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THE EFFECTS OF ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND
INTERNAL/CONTEXTUAL FACTORS ON ACADEMIC ACHIEVEMENT

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Abstract

Attention-deficit/hyperactivity disorder is one of the most common disorders that affects school aged children today. Children with attention-deficit/hyperactivity disorder experience many difficulties academically including under productivity and lower standardized test scores. The aim of this study is to determine whether internal and contextual factors known to affect academic achievement affect achievement in children with ADHD over and above that of ADHD.

275 participants between the ages of 8-12 were recruited for this study. 156 of the participants had ADHD and 119 participants were controls. First, a one-way ANOVA was completed to determine if the dependent variable, academic achievement, significantly affected ADHD. Then hierarchical regressions were conducted to determine if the independent variables (social skills, IQ, student-teacher ratio, and per pupil spending) significantly affected academic achievement over and above that of ADHD.

IQ significantly predicted academic achievement over and above that of ADHD. Social skills predicted academic achievement over and above that of ADHD only when using teacher reports of achievement as a measure. Student-teacher ratio significantly predicted academic achievement over and above that of ADHD. Per pupil spending only predicted academic achievement over and above that of ADHD when looking at teacher reported achievement.

The results of this study show that when educating students with ADHD there are many factors that influence academic achievement. Beyond inattention and hyperactive interventions, the internal and contextual factors looked at in this study should be considered to create the most successful learning environment for students with ADHD.

Table of Contents

Introduction.....	1
Methods.....	13
Results.....	19
Discussion.....	24
References.....	32

Introduction

Teachers face many problems each day in their classroom and teach many different types of children. It is the teacher's job to create an environment suitable for the success of all children and to make sure each child reaches the success that he or she is capable of. However, some children need more help than others and are put at a greater risk for academic failure. Attention-deficit/hyperactivity disorder, better known as ADHD, is a disorder found in many school children across the nation that negatively affects students' academic achievement. According to Barkley (2003), 6-9% of school-aged children have been diagnosed with ADHD. This means in a classroom of 25 students at least one of those students will have been diagnosed with this disorder. Children with ADHD require a great deal of attention from teachers, and according to a study by Arcia, Frank, Sanchez-LaCay and Fernandez (2000), teachers hold many misconceptions when it comes to attention-deficit/hyperactivity disorder. Close to two-thirds of teachers surveyed reported sugar intake as a cause of ADHD; and while many teachers suggest stimulants for treatment, 96% reported having no training regarding information about the stimulants (Arcia et al., 2000). Another study shows that over 50% of teachers believe that ADHD is caused by parental spoiling, and only 13% of teachers believe that ADHD students have a lower IQ than those without (Ghanizadeh, Bahredar, & Moeini, 2005). Teachers' lack of knowledge and negative attitude towards students with ADHD will place more stress on students with ADHD and create more struggles for them academically.

Attention-deficit/hyperactivity disorder is a disorder that is defined by highly active, inattentive, and impulsive characteristics (Barkley, 2003). When a child is thought to possess these characteristics at a degree abnormal for their developmental level they are

considered to have attention-deficit/hyperactivity disorder (Barkley, 2003). ADHD is broken into three subtypes. One subtype is the hyperactive subtype. Children diagnosed with this subtype have an excessive activity level. These children are often fidgety, have trouble staying in their seat, talk a lot, and make impulsive decisions. These children can be described as “driven by a motor” (Barkley, 2003). Second, the inattentive subtype is characterized by the inability to sustain attention, resist distractions, and persist in activities (Barkley, 2003). These children frequently appear off-task. They might have trouble listening, finishing work, remembering directions, etc. The final subtype is the combined subtype, where a child exhibits both inattentive and hyperactive symptoms.

Attention-deficit/hyperactivity disorder is highly prevalent among school-aged children. Various studies state different rates, however, most commonly cited is that 6-9% of school-aged children are diagnosed with this disorder. Prevalence rates across various categories such as gender, race/ethnicity, and socioeconomic status have also been studied. When it comes to sex, ADHD is more often found in boys. Male children are five times more likely to be diagnosed with ADHD than females (Barkley, 2003). Only 2-4% of school-aged girls have ADHD compared to 6-9% of school-aged boys. Studies that have looked at prevalence rates comparing ADHD to socioeconomic status have found inconsistent findings. A study by Lambert, Sandoval, and Sassone (1978), however, found that lower socioeconomic status was consistent with a higher rate of ADHD. However, a study that controlled for comorbid disorders, found that socioeconomic status was no longer significant in predicting the prevalence of ADHD (Szatmari et al., 1989). When looking across different ethnicities the same held true. When controlling for comorbid disorders ethnicity played no role in the prevalence of ADHD (Szatmari, 1992). A study did show that

when looking at only teacher rating scales there were higher rates of ADHD among African Americans than European Americans (Barkley, 2003).

Many follow-up studies have been done to determine the developmental course of attention-deficit/hyperactive disorder. However, there is still a lot left to be discovered and refined before concrete conclusions can be made. Typically most symptoms of attention-deficit/hyperactivity disorder develop by the time a child is around three or four years of age (Loeber et al., 1992). However, the first symptoms to arise are usually hyperactive or impulsive behaviors (Barkley, 2003). In the classroom, this child might be frequently talking and wandering about the room or distracting and interrupting other students' work and play time. It is when the child enters primary grades that problems with sustaining attention arise, paired with the continuation of hyperactivity (Barkley, 2003). This is also the age where comorbid disorders begin to arise. Barkley (2003) states that at least 40-70% of children with ADHD will begin to develop oppositional and aggression problems once they begin school. As the child continues through school, conduct problems will arise in almost 30% of children with ADHD (Barkley, 2003). Most studies have found that 80% of children will continue to have this disorder into their teenage years (Barkley, 2003). While the severity of symptoms often declines as a child reaches adolescence, this does not indicate that the child is out-growing the disorder. Discrepancies arise when looking into ADHD in adults. Studies have found that about 50% of all children diagnosed with ADHD will continue to experience symptoms into their adult lives (Barkley, 2003). Much is still to be learned about the developmental course of this disorder.

As mentioned above, many children with attention-deficit/hyperactivity disorder experience numerous co-occurring problems. These problems can be broken into two

categories. The first being internalizing problems, which includes anxiety, depression, and peer problems. Substantial evidence indicates a connection between ADHD and depression problems. Studies suggest that on average 20-30% of those with ADHD may have a mood disorder (Biederman et al., 1992). However, the connection between ADHD and depression is dependent on the presence of conduct disorder problems. If controlled for conduct disorder, ADHD is not nearly as likely to be connected to depression (Angold, Costello, & Erkanli, 1999). Children with ADHD also experience problems with peer relationships. Children with ADHD are often disliked and rejected by peers leading to fewer friendships. Again this rejection is heightened when the child also has co-occurring conduct problems. Peer problems are said to exist due to children's talkative, active, and impulsive behavior as well as their emotional expression (Barkley, 2003).

Children with attention-deficit/hyperactivity disorder also exhibit external co-occurring problems, which are the most common comorbid disorders. Children diagnosed with the combined subtype of attention-deficit/hyperactivity disorder are most likely to also have oppositional defiant disorder and conduct disorder. By the age of seven almost two thirds of children with ADHD will receive a diagnosis of oppositional defiant disorder or ODD (Barkley, 2003). Conduct disorder is a diagnosis that typically follows ODD in adolescent and late childhood. ODD and CD co-occurring with ADHD is likely to occur because of the severity of ADHD and the limits it places on emotion regulation. It also may occur because of family genetics and difficulties caused by the family environment. The heightened risk of ODD/CD combined with ADHD can often lead to substance use disorders in adulthood (Barkley, 2003).

Predicting Academic Achievement: ADHD

The co-occurring problem, however, that is very relevant to educators is the problems ADHD places on a child's academic success. Children with ADHD are found to have reduced intelligence, compared to controls, by 7 to 10 standard scores. Unlike other co-occurring problems, lower IQ scores in ADHD children are not connected to comorbid conduct problems (Mariani and Barkley, 1997). The relationship between ADHD and IQ hold further implications. In general, lower IQ scores predict lower academic and occupational achievement. Poorer academic and occupational achievement is also characteristic of ADHD (Kunsti et al., 2003). The link between ADHD and IQ has been thought to exist due to deficiencies in neuropsychological functions, specifically working memory. A study shows that most intelligence tests require the use of working memory and other neuropsychological functions to perform successfully (Mariani and Barkley, 1997).

Along with overall lower intelligence, children with ADHD experience many other difficulties when it comes to school performance. Attention-deficit/hyperactivity disorder tends to lead to lower scores on standardized achievement tests and overall under productivity. Some literature states that academic problems stem from cognitive impairments that are related to deficits in executive functions (Ek, Westerlund, Holmberg, & Fernell, 2010). Executive functions include functions related to attention, reasoning, planning, inhibition, and working memory (Biederman et al., 2004) A study done by Biederman et al. (2004) found that executive function deficits in children with ADHD contribute significantly to their under achievement. This study showed that all ADHD children perform lower academically compared to controls, but children with ADHD who

also showed executive function deficits performed lower than children without the presence of EFDs. More specifically this study found that children with ADHD and EFDs were three times more likely to have a learning disability than children just with ADHD (Biederman et al., 2004). One such function strongly related to academic achievement is working memory. Working memory is an individual's ability to retain information on a short-term basis. This causes students with ADHD to have difficulties completing assignments and attending to lessons being taught (Ek et al., 2010).

Other literature suggests that academic problems are related to a child's perception of his or her own academic abilities. It is self-fulfilling prophecy that if the child and adults perceive the child as incapable of academic success because of ADHD that child will underachieve (Ek et al., 2010). Research shows that children's confidence is linked to perceptions expressed by family, teachers, and peers. The negative perceptions of both family members and teachers can affect their willingness to interact or support children with ADHD thus negatively affecting the child's ability to succeed (Eisenberg & Schneider, 2007). When the child picks up on the negative perceptions of those around him, a self-fulfilling prophecy is created. The study by Eisenberg and Schneider (2007) exemplifies the negative perceptions that both parents and teachers hold for children with ADHD. The study found that on average parents, teachers, and the children themselves perceived that the ADHD-diagnosed children were performing poor in both reading and math. The negative perceptions were higher for girls diagnosed with ADHD (Eisenber & Schneider, 2007).

Literature also shows that ADHD increases the risk of a child to have learning disabilities. A child with ADHD is up to ten times more likely than a child without ADHD to

have a learning disability (Bledsoe, Semrud-Clikeman, & Pliszka, 2010). More specifically, studies have shown that at most 50% of children with ADHD have a learning disability for reading and at most 60% have a learning disability for math (Mayes, Calhoun, & Crowell, 2000). A study by Mayes et al. (2000) found that more than reading and math, children with ADHD showed a high number of learning disabilities in written expression. The study also showed that as attention problems increase so did academic problems. Those students with a learning disability and ADHD had the most risk of academic underachievement, followed by children with a learning disability and no ADHD and children with ADHD but no learning disability (Mayes et al., 2000).

Finally, studies have found that while ADHD has negative effects on academic performance, inattentive subtypes are at a higher risk for under achievement (Pastura, Mattos, & Araújo, 2009). A study by Marshall, Hynd, Handwerk and Hall (1997) found that the inattentive subtype performed lower when looking at academic achievement when compared to the hyperactive subtype. More recently a study by Massetti et al. (2007) found that only children in the inattentive subtype showed academic underachievement over time. The study followed children diagnosed with ADHD between the ages of 4-6 over eight years. The study believes that inattentive subtypes might be at a higher risk for academic underachievement due to lack of academic skills that lead to inattention. Massetti et al. (2007) state that inability to learn academic skills may cause children to stop attending to school work rather than the inattention causing the failure.

Overall it is clear that ADHD negatively affects academic achievement and performance when compared to children without ADHD.

Predicting Academic Achievement: Internal and Contextual Factors

Research states that children with ADHD are at a greater risk for academic underachievement. Pastura et al. (2009), define academic underachievement as “school performance below expected cognitive abilities.” This means that children who underachieve academically perform lower than their cognitive abilities or IQ; they perform lower than what is expected based on their IQ. Many contextual factors also contribute to academic achievement in students. One factor often researched is the effect of socioeconomic status of academic underachievement. Research has shown that SES does indeed impact academic achievement (Sirin, 2005). A family’s status determines a child’s resources at home and also determines what kind of classroom a child will experience and his access to educational resources. Understanding the relationship between SES and academic achievement is very important because the majority of a school’s funding stems from property tax. If a school is located in an area of low socioeconomic status, that school and its students are at a greater risk of academic underachievement compared to a school located in an area of higher SES families (Sirin, 2005).

Another factor often found in literature about academic achievement is the relationship between achievement and minority status and ethnicity. When it comes to this relationship, the most notable phrase in literature is “achievement gap.” This gap came about when studies looked at standardized scores of minority students compared to white students. In 2005, tests showed the gap in 8th graders for reading to be at 25 points (Ladson-Billings, 2005). The gap was slightly lower for mathematics tests. The gap can also be seen when looking at high-school drop out rates and college admittance. The minority groups having a higher rate of dropping out and lower rate of acceptance into college. Over

the years much research has been done on the cause of this achievement gap between ethnic groups. Ladson-Billings (2006) cites a study from 1960 where scholars suggested that the achievement gap was due to cultural deficits in children of minority ethnic groups. Other scholars state that stereotyping contributes to the low achievement of minority students, while the majority of the focus is on family background and resources both at the school and home. Much of the gap between minority and white students is also the result of the relationship between SES and academic success. While these factors are very important when it comes to academic achievement in equity in the US school system, this study is focusing on school and social factors that affect academic achievement.

Another factor found to influence academic achievement deals with social competence and peer relationships. Literature shows that social competence is a strong predictor of academic achievement. Wentzel (1991) states that children achieve higher academically if they are accepted by their peers. Students who are able to meet the norms of social interaction in a classroom are likely to have more academic success. These rules and norms create a classroom environment more conducive to learning, thus leading to higher achievement (Wentzel, 1991). Equally important to conducting oneself in a socially acceptable manner is a child's ability to maintain and have peer relationships. Research shows that having friends for both social and academic resources can lead to higher academic achievement (Wentzel, 1991). Alienated students are at a risk for negative school outcomes such as: low levels of academic engagement, grade retention, dropping out of school, and more frequent behavior based problems (Roseth, Johnson, & Johnson, 2008). Two theories that support the view that social competence and positive peer relationships positively influence academic achievement are Maslow's Hierarchy of Needs which states

that people need to feel like they belong. The fulfillment of this need will increase academic engagement and achievement (Roseth et al., 2008). The second theory is Baumeister and Leary's belongingness theory. This theory states that humans have the drive to maintain "lasting, positive, and significant interpersonal relationships" (Roseth et al., 2008). These supportive, lasting relationships will again increase academic engagement and achievement. Students with positive peer relationships have been found to have higher classroom grades, standardized test scores, self-esteem, and classroom participation. Students with positive peer relationships have also been found to have lower instances of negative behavior and substance abuse (Roseth et al., 2008).

Class size/teacher student-ratio also affects academic achievement. Research shows that there have been positive effects of small classes on average achievement for all students (Konstantopoulos & Chung, 2009). Smaller classes lead to better teaching, which in turn leads to greater academic success (Bruhwiler & Blatchford, 2011). Studies have shown that in both reading and math there was higher achievement in smaller classes. Those that benefitted from smaller classes the most were students of ethnic minority status (Bruhwiler & Blatchford, 2011). Literature also shows that small class sizes are particularly beneficial in the youngest years of schooling.

Another factor of interest is the effect of districts' per pupil spending as it relates to academic success. As stated earlier, socioeconomic status plays a large role in predicting the academic outcome of students. Not all students enter school with equal prior knowledge and experiences. Some children experience much more than others before walking into their first day of school. Wenglinsky (1991) claims because economic resources are so strongly associated with achievement, schools with more funds

available will be more conducive to producing high achieving students. American schools are also predominantly funded by local property taxes. Therefore, the wealthiest districts spend almost three times as much per student than more disadvantaged areas (Condrón & Roscigno, 2003). Wenglinsky (1991) study stated that spending measures do indeed play a role in student achievement. Particularly, spending on instruction and administration increases academic success according to this study (Wenglinsky, 1991). More money spent in schooling provides students with more resources, which decrease teacher to student ratio. Other studies have suggested that greater per pupil spending leads to higher achievement by spending more on highly educated teachers and technological resources (Condrón & Roscigno, 2003). Condrón and Roscigno(2003) found that as more money was spent the school's physical condition improved, more resources were purchased, student attendance increased, and the percentage of teachers with a master's degree rose. All of these improvements lead to an increase in academic achievement. For every \$1,000 spent on instruction per pupil there is on average an 8% increase of students passing proficiency exams (Condrón & Roscigno, 2003). Great inequality of student education stems from the large range of per pupil spending across the country.

Study Hypothesis

While there is both research regarding how ADHD influences academic achievement and how school and social factors influence academic achievement, little literature looks at how factors affecting achievement influence children with ADHD beyond the academic limitations already associated with the disorder. This study serves to more specifically identify how school factors influence achievement in children with attention-

deficit/hyperactivity disorder, therefore, enabling teachers to create the most successfully environment for students with ADHD. This study will look at how IQ, student-teacher ratio, per-pupil spending, and peer factors affect academic achievement in children with ADHD above and beyond known academic underachievement.

Methods

Participants

All 275 participants are school-aged children between the ages of 8 and 12. There were a total of 156 ADHD participants and 119 controls. These children were part of a larger study at Penn State's Child Attention and Learning lab between the years of 2005 and 2011. The children attended 62 different schools across 28 schools districts in the Commonwealth of Pennsylvania. The schools were predominantly from Central Pennsylvania. Children were only included in the study if they were between the ages of 8 and 12 and free from other psychological disorders (autism, seizures, etc). Participants also had to be willing to be free of ADHD stimulants for a designated period of time prior to completing the tests.

Recruitment

There were multiple phases in recruiting the participants for this study. The initial phase of the recruitment consisted of a brief phone screen. The phone screen served to eliminate participants who were on the Autism Spectrum, were mentally retarded, had a sibling participate in the study, had previously participated in the study, or were taking a medication that would alter the results of the study. Children taking an ADHD stimulant also had to agree to stop taking medication 24-48 hours in advance, depending on the medication, prior to completing their lab visits. If participants met the above criteria they moved on to the next phase.

The next phase consisted of questionnaire packets sent to both the parents/guardians of the child and a child's teacher that was indicated on the phone screen. The questionnaires included the Behavior Assessment Scale for Children – Second Edition (BASC-2), the Conners' Rating Scale, ADHD Rating Scale, Teacher Social Skills Rating Systems (TSSRS), and the Teacher Peer Relationship Scale (TPRS).

The Behavior Assessment Scale for Children- Second Edition (BASC-2) has two versions. One version is to be completed by parents, the other by teachers. There are two forms per version. The two forms used in this study were for the age ranges 6-11 and 12 and above. The questionnaire for parents included 160 statements (6-11) or 150 statements (12 and above) to be rated on a 4-point scale ranging from “never” to “almost always.” The teacher questionnaire used the same 4-point scale but only consisted of 139 statements. The BASC-2 includes ratings of Adaptive Skills, Behavioral Symptoms Index, Externalizing Problems, Internalizing Problems, and School Problems (teacher forms only). The indices measured on the BASC-2 include Adaptability, Activities of Daily Living (parent form only), Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems, Depression, Functional Communication, Hyperactivity, Leadership, Learning Problems (teacher form only), Social Skills, Somatization, Study Skills (teacher form only), and Withdrawal.

Parents and teachers also received the Conners’ Rating Scale. Parents received the long form of the Conners’ Rating Scale, which has 80 items. Subscales in the parent’s long form included: Oppositional, Cognitive Problems/Inattention, Hyperactivity, Anxious-Shy, Perfectionism, Social Problems, Psychosomatic, Conners’ Global Index, and DSM-IV Symptom Subscales. The teacher received the short form of the Conners’ Rating Scale, which consists of 28 items. Subscales in the teacher’s short form include: Oppositional, Cognitive Problems/Inattention, Hyperactivity, and ADHD Index.

Parents and teachers also received the ADHD rating scale. This scale measures the frequency of ADHD symptoms. The scale looks at inattentive, hyperactive, and impulsive symptoms. The frequency of these symptoms are rated by indicating that the symptom

happens, “never or rarely,” “sometimes,” “often,” or “very often.” There are 18 items, with each of the symptoms of ADHD based on DSM-IV criteria. Parents and teachers are asked to reflect on the frequency of these symptoms over the past 6 months.

ADHD Group Criteria

For the child to be considered an ADHD participant, at least one parent and one teacher screen index had to be above the 84th percentile, or have a T-score greater than or equal to 61. The indices from the BASC-2 reviewed were the Hyperactivity, Aggression, Conduct Problems, and Attention Problems. Also reviewed were the Oppositional Problems, Cognitive/Inattention Problems, Hyperactivity, ADHD Index Subscales from the Conners’ Rating Scale. Finally the teacher and/or parent had to indicate six symptoms combined on the ADHD Rating Scale as happening “often” or “very often.”

Control Group Criteria

For a child to be considered part of the control group. All screen indices had to be lower than the 80th percentile or have a T-score less than or equal to 58.

Laboratory Testing

After the participant completed the screening questionnaires and was considered either an ADHD or control participant the child and the parent who filled out the questionnaire was asked to come into the laboratory for a testing session. During this first testing session the child completed the Wechsler Intelligence Scale for Children- Fourth Edition (WISC-IV), Wechsler Individual Achievement Test-Third Edition (WIAT-III), and various computer tasks. In order for the child to be eligible for a second laboratory visit, no participant could have an IQ below 80. In addition, no control participant could have an IQ higher than 110. There was no IQ cap for participants with ADHD.

While the child completed visit one testing, the parent completed the Diagnostic Interview Schedule for Children Version IV (DISC-IV). This interview seeks to confirm the diagnosis made from the completed questionnaires. In order for a diagnosis of ADHD to be made from the DISC-IV, a set of criteria must be met. The interview first begins with general questions related to ADHD, which most parents will answer yes. The next set of questions revolves around the frequency, duration, and intensity of ADHD. If a parent endorses the symptoms to a level considered clinically significant, the final set of questions asks about the age of onset, impairment, and treatment. Parents also complete the Parent Social Skills Rating System (PSSRS) and other questionnaires to determine more about the child's behaviors.

Independent Variables- Factors affecting Academic Achievement

The factors affecting academic achievement looked at in this study include both internal (within the Child) and external (school related) factors. The internal factors that affect academic achievement used in this study are social skills and IQ. In order to measure the social skills of both participants with and without ADHD, three different measurements were used. The first measurement was the Teacher Peer Relation Scale. The second measurement was taken from the Behavior Assessment Scale for Children-Second Edition (BASC-2). From the BASC-2, the Social Skill Scale was used from both the parent and teacher questionnaires. In this measurement, positive peer relations were assessed. Therefore, the more social a child was the higher he was on the scale. The third measurement was the Parent and Teacher Social Skills Rating System. Teacher received this questionnaire as part of the initial screening process. Parents only completed this questionnaire if the child was brought in for testing. The parents responded to the

questionnaire while their child was completing the laboratory testing session. The Teacher Social Skills Rating System (TSSRS) rates a child on three subscales: cooperation, assertion, and self-control. There are ten items per subscale. The only addition to the Parent Social Skills Rating System (PSSRS) is an additional subscale, which measures responsibility. The parent questionnaire contains 38 items, two of the items account for two subscales.

The second internal factor that affects academic achievement used in this study is IQ. This measurement of intelligence was taken from results of the testing the child completed during his first laboratory visit. The intelligence test used was the Wechsler Intelligence Scale for Children (WISC-IV) . The child completed four subtests, which include matrix reasoning, vocabulary, number order, and letter-number sequencing. Participants IQ in this study ranged from 73 to 152.

Two external or school factors that are known to have an affect on academic achievement were also looked at in this study. The first external factor was student-teacher ratio. The data was taken from the National Center for Educational Statistics (NCES) as reported on greatschools.org. All schools were from Pennsylvania where the average student-teacher ratio is 15 (greatschools.org). Most elementary or middle schools in this study are from Central Pennsylvania. 62 schools were researched across 28 school districts. The student-teacher ratio ranged from 8 to 26.

The second external factor looked at in this study was per-pupil spending. Per-pupil spending is reported by district. Once again there were 28 districts in this study. Spending ranged from \$8,460 to \$12,430. The average per-pupil spending in Pennsylvania is \$10,000 dollars. This data was taken from the National Center for Educational Statistics (NCES) as reported on greatschools.org. Private schools did not report this data, therefore,

when looking at per-pupil spending private schools were excluded from the analyses.

Dependent Variable- Academic Achievement

In order to measure academic achievement in students with ADHD, multiple measurements were looked at. The first measurement used was the Wechsler Individual Achievement Test-Third Edition (WIAT-III). Within the WIAT-III there are three subtests used during the laboratory visit.. They are word reading, numerical operations, and spelling. In this study the three score were combined to create a look at the overall achievement of the child based on these three subtests. The second measurement used was Learning Problems, School Problems, and Study Skills from the BASC-2. These subscales were taken from the BASC-2 teacher form. The third measurement is taken from the SSRS, the Teacher SSRS standard score on academic achievement index.

Results

One-Way ANOVA

A one-way ANOVA was first completed to determine the relationship between ADHD status and the dependent variable (academic achievement). The different measures of academic achievement included Teacher BASC-2 Learning Problems, Teacher BASC-2 School Problems, Teacher BASC-2 Study Skills, WIAT-III Word Reading, WIAT-III Numerical Operations, WIAT-III Spelling, and TSSRS Academic Achievement Index.

Results showed that in all measures of academic achievement children with ADHD showed lower achievement. Children with ADHD had lower academic achievement as indexed by the WIAT-III Word Reading, $F(1,274) = 26.56, p < 0.001$. Children with ADHD had lower academic achievement as indexed by the WIAT-III Spelling, $F(1,252) = 48.25, p < 0.001$. Children with ADHD had lower academic achievement as indexed by the WIAT- III Numerical Operations, $F(1,272) = 25.71, p < 0.001$. Children with ADHD had lower academic achievement as indexed by the TSSRS Academic Achievement Index, $F(1,109) = 37.248, p < 0.001$. Children with ADHD had a lower academic achievement as indexed by the Teacher BASC-2 Study Skills, $F(1, 273) = 529.65, p < 0.001$. Children with ADHD had a lower academic achievement as indexed by the Teacher BASC-2 School Problems, $F(1,275) = 541.94, p < 0.001$. Children with ADHD had a lower academic achievement as indexed by the Teacher BASC-2 Learning Problems, $F(1,276) = 188.85, p < 0.001$. (See Table 1)

Table 1: Means and Standard Deviations of Academic Achievement by Group

Dependent Variables	Control (n=119)	ADHD (n=156)	P-Value
WIAT-III Word Reading	109.07(10.13)	101.05(14.67)	.000
WIAT-III Spelling	111.92(13.89)	99.63(14.18)	.000
WIAT-III Numerical Operations	109.2(14.977)	99.72(15.73)	.000
Teacher BASC-2 Study Skills	58.5(5.05)	41.96(6.53)	.000
Teacher BASC-2 School Problems	42.48(4.73)	60.58(7.63)	.000
Teacher BASC-2 Learning Problems	43.30(4.062)	56.81(10.317)	.000
Teacher SSRS Academic Achievement Index	102.45(7.71)	89.92(11.61)	.000

All measures of academic achievement were significantly affected by a diagnosis of ADHD.

Factor Analyses

To simplify the independent and dependent variables, summary variables were created by running factor analyses for the various measures of academic achievement and

social skills.

The first factor analysis summarized social skills. The measures analyzed included Teacher Peer Relation Scale Positive, Teacher Peer Relation Scale Negative, Teacher Peer Relation Scale Sum, Parents SSRS Social Skills Index, Teacher SSRS Social Skills Index, Teacher BASC-2 Social Skills, and the Parents BASC-2 Social Skills. Communalities ranged from .748-.963. Among the measures two factors were found with eigenvalues over 1. The first factor represented teacher reports of social skill (eigenvalue= 4.69). This factor accounted for 67% of the variance. The second factor represented parent's reports of social skills (eigenvalue= 1.10). This accounted for an additional 16% of variance.

The second factor analysis summarized academic achievement. The measures analyzed included, WIAT-III Word Reading, WIAT-III Spelling, WIAT-III Numerical Operations, Teacher SSRS Academic Achievement Index, Teacher BASC-2 Learning Problems, Teacher BASC-2 Study Skills, Teacher BASC-2 School Problems. Communalities ranged from .771-.946. Among the measures two factors were found with eigenvalues over 1. The first factor represented teacher reported achievement measures (eigenvalue=4.052). This factor accounted for 58% of the variance. The second factor represented WIAT-III reported achievement measures (eigenvalue=1.343). This accounted for an additional 19% of variance. A third factor was also used for achievement, Teacher BASC-2 Learning Problems because for this particular measurement a higher score in learning problems indicated lower academic achievement unlike the others variables where the lower the scores, the lower the achievement.

Based on the results of the factor analyses, five summary variables were created by taking the mean score of each: WIAT achievement (WiatAch,) Teacher Achievement

(TeachAch), Teacher BASC-2 Learning Problems (Tbasclprs), Teacher average social skills (TeachAvgSoSks), and Parent average social skills (ParentAvgSoSks).

Hierarchical Regressions: Independent/Dependent Variables

Finally, hierarchical regressions were completed to determine whether or not parent/teacher report of social skills, per-pupil spending, IQ, and student-teacher ratio had a significant effect on academic achievement (as defined by performance on the WIAT-III and teacher report), above and beyond that of ADHD. There were a number of variables that predicted achievement. FSIQ was positively correlated with WIAT Achievement, $R^2 = .462$, $p < 0.001$. FSIQ continued to predict achievement over and above what was attributed to ADHD, $\Delta R^2 = .339$, $p < 0.001$. FSIQ was positively correlated with Teacher BASC-2 Learning Problems, $R^2 = .220$, $p < 0.001$. FSIQ continued to predict achievement over and above what was attributed to ADHD $\Delta R^2 = .093$, $p < 0.001$. FSIQ was also positively correlated with Teacher Achievement, $R^2 = .232$, $p < 0.001$. Once again, FSIQ continued to predict achievement over and above what was attributed to ADHD $\Delta R^2 = .097$, $p < 0.001$.

Teacher reported social skills was positively correlated with WIAT Achievement, $R^2 = .074$, $p < 0.001$, and Teacher BASC-2 Learning Problems, $R^2 = .183$, $p < 0.001$. Teacher reported social skills continued to predict achievement over and above what was attributed to ADHD with Teacher BASC-2 Learning Problems, $\Delta R^2 = .010$, $p = .040$ and with Teacher Achievement, $\Delta R^2 = .063$, $p < 0.001$. It did not continue to predict achievement when looking at WIAT-III Achievement, $\Delta R^2 = .006$, $p = .186$.

Parent reported social skills were positively correlated with Teacher BASC-2 Learning Problems, $R^2 = .066$, $p < 0.001$; WIAT Achievement, $R^2 = .026$, $p = .007$; and Teacher Achievement, $R^2 = .232$, $p < 0.001$. However, Parent reported social skills only continued to

predict achievement over and above what was attributed to ADHD when looking at Teacher Achievement, $\Delta R^2 = .164$, $p < 0.001$. It did not continue to predict achievement when looking at WIAT Achievement, $\Delta R^2 = .001$, $p = 0.542$ or Teacher BASC-2 Learning Problems, $\Delta R^2 = 0.001$, $p = 0.618$.

With respect to external factors, student-teacher ratio was marginally correlated with Teacher Achievement, $R^2 = .012$, $p = .075$ but was significantly correlated with WIAT Achievement, $R^2 = .016$, $p = .046$. It was not predictive of Teacher BASC-2 Learning Problems, $R^2 = .000$, $p = .773$. Over and above what was already predicted by ADHD status, student-teacher ratio predicted Teacher Achievement, $\Delta R^2 = .016$, $p = .041$ and WIAT Achievement, $\Delta R^2 = .018$, $p = .024$.

Per-pupil spending was correlated to WIAT Achievement, $R^2 = .016$, $p = .047$ and marginally correlated to Teacher Achievement $R^2 = .012$, $p = .085$. It was not predictive of Teacher BASC-2 Learning Problems, $R^2 = .004$, $p = .335$. Per-pupil spending predicted achievement above and beyond what was attributed to ADHD when looking at Teacher Achievement, $\Delta R^2 = .020$, $p = .021$, but not when examining WIAT Achievement.

Discussion

The purpose of this study was to determine if both internal and contextual factors known to affect academic achievement affect students' with ADHD achievement above and beyond that of ADHD. First, a one-way ANOVA was conducted to determine which measures of academic achievement were significantly affected by the symptoms of ADHD. Children with ADHD showed scores lower than children without ADHD in the following measures: WIAT Achievement (word reading, numerical operations, and spelling), BASC-2 (learning problems, school problems, and study skills), and the Teacher SSRS standard score on Academic Achievement Index.

These findings are consistent with previous studies that show that children with ADHD consistently achieve at rates lower than students without ADHD. Previous literature states that elementary-aged children with ADHD score significantly lower on achievement tests, especially in math and reading (Kent et al., 2010). The WIAT Achievement tests in this study, which focused on both math and reading skills, were consistent with this literature and found that children with ADHD had lower scores than the control group. Studies state various reasons for lower rates on standardized or achievement tests, one being the impairment of executive functions often found in children with ADHD (Barkley, 2003). In addition to lower scores on standardized achievement tests, children with ADHD are more likely to be retained, have lower grades, and experience problems related to under-productivity (Kent et al, 2010). The teacher reported scores on academic achievement account for academic problems outside the realm of standardized test scores, which this study also found were lower for children with ADHD. Literature shows that up to 50% of all children with ADHD also have learning disabilities, when learning disability is

defined as a discrepancy between a child's IQ score and performance on standardized achievement tests (Mayes et al., 2000). The learning disabilities could also account for the many academic problems that children with ADHD face. Because it is consistent in literature that ADHD affects a child's academic performance, this study wanted to look at the many other factors that affect achievement to determine which play a greater role in academic underachievement.

After the one-way ANOVA was completed, factor analyses were completed to create summary variables of independent and dependent variables. These summary variables included the combining of WIAT achievement scores and teacher reported achievement. BASC-2 Learning problems was not included in the combining of variables due to the fact that the higher the score, the lower the achievement, as opposed to the other variables where the higher the score, the higher the achievement. The independent variable, social skills, was also combined into two variables: parent reported social skills and teacher reported social skills. Finally, hierarchical regressions were completed using the summary variables, BASC-2 Learning Problems, Per-pupil Spending, IQ, and Student-Teacher Ratios with the dependent variable being academic achievement.

The results of the hierarchical regressions indicate that broadly speaking social skills significantly predict academic achievement above that of ADHD. However, when taking a closer look at the results of the study, teacher reported social skills continued to predict achievement above and beyond that of ADHD, more so than parent reported social skills. This is because teachers have a firsthand look at the specific behaviors that would directly impact the child's achievement. The behaviors a child exhibits at school are the behaviors that are present when the child is in an academically challenging environment.

The behaviors parents are more familiar with, while they might affect studies at home, are not as indicative of the child's behaviors where direct instruction takes place. Neither parent nor teacher reported social skills were predictive of academic achievement above and beyond that of ADHD when using WIAT Achievement scores as the measure for academic achievement. Since WIAT Achievement is the most objective measure of academic achievement used in this study, it questions the results that social skills do indeed play a role in hindering academic achievement over ADHD. Only instances where teacher reported measures of academic achievement were used as measures of achievement were significant above and beyond that of ADHD.

Social skills' link with academic achievement is thought to have stemmed from Maslow's Hierarchy of Needs Theory. The need to feel loved and accepted must be met before other needs, such as academic achievement, can also be fulfilled (Roseth et al., 2008). Literature shows that rejection by peers is connected with underachievement, grade, retention, and dropping out of school. Research states that children with ADHD are at a greater risk for social deficits than children without because of their impulsive and aggressive behaviors that often come across as disruptive (Barkley, 2003). ADHD's comorbidity with ODD is often linked to the overwhelming rejection that children with ADHD experience from peers. The results in this study may be due to the fact that ADHD symptoms cause the social deficits, which may affect academic achievement. Therefore, social skills themselves would not predict achievement over that of ADHD since the social skills are directly impacted by ADHD itself.

The hierarchical regression, however, conclusively reported that IQ affects academic achievement above and beyond that of ADHD. IQ scores significantly impacted all measures

of academic achievement used in this study. This aligns with previous literature that shows broad correlations between measures of intelligence and academic outcomes (Deary, Strand, Smith, & Fernandes, 2007). Specifically, correlations ranging between .4 and .7 have been found between IQ scores and school grades (Makintosh, 1998). A more recent study by Deary et. al found a correlation of .81 between cognitive ability tests and standardized tests, showing the large role of intelligence in academic achievement (Deary et. al, 2007). The current study found that IQ impacts measures of academic achievement above and beyond that of ADHD. Previous literature shows that children with ADHD have lower reports of IQ; specifically, children with ADHD score about 7-12 points lower on IQ tests (Kuntsi et. al, 2004). Because children with ADHD typically have lower levels of cognitive abilities, the results are as expected weighing level of intelligence as predicting achievement beyond ADHD.

The results of the hierarchical regression also indicate that external factors such as per pupil spending and teacher-student ratio significantly impact achievement above and beyond that of ADHD. The study found that per pupil spending significantly predicted achievement for the measure WIAT Achievement and a marginally significant correlation when looking at Teacher Achievement. However, per pupil spending only significantly impacted achievement above and beyond that of ADHD for teacher reported achievement. These results align with previous studies that show inconsistencies over whether or not per pupil spending affects achievement on any level. Some results indicate they do predict achievement at an upwards of 8% difference in proficiency for every \$1,000 spent towards instruction (Condron & Roscigno, 2003). Other studies, however, indicate that there is no relationship between school spending and students' academic performance

(Hanushek, 1996). The validity of teacher reported achievement might not be as strong as that reported by the WIAT Achievement tests, which did not find that per pupil spending was associated with WIAT achievement.

Finally, the hierarchical regression from this study shows that student-teacher ratio impacts academic achievement above and beyond that of ADHD when measuring achievement using WIAT test scores and teacher reported achievement. Both WIAT Achievement and teacher reported achievement were significantly impacted by larger student-teacher ratios. This is consistent with the findings of previous literature, which state that smaller class sizes have positive effects on academic achievement. Studies show that smaller classes also specifically impact disadvantaged students to a greater extent (Bruhwiler & Blatchford, 2011; Konstantopoulos & Chung, 2009).

Implications for teachers

Based on the results of this study, there are many implications that teachers should consider when educating children with ADHD. While focusing on controlling inattentive or hyperactive behaviors is still very much important, there are other factors affecting the child's achievement that can be targeted.

Current budget cuts in many states, including Pennsylvania, will only serve to have a negative impact on achievement of all students, but especially low-attaining students, such as those with ADHD. The findings in this study indicate that broadly speaking, per pupil spending and class size affect achievement above and beyond that of ADHD. With all the budget cuts taking place, class sizes are only getting bigger, with many reaching the maximum capacity that the states have deemed acceptable. Knowing this places an additional negative impact on the achievement of students with ADHD. How are teachers

supposed to create an environment that is the most beneficial to all students? While it might be impossible to decrease the class sizes for the individuals with ADHD, an increase of small group instruction is an option for teachers to help make for a more successful environment. When considering the impact per pupil spending can have on the achievement of a child with ADHD, as a teacher, there is little that can be done when in a district with lower instructional resources. However, it makes a case that children across the country are not receiving equal opportunities due to budgetary issues. So much funding is based on local tax dollars that wealthier communities will only seek to receive more support and schools in lower socioeconomic areas will continually be placed at a disadvantage when it comes to students' achievement as it relates to per pupil spending.

It was also indicated in this study that social skills impact achievement above and beyond that of ADHD and that students with ADHD consistently struggle with many aspects related to social functioning. Encouraging those students who suffer from ADHD to relate to peers and work cooperatively with others is something to focus on to build and foster more positive relationships in the classroom. Positive relationships are associated with higher levels of academic achievement (Wentzel, 1991). Pairing students who struggle with students who are successful, and creating mutually respectful relationships between those students is a way to both motivate the students' learning and, once again, foster strong peer relationships in the classroom (Wentzel, 1991). A study shows that how teachers react to the behaviors of a child connected to his/her ADHD often affects how that child is perceived socially and how much acceptance and support is gained from his/her peers (Sherman, Rasmussen, & Baydala, 2008). Literature suggests, therefore, that instead of teachers taking a punitive outlook on the disruptive behaviors that may occur, they instead

take a stance on preventing the occurrence of these behaviors by responding in a way in which to not publicly discipline the child, which results in the child feeling embarrassed and socially isolated (Sherman et al., 2008).

Limitations

The main limitation to this study is the homogeneous population of the sample used. The participants of this study were only recruited from Pennsylvania, which, in comparison to many states in this country, has a fairly adequate public education school system. More specifically, the participants were mainly from the central Pennsylvania area. This small area does not allow for a look at the great inequality that is America's public school system. Pennsylvania's average student-teacher ratio is 15 students per one teacher (NCES). However, in some states, the average student-teacher ratio is as high as 25:1 (California) and as low as 11:1 (Vermont) (NCES). The inequality of spending was also not adequately represented in this sample. Pennsylvania's state average for per-pupil spending is \$10,013 (NCES). The highest state in the nation spends, on average, \$17,000, which is well above the expenditures of districts in this study (NCES). The participants were also all between the ages of eight and twelve and were predominantly Caucasian. Some literature states that teacher ratings of children with ADHD differ based on the race of the child; however, one study shows that child of ethnic minority were rated more accurately than Caucasian students (Hosterman, DuPaul, & Jitendra, 2008). Therefore, the conclusions found in this study might not translate to other samples taken across various parts of the country where more diversity would occur.

Conclusion

In conclusion, this study does present some findings on the extent to which contextual and internal factors affect academic achievement above and beyond that of ADHD. Further studies conducted on this particular topic should extend to areas outside Central Pennsylvania to gain a bigger picture at the true affects of contextual factors, such as per pupil spending and student-teacher ratio, on a child's achievement. It is important to determine all factors that affect a child's achievement and success in the classroom to create an environment for the child that will best fit all of his needs. Doing so will serve to provide teachers and administrators with the necessary tools to handle the diversity of learning needs present in the classroom and to continue the success of all students.

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ACADEMIC VITA

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EDUCATION:

The Pennsylvania State University, University Park, PA
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RESEARCH:

Child Attention and Learning Lab, *Research Assistant*

Supervisor: Cynthia Huang-Pollock, Ph. D.

- Recruited and screened potential participants
- Administered and scored subtests of the WISC-IV and WIAT-III
- Data entry: BASC-2, Conners', SSRS, ADHD Rating Scales, and Peer Rating Scales
- Transferred recordings of lab visits to digital format
- Trained in SPSS statistical software

Honors Thesis:

The Effects of Attention Deficit/Hyperactivity Disorder and Internal/Contextual Factors on Academic Achievement

RELATED EDUCATION EXPERIENCE:

Student Teaching Practicum, Fall 2011

Franklin Elementary, *First Grade*

- Planned and implemented unit on friendship
- Established classroom management system
- Managed daily classroom procedures
- Planned and taught lessons in all content areas

Pre-service Student Teaching Practicum, Spring 2011

Walker Elementary, *First Grade*

- Planned and taught lessons in all content areas
- Managed daily classroom procedures

Camp Supervisor, Summer 2011

Centre County Parks and Recreation's WeeKidventure, *3-5 year olds*

- Planned and implemented daily activities
- Oversaw staff of five camp counselors
- Held weekly staff meetings
- Communicated with parents
- Managed discipline procedures

Dance Teacher, Fall 2009-Spring 2011

Center Pennsylvania Dance Workshop, *children and adults*

- Taught tap and jazz classes
- Choreographed for local performances
- Managed attendance and office procedures

Teacher's Aide, Fall 2010-Spring 2011

Lemont Elementary School, *Kindergarten*

- Weekly volunteer
- Assisted with learning centers and projects

Camp Counselor, Summer 2009

Baierl Family YMCA, *First-Sixth Grade*

- Oversaw campers in need of emotional support
- Planned and implemented activities
- Managed daily procedures and routines

Tutor, Fall 2008-Fall 2009

State College North Tutoring Center

- Tutored 4th grade ESL student
- Tutored 1st grade student in writing

HONORS:

College of Education Student Marshal, Commencement, *Fall 2011*

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Evan Pugh Scholar Award for Juniors, *2011*

Penn State President Sparks Award, *2010*

Penn State President's Freshman Award, *2009*

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Penn State Tapestry Dance Company, Fall 2008-Spring 2011

- Treasurer, 2010-2011
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- Fundraised for philanthropies, Penn State THON and Race for Grace

Penn State's Student Pennsylvania State Education Association, Fall 2008-Spring 2010

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