

# Teaching Students with ADHD

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A Project Submitted to the Faculty of

The Evergreen State College

In Partial Fulfillment of the Requirements

for the degree

Master in Teaching

2007

This Project for the Master in Teaching Degree

by

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has been approved for

The Evergreen State College

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## Abstract

What are successful strategies to assure students with ADHD are engaged and learn?

The number of students diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) is increasing and thus teachers are being faced with teaching more students who may have difficulties learning and difficulties acting appropriately in a classroom. Until the 1970's students with ADHD were not given special accommodations to help them learn but the passage of Public Law 94-142 and The Americans with Disabilities Act students with special needs were given accommodations and legal rights to learn. This means that teachers are obligated to teach these students to the best of their abilities and have many strategies to choose from. Some of the strategies include using a reward system for behavior, self monitoring to better behavior and academic performance, the use of auditory and visual stimulation and specific classroom seat arrangements. In addition to interventional strategies, the use of medication, usually methylphenidate (Ritalin) has also been shown to increase a student's behavior and academic performance. There are ongoing debates around the use of medication although it has been proven to work. To successfully teach students with ADHD teachers should adopt a multi-modal approach; a combination of strategies, an awareness of the student's medication, knowledge of ADHD itself and an interaction with the student's parents.

## Acknowledgements

This paper could not have been done without the support and assistance of the following people, and for that I thank them sincerely: Maria and the Family for patience, encouragement and understanding; Dr. Sonja Wiedenhaupt for incredible support and helping me organize my thoughts; the Black Hills High School Special Education Department for giving me a chance; Keith Wood and George Bower for showing me that there is usually more than meets the eye; Will Clark for being a childhood hero; Kevin Smith for fashion; Stanley Eisen, Joseph Ramone, Greg Graffin and Vincent Furnier for musical inspiration; David Prowse for striking fear; and Leto Atreides for philosophical exploration.

## Chapter 1: Introduction

There are approximately two million students that have been diagnosed with Attention Deficit Hyperactivity Disorder (Schnoes et al, 2006). Thus, teachers are responsible for teaching many children who may have difficulties learning and difficulties acting appropriately in a classroom. There are numerous problems associated with students with ADHD in class. Teachers must spend a lot of time and energy reviewing a student's Individual Education Plan (IEP), and implementing strategies and accommodations that each student needs to learn. Teachers must understand ADHD as a disorder in order to assist student learning. I believe that all students, regardless of their background, gender, and socioeconomic status, deserve to have access to an education. I chose to investigate effective strategies for working with students with ADHD because these students deserve to have a quality education and may require different types of attention than General Education students. Different teachers may define 'effective strategies' differently, but I feel that an effective strategy is one that helps a wide range of students with ADHD; different ages, different ethnicities and varied levels of motivation. An effective strategy should improve student behavior, academic performance, independence and create a desire to further one's education.

To assure that students with ADHD learn it is important for teachers to know what ADHD is. This information will provide teachers insight into what their students are going through, and will be able to help teachers create strategies. According to the American Psychiatric Association, ADHD is defined as a neuropsychiatric disorder that

begins in early childhood. Some research suggests causative brain abnormalities, especially problems with the frontal lobe function. The frontal lobe region of the cerebral cortex allows for the creation and execution of difficult tasks. The action of this portion is called the executive function.

Treatment of ADHD includes medical and behavioral therapies. Stimulants such as methylphenidate (Ritalin) and dextroamphetamine (Dexedrine) are the most common medical treatments, having been used for nearly half a century. However, some children may do better on one of the medications over another. Other medications, such as the antidepressant desipramine, have been shown to be effective. Guanfacine (Tenex) and clonidine (Catapres) are both high pressure medicines and appear to treat the impulsivity symptoms of ADHD, but not the inattention (Schlozman, 2000).

Ritalin only works for few hours at a time, and has possible side effects such as a decreased appetite, headaches, stomachaches, insomnia, increased tension and an increase in blood pressure and heart rate (Ansotopoulos, 1991).

Traditionally, the dosage amount for stimulant medication has been determined by a child's body weight, using a milligram of dosage per kilogram of weight formula. However, recent dose-response studies show that the behavioral effects of methylphenidate are particular and aren't moderated in body weight. Thus, determining dosage on a milligram per kilogram basis may result in under, or overdosing light and heavy children (Ansotopoulos, 1991).

One theory claims that family dysfunctions can cause behaviors that are consistent with those occurring in ADHD. Similarly, tense family relations can aggravate existing cases



of ADHD. Thus, when treating a specific case of ADHD it may be beneficial to all parties to inquire about a student's family life and coping methods (Smucker, 2001).

One of the listed criteria in the DSM-III-R is that a child with ADHD has difficulty awaiting their turn in a game or group situation. There are many possible reasons that a child may have problems awaiting their turn. It could be a simple symptom of a medical disorder, but also could be explained by a child not learning the rules of the game or appropriate group dynamic. Or, the child may think that by participating in the game they could be made fun of so the child may decide to interfere with the game (Maag & Reid, 1994).

ADHD diagnosis is often based on a child's standing on a behavior checklist that compares the child's behavior to the expected behavior of someone with a similar age and gender. On these checklists parents and teachers rate how extreme or mild the behaviors are and if they are problematic (Greene, 1995). Much of this is subjective and could be influenced by reporter bias and the characteristics of the teacher or parent. A person's education and beliefs on the disorder itself could influence their reporting.

Other researchers theorize that ADHD is hereditary and that it is caused by a mother drinking too much while pregnant or eating too much sugar and drinking too much caffeine. Sugar and caffeine may increase someone's energy level but no studies have shown that they cause ADHD.

The sociological point of view claims that certain situations may have an effect upon ADHD behaviors. Research has shown that children with ADHD have a difficult time attending to tasks that they find boring. If a student finds an assignment boring they may be more likely to act out and display other ADHD symptoms. Conversely, if a student

finds an assignment interesting they probably won't display many of the symptoms, like walking around the classroom or talking inappropriately (Weaver, 1990).

Many believe that the popularity of ADHD is due to the endorsement of the medical profession. The doctors influence decision making in the government which then results in the popularization of the concept and the ever-widening boundaries of its definition (Timimi, 2005).

Regardless of its origins, students with ADHD make up a fairly large percentage of students in schools. Many students with ADHD qualify for accommodations and/or services under Section 504 of the Vocational Rehabilitation Act or the Individuals with Disabilities Act. Over half of the children with an ADHD diagnosis are school identified as being eligible for services under the Individuals with Disabilities Act.

Other Health Impairment (OHI) is the category which students with ADHD without any other disabilities fall under. In the early 1990's OHI was open to students with ADHD based on the 'limited alertness' language in the definition of the disorder. This was designed to include students with ADHD who would not, otherwise, qualify for special education services.

Approximately a quarter or less of students with ADHD also have at least one learning disability. Studies show that a larger majority of students with ADHD have emotional disorders than learning disabilities (researchers theorize anywhere from 25% to 44%). Children with ADHD are likely to receive special education services under the emotional disorder category and are likely to have an IQ lower than their peers although it is unclear if this is attributed to an intellectual deficit or inattentiveness (Schnoes, 2006).

ADHD has numerous symptoms, although the three most identifiable symptoms are impulsivity, hyperactivity and inattention. These (DuPaul and Stoner, 1994) are defined as impulsivity (the tendency to act without consideration or judgment, hyperactivity (the tendency to fidget excessively and having a difficulty working quietly) and inattention (having trouble sustaining and directing attention from lectures, readings and conversation; having a difficulty completing projects, such as homework and in class assignments; having trouble maintaining an organized living and/or work place, such as desks, study areas and backpacks; inconsistent work performance and lacking attention to detail). This results in a difficulty paying attention to details and a difficulty in completing a task (Barkely, 1990).

Students showing symptoms of ADHD are more likely to perform lower academically than non-ADHD students (Barkely, 1990) and may not pay attention to instructions on given tasks. They often act up and disrupt others, call out without permission, become angry when reprimanded, leave their seat without permission, play with classroom objects and constantly tap their hands and feet (DuPaul and Stoner, 1994). In addition, students diagnosed with ADHD have cognitive setbacks such as slow inhibitory processes, working memory deficits, delays in internalizing what they hear, a lack of regulating their emotions, a difficulty motivating themselves and troubles analyzing their own behavior (Coddling, Lewandowski and Gordon, 2001).

Children with ADHD display a level of stubbornness that results in an intense frustration if they are asked to stop their activities and do something new. This often results in agitation, aggression and tantrums (Schlozman, 2000). They may be unable to use what they know about social right or wrongs, even if they understand the

inappropriateness and consequences of their actions. Breaking the rules is wrong, but they are unable to abide by the rules. They may not be able to resist the temptations and impulses that get them in trouble. Essentially, students with ADHD have been biologically predisposed to act in a certain manner.

Although these are all symptoms and results of ADHD, each student will have their own set of needs; intellectual, social and emotional. In order for the student to behave, be engaged and to learn a teacher must take these into consideration as well as the student's developmental expectations (Schlozman, 2000).

The term ADHD is applied to a heterogeneous group of children and adolescents who are encountered in virtually every educational setting (DuPaul and Stoner, 1994). Approximately five percent of the population under the age of eighteen has been diagnosed with ADHD (Glass, 2001). Since teachers can expect their classrooms to have at least twenty students per class odds are each class will have at least one or two students with ADHD. This number may require students to receive special services and that teachers have knowledge on ADHD itself and strategies to help students learn.

Separating the behavior from the cognitive disorder may be challenging for a teacher because in order to change the behavior it may be necessary to understand its origin. Biological forms of ADHD tend to be more severe and are often treated with medication. Environmental forms of ADHD can be improved through specific classroom strategies. These strategies will be examined in greater detail in Chapter Three, but to help meet the needs of all students diagnosed with ADHD a teacher must practice a wide array of methods.

There are many debates surrounding ADHD in general and ADHD in the schools more specifically. Although there is evidence showing that ADHD is a neurological disorder many people dismiss this and believe that it is caused (or created) by environmental factors. They question if it is a medical disorder and doubt that medical treatment is effective or even safe. Many claim that the ADHD industry's research is bogus and biased to fill the pockets of the drug companies. They feel that ADHD is a cultural construct diagnosed on the basis of biological fact (Timimi, 2005).

Teachers may hold that view and thus may be skeptical of their students who are diagnosed with ADHD. This conflict lends itself to the second debate regarding ADHD; how the environment impacts the student's learning and behavior. According to the environmental or social framework, ADHD is conceptualized almost solely from a medical perspective and this can lead to neglect. Teachers and non-medical practitioners can view the assessment and treatment of ADHD as being beyond their grasp and rely solely on medication instead of developing interventional strategies to address the behaviors (Maag & Reid, 1994).

A teacher's ability to engage and monitor a student's education in a classroom setting may impact the student's learning. Conversely, a child's medication may result in a better academic performance, regardless of the environment. Since a symptom of ADHD is a difficulty focusing on something for an extended period of time a student may become distracted and thus will be removed from their surroundings by the teacher. Removing a student from class limits the student's ability to learn the material being taught. In an attempt to remedy this problem a teacher must know various classroom strategies in order

to keep the student's attention and to help the student learn. All strategies for engagement and learning must be taken into consideration.

However, if a student is biologically pre-disposed to lose interest then the lack of attention can be better remedied through medication than a change in environment. If the medication impacts a student's performance, the teacher may assume that the student's behavior is simply biological and choose not to implement classroom strategies (DuPaul and Stoner, 1994).

This paper will examine both the environmental and biological techniques used to help engage and teach students with ADHD. It will explore the effectiveness and ramifications of both. Chapter Three of this paper will present the current state of knowledge concerning ADHD in general education classrooms by critically reviewing and analyzing approximately thirty recent studies done on this topic. It will analyze the steps taken in the studies and how they may have impacted the results of the studies, the debates and questions the results raise and the generalizability of the results.

Chapter Two of this paper will trace the historical roots of ADHD; the origins of the definitions and how they have changed over time. It will explore the rationale of using methylphenidate and Dexedrine as a form of medicating ADHD as well as the history of specific classroom strategies as a way to better student learning. The chapter will explore how the defining symptoms of ADHD have been both ignored and taken into consideration by schools and teachers and how this affected student learning.

The final chapter will summarize the findings of the previous chapters, the author's interpretations of the findings, plans to use the findings and suggestions on what could further be explored.

Teachers have an obligation to ensure that all students learn and since students with ADHD may have diagnosed difficulties learning as well as a dislike of school, teachers are faced with a challenging task. With the number of ADHD diagnoses on the rise, and the number of students with ADHD on the rise, it is crucial that teachers have numerous strategies to engage these students and to ensure that they learn.

## Chapter II: The History and Understanding of ADHD

Attention Deficit Hyperactivity Disorder has been defined and redefined a number of times. However, the earliest concept of the disorder was called minimal brain damage. Prior to the 1940's in the United States, children who had difficulty learning were considered to be mentally retarded, socially and culturally disadvantaged and emotionally disturbed. Beginning in the early 1940's researchers began to examine a fourth possible cause of the difficulties, a neurological cause. Early research suggested that these problems were the result of brain damage (Strauss & Lehtinen, cited in Silver, 1990), but because these children appeared physically normal it was determined that this brain damage must be minimal. Thus, the term used to describe it was 'minimal brain damage.'

Later studies revealed that there was not any evidence of brain damage, so more research was conducted to determine if these children had difficulty with the way the brain functioned. All of the brain mechanisms appeared to be operable, but something was not working correct. The concept of 'faulty wiring', instead of tissue damage, led to the term 'minimal brain dysfunction'. A student with minimal brain dysfunction was defined as "children of near-average, average, or above-average general intelligence with certain learning or behavioral disabilities ranging from mild to severe, which are associated with deviations of function of the central nervous system" (Silver, 1990, page 13).

For years psycho-stimulant medication was seen to reduce the restlessness and behavioral problems in these children. Doctors theorized that children who exhibited



these symptoms might have an organic lesion in their brain. It was believed that hyperactivity was enough evidence to prove they had brain damage (Timimi, 2005).

In 1980 the DSM III symptom of inattention displaced hyper kinesis as the primary symptom of the disorder (Marshall, 1997). In 1980 the DSM-III coined the term 'attention deficit disorder with hyperactivity' (ADDH). The definition consisted of 3 major criteria: 1) it specified multidimensional symptoms, requiring symptoms in the dimensions of inattention, impulsivity, and motor hyperactivity, 2) it specified an age of onset, prior to seven years, and three) it required duration of at least six months (Cantwell, 1991).

The term ADHD was created for DSM-III-R in 1987. While DSM-III required certain symptoms in ADDH the DSM-III-R did not require any specific symptoms or set of symptoms. Instead, it allowed any eight symptoms to be selected from the list of symptoms. The age of onset and duration criteria remained the same. Since the DSM-III-R did not require specific categories and was broader there is more room for diagnoses of ADHD than there was for ADDH (Cantwell, 1991).

There is evidence that much of ADHD is traced to roots in variant neurological structures. However, within this point of view there are different theories. During the 1970's many people claimed that the disorder and similar disorders were myths and dismissed them as a construct by parents and teachers who did not want to work with an energetic child. Similarly, hyperactivity and learning disabilities were used as explanations by parents to why their children could not do well academically.

One theory of its origins links ADHD to an under-functioning of certain neural pathways within the central nervous system. Other studies suggest that the cause of this

under-functioning may be an inadequate amount of brain chemicals; certain neurotransmitters such as norepinephrine and dopamine. More studies suggest that individuals with ADHD have problems in the frontal limbic system of the brain, particularly the striatum. The striatum regulates inhibition and motivation (Weaver, 1990).

### ADHD and Special Education in the Schools

Debates on ADHD do not stop at its causes, however. Regardless of the disorder's roots, students with ADHD have not historically been embraced by the public school system. In the first half of the twentieth century many students who would later be classified as Special Education faced similar barriers as students of different colors. Outside of a few examples these students were not offered any accommodations or recognized as having any serious disorder. A number of cities and school districts began offering classes geared towards these children. In 1922 schools in Baltimore, Maryland had special classes for 'crippled' students, 'disciplinary' students and 'deaf' students (Spring, 2005). However, for the most part children with physical and mental handicaps were excluded from regular education classroom until the second half of the century.

During the 1960's a movement for Special Education rights coincided with the Civil Rights Movement. Most schools considered the disabled children unteachable (Spring, 2002). In the late 1960's the Pennsylvania Association for Retarded Children was one of many groups to demand change in the educational world. Pennsylvania Association for Retarded Children vs. Commonwealth of Pennsylvania was an important

case for the mainstreaming of disabled children. In this case the court stopped Pennsylvania from excluding Special Education children from the schools and required every child to be allowed access to an education.

In 1975 Congress passed Public Law 94-142 (Spring, 2002) which became known as the 'Education for all handicapped children' Act. It guaranteed equal educational opportunities for all special needs children. One of the requirements of the act was that every Special Education student be given an Individual Education Plan (IEP). IEP's are to be written by a committee composed of the student, their parents and councilor and offer the child accommodations based on their individual needs. However, Public Law 94-142 did not mention an attention deficit alone to be a qualifying condition for the services (Weaver, 1994). The Office for Civil Rights in the United States Department of Education did rule, though, that students with ADHD were guaranteed Special Education accommodations from Section 504 of the Rehabilitation Act of 1973. Students received 504 accommodations if their condition limits their ability to learn or to benefit from the General Education program. In 1991, guidelines were given by the Department of Education that guaranteed students the right to Special Education services based solely on having ADD or ADHD.

With Special Education students guaranteed rights and access another debate arose; whether or not the child should be placed in Special Education or General Education classrooms. Federal legislation called for students to be placed in a 'least restrictive environment' (Spring, 2002), meaning that the students spend half their school day in a separate Special Education classroom and half in a regular General Education classroom. Some Special Education advocates felt that this separation harmed the children's

education because they may not receive the full information that a student in a General Education classroom would receive. Advocates demanded a full inclusion where the student would spend their entire school day in Regular Education classrooms. Advocates argued that separating students was akin to segregation and Special Education children would not have equal access to school materials; textbooks, classrooms and libraries.

In 1990 the American with Disabilities Act was passed (Spring, 2002). It banned all forms of discrimination against disabled students, including mandatory separation. Two years later the National Association of State Boards of Education report 'Winners All: A Call for Inclusive Schools' backed the idea of full inclusion. The report called for a full inclusion process where Special Education teachers would teach Special Education children in General Education classrooms.

Although students with disabilities now had access to an equal education many teachers were hesitant to adopt the new regulations. Some teachers disagreed with full inclusion for a number of reasons (Spring, 2002). Some argued that most General Education teachers do not have the understanding or knowledge of various disorders and thus cannot successfully teach Special Education children. They may not have received training in techniques to insure accommodations of IEP's are met. Parents of General Education students have voiced concern because the addition of Special Education children in General Education classrooms may take away from their child's education. Teachers may spend more time on the Special Education students and the Special Education students could disrupt existing classroom norms.

## Conclusion

Students with ADHD are more likely to receive low test scores and poor grades in class than their non-diagnosed peers. Students exhibit deficient motor skills and suffer from poor organizational skills, impulsivity, self esteem issues, social tensions and an inability to pay attention to something for a prolonged period of time, especially if they do not find the task interesting or exciting. Schools have had an influx of students diagnosed with ADHD and teachers have the task of meeting the academic needs of these students.

Historically, students with special needs were left out of mainstream education. Most students who required extra attention or accommodations were simply left out of the schools. Once political and legal changes began opening the schools up, students with special needs began to be integrated in schools. However, all their academic needs were not being met. Students with ADHD have traditionally not had an equal access to an education because they were assumed 'faulty' or 'problem children. Within the last 30 to 40 years reforms have been made to give these students their rights. Although students with special needs and on IEP's are granted the right to learn and are provided with accommodations, this does not necessarily mean that the accommodations are being met. The next chapter will examine this further; information on ADHD that parents and teachers alike need to know to best help their children and students learn, and strategies that can be used to teach skills as well as academic material.

### Chapter III: Literature Reviews of Studies on Engaging and Teaching Students with ADHD

All students face some type of obstacle in their academic career. It may be a disinterest in the material studied, a lack of time to perform the work or possibly learning or behavior disorders. Students with any type of learning disorder or ADHD have additional obstacles to face because their deficiencies may be biological and thus require more work on their part. In addition, parents, peers and teachers also have more work to do to ensure that the student with ADHD not only behaves appropriately but learns the material as well.

Students who have been diagnosed with ADHD tend to score lower on test scores and exhibit behaviors that are often considered inappropriate in a classroom setting (Weaver, 1990). Students with ADHD disrupt the class by talking loudly when it is not their turn to speak, walking around the room when they should be in their seat, fidgeting and playing with objects that do not belong to them and are easily distracted and agitated.

There have been many theories and debates on ADHD and how to manage its symptoms in a classroom. Some research suggests that further medicating a student will produce the desired academic and behavior affect. Other studies theorize that students with ADHD need to have an extremely controlled environment in which to learn, one that does not offer the physical space or opportunity to become distracted. Further studies suggest that family, teachers and school administrators do not know enough about ADHD and its symptoms to be able to successfully engage and teach students with ADHD.

This chapter will investigate three separate points of view about how teachers can help

students with ADHD learn. The first section will explore the amount of contemporary teacher knowledge about Attention Deficit Hyperactivity Disorder and the impact their knowledge makes on student learning. The second section will investigate the impact of medication on student success in the classroom. It will examine the role of Methylphenidate on maintaining student behavior and its impact on student academic performance. The third section will explore specific teacher strategies used to improve student academic performance and behavior.

### Section I: Knowledge, Training and Practices

In an attempt to see the percentage of students with ADHD in the classroom, their usage of medication and their placement (General Education classrooms or Special Education classrooms) Schnoes et al (2006) sent questionnaires to 467 parents that asked about their child's learning disabilities, medication and health. Questionnaires were mailed to the parents who were unavailable to meet with the researchers. 85% of the parents responded to either the initial interviews or the mailings.

Of the 467 students diagnosed with ADHD, aged 6 to 13, 81.5% were male and 77.6% were white, 15.2% African-American and 5.6% were Hispanic. 69.2% received stimulant medication and the families of 36.4% earned under \$25, 000 a year.

Students with Special Education accommodations, whether ADHD or not, were disproportionately male. The students with ADHD had a larger percentage of males than the General Education group (81.5% to 63.6%). Approximately two thirds of students

diagnosed with ADHD received stimulant medications. Only .5% of non-Special Education students received stimulant medication. Special Education students, ADHD and non-ADHD, were more likely to live in low-income households of incomes of or below than \$25,000 than General Education students, 36.4% to 23.3%,

Approximately 63% of Special Education students with ADHD and 69.4% of non-ADHD Special Education students spend a majority of their time in General Education classrooms. Two thirds of those students with ADHD received at least one form of non-academic services. Approximately 91% of students with ADHD received academic assistance, though.

Since approximately 63% of students with ADHD are in General Education classrooms General Education teachers must be cognizant of this and should know how to successfully teach these students. Different teachers, though, have their own ideas on Special Education in general and how to teach students with ADHD in particular. In order to successfully teach students diagnosed with ADHD teachers should have a basic understanding of the disorder itself. In order to implement successful strategies a teacher must understand the symptoms of the disorder, why students are placed in General Education classrooms and the amount of experience schools and teachers have in teaching students with ADHD.

### Teachers' Perceptions and Training

Many teachers may not know much about ADHD and how to successfully teach students with ADHD. Vereb et al (2004) explored the relationship between teachers'



knowledge of ADHD, knowledge of common treatments and the acceptability of different approaches (medication and behavior management).

Elementary school teachers (K-6) were recruited at various in service trainings and could sign up to take part in the study. Forty seven teachers were accepted, 94 percent of them female and the group was equally distributed between the various grades. The group had an average of 13 years of teaching, 79 percent had a Master's degree and 64 percent had received prior training in ADHD. The teachers represented five different school districts in Pennsylvania; urban districts, rural districts and suburban districts.

Teachers were given a survey that was in four categories. The first had 31 true or false statements (with a 'Do Not Know' option) about their knowledge of ADHD. The second featured 12 true or false statements (with a 'Do Not Know' option) on their knowledge of treatments (medications) that are commonly used for students with ADHD. The third category asked teachers about the degree to which they agreed with students being given medication using a four point Likert scale where one equaled 'not at all likely' and four symbolized 'very likely'. Category Four asked teachers the level of which they believed behavioral management strategies were effective, using the same Likert scale.

The results indicate that there is a significant connection between what teachers know about ADHD and the level they agree with students being medicated. There was no relation between the length of time they had been teaching students with ADHD and their knowledge of ADHD. Their experience teaching students with ADHD demonstrated a moderate relationship with the ratings of medication acceptability. This suggests that such experience provides teachers with more exposure to medical interventions than other forms of intervention.

The researchers admit that the sample surveyed was small. Forty-seven teachers do not necessarily represent the entire teaching field and perhaps their educational experience and own academic career do not represent the experience and academic career of other districts or states. Although not discussed by the researchers, Likert scales may be a convenient way of gathering held beliefs but include possible variables. A 'two' to one teacher may not be the same as a 'two' to another teacher and thus the results would be different. The third and fourth categories appear to be subjective. Since they were asked the level of their acceptance on two separate issues there cannot be a universal correct or incorrect answer.

Miranda (2002) evaluated the effectiveness of a multi-component program in a classroom by comparing students with ADHD in a class where the teachers were trained how to deal with ADHD students and with a control group of teachers who had not been trained. The effectiveness was measured by three separate tasks; 1) neuropsychological tests that assess student inhibitory control, memory, perceptual-motor control and attention, 2) behavioral rating scales completed by the parents and teachers on how the students were functioning in their natural environments and 3) direct observations of the behavior in the classroom and a review of their academic records.

A control group of 21 of teachers was designated as well as a group of 29 teachers trained in behavior modification techniques, cognitive behavior strategies and instructional strategies. The teachers were found via an advertisement at the Center of Instruction for Teachers which offered courses for general-education teachers in primary schools who taught students diagnosed with ADHD. The student selection had a criteria of 6 separate categories that needed to be met; 1) they scored 12 or higher on the

Inattention-Disorganization and Hyperactivity-Impulsivity diagnostic criteria of the DSM-IV, 2) had had ADHD symptoms for over one year, 3) had the onset of the symptoms at 6 years or younger, 4) had an IQ of 80 or higher, 5) had an absence of psychosis or strong neurological, sensory or motor impairment and 6) had a lack of stimulant treatment.

The experimental group of students with ADHD included 29 children; 26 boys and three girls ranging from eight years and two months old to nine years and one month old. The control group included 21 students diagnosed with ADHD; 16 boys and five girls ranging from eight and half years old to nine years and four months. Most of the students were of low socio-economic status but reportedly did not have cultural or environmental disadvantages. There were English and Spanish speaking students.

In their courses the teachers had a class on general information about ADHD which aimed to provide the teachers with insight to help in the modification of existing biases in the behavioral explanation of students with ADHD. The second and third classes trained the teachers on specific behavior modification techniques such as positive reinforcement, token systems and how to deal with non-desired behavior using strategies such as extinction, time out and response cost.

The results of the study showed that with the teacher training the students exhibited better classroom management and were better at monitoring their own antisocial behavior. Learning problems and inhibition at school had been reduced. Miranda argued that this study proves that teachers should be trained in ADHD related techniques because of the better results. This is crucial because classroom management is dependent on the teacher and if they are better trained they will be better equipped to set up a classroom where

students with ADHD are better behaved and learn better.

This study included students with a low socioeconomic status but Miranda does not say how many students that was. Although the students reportedly had no cultural or environmental disadvantages, would a class of all poor students get different grades than a class of students who came from a higher economic placing? Both Vereb et al (2004) and Miranda state that teacher training and knowledge impact student behavior and their ability to self monitor, but would a school district in a higher economic placement have more money for training than a school in a lower economic region? This is important because the usage of certain techniques may benefit one group but not another. Graczyk (2005) will investigate these issues later in this chapter.

### Parent Strategies

In addition to teacher knowledge, parents trained in behavioral intervention strategies also affected their children's behavior. Bor et al (2002) studied how groups of parents using different behavioral strategies compared to a control group using the same behavioral strategy. Two variants of a behavioral family intervention (BFI) program were used comparing 87 preschoolers that exhibited ADHD symptoms. The families were randomly allocated to enhanced BFI (EBFI), standard BFI (SBFI) or the control waitlist (WL).

The families were predominantly lower class, with 68% of their studied children identified as white males. Sixty eight percent of the families included both a mother and father. On an average the mother was 29 years old compared to an average age of 32 to

the fathers. Fifty two percent of the mothers and 45% of fathers completed high school. Nine percent of mothers and eight percent of fathers had a history of drug use.

Families in both SBFI and EBFI attended 60-90 minute sessions with a practitioner. On an average the parents participated in 10 sessions that taught 17 core child management strategies. Ten of the strategies were designed to promote a child's competence and development. SBFI parents learned strategies such as offering the child praise, offering them attention, setting a good example, using behavioral charts, giving clear and direct instructions and using time outs.

Parents in the EBFI group received intensive behavioral parent training equivalent to the SBFI parents. They also learned of partner support and coping skills. The partner support introduced parents to a number of skills that would enhance their teamwork as parenting partners by improving communication and consistency of adopting the strategies. They taught positive ways of listening and speaking with one another. The coping skills were aimed to help parents experience personal difficulties such as depression and anxiety.

The results of the study showed that the children of both the EBFI and SBFI groups showed significantly lower levels of disruptive behavior than the children in the control WL group. There were no significant differences between the EBFI and SBFI groups. The researchers admitted that the study had its limitations. They were unable to find a standardized assessment of the children's diagnostic status with DSM-IV criteria for disruptive behavior. Also, many of the parents self reported and could have been dishonest in their reports or their perceptions of behavioral improvements may have been different than the perceptions of the researchers. However, this is consistent with the

studies following the effects of improved teacher knowledge on student behavior. The more someone is aware of different strategies the better student behavior has become.

### Cultural Knowledge

Graczyk (2005) explored how different techniques benefited certain groups over another. Urban educators from a large, urban Midwestern school district were surveyed on their perception of commonly recognized intervention strategies for teaching students with ADHD. Fifty two percent of the students in the district were African-Americans, with 35% Latino and nine percent white.

Three hundred and fifty eight pupil personnel service professionals (PPS) participated in the study. Of the PPS participants, 22% were school psychologists, 37% school social workers, and 41% were school counselors. 46% of the PPS participants were white, 38% African-American and 13% Latino. 84% of the PPS participants had a Master's Degree.

Of the 70 teachers included in the study, 66% were white, 19% African-American and 8% Latino. 60% of the teachers held a Bachelor's degree. All the teachers had been selected by their school's principal. In both categories at least 83% of the participants were females.

The participants were given a survey where they rated how confident they would be in managing hypothetical behaviors commonly exhibited by students with ADHD on a four point Likert scale with one meaning not at all, two just a little, three pretty much and four symbolizing very much. They also rated the effectiveness of commonly used intervention strategies using a five point Likert scale where zero equaled can't rate, don't know the

strategy, one equaled never effective, two equaled sometimes effective, three equaled usually effective, and four symbolized always effective.

The types of intervention were classroom interventions (CI) which included moving the child's seat near the teacher, modifying the student's curriculum, peer tutoring, cooperating learning groups, individual reward systems, classroom reward systems, loss of privileges, school to home daily reports, conferences with parents and conferences with parents. The second type was Mental Health Services (MHS) which included individual counseling and family counseling. The third type was Medication (MEDS) and the fourth was Ineffective Interventions (INEFF) which included restricted diets, restricted sugar intake, biofeedback and isolation in the classroom.

Among the PPS participants, there was a moderately positive correlation between their self confidence in managing a situation and the effectiveness for the Classroom Interventions and Mental Health Services strategies. The teacher's self confidence in managing a situation was moderately correlated with the effective ratings.

The findings of the survey showed that urban educators, both the PPS participants and teachers, had little confidence in the effectiveness of commonly used intervention strategies. For the PPS folk, the more exposure they had to ADHD the more likely they were to feel positively of the intervention strategies, especially medication. The teacher knowledge in ADHD was negatively associated with their perceptions that the strategies were effective. Both groups expressed 'just a little confidence' in their ability to manage a scenario of symptoms commonly exhibited by students with ADHD.

Graczyk et al (2005) realized that the principal's nomination of teachers could have influenced teacher response and neither group was asked the number of students with

ADHD they have had in their classroom or case list. Graczyk suggested that teachers who were nominated by their administration may feel obligated to give a certain or 'correct' response to please their principal. Reid et al (2001) continued this investigation by studying how cross cultural differences may result in how students with ADHD are assessed and treated. The researchers wondered if the same norms could be used for students from different ethnic groups.

Three thousand nine hundred and ninety eight students participated in the study; 2,124 of them were African-American while 1, 874 were white. The students attended nine urban elementary schools in the South East section of the US. Their ages ranged from five to eleven. All of the schools used were considered high risk on the basis of low socioeconomic status, the percentage of students performing below grade level and the number of students with excessive absences. A mean 38% of the students were on free/reduced lunch programs. One hundred seventy eight General Education teachers also took part in the study by being surveyed on the before mentioned students.

Approximately 76.4% of the teachers were white women, 18% African-American women, 4.4% white men and 1.1% were African-American men. Teachers completed a version of the IOWA CONNERS scale on each eligible child in their class.

The IOWA CONNERS is used to assess the dimensions of Inattention and Over activity (symbolized by IO) and Aggression/Defiance (symbolized by WA).

An IO mean for African-American girls was 3.94 and African-American boys was found to be 6.71. Conversely, the white girls were rated at 2.02 and the white boys were rated at 4.14. On the WA subscale the mean for African-American girls was 2.85 and 4.44 for African-American boys. The mean ratings for white girls was 0.95 and 2.08 for



white boys.

Using the WA scale there was a significant age by ethnicity difference. There was an increase of approximately two points for African-American males aged five to eleven while the white boys were considerably lower. The white girls were lower as well, the younger they were. For both IOWA subscales teachers rated the African-American students higher than the whites, meaning they exhibited more inattention, over activity, aggression and defiance. However, African-American teachers perceived there to be less difference between the ethnicities as their results for both ethnicities were closer to each other.

Reid et al (2001) pointed out that no empirical data on actual student performance or behaviors was collected in this study, thus all the findings were strictly based on teacher perception of the student. These may be accurate, but the teachers could also have misjudged the students.

With a growing number of students with ADHD in the classroom teachers and parents have different levels of knowledge on the disorder. The before mentioned studies showed that there are different levels of Special Education knowledge within the schools, among both Special Education and General Education teachers. Most teachers had not received adequate training about the disorder ADHD nor the strategies required to successfully teach diagnosed students. Since both Miranda (2002) and Vereb et al (2004) concluded that teacher training improved student performance and behavior, a lack of training ultimately hurts the students diagnosed with ADHD. Similarly, parent knowledge also resulted in lower levels of disruptive behavior in students (Bor et al, 2002).

## Section II: Medical Interventions

This section will look at studies that examined the examined how medication impacts a student's ability to read, focus and process information. In addition to understanding Attention Deficit Hyperactivity Disorder and how it may impact academic performance, teachers must also be aware of how medication impacts a student's behavior and academic performance. Students with ADHD may take stimulants such as Methylphenidate (Ritalin) and dextroamphetamine (Dexedrine) to control their impulsivity and hyperactivity. To successfully ensure that students diagnosed with ADHD learn teachers should be conscious of how medication affects a student's attention span and academic abilities and then the teacher can plan lessons accordingly. The following section will find that the use of medication does impact student's behavior (Ackerman & Dykman, 1991), ability to self monitor (Mathes et al, 1997) and academic performance (Ackerman & Dykman, 1991 and Silva et al, 2005).

### Behavior and Self Monitoring

Ackerman and Dykman (1991) assessed the effects of methylphenidate on three separate groups of students who had all been diagnosed with ADHD. There were 182 total diagnosed students, all between the ages of seven and eleven. 138 of the 182 students were males, 26 females. All but 18 of the students were Caucasian. One group consisted of students who were only diagnosed with ADHD. A second group consisted of

students who were diagnosed with ADHD and displayed extra hyperactive tendencies. The third group consisted of students diagnosed with ADHD, hyperactivity and who had aggressive tendencies. Half of each group had been diagnosed with a reading disability.

Each student was given a .3-.6 milligram dose of methylphenidate twice a day. Each dose was given at the same time each day and was given within a 90 minute wait period. The goal of this was to test for possible academic and behavior improvement using methylphenidate.

The study found that every child improved in both academics and behavior, but the students that did not have a reading disability did proportionately better than the students who did have a reading disability. The groups were further broken down to compare the effects of medication on the students with both ADHD with aggressive tendencies and a reading disability. This group was compared to one consisting of students with ADHD and a reading disability. The group consisting of the students with an additional diagnosis of aggressive tendencies improved more than the group without aggressive tendencies. However, the results showed that all of the groups improved.

Ackerman and Dykman (1991) gave methylphenidate to 182 students diagnosed with ADHD. The study did not mention what number of the students were regularly taking methylphenidate or any other form of medication. If a student receiving another form of medication was given methylphenidate the results of their test could have been different. The two medications may cause the child to get sick or perform differently than they would on only one dosage. However, since every child improved in behavior and academics, the results of this study would not be significantly different unless a large majority of the participants had been taking another form of medication. Also, the study

had a sample size of 182 diagnosed students with none of the participants being over eleven years old. The study does not examine the impact of methylphenidate on students over the age of eleven. Perhaps high school aged students would react differently to the medication.

Mathes et al (1997) assessed the effects of using a self monitoring procedure to enhance on task behavior who already received medication. Three elementary school boys were selected by their Special Education teacher. They had similar symptoms; disruptive behavior, failure to finish tasks, day dreaming, disobeying the teacher and inappropriate talking during the class.

Student A was nearly 12 years old and received 10 milligrams of methylphenidate twice a day. Student B, eight years old, received 20 milligrams of methylphenidate in the morning and 10 milligrams at noon. Kid C, 10 year old, received 37.5 milligrams of pemoline in the morning.

Every day each student would be alone with a teacher in a Special Education room where their behavior was monitored for 10 minutes. Each observation session was divided into equal 10 second intervals of 10 seconds each. The students monitored their own behavior and the percentage of 'yes' tallies were tabulated at the end of the study.

During the initial baseline procedure observations were done during the student's seatwork assignments for 10 minutes. The teacher didn't use any behavioral interventions. Each had been trained to self monitor their behavior and when a tone rang they were told to ask themselves "was I paying attention when the tone sounded?" They would check their answer and return to work. During the first few days of the study feedback was given by the teacher when the student didn't appear to be discriminating between on and

off task behavior.

The second phase of the study found the teacher taking away the tones but the participants continued to self monitor. The boys were told to ask themselves “was I paying attention” whenever he thought about it and would tally a response. The boys were encouraged to praise themselves if they answered yes. This phase lasted 3 days. Then, during the next few days they were congratulated on their ability to stay on task without the tones and the self monitoring sheet was removed. The participants were told to ask themselves “was I paying attention” whenever they thought about it. Then, the second baseline phase was implemented. Boy C did not participate. The students were without their self monitoring sheets, the tones or the teachers; reminders of what they should be doing. The teachers were instructed not to reprimand the boys during this phase.

The study found that all of the boys’ on task behavior improved significantly once the intervention strategy was applied and it remained high throughout the remaining month of the study. During the baseline phase Boy A’s mean percent interval was 40%, 38% for Boy B and 38% for Boy C. During the first intervention phase Boy A’s went up to 97%, Boy B’s to 87% and Boy C increased to 94%. During the next phases their scores remained significantly higher than they were during the initial baseline phase.

These students were in a controlled environment without any distractions. Unless they constantly worked alone in a room this would not be the case throughout their academic career. Usual classroom environments have distractions that could get the student off task. A student would know, or at least be familiar with, other students in a regular classroom thus could be easily distracted. Combine these distractions with a symptom of ADHD, inattentiveness, and the students could easily get off task. The lack of these variables

should result in a better performance, as seen in the study. Also, they were nominated by their teacher and the reasons, other than the fact that they had ADHD, were not discussed.

Both Ackerman and Dykman (1991) and Mathes et al (1997) found that the use of medication can positively impact the behavior and academic performance of students diagnosed with ADHD. Ackerman and Dykman showed that methylphenidate, applied without an intervention strategy, impacted student's performance while Mathes et al showed that medication, combined with a self monitoring procedure, also impacted student performance.

#### Academic Performance; Reading, Writing, Arithmetic

Silva et al (2005) studied the effectiveness of medication on a child's academic performance as well as comparing different types of medication. It compared the efficacy and safety of two long acting formulations of methylphenidate for students with ADHD.

Fifty four children, ages ranging from six to 12, were recruited from study centers and schools. 34 of the participants were boys, 20 were girls. 63% of the participants were white, 14.8% African-American and 22.2% were classified as 'other' (none of the participants were Asian-Americans). The criteria required that the students had been receiving a total daily dose of 20-40 milligrams of methylphenidate for at least two weeks prior to the study and that all the students had an IQ of at least 80.

Two different types of treatments were used, extended-release methylphenidate (ER-MPH) and modified release (OROS-MPH). Over a six week period the students were assigned to receive a sequence of 5 treatments; 1) ER-MPH (methylphenidate) at 20

milligrams, 2) ER-MPH 40 mg, 3) OROS-MPH 18 mg, 4) OROS-MPH 36 mg and 5) a placebo. These were administered randomly on 5 straight Saturdays. The children were to keep taking their regular dosages Sunday through Thursday but could not receive medication on Friday to avoid possible carryover effects. The study examined the effects of the medication during a 12 hour post-dose period.

Each Saturday the participants were given a math test with 400 problems and were told to do as many as they could in 10 minutes. Measures obtained were the number of problems attempted and the number correctly answered. During each class day vital signs and adverse effects were assessed as well. All adverse effects were measured in terms of start and stop dates, and the severity of the event (mild, moderate and severe).

The results showed that a significantly larger amount of math problems were attempted during the dosages than during the placebo. The amount attempted on the ER-MPH 20 mg dose was not significantly different than the OROS-MPH 18 mg and 36 mg dosages. However, the number of problems attempted was significantly greater with ER-MPH 40 mg than with the OROS-MPH 36 mg dosage. The ER-MPH 40 mg dosage produced significantly better results than the OROS-MPH 36 mg dosage, and other than that the pattern of correct problems was essentially the same as the problems attempted.

However, there were a small number of adverse effects reported during the study. While being treated with the ER-MPH 20 mg dosage two children had headaches, three had an effect while on the ER-MPH 40 mg (a headache, dehydration and dysmenorrhea), five on the OROS-MPH 18 mg (earache, fatigue, skin laceration, headache and toothache), six on the OROS-MPH 36 mg dosage (abdominal pain, breathing problems and headaches) and two even had effects while on the placebo. The researchers theorized

that these adverse effects were not related to the medication given during the study.

The aim of this study was to compare the efficacy and safety of two formulations of once given daily dosages of methylphenidate. The findings showed that ER-MPH 20 mg was equivalent to OROS-MPH 18 mg and OROS-MPH 36 mg throughout the first 10 hours of post-dose study. The ER-MPH 40 mg dosage was more effective than the OROS-MPH's. The administration of, and the amount of, medication that a student receives can effect their academic performance. However, a relatively small sample size could have resulted in ungeneralizable findings. Also, not every student in a classroom is on methylphenidate where the participants in this study were. Since the study was conducted in a controlled classroom environment, the students were not exposed to regular classroom variables such as friends and outside distractions. It is difficult to assume that the findings of this study would carry over into a normal classroom setting because in a regular classroom students will face distractions, thus possibly lowering the scores that the study presented. Silva et al recognized that because all the students were on medication they may have recognized the placebo. He did not mention another variable; students with ADHD generally lose interest and focus the more they do something. The task often becomes repetitive and boring, resulting in a decrease of academic scores. Since the students continually took math tests they may have become disinterested in math and performed poorer as the weeks went on. Six weeks of 400 problem tests may have frustrated the participants and thus negatively impacted their scores. The study did not provide the weekly scores.

In addition to the possibility that methylphenidate impacts math (Silva et al, 2005) and reading (Forness et al 1992), it may impact a child's handwriting (Tucha, 2001).



Twenty one boys diagnosed with ADHD participated in the study. Each diagnosed boy had a comparative boy acting as the control. Each pair was from the same neighborhood and were of similar ages. The students on ADHD received a mean dose of 26 milligrams a day. Seventeen of the students received their dosages twice a day and the other 4 received their dose once a day. All the students had learned of the study from an advertisement in the paper.

Each boy copied a story that was suitable for second graders. The first half of the diagnosed participants wrote while on methylphenidate first, and then the second time around without. Conversely, the other half wrote the first time without any medication and on methylphenidate the second time. Seven days passed between days of testing and retesting.

Every writing sample was analyzed by a group of examiners. They looked for form, alignment, spacing, legibility and uniformity. The examiners filled out a Likert type scaled ranging from one to five where one signified excellent and five represented poor.

During the medicated sessions the handwriting of the hyperactive boys did not differ from the control group on spacing, alignment, form, uniformity or legibility. However, a comparison showed significant differences in the amount of time needed to write the task. Following the withdrawal of the methylphenidate, the hyperactive participants had worse handwriting than the control group. The hyperactive boys off of the methylphenidate did not differ from the control group in the kinematic analysis of handwriting movements.

A small sample size makes it difficult to generalize these findings. Also, all of the participants responded to an ad in the newspaper and this method of recruitment may only appeal to a certain portion of the population. Perhaps a randomly selected group of

participants would reveal different findings. The use of a Likert type scale may produce different results than another form of assessment. It assumes that the examiners will interpret the intervals the same way.

Volkow et al(2004) assessed if methylphenidate, by increasing the dopamine in the brain, would enhance the saliency of a math test, making it more interesting. Sixteen participants took place in the study, 14 of whom were men. The mean age was 35 and the participants were selected from a group that responded to an ad. The participants received payment for taking part in the study. None of them were on any related medication.

Using a PET (positron emission tomography) each person was scanned four times under four conditions; a neural task preceded by a placebo (calcium carbonate), a neural task preceded by the administration of methylphenidate, a math test preceded by a placebo administration and a math test that was preceded by an administration of methylphenidate. The administered dosage of methylphenidate was 20 milligrams that was given orally an hour before the test and the neural tasks.

Each participant was given a math test using questions that they had selected before hand to ensure they scored at least 80%. The math problems were on cards and the cards were shown to the people. The participants received 25 cents per every correct answer. For the neural task the participants were presented with cards that showed images of scenery. The tasks began 15 minutes prior to an injection (to aid the scans) and continued for 45 minutes.

Each person provided was given a Likert type scale from one to 10. They rated their views on the math tests using the following terms; interesting, exciting, tiresome, boring, and motivating. The participants rated each term from one to ten with one being the

lowest and ten the highest.

The placebo/neural task was the condition of the baseline. The placebo/math task assessed the effects of the math task itself while the methylphenidate/neural task assessed the effects of the methylphenidate itself. The methylphenidate/math task assessed the combined effects of the methylphenidate and the math tasks.

A complex series of brain scans showed the interest level of each participant. The methylphenidate increased the extra-cellular dopamine in the striatum (the part of the brain that regulates inhibition and motivation (Weaver, 1990) when administered before doing the math test but not when administered before viewing the scenery pictures. Since dopamine cell activity is sensitive to the environmental stimulation the researchers theorized that the methylphenidate caused increase in dopamine depended on the condition of the administration.

The scans showed that the methylphenidate increased the ratings of interesting, exciting and motivating for the math test. The researchers claimed that this was proof that the methylphenidate influenced motivation and excitement level. However, a few possible variables may have influenced the findings of the study. Since the participants were far older than a student a student's reaction to the dosage could be completely different. Something that is exciting to an adult may not be what is exciting to a ten year old. A low sample size also makes the findings difficult to generalize, though other studies have shown that methylphenidate does increase attention and performance temporarily (Ackerman & Dykman, 1991). The payment of the people may raise suspicion to the findings as well. Since the participants were paid by the researchers they may have lied on their Likert responses and gave an answer they thought the researchers

wanted to hear. Since the participants selected the questions they received on the test, they knew what was coming and this prior knowledge may have skewed their responses.

The section examining the impact of medication on reading, writing and mathematics suggested that medication does have a positive impact on student academic performance. Tucha (2001) showed that methylphenidate improved student's handwriting, while Silva et al (2005) suggested that students on methylphenidate attempted to do more work than they did when not on medication. Similarly, Volkow et al (2004) showed that the use of medication held student attention and increased interest in the material being taught.

### Hearing and Motor Skills

Although math may not require the use of one's auditory skills the effects of methylphenidate on auditory vigilance, auditory processing abilities and receptive language abilities was studied as well (Keith and Engineer, 1991) The researchers studied auditory vigilance using an Auditory Continuous Performance Test (ACPT) that was based on a similar measure of auditory continuous performance. The test was designed to measure a child's ability to respond appropriately to specific cues, and to maintain attention and concentration on these tasks for an extended period of time. These are skills that can influence the performance on a wide array of cognitive and intellectual tasks and could affect a child's language and academic achievement.

Twenty children, ages seven to 13, were selected from a volunteer list at an Ohio program for ADHD. Seventeen of the selected participants were male and 19 were white. One was African-American and all students were middle class. Each had been diagnosed

with ADHD and had been prescribed methylphenidate to control their hyperactivity. All but two participants had been taking their medication for at least one year, the others at least one month.

Fourteen of the students were administered medication twice a day with four subjects on dosages of four milligrams, three on 10 milligrams, five on 15, two on 25 and six on 20 milligrams. All the students had normal hearing, corrected vision and normal intelligence. four of the children had been classified as having a learning disability. None of them had any communication disorders that were sufficient enough to interfere with their understanding of the verbal instructions of the test.

The tests used involved a simple identification task. Each child was tested twice, once on their medication and once without. The two tests were administered between one and three months apart so to reduce both learning and maturation effects. The child would listen and hear a word and respond to when that word was heard. The number of hits (acknowledgements of hearing the selected word) increased when the subjects were on methylphenidate, but without meds the number of hits decreased significantly. The performance was better when the subjects were under the effect of the medication. Thirteen of the 20 performed below the expectancy of their age when not on medication, but when they had received their medication nine subjects performed above their chronological age and the remaining students performed nearer to or at their chronological age level.

The second test tested the students' ability to filter words out from distortion. The average score for this improved significantly when on methylphenidate. The poor performance when not on medication shows that students have a difficult time

understanding auditory information when in unfavorable acoustic environments. They may not hear a teacher if the teacher's back is turned or if the teacher talks too fast.

The auditory figure ground subtest assessed the word discrimination abilities of the students in the presence of competing background noise. The results here improved slightly when on methylphenidate but the difference was not statistically significant.

The competing words subtest tested the student's ability to differentiate and process sounds when different speech stimuli was presented to two ears simultaneously. This subtest found that that information was lost on the students because they were unable to attend to relevant signals for extended periods of time. The child's auditory system functioned similarly to that of a younger child. When on the medication the students significantly improved and performed closer to their chronological age.

Since most children with ADHD are in a classroom that is age appropriate they receive auditory information at rates faster than they can process. Keith theorized that the child's attention problems can cause them to lose focus and fall further behind in their work.

This study had a very small sample size of 20 students and included only one non-white student. The students were tested twice, once on medication and once without. Would the results have been different if more students had been tested more than two times? Also, two of the participants had not been on medication as long as the others. The study did not reveal if their results were significantly different than the participants who had been on medication for over a year. The students who had been on their medication for over a year may have been used to its affects and therefore would not have been impacted as much as someone who had just been treated. However, the findings that the

methylphenidate did positively impact student's ability to hear and filter out the unnecessary noise met the researcher's hypotheses and are congruent with studies reviewed earlier.

While Ackerman (1991) found that the use of methylphenidate impacted behavior and academic levels, Konrad et al (2005) found that methylphenidate effects a child's attention and motor skills as well. Forty four children, age's eight to 12, were recruited from the inpatient Department of Child and Adolescent Psychiatry. Thirty seven of the participants were male. The children received two separate doses of methylphenidate; a small dose of .25 milligrams/kg and a high dose of .50 mg/kg. On 3 days all the students underwent a neural-psychiatric assessment an hour after the medication was given. On the other three days they took capsules of the placebo an hour before school and in both cases their behavior was assessed by a teacher.

Their sustained attention task involved the presentation of 50 series of 12 different patterns of dots. In each series there were an equal number of three dot, four dot and five dot patterns that were shown in random order. The child pushed yes whenever a target four dot pattern arrived and no at the nontarget three or five dots. The reaction time and error rates were recorded. A similar test was also given that recorded the students' stop signal reaction time.

The findings of the study showed that the methylphenidate had a significant effect on all dependent measures. The effects of the medication are greater when the child's activity level is higher. There was a generally small to medium effect size for the lower dosage of methylphenidate, but a medium to large effect size for the higher dose. There wasn't a significant correlation between the object measures of motor activity and the

objective measures of attention. The teacher ratings of inattentive symptoms and hyperactivity were positively correlated in all three conditions, though, where  $r = 0.36$  and  $p < 0.003$ . This is important because teachers will have medicated students in their classroom and may judge a child based on the student's perceived attentiveness. If a student sits quietly a teacher may view them as learning better, but perceived attention (better behavior) does not mean that the student is necessarily learning, though.

The section examining the impact methylphenidate has on a student's hearing and motor skills showed that the use of medication increased student's attention as well as their motor skills (Konrad et al, 2005). Similarly, the use of methylphenidate aided students' auditory processing abilities and receptive language abilities (Keith&Engineer, 2005).

Depending on their attitude towards Attention Deficit Hyperactivity Disorder and medication in general, teachers may vary in their response to the effects of medication on the behavior and academic performance of students diagnosed with ADHD. However, the results of the studies contained in this section showed that the usage of medication does affect both the behavior and academic performance of students.

Ackerman and Dykman (1991) showed that methylphenidate positively impacted academics and behavior. However, the results of this study remain open to interpretation. It found that the students remained better behaved and appeared attentive. However, this does not necessarily equate to a better academic performance.

Silva et al (2005) and Mathes et al (1997) found that methylphenidate positively impacted academic performance, but similar to Konrad et al (2005) they made some assumptions based on a control setting. Both studies created a controlled classroom



where the students improved academically. However, neither of these classrooms contained the normal classroom distractions such as noise and friends. They showed that performance may be increased in a quiet classroom, but that does not necessarily translate into a regular classroom setting.

None of the studies in Section Two examined the long term academic effects of medication. Unless a teacher has a student for more than one school year this may not be relevant to the teacher. Despite the assumptions and variables, the findings in section two do show that the use of medication can, and did, positively impact academic performance (handwriting and attentiveness) among students diagnosed with ADHD, at least in the short term. It is up to the teacher to determine if this short term improvement is adequate student learning.

### Section III: Interventional Strategies

Although the use of methylphenidate has been proven to temporarily affect a student's behavior and academic levels, many people still do not support its widespread usage. There is a large push for the use of behavioral interventions in place of simply medicating a child because medication creates a temporary result while interventions may produce more sustained results. There are many different interventional strategies that have been used.

The following section will explore studies that investigated various interventional strategies and how they impacted student learning. The studies range from using point systems to create student independence and self monitoring to the effects of wait time and

auditory stimulation. Teachers must be aware of different strategies because some strategies may not be appropriate for certain situations and certain strategies may not work for all students.

### Self Monitoring, Rewards and Coping Skills

One of many teacher's goals is for students to be able to monitor their own behavior and academic performance (Packenham et al, 2004). If a student is able to self monitor what they are doing they learn independence as well as give teachers time to work with other students. One strategy to make students self reliant is the use of a truncated functional behavioral assessment (FBA) procedure (Packenham et al, 2004). The FBA is implemented as a simplified procedure for teachers to identify the functions of a behavior, draft a hypotheses based on those functions and implement an intervention strategy.

A male teacher from Australia volunteered to be the participant in the study. He had taught a General Education classroom of 17 with mixed grades (third, fourth and fifth) for eight years. He had no experience with FBA and was to nominate two students who might benefit from intervention. Neither had been identified as disabled but both exhibited symptoms common to ADHD. He selected an eight year old, third grade, girl who talked a lot and constantly interrupted her teacher. The teacher had tried to use timeouts but they did not work. The other nominee was a nine year old, fourth grade, boy with bad grades. The teacher thought he had a learning disability. The boy was constantly off task and would not finish his work.

The researchers and teacher discussed the students, what they did wrong and why the

teacher thought they acted the way they did. Was their behavior driven by a desire to avoid work or to get attention? The teacher was given guidelines to form a hypotheses summary statement and three examples. The summary statement included situation, behavior and consequences. After the hypotheses was completed the FBA was designed. Intervention strategies were drafted collaboratively between the teacher and researcher.

The teacher concluded that the girl acted out as a way to get attention. The strategy was to give her a card to put on her desk if she wanted to talk to him during silent time. The card could only be used once a day. She used it. During the treatment her behavior increased significantly but on the one day that he did not use the intervention strategy she was disruptive. However, her good behavior lasted the entirety of the study.

The boy, the teacher theorized, was overwhelmed by the amount of work and long tasks and acted out to avoid doing it. A few strategies were used; to give the boy specific directions on what was expected, to shorten the assignments accordingly and to give the boy a minimum of what was desired. The teacher would tell the boy that he needed to write five sentences in the next two minutes. The teacher would come back two minutes later. The student received a card divided into five portions, for each day of the school week. If he had his work at the beginning of class he got a check on that day. At the end of the week the amount of checks would determine what prize he got. During the intervention his negative behavior dropped off significantly.

Some of the problems with the study, the researchers pointed out, were that FBA takes a long time to do and many teachers don't have that amount of time. Also, the researchers never saw the bad behaviors upfront and were reliant on the word of the teacher. However, FBA did give the teacher the framework to analyze and work with students and

the study proved that it is possible to draft a theory and strategy for an individual. The findings of this study are important because better behavior may lead to better academic performance (Packenham et al, 2004).

Similar to the Packenham et al study (2004) Fabiano (2003) wondered how teachers could guide students to a position of self reliance, except he used reinforcements. He performed a case study on an eight year old African-American male in the third grade. He was placed in a general education classroom that had two teachers, a general education teacher and a special education teacher. The student took no medication for his ADHD. His IEP had a special education teacher teach him reading and math in a small group. Although academically capable of doing adequate work he received poor grades because he would lose focus on the assignments and stop working all together. His general education teacher reported that he constantly disrupted other students and would get out of his seat without permission.

His general education teacher put together a behavior sheet using graph paper that they would review at the end of each day. If the student behaved well he could color in one square. Once all squares were colored in he would get a reward. The student showed no interest in the graph or the reward. The two teachers met with a councilor who suggested they use frequent and consistent awards to shape the boy's behavior. They began with using a video game he enjoyed. If he got a 75% or better on his daily behavior goal he could play the game for a period of time. Using his own interests the teachers got him to behave better. The goal was to increase the frequency of positive consequences that were earned for appropriate behavior. Since the only feedback he received was at the end of the day the consequences of his actions seemed lost. Moving his review up to

lunch time or having one in the morning and afternoon helped keep his behavior in check. The councilor and the teachers implemented a 'three reminder system' for appropriate behavior. The teachers would say "one more strike and you're out." This improved his behavior because he now knew exactly how far he could go until doing something inappropriate.

The student's behavior did get noticeably better over the year, once the new plans were implemented. The teachers used his own interest as a reward system, gave him more feedback and used a reminder system. The results of this study show behavioral interventions may work. The researchers did not follow the study up as the school year had ended so it is unknown if the strategies had any long term impact on the boy. Since only one child was studied the strategies may not be generalizable for all students with ADHD. The researchers do not claim, though, that these strategies would work for all children. They are ideas that have worked on shaping behavior and upon further research done by the teacher implementing them could be effective strategies to engage and assist the learning of students with ADHD.

Although the researcher does not explore this variable, perhaps a system with more or less than three reminders would have produced different results. If given five reminders would the boy have learned to act out inappropriately only four times as opposed to two times in the three reminder system? Perhaps the boy had learned that he had two opportunities to act up, knowing that he only got three reminders. The researchers did not look further into this; did the participant learn to perform desired behavior or simply to perform an undesired behavior less?

The use of reinforcers has been adopted by other teachers. Coles et al (2005) examined an individual treatment response to behavior modification. The study took place over an eight week time period during the summer. The researchers manipulated the presence of behavioral treatments for a group of four students. The response to the behavioral intervention was then investigated in different settings, such as recreation time, classroom time and daily life.

A group of 13 children participated, aged 11 to 12. Of the eight weeks, six were designated as treatment weeks. In the treatment weeks a point system was set throughout the day. Staff members continually gave behavioral feedback to the children and in turn the children traded in feedback points for backup reinforcers such as field trips and buttons. The students earned points for helping the staff members and following the rules, but could lose points for inappropriate behavior such as interrupting and teasing. If a student broke a serious offense (aggression or the destruction of property) they received a time out.

In the recreational settings the children started out with no points but earned and lost points depending on their behavior. In the classroom each child began each period with 100 points but could lose 10 points for each time they violated one of the set classroom rules. They could earn points for accuracy and the completion of their work. Each student received daily report cards and their parents attended weekly behavior meetings with the staff members.

During the two non-treatment weeks all of the components of the treatment weeks were removed. The children received immediate negative feedback if they acted inappropriately but never received any direct positive feedback, even if they obeyed the

rules. There was no point system designated and the parents did not receive any feedback from the staff members.

At the end of the eight weeks the study showed a large positive effect for the behavioral treatment system. When behavior modification was being used the students followed activity rules in recreational settings more often than when the behavior modification was removed. Work completion and behavior in the classroom setting also improved significantly with the use of the behavior modification.

Since none of the participants were exactly alike (different genders, different medication and different amounts) the study showed that behavioral interventions can successfully be applied to a wide variety of students with ADHD. However, the small sample size and a lack of racial diversity could make the study difficult to generalize. Also, different students could respond to the point system differently. They could become more focused on earning points and thus lose focus on the actual task that they were doing.

Strategies are not limited just to elementary school aged children, however. This was seen in the Volkow study (2004). Behavior of preschool aged children have also been shown to improve with the use of intervention strategies (Boyajian, 2001). Researchers set out to see the effects of a brief functional analyses with preschoolers exhibiting symptoms of ADHD.

Three boys, aged three to five years, were referred to the researchers by a parent, pediatrician or teacher. All of the boys were of lower to upper middle class backgrounds. They did not receive any medication and all displayed physical aggression. Two of the boys were white and the other was Hispanic. Each of them were in daycare for eight to 10

hours a day, five days a week. The instructional periods usually lasted two and a half hours and the participants were in General Education classrooms.

During the analog assessment phase the behaviors were assessed in four different conditions; play, positive reinforcement with attention, positive reinforcement with tangibles, and negative reinforcement-escape. In the play phase the boy had access to toys and no demands were made of him. During the phase where the participant received attention as positive reinforcement they got toys and received 30 seconds of adult attention contingent on the occurrence of a target behavior (yelling and pushing, etc). The teacher would play with the child and then say “I’m going to play with someone else.” As soon as the target behavior occurred the teacher provided the boy with attention. The attention could be praise or reprimands. The teacher ignored appropriate behavior because they were just concerned with how the child responded after the target behavior.

During the positive reinforcement with tangibles phase the participant got a toy and after two minutes the teacher took it away and put a lesser toy in its place. As soon as the target behavior was displayed the teacher gave the good toy back. In the negative reinforcement phase the teacher gave the child prompts (verbal, model, gentle physical). After interacting with the student for two minutes the teacher would say “no more play, you must clean up now.” As soon as the target behavior occurred escape was provided for 30 seconds. After the 30 seconds the teacher reissued the demands.

The phases were done again, in reverse order, but included specific requests such as “May I please have the toy” or the desired behavior was modeled for the boys. There was always a delivered consequence when the child complied.

In the first set of phases all three of the boys displayed their highest rate of bad



behavior. During the replication phase all the behaviors improved with a combination of verbal reminders of appropriate behavior and consequence based interventions. During both sets of play the behavior was constant.

The study demonstrated that behavioral interventions that address specific functions of a student's aggressive behavior can reduce the latter without the administration of medication. The researchers suggest that different variables may have influenced the results, though. Sometimes the study took place in different areas of the school. This could have confused the child, resulting in more aggressive behavior or made them nervous. The lack of follow up data does not show if the behavior remained constant or not. Although the participants were younger than most school aged children the findings support the findings of the studies discussed earlier (Coles 2005; Fabiano 2003).

Not only has a reward system and self monitoring changed behavior, but the use of technology has as well (Fenstermacher et al, 2006). This study investigated the effectiveness of a computer-mediated social skills training program on four boys with ADHD. The program showed specific social skill sequences to the children and their reactions were studied.

The boys ranged from 10 years old to 13 and were in 4th through 7th grade. Three of them were white and one was mixed, African-American and white. All of them met the DSM-IV criteria for ADHD and demonstrated less than 50% mastery of targeted social problems. Although no specifics or rationale was given on how they came to this conclusion, the researchers stated that the children appeared to have average intelligence.

The trainings and observations were held during the late Spring and early Summer months so not to interfere with school. They took place in two clinic settings that looked

the same and held the same equipment; each room had a one way observational mirror, and audio and video recording equipment.

At the beginning of each session the participants met two students that were selected by the researchers to be plants. One was male, the other female, and both were of similar age to the participants. The plants interacted with the participants and the researchers noted on how the participants responded to the plants. During the baseline section of the study the children interacted. Then, the participating boys viewed a series of interactive computer facilitated social scenarios without feedback. During the treatment phase the participants completed a number of computer instruction activities, viewed the scenarios again but this time with feedback, and participated in another role-play with the plants. During the follow up, they completed the program again, this time without feedback.

Each video showed scenarios of real world events that the boys could relate to. They were shown scenarios taking place in classrooms by boys their own age. Participant responses during the videos produced computer generated feedback regarding their skill usage, provided suggestions for appropriate decisions and administered reinforcement. Each response had been pre-assessed by experts. Decisions showing appropriate logic and use of the targeted social skills received higher points than poor behavior.

All of the boys demonstrated increases in mean levels of social problem skills, with the average increases ranging from eight percent to 39%. All of the boys maintained an increase throughout the entirety of the study.

Students with ADHD have been shown to lose interest in something the longer they do it and these students spent quite some time doing similar tasks. Thus, the longer they participated in the study the less they were willing to cooperate. This may have

influenced some of the results. The desired behaviors may have been met in a controlled setting, but this does not necessarily translate to desired responses in a natural setting. A regular classroom may have more distractions and variables, such as more students, frustration from class work and a dislike of the teacher. Although Fenstermacher et al did not mention this, the small sample size may be difficult to draw large conclusions from. Also, the decisions were pre-assessed by a series of experts. However, because these target responses were determined by the experts they were subjective. Perceptions of the decisions may not coincide with the perceptions held by others.

Since many students with ADHD are seen as outcasts and violent, they may have an added stress level to contribute to existing problems (Gonzales et al, 2002). Stress may prohibit them from focusing and learning. Gonzales et al studied the effectiveness of a stress management program on self concept, loss of control and the acquisition of coping skills in school aged children with ADHD.

Forty two children participated in the study, 33 of them males and nine females. 38% of the participants were white, 23.8% Hispanic, 16.7% African-American, 16.7% were considered mixed, and 4.8% of the children were Asian-Americans. All of the students were diagnosed with ADHD and their mean grade level was four. They were randomly assigned to three separate groups; a control group, Group One was taught stress management techniques by a therapist and Group Two which had parents teaching their children students stress management techniques at home.

Group One sessions were held before lunch in rooms with little distractions. Sessions were held twice a week for four weeks and lasted between 30-45 minutes. The parents of the Group Two students received instructions to use workshops and tapes with their

children. The control group received no intervention and during these studies followed their normal routine.

Groups One and Two participated in eight different sessions. Session One was the introduction and definition of stress, Session Two dealt with breathing, muscle relaxation and imagery. The third session taught exercise awareness and physical fitness. The fourth session taught about time being a stressor. Session Five was on assertiveness and learning to say no, Session Six on how to handle anger through patience, and Session Seven taught how to express emotions. The final session was on making friends and developing confidants.

Once the sessions were done the students in all three of the groups were post-tested on self concept, locus of control and coping skills. On the pretest 40% of the students claimed that stressful events were peer related, 36% were school related, 11% were teacher related and 11% were general fears such as being hurt. Two percent of students felt that stressful events were home problems. On the post-test 45% thought that stress was caused by their peer interactions, and 25% thought it was caused by school related issues. Ten percent of the children felt that stress was brought on by interactions with teachers, 10% attributed it to general fears and another 10% felt that home problems resulted in stress.

There were no significant changes in self concept although the mean scores were higher for the parent led trainings than the therapist led trainings and the normal routine of the control group. The researchers claim this proves that parents are the most influential people in the lives of students this age. No significant changes were found in the acquisition of coping skills either. Group One had more appropriate coping strategies,

though, and this shows that it is possible to train children with ADHD cognitive reasoning and life skills. No significant differences were found in the locus of control pre and post tests. The researchers attribute this to the locus of control being a personality trait which cannot be changed over a short period of time.

The researchers suggest that the sample size was too small to show any strong differences or changes in attitudes and skills. Although the researchers do not make mention of this different students could have reacted to the sources of information differently. They do point out that parents are influential but the participants may have simply been more comfortable with their parents than a therapist. Some of the students may have distrusted the therapist as well. However, the findings of this study show that a majority of stress is related to interactions with peers which shows that students with ADHD care about how their classmates view them. Although the study did not examine this, perhaps students who do not have ADHD have the same concerns as the students who are diagnosed with the disorder. The findings showed that diagnosed students have social concerns, but perhaps all students that age do, whether they have ADHD or not.

Another strategy was studied by Semrud-Clikeman et al (1999) by evaluating the effectiveness of an attention training program, coupled with direct training in developing strategies for problem solving, in a teacher selected school population.

A group of teachers from three middle class school districts in the Pacific Northwest identified students who could not remain attentive and who didn't complete their work. 51 total children participated in the study. They were divided into three separate groups. The first group, an ADHD-Intervention (ADHD/I) group consisted of 21 students, 18 of whom were boys and three were girls. Two of the students were African-American and

one was Asian-American. The second group was an ADHD control group (ADHD/C) which was made up of 12 students. The third group was a non-disabled control group with 15 boys and six girls. Of the students with ADHD, only two received medication. Eight had ADHD-Combined Type, 13 had ADHD-Predominantly Inattentive type. None of the students with ADHD had ADHD-Hyperactivity-Impulsive Type.

Each of the participants took a test on their visual and auditory attention. None of the diagnosed students performed well on these tests and five ADHD/C students did not finish the auditory test. The students then met in groups with a teacher, reviewed their scores and set goals for their next task. The visual task had the children find a target among an array of distractions. Each of the students completed with a score of 100%. During the auditory task the children counted targets heard on a cassette. After the tasks the students and teachers came up with a list of strategies to improve their visual and auditory attention, discussed and practiced them. Students learned problem solving variables designed by Kirby and Grimley (1986) which include understanding the task, assessing the effectiveness of the plan, monitoring progress towards task completion, breaking down long term goals into simple short term goals, and assessing their progress and changing their strategies to meet these assessments. They then took another test using these strategies.

Both ADHD groups showed a significantly poorer performance on both the auditory and visual pretests compared to the control group. On the pretest participating students averaged 110 correct responses to 112 correct responses for the controlled group. After learning the skills the ADHD/I students did significantly better on the second set of tests, earning 142 correct responses to 120 correct responses for the students who did not

receive intervention. The students with attention and work completion problems who did not receive intervention (ADHD/C) did not show any significant improvement.

This study shows that students with milder forms of ADHD can reorganize their cognitive structures. Thus, assisting these students to learn how to pay attention may be a good technique. However, there were a few limitations in the study. Semrud-Clikeman suggested that since so few participants received medication the findings may differ than they would be if more students received medication. She does not point out if the scores would have gone up or down with the use of medication. If a student had received medication they may have behaved better (the study does not mention how the students behaved), thus possibly increasing their responsiveness to the intervention strategies. If they were not on medication they may have been inattentive, thus not giving their full attention to the intervention strategies given. Also, she suggests that most of the participants had more difficulties finishing tasks than they did behavioral problems. If the students had more behavioral issues (none of the students had been diagnosed with ADHD-Hyperactivity-Impulsive Type) the results may have not been as good. Although the researchers did not mention this, the fact that students were nominated by teachers as opposed to being randomly selected may have an impact on what type of student was selected.

Not every student diagnosed with ADHD will necessarily have the same motivation and perhaps that can be attributed to the type of ADHD they have. Carlson, Booth, Shin and Canu (2002) studied how two different types of ADHD may influence student's motivation in learning. They compared the motivational styles of three separate groups; a 25 member ADHD Combined Type (ADHD/C) group, a 13 ADHD Inattentive Type

(ADHD/IA) group and a 25 member non-diagnosed control group.

The ADHD/C group consisted of 20 boys, five girls, 16 white students, four Hispanic students, three African Americans, one Asian and one 'other'. Twenty two students were on medication. The ADHD/IA group consisted of seven boys, six girls, 11 white students and two Hispanic students. Eleven of the students received medication. The Control group consisted of 17 boys, eight girls, four Hispanics, two African-Americans and two Asian-Americans. The differences in socio-economic status were insignificant. All students ranged from ages nine to 12. Most of the students who received medication received methylphenidate.

The students with ADHD were recruited from pediatric and neurology clinics. They all met the DSM-IV criteria for ADHD. The students in the control group came from an elementary school or had previously taken part in studies.

The researchers compared ratings given to the students by their teachers with self ratings. The students received three separate interview questionnaires. The first was to see how much they enjoyed learning and had questions such as "When I know I learned something new I feel good inside" and students would rate themselves on a scale of 10-100, with the anchors at 10 point intervals. The second questionnaire asked how they felt about school and had four factors; 1) a desire to avoid work, 2) a desire for self improvement and independent mastery, 3) a desire to share ideas and collaborate with peers on schoolwork, and 4) a desire to perform well to impress the teacher and be seen as academically superior. The third questionnaire was an Intrinsic vs. Extrinsic Motivation study with five parts; 1) a preference for easy work, 2) a curiosity vs. simply getting good grades, 3) an independent mastery vs. a reliance on the teacher, 4) an



independent judgment vs. teacher judgment and 5) an internal criteria for success and failure vs. an external criteria.

Carlson et al found that in all the questionnaires the students with ADHD answers were lower than the control group and the students with ADHD suffered from a low intrinsic motivation. However, in this the two different subtypes of ADHD differed a bit. ADHD/IA students were more likely to try to please teachers while ADHD/C students were more competitive. The teacher ratings and self ratings both showed that the ADHD students preferred less challenging work than the control group and were more likely to rate themselves based on external feedback. The teachers said that students with ADHD were more dependent on the teachers, were less motivated and were more easily discouraged. The teachers said that students with ADHD had poorer cognitive skills than the control group students.

The researchers suggested strategies that could be implemented to meet the needs of both subtypes. Since the students with ADHD/IA were unmotivated by their own intrinsic motivation they could benefit from working cooperatively and ADHD/C students could capitalize on their competitiveness by participating in learning activities that were game oriented. The ADHD/C students could benefit from public recognition of their work as well.

The participants were recruited for the study and were selected because they met the DSM-IV criteria for ADHD. However, the researchers did not explain how big the pool was that they selected the participants from. If they randomly selected the 48 diagnosed students from a large population of 500 students the odds of selecting a wide range of students would be increased. This would have given the researchers more generalizable

findings. Teacher feedback stated that students with ADHD preferred less challenging work and had poorer cognitive skills than students in the control group. The teachers were aware of what group they worked with, though. They knew which students had ADHD and which did not, and this knowledge may have influenced their ratings. Perhaps the teachers had pre-existing attitudes about the academic capabilities of students with ADHD and this could have influenced how they viewed the participants' work effort. Teacher perception of students may influence how the teacher views, and thus teaches, a student. However, the student's self reporting was consistent with the teachers' reports. Either they both agreed or students with ADHD viewed themselves in the same light that the teachers viewed them. The findings of the student's self reporting appear to mirror the findings of the Gonzales study (2002). Gonzales claimed that students with ADHD may have low self esteem. This may contribute to poor self reporting.

Students diagnosed with ADHD face assessments from their peers (Hodgens 2000). Hodgens' research studied peer based differences among boys diagnosed with ADHD. The study examined peer interactions and peer acceptance of three groups of boys ages eight to eleven and a half. The three groups were 1) students diagnosed with ADHD, combined type, ADHD-CT (n=15), 2) students diagnosed with ADHD, predominantly inattentive, ADHD-PI (n=15), 3) students who were not diagnosed with ADHD or any other disorder and were used as non-clinical controls (n=45). All the students were in grades three, four or five.

Twenty seven of the students diagnosed with ADHD were recruited from outpatient clinics for behavior and/or academic problems in the Department of Pediatrics. Twenty eight of the students with ADHD took some form of medication, but the medication was

not used within one day of the research. The non-clinical control boys were recruited using various methods; newspaper or radio advertisements and notes were sent home at various schools.

The boys were assigned to play groups based on the following restrictions: 1) each group consisted of one member of each ADHD type and two to three control boys, 2) no members of the groups had met before the study and 3) no group had mixed races so as to eliminate the chance of racial bias. Twenty African-Americans participated in the study, the rest were Caucasian. One Asian-American boy participated and was put in a Caucasian group. Each group would play and be recorded, and nominate students who fell into certain criteria. Students were asked “what student would you most likely play with?” and “what student would you least likely play with?” In addition, each student would nominate a student who best fit the following descriptions: 1) “a child who is very shy”, 2) “a child who is most likely to start fights or arguments for no reason”, 3) “a child who is most likely to be teased or picked on” and 4) “a child who is most likely to be left out.”

The study found that the boys with ADHD-PI were more likely than the boys with ADHD-CT to be nominated as a boy who is shy and were more likely to be left out. The boys with ADHD-CT were more likely to start fights or arguments but also more likely to reach out and be accepted by peers. The boys with ADHD-CT showed a higher level of sustained interaction. The researcher concluded that the students with ADHD-PI displayed socially drawn behavior which created social difficulty (Hodgens, 2000).

Thus, students with ADHD in a classroom may either remove themselves or feel too removed to participate in class work. The study did not mention what types of schools the

non-clinical boys came from. In a classroom setting, group work may not be separated by race, as was done in the study, so there inevitably will be interaction between races which could produce different results and dynamics. Although a large majority of students diagnosed with ADHD are male, there are females diagnosed with ADHD as well. The study did not look at them. As with the interaction between races in a classroom, there inevitably will be interaction between genders as well. However, the findings of the study seem to support the idea of students with ADHD feeling removed, or not being accepted, thus facing more of an obstacle to learn.

This section provided two separate tasks that a teacher can take on to better ensure students with ADHD learn. The first task is aiding a student monitor their own behavior and performance. Fabiano (2003) showed that using reinforcements improved student performance and Coles et al (2005) showed that a treatment response impact program improved work completion and student behavior. The second task is to provide students with coping skills. Fenstermacher et al (2006) and Semrud-Clikeman et al (1999) showed how training programs not only build self esteem but assist students in monitoring their behavior.

#### Auditory and Visual Stimulation

Looking for other possibilities that could help students with ADHD focus Abikoff et al (1996) evaluated the impact of auditory stimulation on students with ADHD. They distributed a series of math tests to different groups of students. Each student was given a test one grade level below where they were at. The tests were not timed and if the student

scored an 80% or higher they could move on to the next test, a level above. If the participant scored below 80% they would take the next lower test. A child's functional grade level was defined as the highest level that he scored at least an 80%.

Forty boys were selected for the study. Their parents were paid \$30 at the completion of the study. Half of the boys were diagnosed with ADHD, the other half were a non-diagnosed control group. Nine of the students with ADHD were white, eight African-American, three Hispanic. Twelve of the boys in the ADHD group were in special education classes and six of the boys received Methylphenidate with a mean daily dose of 17.5 milligrams per day. The children on medication had to be medication free for at least 24 hours before the test. Of the 20 non-diagnosed boys, 14 were white, four African-American and two Asian. The mean age of all the boys was nine years old. Before testing each boy came up with a list of his favorite songs and the musical artists who recorded them.

Prior to the second test session each boy was given a 10 minute tape of his favorite music. They were given a grade level tests that were given under three experimental conditions; 10 minutes of music, 10 minutes of background speech and 10 minutes of silence. The participants were put in different groups, each group had a tape with a different order (music, speech, silence vs. silence, speech, music, etc. ) Each non-diagnosed boy was paired with a boy with ADHD and they shared the same order.

Each subject generated three separate scores; the number of math questions that they attempted to answer, the number of correct answers and an accuracy percentage. Using the tapes, the groups did not differ much in the amount of attempted problems overall, nor was there a significant effect in the number correct. However, the students with

ADHD, while listening to any type of music, got more correct than they did with the background speech or silence. There was no difference found between the scores received with the background speech or the silence for the students with ADHD. The non-diagnosed students' scores did not differ with the different backgrounds.

The order of the sounds on the tape impacted the scores of the diagnosed students. The boys who had their music play first had more than double the right answers of the diagnosed boys who had the music second or third. When the music was first on the tape, they significantly answered more correct than the non-diagnosed boys.

The auditory stimulation did not negatively affect the performance of either the diagnosed participants or the non-diagnosed participants. The diagnosed group benefited from the music, whereas the tape did not change the scores of the non-diagnosed boys. When listening to music, the diagnosed boys increased the number of correct answers by 33% and 23% relative to their performance during the speech and silence respectively. In comparison, the non-diagnosed students averaged nine percent fewer correct responses when exposed to music than when working under silence or background speech, a non-significant difference.

Trying to explain the difference in scores the researchers theorized that perhaps the diagnosed students preferred faster music than the non-diagnosed and benefited from the energy of the music. However, 98% of all the participants chose rock and roll or rap. Perhaps the diagnosed students with music first did better because students with ADHD can bore easily and may have lost attention the more time they spent on the tests. Thus, a student who received the music third may have already lost focus and the sensation of the music was not enough to regain their attention. Overall, the students with ADHD seemed

to benefit from the facilitative effects of the appealing, highly noticeable stimulation provided by their favorite music. The findings of this study are important for teachers to be aware of because diagnosed students appeared to benefit from the usage of auditory stimulation. Despite the use of medication, this study supports the findings presented by Riccio (1996).

Riccio et al (1996) compared students with the hearing disorder central auditory processing (CAPD) that did not have ADHD to students with both central auditory processing and ADHD (CAPD/ADHD).

Students were referred to a university based research project that was specific to CAPD who demonstrated impaired central auditory function on the Staggered Spondaic Word Test (SSW; Katz 1962). All students demonstrated normal peripheral hearing. The 30 selected students' age ranged from nine years old to 12 years 11 months. The sample was composed of 24 boys and six girls, 28 white and two African-American. The students' mothers averaged 13.8 years of education, compared to 13.4 years for fathers.

The 30 participants were divided into two groups; those who demonstrated impairment of central auditory function but didn't meet criteria for ADHD in DSM-III and those who demonstrated impairment of central auditory function and did meet criteria for ADHD.

The participants were given the ACPT auditory test which was designed to measure the children's ability to attend and respond to specific linguistic cues and maintain attention on a specific task for an extended period of time. The auditory stimulation consisted of a one syllable word (dog). It was recorded in a typical American male voice and was played on a cassette. The test was randomized to play 'dog' every 100 words and

the sequence was repeated six times, lasting 10 minutes. The sound was adjusted to the comfort level of the student listening. The objective of the test was to measure the participant's ability to attend to and respond to specific linguistic cues and to maintain their concentration on a given task for extended periods of time.

The results of the test found that 84.5% of the CAPD students got the test right compared to 80.9% of the students with CAPD/ADHD. Although there was no significant difference found between the groups there was a tendency for the CAPD/ADHD group to have more difficulties with the tasks than the CAPD group. Other findings of the test, though, showed that the students with ADHD were capable of hearing most of the cues. Although the researchers found that the percentage of CAPD students who got the test right was higher than the CAPD/ADHD students, which was their hypotheses, it is important to see that the diagnosed students were able to process linguistic cues and still hold their attention for at least ten minutes. Working with Abikoff et al (1996) this shows that auditory stimulation does not necessarily distract students with ADHD and can even aid in their learning.

Tsal et al (2005) measured the performance of students with ADHD on four tasks that assessed the functions of selective attention, executive attention, sustained attention and orienting of attention. The goal was to examine whether or not students with ADHD revealed deficits in various forms of attention.

Twenty seven students with ADHD were selected for the study; 20 boys and seven girls with a mean age of nine years old. Their ethnicity was not discussed. All of the diagnosed students were located in various ADHD clinics and showed at least six of the nine symptoms on either the hyperactive-impulsive factor or the inattentiveness factor on



the ADHD IV rating scale. Five of the students were on medication but did not receive it during the study. A control group was designed as a comparison. This group consisted of seven students; six boys and a girl with an insignificant age difference (the control group was younger).

The student's selective attention was measured by the use of a search task. The children searched for a blue square that randomly appeared on a background, along with various other colored squares. Students were to signify that they saw the blue square by pointing with their right finger and signify its absence with their left finger. Each blue square was shown and remained on the background until the students responded. The participants were required to respond as fast and accurate as possible. Researchers found that the students with ADHD had a difficult time ignoring irrelevant and distracting information (the other colors) when performing a perceptual task on relevant information.

The student's executive attention was measured by the students responding up or down to an arrow located above or below a selected point and pointing either upward or downward. In one condition the students responded to the location of the arrow and in another condition responded to its direction. In both conditions the children had to ignore the irrelevant aspect of the arrow (its location during the direction condition and the direction during the location condition). Each condition was done randomly. 46% of the attempts by the diagnosed students either took longer or were incorrect compared to 8% of the control chances.

The student's sustained attention was measured by presenting a long series of stimuli to the children and they had to respond to a pre-specified target while withholding responses to the non-target stimuli. Participants were shown sequence of 320 colored

drawings of animals in the center of a screen. If they were told to look for a red horse they were to press a button when they saw a red horse. The target appeared 30% of the time. The rest of the time the students were shown something neither a horse or red, or a variation of the target (a white horse or red cat for example). 3 measures were used to assess the sustained attention: 1) a proportion of omission errors, 2) the standard deviation of reaction times in response time and 3) a proportion of commission errors.

The student's orienting of attention was assessed using a cost benefit task. The students responded to a stimulus preceded by a sudden onset at either of the target locations (a valid cue) or on the opposite side (an invalid cue). A white cross was shown at the center of a screen, along with white rectangles to the left and right of the cross. The target display had either a smiley face or a key and those would appear on either of the two rectangles. One of the rectangles was brighter than the other. Each test set consisted of 30 valid runs where the target appeared at the same location as the bright rectangle and 10 invalid runs where target appeared in the other rectangle. These were intermixed. Students were to respond as quickly and correctly as possible with their right finger to the smiley and left for the key. The two performance measures were: 1) the differences in response times between valid and invalid runs and 2) the differences in accuracy between the runs. These acted as indicators for effective orienting to stimulus location by comparing responses to targets appearing at expected or unexpected locations. Some of the children with ADHD deviated to the left showing no benefit of attending to the valid location (meaning a deficit in orienting) and the other students with ADHD deviated to the right, meaning the wrong location (deficit in disengagement). All of this meant that students had a difficult time benefiting from a cue that automatically attracted attention to

a specified location or an inability in disengaging and reorienting their attention to a different location.

All these studies showed different deficits among students with ADHD. Some could perform and behave better than others in certain fields (listening, attention, etc). However, the deficits in sustained attention were the most pronounced. This could mean that in a classroom students need only one thing to focus on; and that they have a difficult time trying to separate the relevant from the irrelevant. The researchers suggested that teachers leave images or notes on the board for a prolonged (that was not defined) period of time so students could take time processing the information or writing it down. An image or word that was briefly displayed may not be seen or processed by a student.

#### A Hands On Approach

Ervin et al (2000) evaluated assessment based intervention strategies for students diagnosed with ADHD inside a classroom setting. The researchers examined the applicability of functional assessment procedures using three students and explored the efficacy of a variety of classroom intervention strategies in promoting acceptable classroom behavior.

The students attended a school for children with behavior and emotional problems. The children were nominated for the study by their teachers. Student A was a 14 year old African-American male diagnosed with ADHD and Oppositional Defiance Disorder. He received 20 milligrams of methylphenidate three times daily. He was nominated for his motor behaviors (getting out of his seat and playing with random objects), vocal behavior

(humming and inappropriately calling out) and passive off task behaviors. His behavior was mainly a problem in his writing and science classes where he acted up during round robin reading activities and down time. His behavior was fine during the rest of the time. In the writing class he sat in the back corner of the classroom near a magazine rack that distracted him and he distracted himself by rummaging through his backpack. The researchers created a checklist with reminders of classroom routines. The boy checked his behavior and assessed himself. At the end of the period the teacher provided consequences (points) for good behavior. Although the study was not carried out after an initial test the participant's behavior improved significantly with the use of the self-assessment.

The teacher told the child to take notes on pre-designated important aspects of teacher lectures in order to keep him more focused. The percentage of intervals of being on task was significantly higher than the percentage of when he was not taking notes, 97.8% to 54.4%.

Since the researchers and teacher theorized that the child was being distracted by the magazine rack and his backpack they moved him out of the corner and to the front of the class. Before every class he put his backpack at the teacher's desk. His attentive behavior (appearing to pay attention to the teacher) was higher when he did not have access to the disruptive materials than it was when he did, 91.7% to 69.3%.

Student B was a 14 year old white male who did not receive medication. He exhibited many of the same symptoms as Student A; easily distracted and talking inappropriately. When he talked out of turn or said something inappropriate the teacher would stop class and scold him. When the boy talked the children laughed along with him. The researcher

and teacher theorized that these were attention grabbing techniques. At the end of each day he was given a self evaluation form to assess his behavior during class. He'd rate his behavior on a scale of zero (unacceptable) to five (excellent). The teacher would also fill one out. If the two forms, teacher and student, were similar he would get a point, if they were exact he would earn bonus points. During this study the percentage of intervals in which Student B was on task was higher when he self evaluated his behavior (94.7%) to when he was not monitoring his own behavior (48.7%).

Since the teacher normally gave the student attention when he disrupted class the second test had the teacher only giving attention for good behavior. Inappropriate behavior went uncommented on but desired behavior was met with praise. The percentage of intervals on task was higher (95.8%) when the teacher provided attention contingent on appropriate behavior than negative behavior (60.5%).

Student C was an 11 year old white male diagnosed with ADHD and serious emotional disorders. He received 20 milligrams of methylphenidate twice daily and one 100 milligram dose of imipramine daily. He was nominated for the study for his off task behavior, disruption, aggression and running away from school. His academic activities were independent and repetitive. When he acted up the teacher would reduce the amount of work he needed to do. Essentially, he was being rewarded for his poor behavior. During class the teacher would leave the children alone and grade papers.

The child complained of having to do too much writing and became frustrated during the assignments. The first test was to have him write using another medium. Using this, his on task behavior was better when provided with an alternative to the usual writing assignments (93%) than when he had the usual assignment (32%).

The second part of the Student C study addressed the issue of his being distracted by his peers. The teacher and researchers moved his seat to the front of the class where he could not see as many of his classmates. The percentage of intervals on task with a limited view of his peers was 98% to 26% when he could see everyone in the class. His disruptive behavior was lower as well, 25% to 0% when he had a full view.

In an interview Student C said that he preferred to work with his hands instead of simple analog tasks. The third study gave him the chance to partake in more hands on applied tasks and his on task behavior increased 96% during these tasks to 13% during the analog assignments.

The final study with Student C focused on how teacher participation affected student behavior. Since the teacher normally sat at his desk and worked Student C would become frustrated at the lack of help and acted out for attention. This study had the teacher wander the room and pay more attention to the students while they worked. With a more attentive teacher Student C's on task behavior increased to 91% from a two percent rate with no teacher proximity. Likewise, his disruptive behavior remained lower during teacher proximity conditions (4%) than no teacher proximity (55%).

The intent of the study was to examine the role of environmental factors on behavior so it did not necessarily focus on the academic performance of the child. Since Students A and C were on medication their results could have been influenced by the medication. It is difficult to determine if their results were the result of environmental factors or the medication. Student B was not on medication so his scores must have been the result of the environmental factors. Despite a small sample size the age of the participants was higher than normal (two 14 year olds and an 11 year old) and one third of the participants

were African-American.

Harris et al (2005) studied the effects that attention and performance monitoring made on student academics and behavior. They tested six elementary school students.

The students, all diagnosed with ADHD, attended an elementary school in a large, urban city. The school was located in a low to middle class neighborhood where half of the students were on free or reduced lunch. 40% of the school was African-American, 27% white, 15% Asian-American and 18% Hispanic. The school used an inclusion model for the special education students; they were integrated in general education classrooms and the special education teachers worked with the students in the regular classrooms.

The participants were either in 3rd, 4th or 5th grade and all of them were on medication and were allowed to take them at school. Unlike many of the other studies mentioned these students did take their medication during the study. The teachers of all six said that they had difficulty sustaining attention and their performance in the classroom was below level, even while on their medication. All had serious troubles spelling and received low or failing grades on spelling tests. Three of the participants were African-American and three were white. None of them had any additional special education diagnoses.

Experimental procedures were implemented during the language arts period. Monday through Thursday the students spent 15 minutes a day studying weekly spelling words. The list came from words that students had previously misspelled. Students were taught and learned a specific spelling procedure: 1) look at the word, 2) close their eyes and spell the word aloud, 3) study the word again, 4) cover the word, 5) write the word three times and 6) check to see if their spelling was correct. Throughout the study the

participants had a chart listing these steps for them. If they successfully went through the steps and there was additional time, they would do it again.

For this activity the on task behavior was defined as 1) students focusing their eyes on the spelling list, their practice paper or their self monitoring tally sheets, 2) executed any step in the spelling procedure and 3) asked for help if needed.

A momentary time sampling procedure was used to measure on task behavior. At three second intervals during the final 10 minutes of each of the 15 minute spelling periods, participants were observed one at a time on a rotating basis. As a tone rang, the appropriate student was observed and their behavior was coded as being on or off task. Each student was observed 50 times per session. The observations began five minutes after the start to allow the students to have transition time from one task to another. Students were not allowed to interact with the teacher and researcher to limit any possible social reinforcement.

The academic performance was defined as the total number of words a student wrote correctly when practicing the items from their spelling list. After the researcher and teacher looked at the student sheet, each participant was individually interviewed to obtain data on the perceived efficacy of treatments, preferences, recommendations etc. The students were asked “what did you like best about using the tones and graphing procedure to help you pay attention during spelling? What did you like least?”

Then, the children were told that they were going to learn a better way to pay attention. They were taught to ask themselves “was I paying attention” immediately after hearing a recorded tone. The tones occurred randomly, an average interval was 45 seconds with a range of 10-90 seconds. The child was taught to self record if they were on task whenever



the tone rang. The students marked yes or no on their tally sheets. After that they learned another strategy; to count the number of times they practiced the words correctly. Each time the child would record it on a graph.

During the initial spelling quiz the on task behaviors scores averaged 55% with a range of 48% to 82%. During the self monitoring performance, the mean on task behavior was 87% with a range of 84% to 99%. During the self monitoring of attention, the students' on task behavior averaged 94%. Thus, both the self monitoring performance and self monitoring of attention strategies had a positive effect on the task behavior. There was little difference between the two, regardless of which one was administered first. Harris claimed that the increased stability of these on task behaviors was important because stability of behavior is important for students with ADHD.

Following the test the students participated in an exit interview. Four of them preferred the self monitoring performance because it was more entertaining, they could say the words while they counted them and it did not involve any ring tones. They said that it helped them learn more words and they had time to practice more. With the self monitoring of attention students enjoyed hearing the beeps because they helped them stay on task. One of the students liked checking their sheet when they got a step correct. Another student said it was boring and the beeps were distracting.

The results of the study showed that the use of self monitoring procedures demonstrated significant increases of on task behavior. It found that self monitoring interventions have been productive for students in a General Education classroom. Despite the sample size of six participants being small, the study showed that intervention strategies can work.

Umbreit (1995) conducted a case study of a disruptive eight year old white male with ADHD. He was in the 3rd grade and often displayed disruptive behaviors during academic instruction. The boy displayed poor behavior in three classes (Language Arts, Math and Social Studies) and adequate behavior in three others (Art, Music and Physical Education). He took a five milligram dose of Ritalin twice a day; once before school and the second at lunch. His medication was allowed during the study. His teachers stated that the medication reduced much of his impulsivity.

During the classes that he disliked the boy would talk to his neighbors, make inappropriate gestures, walk around the room, tap his pencil and hand and refuse to do his work. These behaviors were not seen in the classes he enjoyed and when asked why he didn't like Language Arts, Math and Social Studies he said they were boring. The classes he enjoyed offered him a chance to use his hands and move around. To manage the inappropriate behavior the teachers and their aides developed a self monitoring program which offered tokens for good behavior. The teachers and aides claimed that it had not worked.

The researcher interviewed the teachers and aides and they all said that he performed poorly when he had other students around him. In all of his classes his seat was in the center of the room so there were constantly students in front, behind, and beside him. Regarding cooperative group work the teachers said that he had more problems when he worked with his friends. The subject was then interviewed and claimed that he did better independent work when he could get away from the other students, and did better in groups that did not include his friends.

For the study the researcher intervened in the three classes that the boy did not like. It

included 4 elements: 1) to sit by himself, 2) in cooperative activities he was assigned to groups that did not include his friends, 3) he was told to request a break whenever he wanted one. When he asked for a break he received a one to two minute break immediately, and 4) teachers ignored all his disruptive behavior that occurred during the intervention. The researcher, teachers and aides theorized that much of his behavior was to receive social attention.

Data was collected over seven weeks with the day each intervention started spread out over the first half of the time. During the baseline conditions the percentage of intervals in which disruptive behavior occurred ranged from 5% to 45% across the different classes. Appropriate behavior occurred during 5% to 45% of the intervals. As the intervention was implemented, all disruptive behavior was virtually eliminated and appropriate behavior happened almost all the time. Requests for breaks occurred only during independent activities and he stopped requesting breaks at day 20.

This study showed that an intervention package can work with diagnosed students in an inclusive, general education classroom. It virtually eliminated all disruptive behaviors in an inclusive environment. However, the participating boy was on medication which his teacher said reduced his impulsivity. Could the results be attributed to the medication instead of the interventions or perhaps the increase in desired behavior was the result of both the medication and the intervention. Umbreit (1995) found that better behavior increased, but this does not necessarily equate to better grades. Academic performance was not studied. The results that the intervention positively impacted behavior coincide with the findings of other studies, however (Fabiano, 2003).

Babyak et al (2000) evaluated effects of story mapping instruction on the reading

comprehension of four upper-elementary school students with behavior disorders. The purpose was to improve the reading comprehension of students with behavioral disorders using a validated strategy for teaching narrative text structure.

Four fourth or fifth grade boys attending summer school were recruited for the study. They knew each other, having attended the same summer school class five hours a day for six weeks. All had poor reading abilities. They could read at a first grade level but understood anywhere from 43% to 79% of what they read. They were all white, received free lunch at school and were integrated in General Education classrooms. The study sessions continued after summer school ended and three of the boys continued the study at home. One was unable to meet at home and left the study once school ended.

Initially the boys read the stories independently, then with the aid of a teacher and then again by themselves. Guided practice was given daily by reviewing what they had already learned. The boys graduated to independent reading when they required little assistance and scored 90% on story questions. To aid their comprehension teachers instructed the students how to map a story. The participants filled in the blanks of the following prompts: main characters, setting, problem, major events and story outcome.

Three measures were used to assess their comprehension of the readings; 1) they had to retell the story after reading it, 2) they answered questions about the story and 3) identified what statement best fit the story. The comprehension questions ranged from 'who was the story about' to 'how did the main character try to resolve the problem?'

During the baseline sessions, Boy A averaged a 55%, Boy B 50%, Boy C 50% and Boy D 60%. During instruction the median scores were 80%, 60%, 70% and 60%. Boy A did not participate in the independent reading because he left the study, but Boy B scored

a median of 90%, Boy C 80% and Boy D scored 100%.

Regarding accuracy scores, a rating of eight indicated that for each eight questions a boy answered correctly, one was incorrect. Boy A averaged 2.6, Boy B 2.0, Boy C 1.9 and Boy D 1.8. All their scores increased during guided practice. Boy A averaged 11.6, Boy B 13.6, Boy C 7.3 and Boy D 10.5

The researchers suggested that environmental influences could have influenced the results. Initially the boys learned the mapping techniques and the baseline sessions were held at school. By the time they got to their independent reading three of the four boys were at home. They may have felt more comfortable at home and thus performed better.

The findings of this study show that story mapping increased reading comprehension among students who had difficulties reading and understanding what they read. The strategy of mapping and teacher scaffolding seems to be an effective one for all students, not just ones with disorders. Most students could benefit from a teacher's assistance and the use of various other intervention strategies.

Antrop, et al (2005) investigated the activity level of 14 students diagnosed with ADHD during periods of waiting and non-waiting in the classroom. The researchers attempted to describe variations in student activity levels according to their environmental stimulation.

Fourteen boys, aged six to 11 years old, were recruited from rehabilitation for mental health care centers, school counseling centers and special school service rooms. All of the boys had been diagnosed with ADHD and all of them had previously taken part in another study anywhere from between four to 36 months before this one. Although that study was unrelated to this one, the researchers used separate staff to ensure that the boys

did not remember the researchers and staff members. All but one of the participants was free of medication. Although the parents gave consent for the study none of the boys knew that they were being studied.

The study took place in the school of each of the diagnosed boys. In each class a non-diagnosed boy was chosen at random as a control subject. The control could not have had any prior behavior problems. Since both boys would be in the same classroom they would both be presented with the same situations. Each pairing of boys were presented with two non-waiting class situations and 3 waiting situations; these were without any stimulation in the presence of non-temporal stimulation and in the presence of temporal stimulation.

On two successive school days the behavior of both the diagnosed and non-diagnosed students were videotaped. The actual experiment took place on the second day where their normal teacher announced he had to leave the room and that a student teacher was in charge. The student teacher was instructed not to interact with the students but could scold them if they became loud or disruptive. The teacher left for 15 minutes and none of the students knew how long he was to be gone.

Eventually five separate situations of 15 waiting periods were adopted; two non waiting situations, one randomly picked in the morning and one in the afternoon. In addition, they created three separate waiting situations: 1) waiting without any sort of stimulation, 2) waiting with non-temporal stimulation by the student teacher reading the students an age appropriate story and 3) waiting with temporal stimulation. For the latter, the student teacher instructed the children to check the duration of their teacher's absence by placing a large clock in front of the class and turning on a slow, ticking metronome to

enhance the temporality of the situation.

Teachers and parents rated the behavior of the children on a scale of zero (not at all) to three (very much). The scores were based on inattention, hyperactivity/impulsivity and Oppositional Defiance Disorder. The behavioral ratings for each student were compiled for two non-waiting scenarios and three waiting scenarios. The criteria for the ratings were 1) the degree of restlessness (i.e. motor activity), 2) the degree of noisiness (the production of any non-vocal sounds), 3) the degree of interaction between peers or student teacher, 4a) the degree of which the behavior of the child was seen as disturbing, 4b) the frustration tolerance of the student, 4c) the degree to which the child searched for extra stimulation.

The researchers found the boys with ADHD to have been restless, noisy, frustrated, disturbing and to have searched for stimulation. The control grouped boys did not behave in that manner. The diagnosed boys seemed to profit more from the non-temporal stimulation that was presented during the waiting periods compared to the control grouped boys. The effects of the temporal stimulation were found to be an additive for noisiness. The diagnosed participants obtained the highest activity rates in the presence of temporal stimulation during the waiting intervals.

Both sets of students became more restless and made more noise during the waiting intervals compared with the non-waiting intervals. Although the students with ADHD were more active across the board, both groups of boys became more active than they were when they weren't waiting. Thus, both sets pretty much acted the same regardless of whether or not they had ADHD.

Antrop et al (2005) admit to having some flaws in their study. The students with

ADHD did not act significantly more disruptive than the non-diagnosed boys and they attribute this to the possibility that the attention span of the diagnosed students may be 15 minutes. Since the researchers only watched 15 minute intervals perhaps the boys had no problem with that length of time. If there was a 20 minute interval the behavior would have become poorer. Also, the researchers theorized that after the first waiting period all of the boys could have predicted the length of the waiting and thus controlled their behavior for the allotted time. The findings are important for teachers because they show that attention spans for both diagnosed and non-diagnosed students did not greatly differ and that prolonged periods of inactivity may cause poor behavior in both.

This section examined how a variety of hands on approaches a teacher can take to better student academic and behavioral performance. Harris et al (2005) and Antrop et al (2005) saw that students diagnosed with ADHD have difficulties sustaining attention. There are a number of ways to remedy this; one being simply creating tasks that do not require much waiting or downtime and another is to use cueing techniques with students to keep them on task. Both Ervin et al (2000) and Umbreit (2005) suggested using strategic physical placement of students to decrease their stimuli. Teachers often place disruptive students in the back of the room (Umbreit, 2005) but by seating the student in front of the room their performance was shown to be improved.

## Conclusion

The studies reviewed in this chapter have shown that teachers and parents alike must educate themselves about ADHD. In order to reach, engage, assist and teach students



with ADHD it is important to understand the disorder, its symptoms and the possible strategies that can aid student learning. The administration of the stimulant methylphenidate has been proven as one such strategy. Although its effects may only be temporary, methylphenidate can assist a student to behave and learn at the same time. Another way to help a diagnosed student learn is by implementing strategic intervention strategies. These strategies range from auditory stimulation to a reward system.

The next chapter will summarize these findings, the history and debates discussed in Chapter Two and will suggest implications for teaching that could be done.

## Chapter IV: Conclusion

Meeting the academic and behavioral needs of all students, including students diagnosed with Attention Deficit Hyperactivity Disorder, is a task that all teachers face. Meeting the needs of the students with ADHD may be a more difficult task for teachers because the characteristics and symptoms of Attention Deficit-Hyperactivity Disorder do not coincide with expected classroom expectations. Since ADHD is becoming diagnosed more frequently, schools and teachers must learn strategies for teaching students diagnosed with ADHD.

One of the primary symptoms of ADHD is a difficulty sustaining attention (Weaver, 1994). This often coincides with the hyperactivity symptom. These two often result in inadequate academic performances by themselves. If a student is unable to sit still and pay attention to the teacher, or the source of information, they will have a hard time processing the information and learning the material. Having academic problems is also a symptom of the disorder. Thus, an inability to focus on the material combined with a predestined difficulty with learning creates an uphill battle for these students.

There is an ongoing debate in how to best teach, and treat, students with ADHD. The center of the controversy is whether ADHD can be treated using environmental strategies or biological strategies. Although both approaches have their pros and cons the biological approach is more common and accepted. Medicating students is seen as easier by all parties involved (families and teachers) as well as taking less time. Since the biological approach is being taken more often, the use of medication such as Methylphenidate is also on the rise. The use of Methylphenidate causes its own debates as well.

Methylphenidate and other stimulant medications have been shown to increase the attention span and task performance of students diagnosed with ADHD (Ackerman and Dykman 1991; Konrad et al, 2005; Silva et al 2005). Classroom behavior is often raised to the expected level and to the level of the ‘normal’ students in the classroom (Barkeley, 1990). However, as of now there is not adequate evidence that the use of stimulant medication remedies behavior or academic levels over an extended period of time.

The other side of the debate involves behavioral intervention on students with ADHD. This path argues that many of the symptoms of ADHD are influenced by environmental factors and can be remedied by changing the learning environment. This places the burden on the family as well as the school. This approach requires a more hands on approach from all parties involved and takes more time and energy than the simple use of medication. The intervention approach also necessitates specific intervention strategies designed and modified for the specific needs of each student with ADHD.

### ADHD: What Can Be Done

Public Law 94-142 is also known as the ‘Education for all Handicapped Children’ Act (Spring, 2002). This law, combined with 1990’s Americans with Disabilities Act, forbids discrimination against children who meet Special Education services requirements. They both guarantee that these students receive equal opportunities at an education. However, the findings of Chapter Three Section One raised questions about diagnosed students truly having an equal opportunity at an education.

Sixty Three percent of students with ADHD are in General Education classrooms (Schoes et al, 2006) and thus receive much of their education from General Education teachers. Unfortunately, not all General Education teachers have received training in how to successfully teach students with ADHD. The teachers who had received more information and training about ADHD and teaching techniques were found to be more likely to use the strategies and meet the academic needs of diagnosed students than teachers who had not received training (Glass, 2001). Better teaching training resulted in improved student academics, behavior and the ability to self monitor their own behavior (Miranda, 2002). In addition to the necessity of teacher training, Bor et al (2002) found that family involvement also impacts the behavior and academics of students diagnosed with ADHD.

Regardless of how much their teachers or families understand ADHD, children with the disorder face many obstacles that could harm their academic pursuits. Silva et al (2005) suggested that students lost focus the more time they spent on something and Antrop et al (2005) found that all the students in the study (diagnosed and non-diagnosed) behaved poorer the longer they had to wait for something. The findings of these studies suggest that students with ADHD should have assignments or tasks that can either be done in a short period of time or are split into smaller sections as to not intimidate the student or give them the time to lose focus. Since one of the symptoms of ADHD is the difficulty sustaining attention (Weaver, 1994) more concise assignments and tasks could benefit a student's behavior and academics. If the student did not lose interest and become disruptive perhaps their grades would improve and they would lose more.

Keith and Engineer (1991) suggested that diagnosed students have difficulties hearing something if it is said too quickly. This not only can jeopardize their access to the information, but Keith theorized that it may lead to frustration and undesired behaviors. Similarly, the findings of Tsal et al (2005) showed that students with ADHD had difficulties focusing on something that changed quickly. So, while the results of the studies performed by Silva and Antrop showed that diagnosed students benefit from shorter activities, teachers must be strategic in the amount of time given because the same students may have problems with an activity or discussion that moves too quickly.

Many studies were done on the effects of a reward system on student behavior (Coles et al 2005; Umbreit 2005). The usage of physical reinforcers such as tokens and small prizes motivated students to finish an assignment or to behave in a certain manner (Coles et al, 2005). The study found that diagnosed students responded positively to keeping track of something that they had an interest in. Each day the students could earn or lose points depending on their behavior. The study also found that using verbal reinforcements also proved to be successful in creating a desired behavior. Since students with ADHD are impatient and have difficulty delaying gratification (Weaver, 1994) they best responded to immediate feedback (Coles et al, 2005). If the student performed the behavior the teacher desired the teacher immediately acknowledged the student. This led the student to behave in this manner more often.

If a teacher uses a reward system with a student with ADHD the student may become reliant on the teacher because the teacher is the one giving the prizes. However, students with ADHD also responded to self monitoring (Mathes et al, 1997). The researchers

found that the usage of a simple ‘yes’ or ‘no’ checklist of on task behavior significantly improved the participants’ ability to stay on task (Mathes et al, 1997).

Medication was found to help diagnosed students hear and process information(Keith and Engineer, 1991) while using music helped students block out distractions and maintain focus on a task (Gonzales, 2002).

### Classroom Implications

It is difficult to monitor student behavior because it is subjective. I tend to believe that good behavior leads to better academic performance, though. A quiet student who appears to be focusing on the teacher or the given task should be able to process the information better than someone who is distracted by a friend or an off-task item. However, a teacher’s evaluation of student behavior is subjective. What someone considers appropriate behavior may be seen by someone else as disruptive and inappropriate. Many of the studies in Chapter Three state that appropriate behavior increased with the use of medication and/or intervention strategies (Ervin 2000; Harris et al 2005; Hodgens 2000). These either make the assumption that an appropriate behavior (however the teacher or researcher defined the term) results in a better academic performance or simply did not focus on the student learning.

I believe the most important thing a teacher can do to successfully teach students diagnosed with ADHD is to be educated about ADHD as a disorder as well as receive training about possible strategies that can be used. Training about the disorder will give teachers insight into their students as well as the symptoms that they can expect to

experience. A student who appears overly active in class may be seen as disruptive. A simple solution could be to send the child to the hall or Principal's office which would ensure they not learn the material being taught. However, if a teacher knew about and understood ADHD they may have some empathy towards the student and could devise a strategy that uses the energy instead of containing it.

Using visual and auditory stimulation would benefit the student's learning. Many students complain that their activities are not interesting and thus they refuse to do them or do them poorly. Using films or audio recordings may engage a student as well as helping them process the information presented. Again, teacher knowledge of ADHD may encourage teachers to allow things they may view as distractions. It can be easy to assume that a student listening to headphones in class is not paying attention and thus may be reprimanded. The reprimand could frustrate the student and create apathy about the lesson. If a teacher knew that music helps students focus the teacher may allow, or encourage, music in class.

Teachers should use class time and classroom space affectively. Teachers may have the urge to put a 'problem' child in the back of the classroom but this only creates more problems. Since students with ADHD are easily distracted placing them in a seat with limited access to their peers may help them behave and focus on the teacher. Sitting in the front row of the class not only gives a student a better view of the teacher and puts them in a better hearing range, but should also increase their behavior by omitting the amount of distractions. Similarly, diagnosed students may be noisy to get attention and the placement of a student in mixed groups with people they do not know may result in better behavior (Umbreit, 1995).

If behavior or task completion is a problem with a student the teacher can use props to help the student self monitor their own behavior or schoolwork. Depending on the age of the student various forms of rewards can be used, from points to tokens. Since having difficulties organizing and finishing work are symptoms of ADHD the use of a reward can help students learn a skill (organization) in addition to task completion. Although keeping students on task should benefit the teacher, student and class a reward system creates a dependence on the teacher. I believe part of teaching is to help children become independent so a reward system should be done in moderation and lead to self monitoring. Having a student create their own chart that keeps track of their behavior and work is ideal because they learn independence as well as staying on track behaviorally and academically.

### Implications for Further Research

Most of the intervention research has studied how to best control behavior in students with ADHD. While this is important to allow students the ability to focus on the material studied, most of the studies have not proposed strategies that best present information to students. It seems that a use of different mediums best aids student learning, such as breaking up activities, presenting information in a direct and regimented manner as well as using their energy instead of suppressing it. However, further studies could look at the



effects of using movement in teaching diagnosed students. How much movement can be used and when would a physical classroom become too distracting for a student?

Since a majority of diagnosed cases of ADHD are white males, most of the studies used a sample predominantly consisting of white males. However, are the strategies used for white males the same as for white females or African-American students? Further research could explore these questions and females with ADHD in general.

Another area that begs further research is the size of a classroom and the presence of teacher aides or educational assistants. Many of the studies discussed teacher aides acting as the primary teacher for Special Education students but what are the effects of their presence as a support network? Does the presence of two adults in a classroom increase a student's anxiety level or does it provide the attention needed?

Researchers could also further explore the long term lasting impact of the strategies implemented. Most of the results were for short test periods instead of the entirety of an academic year or for the duration of a child's academic career. What strategies do the students internalize and use for more than a month and what strategies do they abandon after a vacation or a difficult day? What is the long term impact of various intervention strategies?

## Conclusion

Attention Deficit Hyperactivity Disorder is being diagnosed at a high rate and teachers will be faced with the job of teaching students with this disorder. Odds are that each class

period will have at least one child diagnosed with ADHD and every child is different. They may be interested in different things and have different levels and subtypes of ADHD. Teachers need to take these differences into consideration and implement individual strategies for each student as opposed to simply relying on medication or one intervention strategy. Teachers should realize that all children, whether they are classified as Special Education or General Education, have the right to learn and much of this responsibility falls on them as educators. It is therefore important for all teachers to educate themselves about ADHD, its symptoms and possible strategies to enhance student learning.

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