86%), edibles (71%), and escape (43%). The results of the behavioral - paired choice showed that Sally's highest preference was activities which was chosen in 100% of presentations. The remainder of the categories were chosen in the following order: edibles (80%), escape (60%), teacher attention (40%), tangibles (20%), and peer attention was never chosen. As a result, Sally was given a choice between the activities and edible token coupons during the behavioral interventions.

Phase 1

Based on the initial classroom observation, Sally's reinforcement schedule during the token coupon condition was one minute. After 6
consecutive 10-second intervals without disruptive or off task behaviors, the observer cued the experimenter to deliver a choice of coupons. The experimenter placed 2 coupons (i.e., 1 activity, 1 edible) in front of Sally and she was instructed to pick one. The experimenter then prompted Sally to return to work. Sally could earn a maximum of 5 coupons for each session. Immediately following each session, Sally was allowed to cash in coupons for specific back up reinforcers.

During the placebo condition, Sally engaged in high levels of disruptive classroom behavior across all sessions ($M = 82\%$ of intervals; range, 70\% to 100\%). During the token coupon condition, Sally's disruptive behavior occurred at lower levels ($M = 10\%$ of intervals; range 0\% to 40\%) with a stable, downward trend. When Sally received 15 mg of MPH, her disruptive behavior occurred during a mean of 4\% of intervals (range, 0\% to 10\%). The combined intervention (token coupons and 15 mg of MPH) resulted in the zero levels of disruptive behavior.

Sally also engaged in high levels off task behavior across all sessions ($M = 65\%$ of intervals; range, 43\% to 100\%) during the placebo condition. During the token coupon condition, Sally's off task behavior occurred at lower levels ($M = 19\%$ of intervals; range 3\% to 37\%). When Sally received 15 mg of MPH, her off task behavior occurred during a mean of 6\% of intervals (range, 0\% to 10\%). The combined intervention (token coupons and 15 mg of MPH) did not result in any clear improvements over medication alone ($M = 5\%$ of intervals; range 0\% to 13\%).
Figure 4. Sally: Results of intervention procedures for percent of intervals with disruptive classroom behavior (top panel) and number of digits correct (bottom panel).
Sally completed a mean of 19 digits correct (range, 0 to 34) during the placebo condition and 28 digits correct (range, 6 to 44) during the token coupon condition. While receiving 15 mg of MPH, Sally’s mean number of digits correct was 47 (range, 30 to 59). The combined intervention (token coupons and 15 mg of MPH) resulted in a mean of 52 digits correct (range, 46 to 61).

Overall results indicate that both 15 mg of MPH and token coupons alone, were effective interventions for decreasing Sally’s disruptive classroom behavior to zero levels and increasing her academic performance as compared to placebo. However, 15 mg of MPH was more effective than token coupons for decreasing off task behavior and increasing the number of digits Sally completed correctly during independent seatwork. The combination of token coupons and 15 mg of MPH resulted in the highest number of digits correct across all conditions and zero levels of disruptive behavior.

The results from the both the token coupon condition and 15 mg of MPH alone, indicated maximum improvements in Sally’s classroom behavior and academic performance as compared to placebo when stability and trend are considered. Based on these results it was determined by Sally’s parents and the consulting psychiatrist not to increase the strength of the behavioral intervention or increase the dosage of MPH.
Teacher Ratings

Teacher ratings were lowest when Sally received medication as compared to placebo (See Appendix F).

Side Effects

Teacher ratings on the Stimulant Drug Side Effects Rating Scale indicated no significant side effects.

Ricky

Reinforcer Assessment

On the Reinforcer Assessment Survey (RAS), Ricky indicated high preferences for all categories with a percentage score of 100%. The results of the behavioral-paired choice showed that Ricky chose edibles, peer attention, and escape in 80% of presentations. Teacher attention, tangibles and activities were chosen in 20% of presentations. As a result, Ricky was given a choice between the edible, peer attention and escape coupons during the behavioral interventions.

Phase 1

Based on the initial classroom observation, Ricky's reinforcement schedule during the token coupon condition was one minute. After 6 consecutive 10-second intervals without disruptive or off task behaviors, the observer cued the experimenter to deliver a choice of coupons. The experimenter placed 3 coupons (i.e., 1 edible, 1 peer attention, 1 escape) in front of Ricky and he was instructed to pick one. The experimenter then prompted Ricky to return to work. Ricky could earn a maximum of 5
coupons for each session. Immediately following each session, Ricky was
allowed to cash in coupons for specific back up reinforcers.

During all conditions, Ricky engaged in very low levels of disruptive
classroom behavior (M = 3% of intervals; range, 0% to 33%). During the
placebo condition, Ricky engaged in off task behavior during a mean of 31%
of intervals (range, 0% to 53%). During the token coupon condition, Ricky’s
off task behavior occurred during a mean of 14% of intervals (range, 3% to
33%). When Ricky received 5 mg of MPH, he engaged in off task behavior
during a mean of 17% of intervals (range, 3% to 43%). During the combined
condition (token coupons plus medication), Ricky engaged in off task
behavior during a mean of 23% of intervals (range, 0% to 67%). Across all
conditions, Ricky’s off task behavior was highly variable.

Ricky completed a mean of 14 digits correct (range, 3 to 25) during
the placebo condition with an apparent downward trend. During the token
coupon condition, Ricky completed a mean of 18 digits correct (range, 14 to
24). When he received 5 mg of MPH, Ricky completed a mean of 21 digits
correct (range, 10 to 29). During the combined condition (5 mg and token
coupons), Ricky completed a mean of 19 digits correct (range, 10 to 29).

Overall results indicate that Ricky engaged in near zero to zero levels
of disruptive behaviors across all conditions. Five mg of MPH resulted in
the highest number of digits correct compared to all other conditions and
results were more stable than other conditions. The token coupon condition
and the combination of token coupons and 5 mg resulted in slightly more
Figure 5. Ricky: Results of intervention procedures for percent of intervals with disruptive classroom behavior (top panel) and number of digits correct (bottom panel).
digits correct as compared to placebo but results were somewhat variable. Ricky engaged in slightly higher levels of off task behavior during the placebo condition as compared to all other conditions, however, results were variable across all conditions. Results also demonstrated that the token coupon condition was slightly more effective than 5 mg of MPH for decreasing Ricky's off-task behavior as compared to placebo.

**Teacher Ratings**

Teacher ratings were lowest when Ricky received medication as compared to placebo, but were relatively low across both conditions (See Appendix F).

**Side Effects**

Teacher ratings on the Stimulant Drug Side Effects Rating Scale indicated no significant side effects.

**Treatment Acceptability**

Ratings of the acceptability of all behavioral intervention procedures are reflected by a total score on the fifteen item Intervention Rating Profile (IRP) scale, which has a possible range of 15 to 90 points. Responses on the IRP - 15 both prior to and following all behavioral interventions are presented in Appendix G. Overall acceptability scores for the token coupon intervention prior to the intervention procedures were 72 (Max), 49 (Bryan), 57 (Betty), 70 (Sally), and 52 (Ricky) indicating varying level of acceptability. Overall acceptability scores following use of the token coupon
intervention procedures were 77 (Max), 69 (Bryan), 89 (Betty), 87 (Sally), and 77 (Ricky), indicating higher levels of acceptability.

Overall, acceptability scores for the token coupon plus response cost intervention prior to the implementation of the intervention were 90 (Max), 90 (Bryan), and 88 (Betty), indicating high levels of acceptability. Acceptability scores following the intervention procedures were 89 (Max), 90 (Bryan), and 66 (Betty) also indicating high levels of acceptability, although ratings for Betty decreased.

Overall acceptability scores for the token coupon plus time out intervention prior to the implementation of the intervention were 90 (Max), and 87 (Bryan) indicating high levels of acceptability. Acceptability scores following the intervention procedures were 90 (Max) and 90 (Bryan) indicating continued high levels of acceptability.
CHAPTER 4
DISCUSSION

This study evaluated the separate and combined effects of varying dosages of MPH (Max, 10 mg and 15 mg; Bryan, 10 mg; Betty 10 mg; Sally, 15 mg; Ricky, 5 mg) and behavioral interventions of varying strengths on the academic performance and disruptive behavior of 5 children with ADHD. Overall, results indicated the behavioral interventions at some level were comparable to previously prescribed dosages of MPH for decreasing disruptive classroom behavior for 4 of 5 participants. For a fifth participant (Ricky), results indicated that MPH was not necessary. Results for academic performance indicated that the behavioral interventions alone were not comparable to MPH alone for 4 of 5 participants. However, for 3 of these participants, the combination of the behavioral intervention (at some level) and MPH was more effective than MPH alone for increasing academic performance. Interestingly, these findings are inconsistent with previous group studies which suggest that behavioral interventions do not result in any further (additive) improvements over medication alone for academic performance. For a fourth participant (Bryan), medication alone was always more effective for academics. For a fifth participant (Ricky), results only indicated slight improvements in academic performance for medication alone and again MPH was not necessary.

Results for all participants showed results comparable to medication for at least one level of the behavioral interventions alone, however, the
type (i.e., strength) of behavioral intervention necessary to achieve maximum improvements was idiosyncratic. For Sally, the token coupon intervention alone resulted in near zero levels of disruptive behavior and was comparable to her previously prescribed dose of MPH (15 mg). However, the combination of the token coupon intervention and 15 mg of MPH was most effective for academics. For Betty, the addition of response cost to the token coupon intervention resulted in zero levels of disruptive and off task behavior which was comparable to her previously prescribed dose of MPH (10 mg). However, the combination of the token coupon intervention (without response cost) and 10 mg of MPH was most effective for Betty's academic performance. For Max and Bryan, token coupons and time out were necessary to achieve results comparable to their previously prescribed doses of MPH for disruptive behavior. However, for Max, the combination of 15 mg and time out resulted in the highest level of work productivity. Whereas Bryan's academic performance was best when he received 10 mg of MPH alone regardless of the behavioral intervention. Ricky engaged in zero levels of disruptive behavior across all conditions including placebo. However, the token coupon intervention alone resulted in the lowest levels of off task behavior across all conditions. Five mg of MPH was slightly more effective for Ricky's academic performance and also resulted in low levels of off task behavior comparable to the token coupon intervention alone.
Results indicated clear effects for MPH alone for both disruptive behavior and academic performance for 3 of the 5 participants at their previously prescribed dosages. However, results also showed that for a fourth participant (Max), his previously prescribed dose of 10 mg was not an optimal dose for his behavioral and academic performance. Additionally, for a fifth participant (Ricky), results clearly indicated that MPH was not necessary. Overall, findings indicated that for 2 of 5 children in this study, their previous dose of MPH was inaccurately prescribed.

These findings have several implications regarding the importance of conducting individualized assessments of both behavioral and medication treatments for children with ADHD. First, results are consistent with previous studies which have shown that MPH is prescribed for some children for whom it is not necessary (e.g., Ricky). Unfortunately, Ricky continued taking this dose of MPH despite the academic and behavioral outcome data. The failure to communicate these results to parents and physicians is a limitation of the current procedures. Also, the current results suggest that behavioral interventions (at some level) were almost always an alternative to medication if the teacher and/or parent is willing to spend a considerable amount of time implementing and monitoring intervention effectiveness, and making necessary modifications (i.e., increase in strength) until maximum benefits are achieved. However, this study also shows that for some children, comparable benefits can be achieved with medication treatment alone, which does not require the
increased amount time and effort that is necessary when implementing behavioral interventions. Factors such as availability of classroom staff, willingness of classroom teachers to implement behavioral interventions, overall acceptability and side effects of medication treatment often may be the deciding factor for which intervention is used.

This study extends current literature in several ways. First, it replicates previous studies which have demonstrated the utility of single-case designs to evaluate the effects of MPH on both disruptive and academic behavior directly in classroom settings. Second, this study extends previous research to include a simultaneous evaluation of a behavioral intervention, both separately and in combination with MPH, within the classroom across behavioral and academic domains. Most previous combination studies are group designs and/or do not take place in school settings. Third, and perhaps most importantly, it is the first usage of a comprehensive school-based assessment that evaluated specific behavioral interventions at increasing levels of treatment strength as compared to varying dosages of MPH. Previous studies that have evaluated treatment strength (Hoza et al., 1992; Carlson et al., 1992) used comprehensive interventions (e.g., token economy plus response cost, bonus point system, time out, and school home note) rather than a single intervention (e.g., token coupons) as the lowest "dosage" of behavioral intervention, while others have only evaluated the effects on behavior and not academic performance (Abramowitz et al., 1992).
The use of reinforcer assessments to identify preferred reinforcers for each participant also extends previous studies and may have contributed to the effectiveness of the behavioral interventions in this study. In addition, parents attended workshops throughout the course of the program during which they received direct instruction on various behavior modification techniques (i.e., positive reinforcement, time out). It is unknown to what extent parents utilized these techniques at home, however, the consistent use of these techniques across settings (i.e., school and home) may have also contributed to intervention effectiveness.

This study also extended the current literature regarding school based medication evaluation procedures (Gadow et al., 1991; Fisher & Newby, 1991; Gulley & Northup, 1997) by providing a relatively brief method to evaluate both medication and behavioral treatments simultaneously within the classroom. Overall, assessments took an average of 10 minutes daily over 12 days to complete. This is considerably less time than previous methods that have evaluated medication effects alone. Additionally, these procedures could be used to correspond with current prescription practices for medication rather than evaluating multiple dosages concurrently. For example, results for Max illustrate how physicians can utilize relevant classroom data to make a determination concerning the effectiveness of current medication dosage. When Max's dose was increased by the physician, these procedures were repeated to continue to evaluate the increased dose of 15 mg.
Another extension of research provided by this study was the demonstration of the utility of these procedures for determining the effectiveness of MPH for preschool aged children. Although MPH is commonly used with this population, very few studies have demonstrated it's efficacy and some reports have suggested that response to MPH is more variable in preschool children and the rate of side effects may be higher. Current evaluation procedures may be useful for future studies to systematically evaluate the effects of MPH for preschool children.

One limitation of this study was that all interventions were conducted by the examiners and not the classroom teacher. Although each level of the interventions was effective for different participants, even the lowest “dosage” of behavioral intervention required a considerable amount of time (coupon delivery every minute) for one teacher to implement in the regular classroom. However, all behavioral interventions received acceptable ratings from the classroom teacher. This may in part be due to the fact that the teacher did not actually implement the interventions. Future research is needed to evaluate both the effectiveness and acceptability of the behavioral interventions used in this study when they are implemented by the classroom teacher.

Another limitation was that this study was conducted during a summer research program, therefore it is unknown to what extent the current results might generalize to the child’s regular classroom. Several variables such as class size, experience level of the teacher, and the
increased number of adults in the classroom all could have influenced the results. Also, the summer research program had access to resources such as a consulting psychiatrist which is typically not available in most regular education settings.

Another limitation was the selection of the 3 specific behavioral interventions. Although research has demonstrated that these procedures are often used and effective for disruptive classroom behavior, further treatment evaluation may be warranted. For example, no clear beneficial effects were observed for Ricky during the token coupon intervention for academic performance. Because he did not engage in any disruptive behavior, the addition of response cost was not justified. However, a possible alternative could have been a simple goal setting intervention where Ricky could have received token coupons for completing a specified number of problems as opposed to a time criterion intervention like the one used in this study.

Also, other parameters of reinforcement (i.e., rate, delay, effort, value) could have been varied before implementing mild punishment procedures (i.e., response cost). For example, results for Betty showed the token coupon intervention was effective for decreasing disruptive behavior, however, maximum improvements were not achieved. Rather than implementing a response cost procedure, the rate of reinforcement could have been increased (i.e., 1 coupon every 30 seconds).
Additionally, it is not currently known what the best strategy might be to determine various "strengths" of behavioral interventions and is a consideration for future research. It is possible that the strength of each of the behavioral interventions used in this study could be changed by varying all of the above reinforcement parameters. Recent studies have suggested that it is important to consider not only the topography, but the function of the behavior when designing behavioral interventions (Umbreit, 1995; Ervin et al., 1998). Ideally, behavioral interventions and subsequent increases in strength would be determined based on the results of a functional assessment, rather than only the topographical description of the interventions, as was shown in this study.

A final limitation is the absence of a follow-up phase upon completion of the assessments within the participants regular classroom. Follow-up is recommended with any treatment program. Many children begin taking MPH at an early age, and continue to take it throughout elementary school. Also, adjustments in behavioral interventions are a recommended part of any comprehensive treatment plan. Follow-up sessions would allow accurate monitoring to determine if the results of the assessment were consistent over time. In addition, the situations in which the "most effective" dose of either medication or behavioral treatment is no longer effective, may reveal important information regarding the child's progress and the long-term use of stimulant medication and behavior modification techniques.
The results from this study clearly illustrate the need to evaluate both medication and behavioral intervention "dosage" on an individual basis. These results are consistent with previous findings that have demonstrated children's response to both medication and behavioral treatments is idiosyncratic. This has important implications regarding group comparison studies in general. Group studies may not necessarily help to predict which treatment, at what level, or combination would be most effective for an individual child. However, group comparison studies remain a focus of ADHD treatment research. For example, the National Institute for Mental Health (NIMH) has initiated a 5 year, multisite, multimodal treatment study for children with ADHD (Richters et al., 1995), although current research suggests that single case methodology is optimal. Additionally, group comparison studies will fail to detect the highly idiosyncratic response to different types (i.e., strengths) of behavioral treatment as shown in this study.

However, single case treatment comparison studies have typically examined behavioral interventions which consist of multiple components (e.g., school home note, token economy, response cost) with many different parameters. Thus, there is little or no continuity across single case comparison studies as each study typically evaluates many different types of behavioral interventions. Johnston and Pennypacker (1993) suggest that conducting these types of comparison studies are problematic due to the nature of the experimental question, the nature of the comparison, and
constraints on the generality (and thus the utility) of the conclusions.

Overall, it is suggested that comparison studies should not attempt to
determine what treatment is the best overall, but what treatment is "the
more applicable and effective choice" (p. 127).

In conclusion, these results also suggest that procedures presented in
this study can provide a practical and relatively efficient method to
systematically compare both the separate and combined effects of MPH and
behavioral interventions to placebo. School psychologists can play an
invaluable role in conducting these evaluations in the classroom.
Specifically, most school psychologists have the training to systematically
measure academic and behavioral performance through the direct
observation and CBA techniques that were used in this study. Additionally,
the school psychologist is trained to develop and implement behavioral
interventions in collaboration with the classroom teacher. The school
psychologist can help provide the physician access to relevant academic and
behavioral data from the school setting. They also have the ability to
communicate all assessment information to parents, schools and physicians.
Ideally, the school psychologist and physician can work collaboratively to
gather the information that is necessary to determine an optimal "dose" of
medication (if any) and behavioral intervention for a child, as well as
continuing to monitor the effectiveness of both interventions.
REFERENCES


I hereby give permission for ___________________________ under the (child's name) supervision of __________________________ to participate in a research (physicians name) study. The study is directed by John Northup, Ph.D. at Louisiana State University. I understand that participation will also require the advice and consent of a supervising physician and may include the following activities:

1) Assessment Procedures: Standardized assessments of the child’s academic and social behaviors will be conducted in a classroom setting. Specifically, a standard psychological or educational assessment will be completed upon my request. In addition, my child will be observed when he/she is working in the classroom setting. He or she will be provided with one of the following events in each session: token coupons, response cost or time-out. A minimum of twelve 5-minute sessions will be conducted, with each event presented in isolation three times.

2) Medication Procedures: At my request, and as determined and prescribed by the supervising physician, a medication evaluation may be conducted during the course of the program. Parents will be responsible for administering the medication each morning immediately following breakfast on the assigned days.

3) Upon completion of all assessments, a report for the child with the results will be prepared and discussed with the child’s family.

The possible benefits of participating in this project are that: 1) A comprehensive assessment of all major aspects of a student’s classroom performance will be conducted and be available to both parents and teachers. The results may be especially useful for educational instructional planning, in addition to recommending specific behavioral management strategies. 2) The results from a medication evaluation may contribute to both you and your physician’s evaluation of medication effectiveness.

Regarding medication evaluations, the current assessment procedures should pose no additional risks for your child. However, possible discomforts that are associated with any use of methylphenidate include: appetite reduction, insomnia, irritability, headaches, stomachaches, and in rare cases, motor and vocal tics (Barkley, 1990). However, teachers and/or staff will complete a side effects rating scale so that the occurrence of any side effects can be monitored daily.
I understand that my child's participation in this project will not cost me any money and I have been told that I will not receive any money and that no form of compensation for medical treatment is available. I also understand that I am free to ask any questions at any time concerning the procedures of the evaluation, that I have access to all results, and that I have the right to withdraw consent at any time and that there are no adverse consequences for doing so. I understand that this evaluation is a part of a research project and that in the event that the data from this project is published, my child's name will remain confidential. I have read the attached description of all assessment and evaluation procedures. This Consent Form is valid until it is expressly revoked and the revocation is communicated to _______________________. I understand and agree that it is my responsibility to communicate any revocation of this consent to _______________________.

________________________
Signature (parent/guardian)

________________________
Witness

______________
Date

I ____do _____do not wish for my child to be videotaped during research sessions.
APPENDIX B: REINFORCER ASSESSMENT SURVEY

"Boys and girls like to get good things. I am going to name things that kids sometimes get in school. I want to know how much you like each of these things. After I name each thing, you tell me if you like it "not at all", "a little", or "a lot". For example, if I say "Going to the supermarket" you might say you like it "not at all", but if I say "Going to see your favorite movie" you might say you like it "a lot".

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Just a little</th>
<th>A lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gum</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Help friend with schoolwork</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. Art projects</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. Certificates, awards</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. Teacher says “Good job, I like that”</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. Get out of math</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. Nuts</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8. Spend time with a friend at school</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9. Help the teacher</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10. Stickers, stars</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11. Teacher says “You’re really paying attention”</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12. Put up your feet and relax</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13. Juice, drinks</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14. Friend says, “Good job, I like that.”</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15. Read a book</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16. Pencils or pens</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17. Teacher says “That’s right, that’s correct”</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18. Get out of the classroom</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19. Pretzels, chips</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>20. Friend pats you on the back / hugs you</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>21. Run/jump/dance</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>22. Pennies</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>23. Teacher says “I’m going to let your parents know your doing a great job”</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>24. Get out of reading</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>25. Cookies</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>26. Play a game with a friend</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>27. Play a computer game</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>28. Crayons or markers</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>29. Teacher pats you on the back/hugs you</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>30. Get out of sitting in your seat</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Item Description</td>
<td>Rating 1</td>
<td>Rating 2</td>
<td>Rating 3</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Popcorn</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Talk with a friend at school</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Free time in the library</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>File folder / pocket folder</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Time with a favorite teacher at school</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Get out of snack time</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Candy (M &amp; M's, Snickers)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Friend says &quot;You're really doing a good job&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Play with toys (legos, dinosaurs, Barbie)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Erasers</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Teacher helps you with your work</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Get out of a school activity</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Which of these is your favorite?

Is there anything else you would like?

How much do you like that?

Scoring

- **Edibles**: (Sum items 1, 7, 13, 19, 25, 31, 37 divide by 14)
- **Peers**: (Sum items 2, 8, 14, 20, 26, 32, 38 divide by 14)
- **Activities**: (Sum items 3, 9, 15, 21, 27, 33, 39 divide by 14)
- **Tangibles**: (Sum items 4, 10, 16, 22, 28, 34, 40 divide by 14)
- **Teacher Attn**: (Sum items 5, 11, 17, 23, 29, 35, 41 divide by 14)
- **Escape**: (Sum items 6, 12, 18, 24, 30, 36, 42 divide by 14)
APPENDIX C: BEHAVIORAL PAIRED-CHOICE QUESTIONNAIRE

Directions: I'd like to know what things you might like to earn by doing lots of hard work at school. I am going to read some statements to you. After each statement that I read, choose what you would like by picking up the coupon that goes with it or if you don't like either of the choices say neither one.

 WHICH WOULD YOU RATHER GET FOR DOING HARD WORK?

Something to eat or drink (like ...) OR something to have (like ...) OR neither one?

Something to do (like ..) OR have a friend say or do something (like ...) OR neither one?

Have a teacher say or do something (like ...) OR do something (like ...) OR neither one?

Get out of something (like ...) OR something to eat or drink (like ...) OR neither one?

Something to have (like ...) OR do something (like ..) OR neither one?

Have a friend say or do something (like ...) OR something to eat or drink (like ...) OR neither one?

Have a teacher say or do something (like ...) OR get out of something (like ...) OR neither one?

Do something (like ...) OR something to eat or drink (like ...) OR neither one?

Get out of something (like ...) OR have a friend say or do something (like ...) OR neither one?

Something to eat or drink (like ...) OR have a teacher say or do something (like ...) OR neither one?

Something to have (like ...) OR get out of something (like ...) OR neither one?
Have a teacher say or do something (like ...) OR have a friend say or do something (like ...) OR neither one?

Have a friend say or do something (like ...) OR something to have (like ...) OR neither one?

Have a teacher say or do something (like ...) OR something to have (like ...) OR neither one?

Do something (like ...) OR get out of something (like ...) OR neither one?

<table>
<thead>
<tr>
<th>Category</th>
<th>Times chosen:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edible</td>
<td></td>
</tr>
<tr>
<td>Tangible</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Times chosen:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td></td>
</tr>
<tr>
<td>Peer</td>
<td></td>
</tr>
<tr>
<td>Escape</td>
<td></td>
</tr>
</tbody>
</table>
The purpose of this questionnaire is to obtain information that will aid in the selection of classroom interventions. Circle the number best describes your agreement or disagreement with each of the following statements.

1. This is an acceptable intervention for the child's problem behavior.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

2. Most teachers would find this intervention appropriate for behavior problems in addition to the one described.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

3. This intervention should prove effective in changing the child's problem behavior.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

4. I would suggest the use of this intervention to other teachers.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

5. The child's behavior is severe enough to warrant the use of this intervention.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

6. Most teachers would find this intervention suitable for the behavior problem described.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

7. I would be willing to use this intervention in the classroom setting.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

8. This intervention would not result in negative side-effects for the child.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

9. This intervention would be appropriate for a variety of children.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

10. This intervention is consistent with those I have used in classroom settings.
    Strongly Disagree  1  2  3  4  5  6  Strongly Agree

11. The intervention was a fair way to handle the child's problem behavior.
    Strongly Disagree  1  2  3  4  5  6  Strongly Agree
12. This intervention is reasonable for the behavior problem described.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

13. I liked the procedures used in this intervention.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

14. This intervention was a good way to handle the child’s behavior problem.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

15. Overall, this intervention would be beneficial for the child.
   Strongly Disagree  1  2  3  4  5  6  Strongly Agree

(Martens, Witt, Elliott, & Darveaux, 1985)
## APPENDIX E: AVERAGE OFF-TASK BEHAVIOR

### Max

<table>
<thead>
<tr>
<th>Placebo</th>
<th>Phase 1: Edibles &amp; 10 mg</th>
<th>Phase 2: Edibles plus Response Cost &amp; 15 mg</th>
<th>Phase 3: Edibles plus Time Out &amp; 15 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>80</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Behavior Treatment Only</td>
<td>59</td>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td>Medication Only</td>
<td>58</td>
<td>53</td>
<td>63</td>
</tr>
<tr>
<td>Combined</td>
<td>59</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

### Bryan

<table>
<thead>
<tr>
<th>Placebo</th>
<th>Phase 1: Token Coupons (TC) &amp; 10 mg</th>
<th>Phase 2: TC plus Response Cost &amp; 10 mg</th>
<th>Phase 3: TC plus Time Out &amp; 10 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>70</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Behavior Treatment Only</td>
<td>28</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>Medication Only</td>
<td>13</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Combined</td>
<td>.8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Betty

<table>
<thead>
<tr>
<th>Placebo</th>
<th>Phase 1: Token Coupons (TC) &amp; 10 mg</th>
<th>Phase 2: TC plus Response Cost &amp; 10 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>52</td>
<td>24</td>
</tr>
<tr>
<td>Behavior Treatment Only</td>
<td>32</td>
<td>3</td>
</tr>
<tr>
<td>Medication Only</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Combined</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

### Sally

<table>
<thead>
<tr>
<th>Placebo</th>
<th>Phase 1: Token Coupons &amp; 15 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>65</td>
</tr>
<tr>
<td>Behavior Treatment Only</td>
<td>19</td>
</tr>
<tr>
<td>Medication Only</td>
<td>6</td>
</tr>
<tr>
<td>Combined</td>
<td>5</td>
</tr>
</tbody>
</table>

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APPENDIX E (con't): AVERAGE OFF-TASK BEHAVIOR

Ricky

<table>
<thead>
<tr>
<th>Phase 1 Token Coupons &amp; 5 mg</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Placebo</td>
<td>31</td>
</tr>
<tr>
<td>Behavior Treatment Only</td>
<td>14</td>
</tr>
<tr>
<td>Medication Only</td>
<td>17</td>
</tr>
<tr>
<td>Combined</td>
<td>23</td>
</tr>
</tbody>
</table>
# APPENDIX F: TEACHER RATINGS

Average T-score from the ADHD Index (CTRS - R)

<table>
<thead>
<tr>
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<th>Max</th>
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</table>
VITA

Veronica Schilling Gulley was born and raised in Baton Rouge, Louisiana. She received her Bachelor of Science degree from Louisiana State University. She entered the doctoral program in school psychology at LSU in 1993 and received her Master of Arts degree in 1996. Veronica's research interests include school-based behavioral assessment and intervention, and behavioral and medication treatments for students diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). Her educational experience includes project coordinator for summer research programs for students with ADHD, coordinating and conducting school-based medication evaluations, and program development for an alternative elementary school program in East Baton Rouge Parish. She is presently employed as a Behavior Analyst for East Baton Rouge Parish School System in Louisiana.
Candidate: Veronica S. Gulley

Major Field: Psychology

Title of Dissertation: A Brief Method for Evaluating the Effects of Stimulant Medication and Behavioral Interventions on the Classroom Performance of Children with Attention Deficit Hyperactivity Disorder (ADHD)

Approved:

[Signatures]

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: 10/13/98