ABSTRACT

SELF-MONITORING FOR ADHD: A META-ANALYSIS

by Aubree Michelle Hanson

What happens when students with Attention Deficit Hyperactivity Disorder are taught self-monitoring skills regarding their academic and behavioral performance? This meta-analysis analyzed ten studies to determine the effectiveness of teaching a self-monitoring intervention to students with ADHD. This study highlights the positive benefits of the implementation of a self-monitoring intervention for students with ADHD across grade levels, gender and classrooms. Positive benefits include improved academic attention, a reduction in problem behaviors such as talking out of turn, increased accuracy and completion of assignments, as well as increased attention to the instruction as well as following the rules of the classroom. Self-monitoring interventions can be highly effective in the classroom. Further research needs to be conducted in academically rigorous settings as well as within special education, with a focus on generalizing the skills learned to college and future workplaces.
SELF-MONITORING FOR ADHD: A META-ANALYSIS

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Dedication

This thesis is dedicated to my parents, Michael and Tonya Hanson. Thank you for the words of encouragement, and for always believing in me. Thank you for always pushing me to achieve my dreams, and always reminding me that nothing can be achieved without hard work.

I would also like to thank my friends and family who supported me through this process. I would specifically like to thank my best friend, Courtney McDonald, for being my cheerleader and always believing I could accomplish anything I put my mind to.

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As the Beatles sang, “I get by with a little help from my friends”.

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Aubree Hanson, M.S.
Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a common childhood disorder affecting attention and impulse control. Approximately 3 to 7 percent of all children have the disorder, with boys being three times as likely to have the disorder as girls (Barkley, 2006). The disorder has been studied in many cultures, and has found to be existent in North America, South America, Great Britain, Scandinavia, Europe, Japan, China, Turkey and the Middle East, among many others (Barkley, 2006). The disorder is most commonly found in families where a history of ADHD exists, or in families who have a history of depression (Barkley, 2006). The disorder is also found more commonly in individuals who have a comorbid diagnosis of conduct problems; tic disorders; Tourette’s syndrome; learning disabilities; or those who have a history of delinquency, prenatal alcohol or tobacco exposure, premature delivery, or significant trauma to the frontal lobe (Barkley, 2006). ADHD has a high heritability rate, and in some studies, has been found to have a heritability rate as high as 80 percent (Barkley, 2006).

ADHD is most commonly treated with stimulant medications such as Ritalin or Adderall, but behavior therapy can also be effective. In schools, students with ADHD can receive services through the Individuals with Disabilities Education Act (Individual with Disabilities Education Improvement Act, 2004) under the classification of “Other Health Impaired” if their disorder is found to be severely impacting their academic performance. They are also able to receive accommodations and modifications in school if they are serviced under Section 504 of the Rehabilitation Act (Rehabilitation Act, 1973); under a 504 plan students can receive more time on tests, a quiet area to take a test, or altered assignments that would help them be more successful in school.

Many schools use reactive strategies that can help students with ADHD achieve their best in school; many schools illustrate the benefits of praising appropriate behavior and defining the expected behavior of students with ADHD, or they recommend that the teacher ignore the problem behaviors of the student. These reactive strategies may provide some assistance in the education of individuals with ADHD, but they do not give the student the resources to learn how to manage his/her own behaviors. A teacher may not be able to ignore the behaviors of the student with ADHD, especially if the student is disrupting the learning environment for his/her peers. Furthermore, these interventions and techniques require the teacher to constantly provide their attention to the student with ADHD, either to praise the positive behaviors or to remind the student what is expected or when they are behaving negatively. This reduces the amount of direct instruction or assistance the teacher can provide for the student with ADHD, as well as for the rest of the classroom (Teaching Children, 2008). Thus, this thesis is looking at the effect of self-regulation interventions for students with ADHD, as they require little time on the part of the teacher once they are trained and self-monitoring puts the responsibility for management in the hands of the student.

Literature Review

Attention Deficit/Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder is a common disorder that affects individuals from childhood to adulthood and is marked by the impairing inability to stay focused, difficulty paying attention, controlling behaviors and hyperactivity (Attention Deficit, 2016). ADHD is broken down into three subtypes: predominantly hyperactive-impulsivity, predominantly inattentive, and combined type. Individuals with predominantly hyperactive subtype may fidget
in their seats, talk non-stop, and have trouble sitting still during class time. Individuals with predominantly impulsivity subtype may be impatient, speak and react without thinking through their actions as well as interrupt the conversations of others, (Barkley, 2006). The predominantly inattentive subtype presents itself as the individual being easily distracted, frequently switch between activities, having difficulty focusing, lack organizational skills; they may struggle to follow directions, and seem as if they are daydreaming or ignoring those who are talking to (Attention Deficit, 2016).

Individuals with ADHD typically display deficits in three areas—impaired inhibition of impulses, poor regulation of task irrelevant activity and impaired sustained attention along with a lack of persistence of effort for task completion (Barkley, 2006). The deficits caused by ADHD can affect the education of individuals with the disorder, as they have difficulty with classroom expectations; impaired impulse control may cause the student to speak out of turn in the classroom, or the student may appear to act before thinking through the consequences of their actions.

Task irrelevant activity can be described as the individual seeming to be excessively fidgety, or unable to inhibit movement of their body in situations such as direct teacher instruction that requires him/her to remain still in their seats. Young individuals with ADHD tend to have greater difficulty with remaining still and can at times be observed to run excessively around the classroom or show other types of gross motor activity (Barkley, 2006) that can negatively impact their educational experience. A student who is constantly on the move around the classroom requires frequent redirection from the classroom teacher—and any other adult in the room—which takes the focus the topic that is being taught in the classroom.

Poor sustained attention becomes apparent in individuals with ADHD when they are required to complete assigned work that they view as being boring, tedious, or repetitive that is not intrinsically motivating for that individual. Individuals with ADHD are described as lacking “the same level of persistence...motivation and will-power of others their age when uninteresting yet important tasks must be performed,” (Barkley, 2006, p. 3). Individuals with ADHD may state that when an activity is uninteresting to them that they fail to provide their full attention to that activity and instead bounce between many uncompleted activities, failing to stay on task during independent work. Having poor sustained attention can distract from the education of those with ADHD, as they may require more direct supervision on task completion than their peers without ADHD; by requiring more direct supervision from staff, the students may occupy more of the teacher’s time than other students in the classroom, while also being unable to regulate their attention without reminders from others.

Loe and Feldman (2007) conducted a study of underachievement and ADHD reporting that ADHD played a significant role in several areas. Broadly, individuals with ADHD show significant academic difficulties and are 4 to 5 times more likely to use special education services than their peers without ADHD; they are found to use more ancillary services as well such as tutoring, pull-out classes, after-school programs and special accommodations (Loe, 2007). Loe and Feldman (2007) found that academic underachievement and poor educational outcomes that are associated with ADHD are persistent problems, and that individuals with ADHD are more likely to be rated as below average and failing than their peers without ADHD (2007). Students with ADHD have many academic and educational difficulties such as failing more grades, achieving lower grades, being ranked lower in classes, and performing lower on standardized assessments (Loe, 2007). Students with ADHD also are more likely to face expulsions, have higher dropout rates and a lower rate of college completion (Loe, 2007). Zentall
states that “the core symptoms of ADHD—inattention, hyperactivity and impulsivity—make meeting the daily rigors of school challenging,” (1993, p. 144).

**Comorbidity**

Individuals with ADHD are commonly diagnosed with another disorder; Shimabukuro states that “the co-occurrence of learning disabilities with ADHD is significant. As many as 10 to 20% of children and adolescents have diagnosed learning disabilities and about 20 to 25% of them also have an ADHD diagnosis” (2000, p.398). Shimabukuro goes on to state that while many students who have comorbid LD and ADHD receive special education services, increasing numbers of students are being placed in general education settings, thus requiring them to learn independent learning skills and strategies. Mood disorders are also commonly diagnosed with ADHD, with 25-48% of children with ADHD receiving an anxiety diagnosis. 11% of students with ADHD have a comorbid diagnosis of Tourette’s disorder or associated tic disorders; 40-60% of students have comorbid Oppositional Defiant Disorder; 14-20% have a comorbid diagnosis of Conduct Disorder; and less than 1% of students with ADHD receive an additional diagnosis of Bipolar Disorder (Tannock, 2009).

**ADHD and Gender**

Attention Deficit Hyperactivity Disorder (ADHD) affects 3 to 5% of the general population, and research has shown that ADHD is commonly diagnosed more often in males than in females. Research has shown the gender differences in ADHD to range from a ratio of 3 males diagnosed for every female (Szatmari et al.1989), all the way up to the American Psychiatric Association’s estimate of nine males diagnosed with ADHD for every female diagnosed. Gershon’s 2002 meta-analysis found that females manifested fewer primary symptoms of ADHD as well as fewer externalizing problems than their male counterparts. The results of the meta-analysis showed that females with ADHD exhibited more internalizing problems than males, which can suggest that females with ADHD are more likely to be diagnosed with comorbid disorders such as depression and anxiety. Females with ADHD were also recognized as having less hyperactive tendencies (Gershon, 2002). Gershon stated that Abikoff et al. found in their 1993 study that teachers ratings may cause a phenomenon known as the ‘halo effect’, where teachers attend more to disruptive behaviors, and ignore inattentive behaviors of females with ADHD, which could be an explanation for the under identification of females with ADHD (Gershon, 2002).

**ADHD and Ethnicity**

While there is abounding research on ADHD, most it has been conducted on white, male, middle-class subjects (Bryant, 2005). Little research has been done on the role of ethnicity in ADHD diagnoses and ADHD diagnoses varies across all races in the United States. Multiple studies have been conducted that found African-American children had the highest hyperactivity rating, with Asian-Americans having the lowest, and Hispanics scoring around the average of the white norms that were used in the study (Gingerich et al, 1998). More recent studies have cited the same findings, and yet the question remains on if the differences between groups exist due to real differences, rater bias due to the student’s ethnicity, or a combination of both (Reid et al., 2000). Reid et al (2001), found that teachers exhibit bias in their ratings of ADHD symptoms if the student they are rating is African American. Their research showed that teachers rated African-American males as being 2.5 times more likely to have ADHD than their Caucasian
counterparts and African-American females as being 3.5 times more likely to have ADHD. This discrepancy was more extreme when the teachers rating the students were Caucasian themselves. Teacher bias in the assessment of ADHD symptoms is thought to be a contributing factor to the overrepresentation of African-American students in special education.

**ADHD and Pharmacological Interventions**

The most common intervention for students with ADHD is the prescription of psychotropic medication (DuPaul, 2011), and research has shown that more children are prescribed medications to control their symptoms of ADHD than any other childhood disorder (Barkley, 1990). Swanson (1993), states that the most commonly prescribed medications are psychostimulants such as methylphenidate (commonly known as Ritalin), d-amphetamine (Dexedrine), and pemolin (Cylert). While psychostimulants are the most common intervention for students with ADHD, they do not work for every child with the disorder, and they are not effective for every symptom of ADHD that can negatively impact a student’s education. Mathes et al (1997) states that some teachers and parents have become too dependent on medication as the primary treatment for ADHD and have not fully utilized additional interventions to enhance the students’ success in school.

Research has found that psychostimulant medication is effective for only 70% of students with ADHD, leaving 30% of students who do not respond favorably to medication, and thus require other interventions to mediate their symptoms (Swanson, 1993). Research has shown that even for students who respond favorably to psychostimulant medications, additional interventions are needed for their behaviors to fall within the normal range. Pelham (1993), states that while psychostimulants treat inattention, impulsivity and hyperactivity, the effects are often temporary, and only a “small number of children demonstrate sufficient improvement of their behavior to fall entirely in the normal range, and thus most children receiving methylphenidate also require other types of interventions”.

**Executive Functioning**

Research suggested that “ADHD is essentially a developmental impairment of the brain’s executive functions—the management system of the brain’s cognitive operations (Brown, 2002, p. 910). Brown describes executive functioning of children with ADHD as a “symphony orchestra made up of very fine musicians, but without a conductor to organize and integrate the musicians’ individual efforts,” and goes on to state that “the problems with ADHD are not with those parts of the brain that would correspond to… the individual musicians, but in the management system that controls and manages activities and integrates them movement by movement” (2002, p. 910). Executive functioning develops alongside the development of the prefrontal cortex in childhood and continues throughout adulthood. Cultural expectations of parents and educators cause students to increase their abilities to self-regulate their behaviors and activities, starting as basic as preparing themselves to leave for school, to managing the expectations and requirements of multiple classes in middle and high school. Brown illustrates that impairments of executive functioning can “occur at the most basic levels of behavior management” exhibiting as the individual finding it difficult to control their actions and verbalizations, thus their behaviors “manifest as hyperactivity or extreme impulsivity” (Brown 2002). Executive functioning deficits can also be less observable and can affect an individual’s memory, organizational skills, and their abilities to plan.
Self-Regulation

A concept that frequently gets mentioned alongside executive functioning when ADHD is being discussed is a concept called self-regulation. Russell Barkley defines self-regulation as “the means by which an individual manages themselves to attain their goals...self-regulation involves any action an individual directs at themselves to result in a change in their behavior to change the likelihood of a future consequence or attainment of a goal”, (Barkley, 2012, p. 1). Self-regulation requires a student to be aware of when a problem has arisen, and then he/she needs to be able to exhibit a behavior that is appropriate for the situation they are in. The student then needs to be able to redirect attention away from the temptation and be able to use self-talk to speak to himself/herself about the situation, and then be able to successfully attain the proper way of acting. Virginia Douglas (1970), asserts that ADHD likely (as cited in Barkley, 2012) involves a deficiency in self-regulation, because ADHD involves deficits in inhibition, managing attention, self-directed speech, rule following, self-motivation, and at times, self-awareness. Some researchers have stated that ADHD is self-regulation deficit disorder (SRDD) (Barkley 2012).

Although medication is the most common intervention for individuals with ADHD (Castle, 2007), many non-medicinal interventions exist, such as self-regulation interventions that include self-monitoring. Research has illustrated that self-regulation interventions can help students with ADHD perform better in both general and special education settings (Barkley, 1990). Research has shown that student self-monitoring of attention has increased the on-task behavior when paired with pharmacological interventions for students with ADHD (Shimabukuro, 1999). Self-monitoring of academic performance has been found to increase academic productivity, accuracy, and the use of effective strategies for students with ADHD, LD, and behavioral issues (Shimabukuro, 1999). It has also been found that self-monitoring of attention has had positive effects on academic productivity for students with learning disabilities, emotional disabilities, and attention and academic difficulties (Blick, 1987).

Self-regulation has been found to be effective for a wide range of students—preschool age up to secondary school aged students—as well as across a wide range of academic and behavioral problems (Shapiro & Cole 1994), illustrating that self-regulation interventions are generalizable to diverse populations of students, as well as across a wide range of behaviors and activities that are desired to be changed. Self-regulation interventions can be described as existing upon a continuum; on one extreme the intervention is completely controlled by the teacher, or some other adult that interacts with the student. The adult establishes if the student has met the goals that have been set for them, or not. On the other end of the spectrum, the intervention is completely in the hands of the individual student; he/she oversees evaluating their own behavior against the set criteria, without the input of the classroom teacher, or other adult. In this case, the student self-administers any predetermined reward or punishment—essentially the entire intervention is dependent on the student monitoring their behavior, and taking appropriate action based on their observations (Shapiro 1998). Many self-regulation interventions begin with the teacher, or another education professional, being solely responsible for the intervention, with gradual shifts towards the student controlling their own intervention.

Self-regulation strategies are broken up into contingency management or cognitive control strategies (Roberts & Dick, 1982). Contingency management techniques illustrate the relationship that exists between responses and their consequences; they require the student to evaluate their own response and then apply the appropriate consequence after responding. A common example of a contingency management technique is self-monitoring (Shapiro, 1998).
Cognitive-based strategies emphasize the antecedents of responding; these procedures require an individual to examine the thought process that precedes the response. The goal is to alter the thought process, with the expectation that by changing how one thinks about a situation is likely result in a different outcome (Shapiro, 1998). One of the most common examples of a cognitive based strategy is self-management.

The most common outline for self-regulation interventions was established by Rhode in 1983; Rhode’s model follows 5 phases—baseline, teacher management, matching, fading to self-management, and complete self-management (Rhode et al, 1983).

During the baseline period of the intervention the teacher is asked to identify the desired behaviors for the student; these can either be academic behaviors, nonacademic behaviors or a combination of both (Shapiro, 1998). Academic related behaviors could include work accuracy, and nonacademic behaviors can be something such as following the classroom rules. Once the target behaviors are established, they are used as reference points for the development of a numerical scale that can be used to give the student’s performance a quality rating across the specified behaviors. The teacher is then asked to provide a baseline using a scale of 1 (poor) to 5 (excellent) of the student’s performance during a predetermined period; this is usually done during the class or time of day that the intervention will be put into effect, as the student is most likely to exhibit problem behaviors in that setting. Shapiro (1998) states that the designated academic period—typically 60 minutes—is divided into equal intervals of 15 minutes. At the end of each interval, the teacher rates the student’s performance during that 15 minutes. These ratings are not shared with the student, as the teacher is establishing reliability in their ratings of the student’s behavior (Shapiro, 1998, p. 547).

The second phase is teacher management; during teacher management the student is made aware of the teacher’s ratings of their behaviors. Once each rating interval is finished, the teacher verbally informs the student of their behavioral ratings. The ratings are translated to a point scale and then exchanged at the end of the day for predetermined rewards to reinforce desired behaviors; the predetermined rewards should be decided by both the teacher and the student. The teacher should then graph the student’s behavioral ratings so that the student can see their change over time when the intervention is in place. The teacher management phase lasts until the student can achieve desirable ratings for an entire school week, (Shapiro, 1998).

The third phase is called matching; during this phase, the student begins to rate their behavior at the end of each fifteen-minute interval. The teacher is still expected to rate the student’s behaviors as well, as it is important for the teacher and the student to compare their ratings at the end of the day. The student is awarded points only if their self-rating is within one point of the teacher’s rating; the teacher then should complete a brief written explanation that describes what caused the point discrepancy between the two scores. If a student matches their rating exactly to the rating of the teacher, the student will be rewarded the points that equal their ratings (such as 4 points if they rated their behavior a 4), plus an additional bonus point. On the other hand, if a student’s rating is more than one point off from that of the teacher’s rating, the student receives no points for that interval. The main goal of the matching phase is for the students to learn how to accurately judge their own behavior when compared to the teacher’s perceptions of their behavior, (Shapiro, 1998).

The fourth phase is fading to self-management/monitoring. This phase includes the simultaneous fading of the frequency with which students compare their self-ratings to that of the teacher’s ratings, and a reduction in the frequency of receiving backup reinforcement. The fading of the number of matching opportunities is done with two different strategies. The first strategy
is for the student and the teacher to continue to record their rating at the end of each interval; the
difference is the frequency with which the student and the teacher compare their ratings for the
student to earn bonus points is reduced gradually. At the beginning of the matching phase the
student is awarded bonus points 100% of the time, and then is gradually reduced to 75%, and
then to 50%, then 25% and finally the matching is discontinued. Shapiro (1998, p. 547) suggests
that an easy way to gradually reduce the frequency of matching is to use colored cards—he states
that” one way to accomplish this reduction successfully would be to select three red playing
cards, and one black card. At the end of each interval a card is randomly selected. If the card is
red, matching for bonus points occurs. If the card is black, the student does not compare their
behavior ratings with the teacher. By changing the number of red and black cards, one gradually
shifts from 100% matching to 0% matching”.

At the same time, as the possibility for matching is reduced, the duration of the rating
interval should be gradually lengthened. If the interval was 15 minutes in length at the beginning
of the interval, it should be gradually increased in length until the rating interval lasts for the
entire academic period. The value of the points should also be lessened by increasing the amount
of time between when the student earns the points, and when they are exchanged for rewards.
Initially the exchange of points for a reward may have been at the end of each academic period;
this should be extended to the end of the day, then every other day, until the student is only able
to exchange their points at the end of each academic week. This will make it so that students will
take a longer time to accumulate the same amount of points they had been earning under the
previous phase, (Shapiro, 1998, p. 547).

Fading to self-management/monitoring can be tedious process, and can at times, take up
to several months to complete depending on the responsiveness of the student. Those in charge
of implementing the intervention should match the pace of reducing frequency as determined by
two factors: the degree to which a student exhibits a positive behavior change, and the student’s
accuracy in matching the teacher’s ratings, (Shapiro, 1998, p. 547).

The final phase is complete self-management/monitoring. This phase is when the student
has achieved matching his or her behavioral ratings to that of their teacher’s ratings and have
made significant movements to total self-management/monitoring of their behavior. The
movement towards complete student self-management requires the removal of the rating system
as well as all of the backup rewards, so that behavior is controlled by the natural consequences
that exist in the classroom. To facilitate the maintenance of self-managed behavior, the self-
evaluation procedures are gradually faded; first students transition from written ratings of their
behaviors, to providing oral ratings at the end of the designated intervals. During this phase the
students are not required to match teacher ratings, they are only required to tell the teachers how
they thought they acted in class. Oral ratings are then slowly faded to covert ratings where the
teachers randomly prompt students to think about how they believe they performed over a set
period. The random prompts are akin to the natural self-evaluation that is done by students who
do not have ADHD, (Shapiro, 1998).

Overall, while subtle differences exist in how educators implement self-regulation
interventions, most follow some variation of the abovementioned process, and have been found
to be effective for helping students with ADHD learn to self-regulate their behaviors.

Meta-Analysis

A meta-analysis statistically accumulates research findings from individual studies into a
review summary and/or combines those results across studies. Meta-analysis results can
summarize large bodies of instruction and can have a positive impact on theory and practice of special education (Banda, 2008). In a *Teacher's Guide to Meta-Analysis*, Banda discusses many advantages that exists. Among these advantages, meta-analyses are more useful for research than traditional narrative reviews (Banda, 2008, p. 66). Meta-analyses also use quantitative-statistical methods for organizing and extracting information from large databases, along with eliminating study selection bias while increasing objectivity of the study. One of the most beneficial advantages to conducting a meta-analysis is that they can use all information provided, and the findings of a meta-analysis express the magnitude of effect related to several independent variables (i.e. interventions) by synthesizing results across several studies (Banda, 2008, p. 68).

A portion of educational research reviews are summarized through traditional narrative reviews where the data is qualitative, and studies are typically summarized for the reader. Narrative reviews do not let the reader compare different studies, leading to an increased use and necessity of meta-analyses. Meta-analyses provide standardized values for different outcome variables that can be quantified to a single numerical value known as an effect size. The computation of an effect size allows the results of each study’s dependent variables to be compared with other studies (Banda, 2008, p. 68).

Meta-analyses are important as they provide an integrated overview of accumulated research results that were conducted on specific topics. Through reading results of a meta-analysis, researchers can fill the ‘gap’ between past and future special education research (Banda, 2008, p. 68). Meta-analyses are easy to translate into practice in the classroom, as they require no advance knowledge of statistics to understand. Teachers need only know what effect sizes are, and how to interpret them in order to interpret the findings of a meta-analysis. Meta-analyses are useful for teachers, as they can assist in the selection of evidence-based interventions to use with their students (Banda, 2008, p. 68).

**Purpose**

The purpose for this meta-analysis is to examine whether self-monitoring for problem behaviors is effective to decrease problem behaviors and increase desired behaviors in students with ADHD. Specifically, this meta-analysis seeks to answer the following research questions: Are self-monitoring strategies effective for decreasing problem behaviors and increasing on-task behavior of students with ADHD?

Effect sizes will be examined to determine the effectiveness of the strategies studied, and what population of students the intervention is the most effective for, such as adolescents with ADHD, adolescents with comorbid ADHD and learning disabilities, etcetera. If self-monitoring is found to be effective at decreasing problem behaviors for students with ADHD, it has the potential to improve the academic experience for many students who may currently be struggling in school. Self-monitoring is relatively simple to implement in classrooms, and allow students to take responsibility for their behaviors, thereby teaching students how to recognize inappropriate versus appropriate classroom behaviors. Self-monitoring can potentially decrease the negative behaviors of students with ADHD, subsequently decreasing the consequences they face in school, which would allow for an overall more positive education experience for students with ADHD.

**Methods**

The cases that were included in this review met specific criteria for selection. Cases had to include (a) students identified as having ADHD, (b) students had been identified as having
academic, behavior and/or social problems, (c) students had to be enrolled in school, from grades Kindergarten through twelfth, (d) examine self-monitoring strategies that taught students how to be aware of their behaviors, and how to correct those behaviors, including self-monitoring, and self-monitoring with reinforcement, (e) use single-subjects designs and (f) been published from 1980 to 2015.

A comprehensive search of literature was conducted. First, a search was completed using the online databases, Academic Search Complete, EBSCOhost, Psych Info, and Google Scholar; the search was completed using studies conducted from 1980 to 2015. For the purpose of finding studies that met the criteria of the review the following search terms (listed in alphabetical order), were used in varying combinations: ADHD, ADD, attention deficit/hyperactivity disorder, behavioral problems, interventions, self-management, self-monitoring, and self-regulation. The abstracts of these cases were reviewed before they were included in the study so as only data-based articles were included. This search yielded 16 cases. Dissertations were also searched, but none fit the inclusion criteria. Finally, an ancestral search of the located studies was conducted, which yielded no new cases. In total, 16 cases were obtained that fit the initial criteria for inclusion in the review.

The researcher reviewed the articles in depth to ensure that they met the criteria for inclusion. Four cases were excluded as they did not meet inclusionary criteria. Three cases were excluded due to not conducting a single-subjects study on self-monitoring for students with ADHD. One case was excluded as it did not measure on-task behavior of students. The case measured academic productivity and accuracy which was not a research focus for this meta-analysis. One case was excluded as it was a case study of one student, and the researchers determined it did not meet single-subject design criteria. The search produced a total of 11 cases.

Data Analysis: Coding Procedures

Once the 11 cases had been reviewed for inclusion in the review, they were coded for participant information (grade, age, gender, ADHD only, ADHD comorbid with ODD, ADHD comorbid with LD, ethnicity), design (methodology, participant assignment, and treatment fidelity), intervention characteristics (self-regulation, self-monitoring, self-management, self-monitoring with reinforcement, self-management with reinforcement), and setting (general education classroom, resource room, or other). The primary researcher and another graduate student independently coded all the studies \((N=11)\) for the aforementioned inclusionary criteria. An interrater agreement of 100% was established (agreements/(agreements+disagreements)), (Cohen & Swerdlik, 2005). See Figure One for code list.

Computation of Effect Sizes

Single Subject Designs

Effect sizes in single subject designs were evaluated using percentage of nonoverlapping data (PND) as well as tau-U values. These analyses were conducted for each single subject design that was included in the study. Analysis of single subject designs were conducted using PND due to PND being an acceptable metric for the inspection of single subject design for the last 25 years (Scruggs & Mastropieri, 2012). Due to critiques of PND and its inability to correct for positive trends in baseline, tau-U was also included in the analysis of single subject designs.
These values were calculated using the tau-U ES calculator (www.singlecaseresearch.org). See Table One for effect sizes.

**Interrater Reliability of Effect Size Calculations**

Together, the main researcher (a graduate student in school psychology) and a professor with training in meta-analytic calculations, calculated effects using the methods listed above. They came to 100% agreement on the final effects.

**Results**

**Participants**

Across all the cases, there were a total of 39 participants: 34 males (87%), and 5 (13%) females. All studies reported grade levels of the participants; 13 participants were in Early Childhood--Kindergarten through third grade--(33%), 14 were in Middle Childhood, grades fourth through eighth, (36%), and 12 were in Adolescence, ninth through twelfth grade (31%). Ethnicity was reported for all students, although one study did not identify which students were Caucasian or African American, just stating that half of the participants were Caucasian, and half were African American (Harris et al., 2005). Of the 39 participants, 27 participants were Caucasian (69%), 3 were African American (8%), and 9 participants reported an ethnicity of Native American or were biracial (23%). All participants reported a diagnosis of ADHD, with 10 participants reporting a comorbid disorder such as conduct disorder, oppositional defiant disorder, or a learning disability (26%). Of the 10 articles, 2 specified the subtype of ADHD each participant had been diagnosed with. Of the 39 participants, 2 were reported to have been diagnosed with ADHD hyperactivity (5%), 2 were diagnosed with ADHD inattentive (5%), 3 were diagnosed with ADHD combined subtype (8%), and ADHD subtype was not reported for 32 participants (82%). Of the 39 participants, 28 were reported as having a pharmacological intervention in place for their ADHD (72%). All participants self-monitored on-task behavior, either academically or behaviorally.

**Study Characteristics**

Of the 11 cases included in this review, 2 had participants self-monitor academic on-task behaviors (20%), 3 studies had participants self-monitor behavior on-task (30%), and the remaining 5 had participants self-monitor both behavior and academic on-task behaviors (50%). 4 of the 10 studies in this review discussed the presence of teacher matching in their studies (40%), with the other 6 not reporting teacher matching of student’s self-monitoring scores (60%). No study in this review discussed a generalization measure of the intervention across settings (100%). Three of the 10 studies had the teacher verbally cue students to complete their self-monitoring sheet (30%), 5 studies cued students to begin self-monitoring with an electronic tone or vibration (50%), and 2 did not mention how students were cued to begin self-monitoring (20%). Four of the 10 studies included in this review faded the intervention (40%), while the other 6 did not report a figure for fading of the intervention (60%). Of the 10 studies in this review, 4 provided reinforcement for matching the teacher’s rating of the on-task behavior (40%), while the other 6 studies did not reinforce participants’ monitoring of on task behavior (60%). 70% of the interventions occurred within the general education classroom, 20% of the interventions occurred in a resource room at the participant's’ school, and 10% of the interventions occurred at the participant’s home. In 5 of the studies (50%), the researcher
implemented the intervention. In one of the studies, multiple people implemented the intervention (10%). Of the 10 studies, 4 reported the classroom teacher being the main interventionist (40%).

**Overall Findings**

The primary purpose of this review was to determine the effectiveness of self-monitoring of on-task behavior for students with ADHD. Following the systematic review process, 10 studies were reviewed, coded, and analyzed for the purpose of determining the effectiveness of self-monitoring for increasing on-task behaviors for students with ADHD. All 10 studies implemented single subject methods (PND range of 71 to 100; tau-U range of .0.7037 to 1.00). See Table 1 for individual study effect sizes. Throughout the ten studies analyzed, large effect sizes were found illustrating that self-monitoring interventions are highly effective for students with ADHD.

**Discussion**

The primary purpose of the current thesis was to determine the effectiveness of teaching self-monitoring strategies to students with ADHD. This review evaluated the effectiveness of self-monitoring strategies across gender, age and school setting. When examining the intervention focus of each study, it was found that self-monitoring strategies were implemented across three main intervention categories; academic, behavioral, and self-monitoring of both academic and behavioral on-task behaviors. The similarities and differences between these categories are described below.

**Similarities and Differences Between Academic, Behavioral and Combined Studies**

Of the ten articles included in this analysis, two implemented self-monitoring for academic on-task behaviors only, three implemented the intervention for behavioral on-task, and five implemented the strategy for both academic and behavioral concerns. The two studies that implemented the intervention for academic on-task behaviors taught students how to monitor their attention to their assignments, their accuracy and completion of assignments, as well as attention to the instruction. The three studies that implemented the intervention for behavioral concerns taught students to monitor behavior such as following the rules of the classroom such as staying in their seats, following teacher directions, and being prepared for class work by having all materials necessary. The remaining studies that implemented the intervention for academic on-task behaviors as well as behavioral concerns instructed students how to monitor a combination of the aforementioned behaviors.

Across all three categories, the intervention was implemented across all grade levels, and included female and male students. The intervention occurred primarily in the general education classroom, with some of the studies implementing the intervention during a resource classroom; Axelrod (2009), implemented the self-monitoring intervention in the homes of the participants. Of the ten studies included in this analysis five of them had the researcher implement the beginning components of the study, before the teacher and the student independently collected data. Four of the studies had the teachers as the primary interventionist for the study, with the researcher training them, while one study (Davies, 2000) had multiple interventionists, with the teacher and peers implementing the bulk of the intervention. Over all studies it took a range of 1-17 days to train the students to effectively manage their behaviors utilizing the intervention. Out of all the studies, one study (Hoff et al. 2013) had participating teachers attend a professional development where they were instructed on how to effectively implement the intervention.
Due to the small sample size in this study, it was found that none measured generalizability across multiple settings; all studies indicated increased levels of academic on-task behaviors, and a decrease in inappropriate behaviors (i.e. walking around the classroom, failure to complete work, talking out). Of the ten articles included in this meta-analysis, three studies discussed fading of support during the intervention, reporting that the participants in their studies were able to maintain targeted behavior after support was removed. This illustrates the potential long-term effectiveness of self-monitoring interventions for students with ADHD. All the studies included in this meta-analysis were determined to have a large effect size, with solely self-monitoring for academic on-task behaviors being found to be slightly more effective. Studies that implemented the intervention for student self-monitoring for academic on-task behaviors had Tau-U values ranging from .8961 to 1. Studies implementing student self-monitoring for behavior had Tau-U values ranging from .8258 to 1 while studies that taught students to self-monitor for both academic on-task and behavior had Tau-U values ranging from .7037 to 1.

The overall analysis of the 10 studies included in this review determined that self-monitoring is a highly effective intervention when implemented in the classroom to improve on-task academic behavior, as well as reducing off task behaviors for students across all grade levels. Self-monitoring interventions for students with ADHD can be used across multiple settings and can support multiple behaviors. Across all ten studies, it was found that self-monitoring interventions can reduce student off-task behavior, while also increasing student’s academic on task behaviors. Self-monitoring has been illustrated as an effective intervention, regardless of class location, age and implementation, highlighting that while self-monitoring may be more effective for reducing problem behaviors or increasing on task behaviors separately (Tau-U of .8258 to 1 for behavior only, and a Tau-U of .8961 to 1 for academic time on-task versus a Tau-U of .7037 to 1 for a combined intervention).

While self-monitoring interventions have been illustrated to be effective in reducing off-task behaviors and increasing academic time on task, they can be time-consuming and cumbersome to implement in the classroom. Across the ten studies included in this meta-analysis, time required to effectively implement the intervention ranged from an afternoon session that explained the intervention to students and assessed their understanding of the expectations (Davies, 2000), to 20 minutes each day for a week to discuss the expectations of the intervention with the five students being targeted by the intervention (Barry, 2003). The demands of a self-monitoring intervention can be overwhelming for a teacher, as it requires them to be taught the implementation and data-collection procedures for the intervention, and if they are implementing the intervention on their own, the teacher is then responsible for educating the students about the intervention and determining the effectiveness of the intervention.

**Limitations**

There are three main limitations in this study. First, the ten studies included in this analysis were single subject, limiting the analyses that were conducted. Consequently, the single subject studies that were analyzed provided a small sample size, with a total of 39 participants. Secondly, the included studies did not use standardized measurements of the dependent variables (e.g. academic on task behaviors), which can influence the reliability and validity of this analysis.
Overall Implications

This analysis calculated the effect of teaching self-monitoring interventions to students with Attention Deficit Hyperactivity Disorder (ADHD). There is currently a lack of research on highly effective classroom interventions for ADHD, thus illustrating a need for further research on self-monitoring interventions. Research on students with ADHD has illustrated a negative impact on the student’s education. Loe and Feldman (2007) found that individuals with ADHD show significant academic difficulties and are 4 to 5 times more likely to use special education services than their peers without ADHD. Individuals with ADHD have a higher usage of ancillary services as well such as tutoring, pull-out classes, after-school programs and special accommodations (Loe, 2007). Loe and Feldman (2007), found that academic underachievement and poor educational outcomes that are associated with ADHD are persistent problems, and that individuals with ADHD are more likely to be rated as below average and failing than their peers without ADHD (2007). Students with ADHD have many academic and educational difficulties such as failing more grades, achieving lower grades, being ranked lower in classes, and performing lower on standardized assessments (Loe, 2007). Students with ADHD also are more likely to face expulsions, have higher dropout rates and a lower rate of college completion (Loe, 2007). Self-monitoring interventions when implemented effectively can teach students with ADHD to manage their own behaviors, while reducing the need for teacher intervention. Overall, the implementation of self-monitoring reduced the participants off task behavior and allowed them to be more attentive to the demands of the classroom. If research continues to study the effectiveness of self-monitoring of attention and off-task behavior, interventions can be developed that focus on reducing the effect of ADHD on a student’s education.

Researchers have illustrated a correlation between ADHD and academic impairments. Frazier, Youngstrom, Glutting and Watkins (2007) conducted a meta-analysis on 181 effect sizes collected from 72 studies. They looked at standardized achievement tests, parent and teacher rating scales, grade point average, and the placement the students had been in (i.e., special education, and if the student had been retained). They found an effect size of .71, suggesting lower achievement for students with ADHD when compared to their non-ADHD peers, (Frazier et al, 2007). One can hypothesize that this correlation between ADHD and lower achievement can be due to the impacts of a student’s ADHD symptoms on the learning environment. Inattentiveness and off-task behaviors can negatively impact a student’s exposure to the materials being taught in the classroom. With the use of interventions such as self-monitoring, a student may be better able to focus on the events of the classroom, thus allowing for the potential closing of the achievement gaps between students with ADHD and their typical peers. More research needs to be conducted to determine the effectiveness of self-monitoring and increasing the achievement of students with ADHD.

Of the 39 participants included in this analysis, 26 were of middle and high school age, highlighting the need for further research for students in elementary school. The Center on the Developing Child at Harvard University states that “the basic principles of neuroscience indicate that early preventive intervention will be more efficient and produce more favorable outcomes than remediation later in life” (Center on the Developing Child, 2007). Early intervention is best practice in the field of education, and earlier instruction on self-monitoring of attention and behaviors could positively affect a student’s performance in middle and high school when the expectation for student performance and behavior increase.

Future research on this topic needs to include more diverse student populations, specifically regarding gender, as most of the participants in this meta-analysis were males. Many
studies in this meta-analysis implemented the intervention in special education classes or resource rooms where confounding variables are easier to control. This illustrates a need for more research on the effectiveness of self-monitoring in inclusion class settings, as well as more rigorous classroom settings, such as Advanced Placement and honors level classes. Research has found that students with ADHD are more likely to drop out of high school than their peers without ADHD (Loe, 2007), and with the requirements and expectations in education increasing, the need for research on the generalizability of self-monitoring is a necessity. Research needs to be conducted on students with ADHD in rigorous courses, and if this intervention is effective in preparing the student for college level curriculum. Research should also be conducted on students with ADHD to measure the generalizability of self-monitoring from a school setting to the workplace, as many of the core symptoms of ADHD can have a negative impact on an individual’s performance at their job. Most importantly, the research results of self-monitoring interventions need to be shared with educators through high quality professional development.
References


Individuals with Disabilities Education Improvement Act of 2004.


Table 1

**Effect Sizes**

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Subjects</th>
<th>PND</th>
<th>Tau-U (variance)</th>
<th>Tau-U p</th>
<th>Tau-U 95% C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gureasko-Moore</td>
<td>3</td>
<td>87.9%</td>
<td>.9434</td>
<td>0</td>
<td>.5434</td>
</tr>
<tr>
<td>Mathes</td>
<td>3</td>
<td>96.96%</td>
<td>1</td>
<td>0</td>
<td>.6094</td>
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<tr>
<td>Axelrod</td>
<td>5</td>
<td>100%</td>
<td>.9398</td>
<td>0</td>
<td>.6287</td>
</tr>
<tr>
<td>Harris (performance)</td>
<td>6</td>
<td>83.33%</td>
<td>.8961</td>
<td>0</td>
<td>.5913</td>
</tr>
<tr>
<td>Harris (attention)</td>
<td>6</td>
<td>72.75%</td>
<td>.9933</td>
<td>0</td>
<td>.6929</td>
</tr>
<tr>
<td>Barry</td>
<td>5</td>
<td>93.7%</td>
<td>.7633</td>
<td>.001</td>
<td>.3928</td>
</tr>
<tr>
<td>Davies</td>
<td>4</td>
<td>100%</td>
<td>1</td>
<td>0</td>
<td>.6519</td>
</tr>
<tr>
<td>Graham Day (w/o reinforcement)</td>
<td>3</td>
<td>74%</td>
<td>.7037</td>
<td>.002</td>
<td>.3232</td>
</tr>
<tr>
<td>Graham Day (w/reinforcement)</td>
<td>3</td>
<td>100%</td>
<td>.984</td>
<td>.001</td>
<td>.5064</td>
</tr>
<tr>
<td>Hoff</td>
<td>3</td>
<td>40.51</td>
<td>.8258</td>
<td>.001</td>
<td>.4011</td>
</tr>
<tr>
<td>Wills</td>
<td>2</td>
<td>89.1%</td>
<td>1</td>
<td>0</td>
<td>.4692</td>
</tr>
</tbody>
</table>
Figure 1

**Code List**

**Gender:** the state of being male or female (typically used with reference to social and cultural differences rather than biological ones)

- **Male:** 0
- **Female:** 1

**Grade:**

- **Early Childhood (K-3rd):** 0 the period from birth to eight years old. A time of remarkable brain growth, these years lay the foundation for subsequent learning and development.
- **Middle Childhood (4th-8th):** 1 is a time when children develop foundational skills for building healthy social relationships and learn roles that will prepare them for adolescence and adulthood.
- **Adolescence (9th-12th):** 2 a transitional stage of physical and psychological human development that generally occurs during the period from puberty to legal adulthood.

**Diagnosis:**

- **ADHD:** 0 is a chronic condition marked by persistent inattention, hyperactivity, and sometimes impulsivity. ADHD begins in childhood and often lasts into adulthood. As many as 2 out of every 3 children with ADHD continue to have symptoms as adults. Student has a diagnosis of ADHD.
- **ADHD+LD:** 1 ADHD is a chronic condition marked by persistent inattention, hyperactivity, and sometimes impulsivity. ADHD begins in childhood and often lasts into adulthood and are neurological disorders that can make it difficult to acquire certain academic and social skills. They are not the result of poor intelligence or laziness. Knowledge about LD will allow you and your child to advocate for success in learning and in life. Student has a diagnosis of ADHD and LD.
- **ADHD+ODD:** 2 ADHD is a chronic condition marked by persistent inattention, hyperactivity, and sometimes impulsivity. ADHD begins in childhood and often lasts into adulthood. As many as 2 out of every 3 children with ADHD continue to have symptoms as adults. (ODD) is defined by the DSM-5 as "a pattern of angry/irritable mood, argumentative/defiant behavior, or vindictiveness lasting at least six months." (has a diagnosis of ODD)
- **ADHD+Other:** 3 Student has ADHD, and another, not specified in the research, diagnosis. ADHD is a chronic condition marked by persistent inattention, hyperactivity, and sometimes impulsivity. ADHD begins in childhood and often lasts into adulthood. As many as 2 out of every 3 children with ADHD continue to have symptoms as adults.
ADHD Subtype:
ADHD inattentive type (0) means a person wanders off task, lacks persistence, has difficulty sustaining focus, and is disorganized; and these problems are not due to defiance or lack of comprehension.

Hyperactive/Impulsive: (1) Hyperactivity means a person seems to move about constantly, including situations in which it is not appropriate when it is not appropriate, excessively fidgets, taps, or talks. In adults, it may be extreme restlessness or wearing others out with their activity. Impulsivity means a person makes hasty actions that occur in the moment without first thinking about them and that may have high potential for harm; or a desire for immediate rewards or inability to delay gratification. An impulsive person may be socially intrusive and excessively interrupt others or make important decisions without considering the long-term consequences

Combined (2)
Not mentioned (3)

Combined Type (2): Students exhibit symptoms from both inattentive and hyperactive/impulsive subtypes.

Ethnicity:
Caucasian: 0 “White” refers to a person having origins in any of the original peoples of Europe, the Middle East, or North Africa.
African American: 1 “Black or African American” refers to a person having origins in any of the Black racial groups of Africa
Hispanic: 2 a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin
Other: 3 ethnicity is not directly stated in the research/not mentioned in the above categories

Intervention Characteristics:

Self-monitoring:
Academic (0): students monitor their attention to their assignment, their completion of assignments, accuracy of completed assignments, as well as focus to instruction.
Behavior (1): students monitor if they are following the rules of the classroom, such as staying in their seats, following directions, preparation for classwork (all materials ready, etc), etc..
Multi (2): Students are monitoring both academic and behavior

Teacher Matching:
If the teacher monitors student behavior and then compares it to the student.
Yes (0):
No (1)

Generalization Measure:
Yes (0)
No (1)

Cue Type:
   **Teacher Cue (0):** Cues to begin monitoring are provided by the teacher by some kind of prompt, such as writing on the board, tapping the student, or a verbal prompt.
   **Automated (1):** Students are prompted by either a tone, flashing lights, or a vibration, typically from a tablet, or an audio recording.
   **No Mention (2):** Cue type is not included in the information on the study.

Fading:
   **Yes (0):**
   **Not mentioned (1)**

Incentive:
   **Yes (0):** Reinforcement of some type was given to the student for accurately monitoring their behavior/attention
   **No (1):** No reinforcement was provided.

Setting:
   **General Ed Classroom: 0** a room in the school where, a class of typically developing students are taught.
   **Resource Room: 1** a separate, remedial classroom in a school where students with educational disabilities, such as specific learning disabilities, are given direct, specialized instruction and academic remediation and assistance with homework and related assignments as individuals or in groups
   **Special Education Room: 2:** a separate class in a school where students with disabilities are given direct, specialized education away from typically developing peers.
   **Home Based: 3** the intervention is implemented in the student’s home
   **Other: 4** the intervention is implemented in a different setting from the three aforementioned rooms such as the school psychologist’s office, at home, recess, etcetera.

Interventionist

   **Researcher: 0** the person conducting the researcher experiment implements the intervention in the study themselves.
   **Peer: 1** a same aged peer in the classroom implements the intervention with help of the teacher and is responsible for helping the student self-manage behavior.
   **Teacher: 2** the classroom teacher (either general education, special education or resource room teacher) implements the intervention for the student and is responsible for helping the student self-manage behavior.
   **Para-Professional: 3** a para professional is responsible for implementing the intervention and helping the student self-manage behavior.
   **School Psychologist: 4** the school psychologist is responsible for implementing the intervention and helping the student self-manage behavior.
Graduate Student (Not Researcher): 5 a graduate student working on the research project--but is NOT the primary researcher--is responsible for implementing the intervention and helping the student self-manage behavior.

Multi (5): multiple individuals are implementing the intervention together.

Pharmacological Interventions:

Pharmacological interventions being used: 0 student(s) are on a prescribed medication that is used for the treatment of ADHD

Pharmacological interventions not being used: 1 student(s) are NOT on a prescribed medication for the treatment of ADHD.

Pharmacological interventions not mentioned: 2 it is not mentioned in the research if a student is or is not receiving pharmacological interventions.