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A Review of Self Management Interventions for Children with ADHD and Implications for Education Professionals

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A REVIEW OF SELF MANAGEMENT INTERVENTIONS FOR CHILDREN WITH ADHD AND IMPLICATIONS FOR EDUCATION PROFESSIONALS

by

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Section I

Introduction

Description of Attention Deficit Hyperactivity Disorder

An increasing number of children are affected by mental health disorders. These rates vary depending upon the type of disorder, age, and diagnostic tool used in diagnosis. Studies conducted in the United States (e. g. Costello, Costello, Edelbrock, Burns, Dulcan, Brent, & Janiszewski, 1999; Shaffer, Fisher, Dulcan, Davies, Piacentini, Schwab-Stone, Lahey, Bourdon, Jensen, Bird, Canino, & Regier, 1996), New Zealand (e. g. McGee, Feehan, Williams, & Anderson, 1992), Canada (e. g. Offord, Boyle, & Racine, 1989), Puerto Rico (e. g. Bird, Canino, Rubio-Stipec, Gould, Ribera, Sesman, Woodbury, Huertas-Goldman, Pagan, Sanchez-Lacay, & Moscoso, 1988), and the Netherlands (e. g. Verhulst, Ende, Ferdinand, & Kasius, 1997) suggest that 9% - 22% percent of children have clinically severe behavioral and emotional problems. These studies also show significant differences between rates in boys and girls. Studies show that school age boys are more often diagnosed with mental health disorders than girls (Anderson, Williams, McGee, & Silva, 1987; Cohen, Cohen, & Brook, 1993; Costello, Angold, Burns, Stangl, Tweed, Erkanli, & Worthman, 1996; McGee et al., 1992). In the United States, one of the most common reasons children are referred to mental health clinics is for diagnosis and treatment of Attention Deficit Hyperactivity Disorder (ADHD). Children referred for ADHD account for up to 50% percent of all referrals to outpatient mental health clinics (Adams & Sutker, 2001).

ADHD prevalence rates in children. ADHD is a disorder, with a childhood onset, which is usually diagnosed in childhood. In the United States, the prevalence of ADHD among school-aged children is between 3%-7% (American Psychiatric Association, 2000). These statistics are similar to other countries such as Spain, Brazil, Hong Kong, Australia, Europe, and Sweden (Carrasco, Catala, & Gomez-Beneyto, 1995; Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001; Kadesjo, & Gillberg, 2001; Rohde, Biederman, Busnello, Zimmermann, Schmitz, Martins, & Tramontina, 1999; Wang, Chong, Chou, & Yang, 1993). On average, boys are four times more likely to be diagnosed with ADHD than girls (Cantwell, 1996).

ADHD Diagnostic criteria. There are three subtypes of ADHD as currently defined in the Diagnostic and Statistical Manual for Mental Disorder IV – Text Revised (DSM-IV-TR): Predominantly Inattentive, Predominantly Hyperactive-Impulsive, and Combined. The diagnostic criteria include many symptoms that must be observed to be in clinical levels before the age of 7; however, the diagnosis, at times, may not be given until later (American Psychiatric Association, 2000). This may be due to the symptoms related to ADHD becoming more profound as the student progresses in their education. For example, symptoms may not be noticeable within a kindergarten or first grade classroom, but as skills such as math or spelling become more complex, the symptoms of ADHD may become more noticeable as the student struggles to focus and learn new, more difficult skills.

Along with ADHD, several other comorbid diagnoses can occur. These other disorders, although not always found in all cases may include: Anxiety, Depression, Oppositional Defiant Disorder, Conduct Disorder, Bipolar Disorder and others (American Psychiatric Association, 2000). The most prevalent and consistent comorbid disorder is Oppositional Defiant Disorder (Jensen, Mrazek, Knapp, Steinberg, Pfeffer, Schowalter, & Shapiro, 1997). These comorbid

disorders can add other complexities to the lives of children with ADHD.

Problem behaviors exhibited. Large amounts of research have been conducted on ADHD and the difficult behaviors associated with this disorder. Research indicates that the symptoms of children's ADHD affect those involved in their education including classroom teachers, classmates, administrators, and others (Reis, 2002). The outward projection of many of these ADHD symptoms may be disruptive, which can make the learning environment difficult for teachers and other classroom students. These associated behaviors may include difficulties with: on-task behavior, following directions, social skills, impulse control, assignment completion, etc. These behavioral and academic difficulties may become elevated enough to cause problems at home and with school administration, resulting in school suspension, expulsion and even problems with local law enforcement (American Psychiatric Association, 2000).

Self-Regulation of Attention Deficit Hyperactivity Disorder

Within the school setting, the ability to monitor one's behavior, recognize behaviors that need modification, and adjust or change said behavior is known as self-regulation and is a key component within a student's development and learning (Harris, 1982; Zimmerman & Schunk, 1989). Whereas the ability to self-regulate is considered an asset and is desirable, the creation of such skills is a challenge for many (Harris & Schmidt, 1997). Children with ADHD who struggle with behaviors related to inattention, impulsivity, and hyperactivity may find self-regulation to be difficult (Semrud-Clikeman, Nielsen, Clinton, Sylvester, Parle, & Connor, 1999; Shimabukuro, Prater, Jenkins & Edelen-Smith, 1999).

There is much research on interventions to support those with ADHD. The most common intervention for students with ADHD is the use of stimulant medications; however,

other interventions may include behavioral parent training and classroom behavior management skills. The design of these other intervention programs is to support parents and teachers to devise and enact consistent behavior management programs that: set goals for the student, have a simple means of measuring progress toward goals, have a set of consequences which encourage the success of the student in reaching the goals, and to extinguish unwanted behaviors by making them unrewarding (Barkley, 1997; Pfiffner & O'Leary, 1993). The target of these interventions should include specific academic behaviors such as independent work, accuracy and completion of work, organizational skills, increased academic performance, and the ability to learn and succeed academically (DuPaul & Stoner, 2003; Purdie, Hattie, & Carroll, 2002).

Description of self-regulation for ADHD. Much of the early research on interventions for ADHD focused on cognitive-based classroom interventions. Today much of the research tends to focus on behavioral interventions for ADHD, such as the problems relating to intrinsic and extrinsic motivation. Some research has made the distinction between "Won't Do" or "Can't Do" difficulties: whether the student "Won't Do" a task out of lack of motivation or the student "Can't Do" a task out of a lack of ability or knowledge. This is an important aspect when creating an intervention for students with ADHD as many of these students may also have comorbid disorders, such as Oppositional Defiant Disorder or Learning Disabilities, which need to be evaluated for the intervention to be effective. Students who are also diagnosed with Oppositional Defiant Disorder may have increased difficulties with "won't do" behaviors as these students may choose to not accomplish tasks due to rebellious behaviors. Students who have Learning Disabilities need interventions which focus on aspects of "Can't do" as they may not be able to accomplish certain academic tasks as they may not know how. Recognizing that interventions need to include aspects of "Won't Do" or "Can't Do" in the development phase of

the intervention can help in its effectiveness and success; however much of the research reviewed did not include assessments for "Won't Do" or "Can't Do." Although the research techniques have varied greatly over the years, much has been learned regarding the types of interventions that are effective in supporting students with ADHD. Barkley (1997) proposed Self-Regulation Theory for ADHD which is a theory of behavioral inhibition, executive function, and sustained attention in which he stated that the primary difficulty with ADHD is a neurological defect within the prefrontal cortex, which causes dysfunctions in inhibitory control. The resulting struggles, caused by lack of inhibitory control, include defects in executive functioning that directly affect an individual's ability to self-regulate behavior.

Research supports Barkley's theoretical model and the idea that those with ADHD show a deficit in self-regulation (Douglas, 1989; Miranda, Presentacion, & Soriano, 2002; Pennington & Ozonoff, 1996; Sergeant & Van Der Meere, 1990; Tannock, 1998). Research further supports the idea that behavioral self-regulation interventions can be effectively implemented to address the deficits found in ADHD (Hinshaw & Melnick, 1992; Shapiro, DuPaul, & Bradley-Klug, 1998). These behavioral interventions focus on the feedback cycle, which is a series of steps created to assess their own progress and then evaluate their behavior (Reid, Trout, & Schartz, 2005). Although there are many forms of self-regulation and many of the terms for self-regulation have varied throughout the past decade, this review will focus on only three forms of behavioral self-regulation: Self-Monitoring, Self-Monitoring Plus Reinforcement, and Self-Reinforcement.

Self-Monitoring. One of the most important parts of self-regulation is the "conscious appraisal of immediate past behavior" (Reid et al., 2005, p. 362). One way this appraisal of immediate past behavior can occur is through self-monitoring. This occurs when a person self-

assesses a targeted behavior and self-records the results in some manner (Nelson, 1977). Two forms of self-monitoring are commonly used in the educational setting, self-monitoring of attention and self-monitoring of performance. Self-monitoring of attention requires that a student be instructed to self-assess their level of attention and to self-record these results when cued. The cueing is typically performed through the use of a beep tape that plays through headphones and reminds the student to self-assess (Hallahan, Lloyd, Kosiewicz, Kauffman, & Graves, 1979). Self-monitoring of performance requires that a student be instructed in the process of self-assessment and self-recording. The student is required to assess some aspect of academic performance and record the results (Reid, 1993; Reid & Harris, 1989). It is important to note that there is more variability within self-monitoring of performance as the area of academics, productivity, accuracy, or academic strategy may be included as forms of performance.

Self-Reinforcement. The origins of self-reinforcement began in 1976 with Bandura's Social Learning Theory. Social learning theory is considered a link between cognitive learning theory and behavioral learning theory (Bandura, 1976). While this review of the literature does not focus on the cognitive aspects of learning, one aspect of Bandura's Social Learning Theory is prevalent: behavior can be modified through appropriate reinforcement. Self-reinforcement requires a person to set goals or objectives; self-assess his/her performance of predetermined expectations and self-reward or reinforce his/her performance of these goals. Self-reinforcement differs from other forms of reinforcement as self-reinforcement requires individuals to set goals, self-assess their performance, and self-reinforce their behavior according to their performance where other forms of reinforcement are usually rewarded by an observer who assesses the performance of predetermined goals or objectives and then rewards accordingly.

Self-Monitoring Plus Reinforcement. Self-Monitoring Plus Reinforcement includes the same steps involved in Self-Monitoring with the addition of a reinforcement system to encourage the student to continue performing the expected behaviors. The idea is that the combined success of self-monitoring and reinforcement will allow students to acquire the needed skills to continue the intervention in duration and in other areas of their lives.

Why Self-Management for ADHD?

Studies show that children with ADHD have a greater chance of receiving special education services, higher rates of grade retention, lower GPA in the secondary education system, higher rates of school dropout and are less likely to enroll in higher education (DuPaul & Stoner, 2003). Barkley states that ADHD is a dysfunction in a persons' ability to self-regulate behavior (Barkley, 1997). In other words, individuals with ADHD often know what to do but have difficulties performing the tasks due to a lack of behavioral inhibition (Barkley, 1997). Teaching students the skills needed to manage their own behaviors through self-managing their behaviors can increase classroom performance (DuPaul & Stoner, 2002; Harris, 1982; Lamb, Cole, Shapiro, & Bamabara, 1994; Reid, 1996). These interventions have been proven to be effective with other student populations within the special education classroom (Shimabukuro et al., 1999). These interventions have also been found to be easily accepted by teachers, as they require less time to run than other interventions (Fantuzzo, Polite, Cook, & Quinn, 1988). This paper will focus on the use of self-management strategies for children with ADHD to draw some conclusions about the effectiveness of these strategies. It will review current self-monitoring techniques for ADHD and their successes in classroom settings. Knowing what works, in treating ADHD and its symptoms, will help educators make better decisions when implementing interventions within the classroom.

Section 2

Literature Review

The literature collected on self-management was focused on the behavioral interventions of self-monitoring, self-reinforcement, and self-monitoring plus reinforcement. The most prevalent self-management interventions involve self-monitoring; however, the number of studies found in the existing literature was still low. This may be due to the larger number of studies which focus on cognitive and behavioral interventions for self-management; however, this review focuses solely on studies that only utilized behavioral interventions.

In order for studies to be included in this review, they had to meet the following inclusion criteria: (1) articles must be from a peer reviewed source between 1980 and 2012, (2) articles must evaluate self-management interventions in school settings and (3) articles must include results for school aged children with ADHD and/or ADHD behaviors. Articles that met these requirements but contained any of the following were excluded: (1) participants with autism and autism spectrum disorder, (2) dissertations, thesis, or non-peer reviewed articles, (3) articles related only to adult ADHD.

Self-Monitoring

Seven self-monitoring studies met the required criteria to be included within this review, as they consisted of self-monitoring of school aged children who were diagnosed with ADHD. Across these seven studies, children varied in age from eight to fifteen years old and from the third through tenth grades. These studies included 21 males and 1 female. Gender imbalance is to be expected as ADHD is more prevalent in boys than girls. These studies used either a single case design, with one participant, or a case study method with up to six participants.

Of the seven studies, five were completed at the elementary school level, one involved

students in middle and high school and one study involved a combination of 6th and 7th grade students. The use of medication within these studies was quite low as only one study actually included pharmacological interventions as part of the study. Four of the studies did report the use of psychotropic medications during the studies; however the use of these interventions was considered an outside or external variable as the use could not be controlled or regulated. The other two studies did not report on the use of medications.

The targeted behaviors found within these studies can be separated into either self-monitoring of academic performance or self-monitoring of classroom behavior. Of these studies, one included self-monitoring of academic performance (Shimabukuro et al., 1999), while four included self-monitoring of classroom behavior (Christie, Hiss, & Lozanoff, 1984; Mathes & Bender, 1997; Stahr, Cushing, Lane, & Fox, 2006; Stewart & McLaughlin, 1992), and the other two studies were a combination of both self-monitoring of classroom behavior and performance (Barry & Messer, 2003; Harris, Friedlander, Saddler, Frizzelle, & Graham, 2005).

Self-Monitoring of academic performance. One study reviewed focused on self-monitoring of academic performance. The academic behaviors that were measured included productivity (i.e., amount of work completed) and accuracy (the amount of work completed correctly such as the number of spelling words written correctly) (see Table 1).

Table 1

Self-Monitoring of Academic Performance

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Shimabukuro, Prater, Jenkins, & Edelen-Smith (1999) Single group, multiple baseline.	3 male students with ADHD. One 6th grader and Two 7th graders who were 12-13 years old in a Self-contained, private school, mixed grade classroom. (Diagnosis by physician.)	Self-monitoring and self-graphing of academic performance in Math, Written Expression, and Reading Comprehension. On-task behavior was recorded by teacher. No medication was reported.	Academic productivity and accuracy increased across the 3 academic areas during self-monitoring and self-recording. Teacher rated an increase in on-task behavior.

Shimabukuro et al. (1999) conducted a multiple baseline study that focused on self-monitoring of performance in academics across three areas: reading comprehension, math, and written expression. The study measured the effects on three students with learning disabilities and ADHD within a 6th and 7th grade self-contained resource classroom. Students self-monitored and graphed their academic accuracy (percent correct) and academic productivity (percent of assignment completed). The students did not self-monitor on-task behavior; however, the teacher monitored on-task behavior at the end of each period.

The classroom teacher collected thirty-two days of classroom work, which created a baseline for this study. Baseline productivity scores for reading comprehension were below 45% for the three students. These scores increased for all students during the self-monitoring phase to a productivity mean of 96%. Mean baseline productivity scores for math were 56.4% and showed an increase for all students to a combined mean of 93.5%. Written expression baseline mean productivity scores were 40% and showed an increase for all students to a combined mean of 73.1%. These results show a significant increase in productivity while using a self-monitoring

intervention. Academic accuracy scores for reading comprehension increased for all students from a combined baseline mean of 52.3% to a combined mean of 83.2% where accuracy scores for math increased for all students from a combined baseline mean of 63.4% to a combined mean of 87.9% and scores for written expression increased for all students from a combined baseline mean of 40% to a combined mean of 73.1%. During teacher monitoring of on-task behavior, all students showed consistent improvement of behavior during reading comprehension from a combined on-task baseline mean of 46% to a combined mean of 87%. The highest levels of on-task behavior were measured for the group during math where the baseline mean changed from 46.4% to a combined mean of 92.1%. The lowest levels of improvement in on-task behavior were measured for the group during written expression where baseline means for the group improved from 54.1% to a combined mean of 70%. It is important to note that written expression included when students participated in whole class instruction, instead of small group instruction like reading comprehension and math. This change in instruction type may account for the on-task variation found between reading comprehension and the other two academic areas.

The study by Shimabukuro et al. (1999) indicates that self-monitoring of academic performance with a focus on productivity and accuracy may result in an increase of on-task behavior, academic productivity, and academic accuracy. While results for this study show a greater increase in the amount of work completed versus academic accuracy, the results showed significant improvements in all areas and with all students. In addition to these successes, teachers also reported the ease of implementing this intervention within the regular education classroom.

The results from the above study suggest that self-monitoring of academic accuracy and

performance can be effective at changing and improving on-task behaviors of students with ADHD in the secondary school setting. An aspect that is not measured within this study is the effects of self-monitoring at improving attention.

Self-Monitoring of classroom behavior. Four studies for self-monitoring of classroom behavior focused on increasing on-task student conduct, while decreasing disruptive classroom behaviors (see Table 2). Of the four studies reviewed which focused solely on self-monitoring of classroom behavior, three were conducted with students on an elementary level in 3rd-5th grade, while the other study was conducted on a high school level using a 10th grader. Nine students were male and one was female. Four of the studies were done within a special education setting and the other was done in a general education classroom. The behavior target of these interventions was to increase on-task classroom behavior, by decreasing off-task classroom behavior, such as inattention, disruptive behaviors, and inappropriate classroom behavior. Two studies reported nothing on medication, whereas, two reported the use of medication although these were external factors to the studies as there were no controls for frequency, duration, quantity, or type of medication.

Table 2

Self-Monitoring of Classroom Behavior

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Christie, Hiss, & Lozanoff (1984) Single Case	Three boys with ADHD. Two 4th graders and one 3rd grader in a General Education classroom. (Diagnosed by study personnel.)	Teacher directed, self-monitoring. No medication use reported.	Self-monitoring resulted in an increase in on-task behaviors and decrease in inattentive and inappropriate classroom behaviors.
Mathes & Bender (1997) Multiple baseline	Three 8-11 year old males with ADHD in the 3rd, 4th, and 5th grades. Served in a resource classroom for students with behavior disturbances. (Diagnosed by physician.)	Self-monitoring with use of beep tape and headphones to increase on-task behavior. Students were taking stimulant medication.	On-task behavior Baseline = 40%, 38%, 37% Phase 1 (On-Task) = 97%, 87%, 94% Maintenance (26 Days Later) = 60%, 46%, 93%
Stahr, Cushing, Lane, & Fox (2006) Multiple Baseline ABAB in Math and Language Arts	One 9 year old male student with ADHD served in a 4th grade self contained classroom for students with emotional and behavioral disturbances. (Diagnosed by physician.)	Self-monitoring six question check-list with hierarchy of request cards for seeking help and an extinction component. Student was taking medication.	Language arts on-task behavior increased from 32.83% to 74.44%. Math on-task behavior increased from 10.6% to 72.33%.
Stewart & McLaughlin (1992) ABAB Single student replication	One male 15 year old student with ADHD, in a self contained classroom for students with behavioral disturbances. (Diagnosed by physician.)	Self-monitoring of on-task behavior. No medication was reported.	Decrease in off task behavior. Severity of disruptions also declined per student observer.

Christie et al. (1984) conducted a study with three boys in the 3rd and 4th grades who were identified by researchers as having high levels of ADHD behaviors. The purpose of the study was to evaluate the effects of self-monitoring on unacceptable classroom behaviors. The students were trained how to self-monitor their behaviors by self-recording within the general education classroom setting. Students were cued by their teacher to immediately record the results of their behavior. The time intervals used to signal the children varied throughout the study and the students were cued when the time was convenient for the teacher. Results from this study show an increase in on-task classroom behaviors, from a baseline mean of 41.9% to a final treatment phase mean of 65%.

Stewart et al. (1992) implemented a self-monitoring program in a self-contained special education classroom with a 15 year old male student with ADHD who struggled with on-task behavior and classroom disruptions. This ABAB design study was performed only in the special education classroom. While the intervention was effective in the self-contained classroom at reducing off-task classroom behaviors, from a baseline mean of 85.2% to a self-monitoring treatment mean of 28.12% across study phases, the student was not trained to use this program in less structured classes. As the intervention was not expected to be performed throughout the student's entire day the student struggled to perform the same skills within these less structured classes. Regular education teachers reported that although classroom disruptions did decrease, while the student was participating in the intervention, the effects did not continue after the intervention ceased, as it was the opinion of the regular education teachers that classroom behaviors returned to previous levels. This would suggest a lack of generalization for self-monitoring within this study; however no data were collected to show whether classroom behaviors truly returned to baseline levels.

Mathes et al. (1997) explored the maintenance effects within the general education classroom setting utilizing a multiple baseline study across subjects which included multiple phases of fading for the purpose of measuring how well the students maintained treatment gains. Participants were three male students in 3rd through 5th grades, who were also receiving pharmacological interventions for ADHD; although one student's participation varied throughout the study. While the medication was not controlled by the researchers within the study, the participants' parents did agree to medicate their children throughout the study. On-task behavior was used as the measurement for attention throughout the study. Students were trained within a resource classroom how to self-monitor and record, while using a beep tape as a cue. Initial baseline data shows an average on-task behavior of 39%. Phase one of the study, which was the intervention phase, consisted of ten days of self-monitoring while using a beep tape and self-monitoring tracking sheets to measure on-task behavior. Following implementation of phase one on-task behavior increased to an average of 93%. The students then immediately entered phase two of the intervention, which included the first of two fading phases. This included removing the beep tape from the intervention and required the student to self-cue and record on the self-monitoring tracking sheet. Phase three included the second fading phase of the intervention which removed the self-monitoring tracking sheet in addition to the already removed beep tape. A second baseline was then obtained which showed average on-task behavior of 53%. Students then began the 4th phase of the intervention that included treatment similar to phase one. This increased on-task behavior to an average of 95%. The last phase of this study included a final fading phase, where the beep tape and tracking sheet were removed again, and on-task behavior continued to remain high with an average of 98%. Maintenance, within the general education classroom, was measured by conducting structured interviews with the student and the general

education teacher. No other measures for maintenance were used. Response scores between the student and teacher were very similar to each other and encompassed the idea that the intervention was good and the students were getting into less trouble. One student from the study actually became student of the week in one class. According to the teacher survey, the intervention generalized throughout these students' general education classes as teachers stated that there was a noticeable increase in on-task behavior and an increase in academic accuracy during the intervention.

Another study, which also included a student on medication for ADHD was Stahr et al. (2006). This study included a 4th grade male student who was served in a self-contained setting for students with emotional and behavioral problems. This study utilized a multiple baseline across two settings with a withdrawal component (ABAB) design. The intervention package included three components: a self-monitoring system, extinction, and a color coded communication system. Data were collected throughout two classes, Language Arts and Math. The goal of the intervention was to increase on-task behavior and appropriate skills for seeking adult attention, while decreasing inappropriate behaviors used to escape a task such as verbal and physical aggression towards others.

The self-monitoring program mimicked other interventions of the same type with typical self-assessment and self-recording via a checklist after an environmental cue. This cue consisted of pieces of paper taped to a clock at fifteen minute intervals to remind the student to complete the checklist. The accuracy of the student's self-rating was verified by the classroom teacher for the first three days, with perfect inter-rater agreement during this time. After this phase, the student was required to self-monitor independently. During this time of self-monitoring, the student was also required to assess his level of frustration. This form of self-monitoring was

accomplished through the use of color coded cards, allowing the classroom teacher to immediately see how the student was doing regarding his levels of frustration and ability to self-control. The student was required to self-assess on a continuous basis via the card system. When the student needed some form of support or assistance within the classroom, he was required to signal the teacher in an appropriate manner and the teacher would then be able to view the card on the desk and understand the urgency of the student's duress. Green cards meant that the student was doing fine and that the teacher should come to assist when it was convenient for the teacher; yellow cards were interpreted as the student is attempting the assignment but would need help within five minutes. It also indicated to the teacher that the student's levels of aggravation were increasing. Red cards meant that the student needed immediate assistance with the class work and that present levels of anger were extremely elevated. The teacher was required to respond to this card within one minute.

During Language Arts, following an ABAB design, mean on-task behaviors increased from a baseline of 33% (A) to 74% (B) during the initial phase of the intervention. The mean on-task scores for the second phase of the intervention for Language Arts were similar to the first phase with a baseline mean of 37% (A) and intervention mean of 68% (B). Once the on-task behavior for the Language Arts class was stabilized, the intervention was introduced in Math class. Through an evaluation of baseline data alone, the student's on-task behavior was considerably lower in Math. Mean scores of on-task behaviors for Math increased from a baseline of 11% (A) to 58% (B) for phase one. During phase two, mean scores increased from a baseline of 11% (A) to 72% (B).

The teachers and the student were given a pre and post social validity measure to assess their views on the intervention and the success of it. The scores for both teachers' and the

student's views, remained fairly consistent from pre and post assessments and showed a positive trend. One of the teachers did complain about the amount of record keeping required for the self-monitoring sheets as she felt that it was cumbersome. The same teacher did, however, report positively on the use of the color cards used to increase student communication. When the first intervention phase in Language Arts was removed to acquire a new baseline, the student requested that the intervention be reinstated as he felt that it was a good way to seek teacher attention and assistance in a positive manner. This request, made by the student, may give a better idea of the acceptability of the intervention and the level of ease in which the student felt while self-monitoring.

The studies for self-monitoring of classroom behavior show positive significant changes in classroom behavior during treatment phases. Stewart et al. (1992) showed that while the intervention was only being conducted within the special education setting, teachers within the student's general education classes stated that they noticed a decrease in classroom behavioral problems. However, when the intervention was terminated the effects within all classrooms returned to baseline levels. The results from this study suggest that self-monitoring of classroom behavior interventions need to be continued to maintain treatment effects. This would not be a difficult task as teachers and students from multiple studies stated that these interventions are effective at increasing on-task behavior, require little training, and are fairly easy to maintain (Mathes et al., 1997; Stahr et al., 2006).

Self-Monitoring of classroom behavior and performance. While a student's classroom behavior may be disruptive due to attentional issues, interventions reviewed for self-monitoring of attention did not include measures for increases in academic learning. Without concrete interventions measuring academic learning, this explicit problem may never be fixed.

The following two studies included both self-monitoring of classroom behavior and academic performance within their interventions (see Table 3). A benefit of combining self-monitoring of both classroom behavior and performance is the improved measures of classroom specific skills which are typically regarded as key deficits within the ADHD student.

Table 3

Self-Monitoring of Classroom Behavior and Performance

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Barry & Messer (2003) Single Case ABABAB design	Five 12 year old males with ADHD in a 6th grade General Education classroom. (Diagnosed by physician.)	Behavioral self-management of Academic performance, on-task and disruptive behaviors. All were taking stimulant medications.	Increase in academic performance of work completion and accuracy. Increased on-task behavior. Decreased disruptive behavior. Study shows maintenance at one month follow-up.
Harris, Friedlander, Saddler, Frizzelle, & Graham (2005) Multiple baseline, across subject	Six 3rd-5th grade students with ADHD, 5 males and 1 female served in the General Education Classroom. (Diagnosed by physician.)	Self-monitoring of attention (on-task behavior) and Self-monitoring of academic performance during spelling. All students were taking medication.	On-task behavior = 55% (Baseline) SMP = 92% SMA = 94% Academic Performance or percent of spelling words written correctly = 19% (Baseline) SMP = 42% SMA = 57%

Harris et al. (2005) conducted a multiple baseline across subject design study to measure the differences between self-monitoring of classroom behavior and self-monitoring of performance and their effectiveness at increasing on-task classroom behavior and academic skills. This study involved six, 3rd through 5th graders in the general education classroom, five males and one female, who were diagnosed with ADHD by their family physicians and concurrently taking medications. The intervention was completed only during classroom time for language arts and therefore does not contain information regarding generalization.

The self-monitoring of classroom behavior phase began with a student-teacher interview in which the student was reminded about the importance of attending during class time. The student was then given a random interval beep tape that was used to initiate self-assessment and then self-recording. During the self-monitoring of performance phase very similar training was used in which the teacher met with the students individually and reminded them of the importance of practicing their spelling words. The children were then taught how to count the number of times the spelling words were practiced correctly and this recording occurred at the end of each spelling period.

Results from this study show a comparable increase of on-task classroom behavior throughout both self-monitoring of classroom behavior and self-monitoring of performance interventions. Baseline on-task classroom behavior increased from a mean of 55% to a self-monitoring of performance mean of 92% and a self-monitoring of classroom behavior mean of 94%. The intervention most effective for academic performance, or spelling words written correctly, was self-monitoring of classroom behavior. Baseline academic mean scores of 19% increased to self-monitoring of performance mean scores of 42% and self-monitoring of classroom behavior mean scores of 57%. Although no fading was used, and therefore no

generalization assessed, the immediate success found within self-monitoring of classroom behavior and performance reasserts its importance within the general education classroom.

Another multiple baseline study by Barry et al. (2003) also focused on self-monitoring of classroom behavior and performance; however generalization was included to measure the longevity of these effects. This study consisted of five, 12 year old males, within the 6th grade general education classroom. All students had been previously diagnosed with ADHD and were also taking stimulant medications. The data were collected two hours prior to lunch each day and therefore assignments and activities varied depending upon the teacher's lesson plans. A self-monitoring checklist was created that included questions focusing on various aspects of classroom behavior and performance. Every 15 minutes the students were required to self-assess and self-record their performance according to the checklist. Although no numerical data were provided, all graphs indicated an increase in on-task classroom behavior and performance throughout this study. A follow-up was conducted one month after this intervention was completed which showed some residual effects of the self-monitoring program with on-task classroom behavior and academic performance.

Summary. Self-monitoring of classroom behavior and performance, whether using a beep tape or some other cuing device, consistently show increases in on-task classroom behavior, academic accuracy, and performance. These increases are shown in both individual and large group settings and appear, through teacher report, to be simple to control and implement within both elementary and secondary settings whether they pertain to specialized classroom settings or not. Although many factors affect the success of these interventions, such as the length of the interventions and number of self-monitoring trials, they appear to be effective during the interventions. This suggests that the skill of self-monitoring of classroom behavior and

performance can be taught. Due to the positive results from using the self-monitoring interventions students can be taught this skill making it a useful intervention for classrooms. In addition to self-monitoring, rewarding the students for performing these academic and classroom skills through self-reinforcement can motivate students while showing continued success.

Self-Reinforcement

Four studies examining self- reinforcement with ADHD students focused on increasing on-task behavior and academic achievement (see Table 4). The studies were performed with 28 male students in 2nd through 6th grade. Two of the studies were conducted within a special education setting (Ajibola & Clement, 1995; Bowers, Clement, Fantuzzo, & Sorensen, 1985), while the other two were in an experimental classroom setting (Chase & Clement 1985; Fantuzzo & Clement, 1981). The behavior target of these interventions included increasing on-task behavior, math achievement, reading comprehension, and number of assignments completed. These studies all utilized social learning theory concepts of self-reinforcement through setting goals and standards, observing their own performance of these goals, self-assessing their performance, and self-reinforcing the behavior according to their performance (Bandura et al., 1976).

Table 4

Self-reinforcement

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Ajibola & Clement (1995) Modified Latin-square.	Six 9-12 year old, 4th-6th grade, male students with ADHD in a Special Ed classroom. (Diagnosed by study personnel.)	Measure ADHD behaviors of inattention, impulsivity, hyperactivity, and academic performance with non-contingent reinforcement (NR), self-reinforcement (SR), placebo (P), high dose medication (HD) and low dose medication (LD).	Academic performance increased most with SR + LD. Accuracy of academic performance showed no sig. change with treatments. Hyperactivity decreased most with LD with either NR or SR. Impulsivity decreased most with LD and HD with SR. Inattention decreased most with HD and SR.
Bowers, Clement, Fantuzzo, & Sorensen (1985) Six single subject counter-balanced design with reversal.	Six 8-11year old males with ADHD, served in a special ed. classroom. (Diagnosed by study personnel.)	Teacher reinforcement vs. self-reinforcement on attention to task & reading accuracy. No medication reported.	Teacher-Reinforcement Attention = 67.2% Accuracy=91.46% Self-Reinforcement Attention=79.23% Accuracy=92.64%
Chase & Clement (1985) Individual baselines & treatments counter-balanced across all treatment phases.	Six 9-12 year old 4th-6th grade students with ADHD in an experimental classroom. (Diagnosed by physician.)	The use of Self-Reinforcement and Meds to increase academic accuracy. No medication during baseline, but it was controlled throughout the treatment phases.	Self-Reinforcement increased accuracy of academic performance more than medication alone. Using both was the most effective.
Fantuzzo & Clement (1981) Multiple series single subject ABAB withdrawal	Nine 7-9 year old 2nd grade students with ADHD in an experimental classroom. (Diagnosed by study.)	Behavioral modeling and self-reinforcement of attention and academic achievement. No meds were used.	Increased On-Task Behavior from 34.5% to 80.1%. Increased Academic Achievement from 49.1% to 59.4%.

Fantuzzo et al. (1981) assessed the use of self-reinforcement with nine male students, ages 7 to 9 years old, which were in the 2nd grade. Students were referred to the program due to elevated ADHD behaviors, measured through the use of multiple behavior checklists. No medication usage was reported in this study. The study was conducted during summer vacation within an experimental classroom. The design consisted of three sets of ABAB withdrawal single subject studies. The purpose of this study was to measure the effects of self-reinforcement on student attention and academic achievement. This was done through the use of a confederate who modeled appropriate behavior with the purpose of influencing the treatment participants to conform.

The nine boys were assigned to one of three experimental conditions each lasting 22 days, with the entire study lasting a total of 66 days. The three experimental conditions were: teacher reinforcement; self-reinforcement; and opportunity to self-reinforce. Each experimental condition included the confederate and one student. The experimental conditions were replicated across the three participants using an ABAB design, where phase A consisted of baseline and phase B consisted of treatment, within each experimental condition. This consisted of 10 minutes of math instruction via television and 10 minutes of seatwork while doing math worksheets. Data were only collected during the 10 minutes of seatwork.

During baseline, behavioral instructions were given to the confederate once every 10 seconds, via ear piece, and split his behavior between on-task behavior at a rate of 20% of the time and off-task at a rate of 80% of the time. At no time was the confederate allowed to speak with the other student. No reinforcement was used to alter behavior during baseline phases.

Within the teacher reinforcement experimental condition the behavior of the confederate was adjusted to 80% on-task and 20% off-task for treatment phase B and 20% on-task and 80%

off-task for baseline. The teacher reinforced at a 60 second variable interval, through praise and points, which were given to the confederate only. When the tone sounded, the teacher was required to assess if the confederate was on-task and reward him through a point system. In conjunction with the point, the teacher was also required to tell the confederate, calling him by name, “good job.” At the end of each session, each participant received a treat, while the confederate was allowed to exchange his points for more treats, one treat per point. Results for the three students, within the experimental condition of teacher reinforcement, showed a phase A baseline mean, for on-task behavior, to be 26.7% and 24.8% for academic achievement, or percentage of problems completed correctly. During the treatment phase B, of teacher reinforcement, mean on-task behavior was 16.3% and academic achievement was 15.8%. In the return to baseline phase A, mean on-task behavior was 13.2% and academic achievement was 13.5%. In the final treatment phase B of teacher reinforcement, mean on-task behavior was 11.2% and academic achievement was 12%.

During the self-reinforcement condition, a beep tape continued to play as in the teacher reinforcement condition, but the confederate self-assessed on-task behavior and rewarded himself points, instead of the teacher. The confederate was required, when on-task, to say “good” while rewarding the point. At the end of the session, both participants were given a noncontingent treat and the confederate was also allowed to exchange points. Data for baseline phase A of the self-reinforcement condition showed mean on-task behavior to be 37.1%, while academic achievement was 45.3%. In treatment phase B, mean on-task behavior was 64.7% and mean academic achievement was 49.8%. In the return to baseline phase A, mean on-task behavior was 21.5% with mean academic achievement at 33.1%. The final treatment phase B showed on-task behavior to be 56.3% and 40% for academic achievement.

The opportunity to self- reinforce intervention included the same aspects of the self-reinforcement except all participants were given counters to record points. Students were told that the point counters were not toys and were to be used to help themselves if desired. No further explanation was used to direct students on operation or frequency of reinforcement. At the end of the session, both participants were given a noncontingent reinforcement, a treat, while only the confederate was allowed to exchange points earned for extra treats. In baseline phase A for the opportunity to self-reinforce condition mean on-task behavior was 34.5% with academic achievement measuring 49.1%. In treatment phase B on-task behavior was 80.1%, while academic achievement was 59.4%. In the return to baseline phase A mean on-task behavior was 25.5% and mean academic achievement was 38.1%. In the final treatment phase B, mean on-task behavior was 69.1% and mean academic achievement was 59.1%.

Data suggest increases in academic achievement and on-task behavior due to the use of a confederate to model behavior within self-reinforcement and the opportunity to self-reinforce conditions. Each experimental condition resulted in desired changes, as the students' behaviors were affected through the confederate's behaviors. The data show that the modeled behavior of the confederate was sufficient to cause students to adjust both on-task and academic achievement to mimic peer performance. Although the students' behaviors did not match the magnitude of the confederate's, the students' behavior mimicked both the positive and negative changes of the confederate's behavior.

Bowers et al. (1985) performed a single subject counterbalanced design with reversal with six 8 to 11 year old boys within a special education classroom. Each student was identified as having attention deficits and no medication was reported. The purpose of this study was to measure the effects of teacher reinforcement versus self-reinforcement at increasing on-task

behavior and accuracy of academic performance while accomplishing reading comprehension and word recognition assignments. Through-out the study, students' were paid five cents for attending class and five cents for every point earned with a maximum of 50 cents per day. Money was the only reinforcer used for all conditions. The students were required to participate in three treatment conditions: baseline, teacher reinforcement, and self-reinforcement, which were conducted across seven phases. Within each treatment condition, academic accuracy, sustained attention, and accurate reinforcer delivery were evaluated.

Baseline condition required the student to attend class and self-record daily attendance. Sustained attention to task during baseline shows a mean of 53.91%, while accuracy of reading comprehension averaged 85.84%.

During the teacher reinforcement condition, the teacher informed the students that they would receive points for on-task behavior. The teacher witnessed this behavior as the teacher followed a two minute variable interval schedule which lasted 12.5 minutes. The teacher was required to reward the student by placing a check mark on a tracking sheet which was on the student’s desk. Sustained attention during this condition was an average of 67.2% with a mean difference effect size of 0.79, while accuracy of reading comprehension averaged 91.46% with an effect size of 0.33.

The self-reinforcement condition was similar to the teacher reinforcement condition except students were trained to perform the teacher’s role of reinforcement. Students used a cuing device to signal self-assessment of sustained attention and used a wrist counter to track points. Sustained attention during this condition was an average of 79.23% with a mean difference effect size of 1.87, while accuracy of reading comprehension averaged 92.64% with an effect size of 0.42.

Self-reinforcement was more effective at increasing sustained attention than teacher reinforcement. However, self-reinforcement and teacher reinforcement showed significant increases in sustained attention through both treatment conditions. Minor increases in academic accuracy were measured during the two reinforcement conditions however these produced small effect sizes. Although these effect sizes were small, academic accuracy were found to be above 90% during these conditions.

Chase et al. (1985) further assessed the use of self-reinforcement with six male students' ages 9 to 12 years old that were in the 4^{th} through 6^{th} grades. Students were diagnosed with ADHD by a family physician and were taking medication for ADHD, as medication was an integral part of the study. The study was conducted within an experimental classroom and consisted of individual baselines and treatments, counterbalanced across all treatment phases. The purpose of this study was to evaluate the effectiveness of Ritalin plus noncontingent reinforcers, placebo plus self-reinforcement, Ritalin plus self-reinforcement, and their effects on academic accuracy and performance. Within the baseline condition, students were required to attend class, complete worksheets, and cease taking psychotropic medications. During the study students were paid 80 cents per day to attend a 30 minute tutoring class each morning. In addition, a response cost system was employed and student's pay was deducted if classroom property was destroyed, if the student left the class early, or physical aggression occurred.

During the Ritalin plus noncontingent reinforcers condition, medication and a classroom point system based on the number of points earned during self-reinforcement were added. The students were unaware of the relationship between the points earned and the self-reinforcement condition. Students were informed that the points could be saved and exchanged for backup reinforcers. In the condition of placebo plus self-reinforcement, students took a placebo pill

instead of Ritalin and were required to set a goal at the beginning of the week regarding the number of reading questions to be completed each day. A wrist counter was used by the student to record the number of questions completed and was reviewed at the end of class with the teacher. Within the condition of Ritalin plus self-reinforcement, all treatment conditions continued as in Placebo plus self-reinforcement, with the exception that the placebo was replaced with Ritalin.

Within-subject analyses were conducted to show the effects of treatment conditions on accuracy and amount of academic performance. Effect sizes and binomial tests were computed to compare adjacent phases for significance, and treatment outcome. An across-subjects analysis was calculated to determine the size and direction of academic performance.

The treatment effects for accuracy for academic performance show the largest mean effect size to be -1.73 for Ritalin plus noncontingent reinforcement, while self-reinforcement plus placebo shows a medium effect size (ES =0.67). When combined, Ritalin plus self-reinforcement, show a mean effect size of 0.99. This suggests that Ritalin, when used alone, decreases academic accuracy, while sustaining the idea that a combined treatment of Ritalin and self-reinforcement shows positive increases in the accuracy of academic performance.

The treatment effects for the amount of academic performance were large for Ritalin plus self-reinforcement (ES=3.10) and self-reinforcement plus placebo (ES=2.39). Treatment effects were large, but negative for Ritalin plus noncontingent reinforcement (ES=-0.93). Taken together, these results suggest that self-reinforcement is effective at producing positive outcomes on the amount of academic performance.

As phases were compared, self-reinforcement was found to be more successful at increasing the amount and accuracy of academic performance, than Ritalin alone. When a

combined treatment of Ritalin plus self-reinforcement was used for amount and accuracy of academic performance, they were found to be more successful than either Ritalin or self-reinforcement alone. These findings are consistent with other findings that Ritalin alone fails to improve both accuracy and amount of academic performance in children diagnosed with ADHD (Aman, 1980, 1982; Gadow, 1993).

Ajibola et al. (1995) also assessed the effects of medication and self-reinforcement using a modified Latin-square design with six male, 9 to 12 year old students, within a 4th through 6th grade resource classroom. Each participant was diagnosed with ADHD by using the Conners Teacher Rating Scale (Conners, 1969). The intent of the study was to measure changes in the following ADHD related behaviors: inattention, impulsivity, hyperactivity, amount of academic performance, and accuracy of academic performance through the use of noncontingent reinforcement, self-reinforcement, placebo, high dose medication, and low dose medication.

Students were asked to attend a 30 minute tutoring class which occurred each morning for 65 school days. The intervention consisted of a five day baseline which was followed by six, 10-day treatment phases which were measured for individual effect size. These phases consisted of: Baseline; A=Drug placebo plus noncontingent reinforcers; B=Low dosage plus noncontingent reinforcers; C=High dosage plus noncontingent reinforcers; D=Low dosage plus self-reinforcement; E=High dosage plus self-reinforcement; and F=Drug placebo plus self-reinforcement.

During baseline, participants were monetarily rewarded for attending class and fined if they broke any classroom rules. In addition to baseline routines, students were required to perform the following two tasks within Phase A, Drug placebo plus noncontingent reinforcers: take a placebo pill in the presence of their parent; and use a wrist counter to record the number of

beeps produced via a tape recorder placed on the front table within the classroom. When a students' total on the wrist counter came within 20% of the audible tones produced within the class period, during the week's time, the student was provided with a weekly backup reinforcer. (Within this study noncontingent reinforcers differ from self-reinforcement as the students reward was not based upon accomplishing academic work, but through accurately counting beeps on a beep tape. Therefore reinforcement was not contingent upon the amount of work completed but their attention to environmental stimuli.) Phase B was identical to phase A with the exception that the placebo was replaced with 0.3 milligrams of methylphenidate per kilogram of the child's body weight. Phase C, high dosage plus noncontingent reinforcers, was similar in all aspects as phase B, except the medication was increased to 0.7 milligrams per kilogram of body weight.

Phases D through F focused on self-reinforcement as the students were required to: set goals for reading comprehension; choose their reinforcer; sign contracts with the teacher regarding student performance; use a wrist counter to record the number of reading comprehension questions completed; and report daily totals to the teacher each day. Phase D also included the use of 0.3 milligrams of methylphenidate per kilogram of body weight in conjunction with all tasks required for self-reinforcement. Phase E was identical to phase D with the exception to the methylphenidate being increased to 0.7 milligrams per kilogram. The final phase, F, was again identical to phases D and E, although the medication was replaced with a placebo.

The largest effect sizes for changes in inattention occurred with self-reinforcement treatments which included placebo (ES =0.34), low dosage (ES =0.57), and high dosage medications (ES =1.68). All other noncontingent phases, placebo (ES =-0.06), low dosage (ES

=0.14) and high dosage (ES =0.24) showed minimal effects suggesting that self-reinforcement plus medication is the most effective at increasing attention.

Mean effect sizes for changes in impulsivity were large across all phases which included medication treatment. Effect sizes for noncontingent reinforcers with different medication levels were: placebo (ES =0.02), low dose (ES =1.64) and high dose (ES =0.88). With self-reinforcement the effect sizes were: placebo (ES =0.29), low dose (ES =2.16) and high dose (ES =2.72). This suggests that intervention phases for impulsivity that did not use medication are not as effective at controlling impulsivity as a combined treatment of self-reinforcement with low dose medication (ES =2.16) and high dose medication (ES =2.72) (e.g. placebo plus self-reinforcement ES =0.29 and placebo plus noncontingent reinforcement ES =-0.02).

For hyperactivity, mean effect sizes were lowest with high dosage medication plus noncontingent reinforcers (ES =0.01), and placebo plus self-reinforcement (ES =-0.26). Low dose medication with noncontingent reinforcement (ES =0.72), was found to be similarly effective at reducing hyperactive behavior as low dose medication with self-reinforcement (ES =0.75).

When accuracy of academic performance was measured between noncontingent phases including placebo (ES =-1.39), low dosage (ES=-0.96), and high dosage (ES =-0.68) showed negative effects. Self-reinforcement phases were similar to noncontingent phases as placebo (ES =-1.30), low dosage (ES=-0.78), and high dosage (ES =-0.28) also show negative effects in academic accuracy. These effect sizes suggest that these interventions are not effective interventions for increasing accuracy of academic performance.

For amount of academic performance, results show self-reinforcement with low dosage (ES =3.89), high dosage (ES =1.89), and placebo (ES =2.66) had greater effect sizes than all

noncontingent phases including, placebo (ES =1.39), low dosage (ES =0.50) and high dosage (ES =0.14). This suggests that self-reinforcement is an effective way of increasing the quantity of academic performance within students.

Summary. Interventions using self-reinforcement varied depending upon the use of medication and the effectiveness of the reinforcement used. Students taking higher doses of stimulant medications appeared to have a decrease in the amount of class work completed. An essential component of self-reinforcement is the type and frequency of the reward used; the use of medication can increase this effect. These above studies suggest that when students are given the opportunity to work towards a reward of their choice, quality and quantity of academic performance increases. As these above studies contained a maximum of 6 students within the classroom and with the intensity required to maintain the above intervention, this may make them unwelcome in many classrooms where the teacher is required to maintain a classroom of twenty or more students. Combining a self-monitoring intervention with a reinforcement intervention where the student is required to perform the intervention with minimal support from the teacher may be more effective within this setting and easier for teachers to implement.

Self-Monitoring Plus Reinforcement

Seven self-monitoring plus reinforcement studies met the required criteria to be included within this review, as they consisted of self-monitoring plus reinforcement of school aged children who also had ADHD behaviors. These children varied in age from seven to 16 years old and from the 2nd through 11th grades. These studies included 73 males and 16 females. Gender imbalance is to be expected as ADHD is more prevalent in boys than girls.

Of the seven studies, three were completed at the elementary school level, three involved students in middle and high school and one study involved a combination of elementary and

secondary students. The controlled use of medication within these studies was quite low as only two studies included pharmacological interventions as part of their study; one would not allow use of medication during the study, the other required 100% fidelity to the use of medications. Two of the studies did report the use of psychotropic medications during the studies; however the use of these interventions was considered an outside or external variable as the use could not be controlled or regulated. The other three studies did not report on the use of medications.

The targeted behaviors found within these studies can be separated into either self-monitoring plus reinforcement of academic performance, self-monitoring plus reinforcement of classroom behavior, or a combination of both. Of these studies, one included self-monitoring plus reinforcement of academic performance (Meyer & Kelley, 2007), while four included self-monitoring plus reinforcement of classroom behavior (Barkley, Copeland, & Sivage, 1980; Ervin, DuPaul, Kern, & Friman, 1998; Hoff & DuPaul, 1998; Peterson, Young, West, & Peterson, 1999), and the other two studies were a combination of both self-monitoring plus reinforcement of classroom behavior and academic performance (Axelrod, Zhe, Hugen, & Klein, 2009; Edwards, Salant, Howard, Brougher, & McLaughlin, 1995).

Self-Monitoring plus reinforcement of academic performance. The behavior that was measured for self-monitoring plus reinforcement of academic performance included completion and accuracy of homework (see Table 5). Meyer and Kelley (2007) conducted a between groups design study focusing on a single component design for secondary students. These students had been diagnosed previously by a physician with ADHD and were struggling with homework completion. The study consisted of 42 students, 36 males and 6 females in the 6th through 8th grade, whose ages ranged from 11 to14. The purpose of the study was to measure the effectiveness of self-monitoring plus reinforcement versus parent monitoring plus reinforcement

of homework behavior and study skills. Ninety three percent of the participants were also taking psychostimulant medication for problems with attention. Several measures were used to assess students' academic and behavioral skills. The scales used at pretreatment, post treatment, and the four week follow-up included the Connors Rating Scale (Conners, 1997); the ADHD Rating Scale-IV (DuPaul, Power, Anastopulous, and Reid, 1998); the anxiety disorders interview schedule for DSM-IV (Silverman & Albano, 1996); the Homework Problem Checklist (Anesko, Schoiock, Ramirez, & Levine, 1987); and the Classroom Performance Survey (CHADD, 1996). Teachers were also asked to record the number of homework assignments given and the number completed during the three measurement periods. Students were randomly assigned to one of three groups which included a wait-list control group which received no treatment, parent-monitoring plus reinforcement group, and a self-monitoring plus reinforcement group. The self-monitoring plus reinforcement group and parent monitoring plus reinforcement group were trained on study skills and how to establish a proper homework routine as well as maintaining self-monitoring forms. These groups were similar in every aspect, including a reward for 80% completion of self-monitoring forms, except that in the parent monitoring plus reinforcement group, parents were required to check accuracy and completion before reinforcement was given.

Students in both treatment groups increased their percent of homework turned in. Based on teacher report, homework completion rates in the self-monitoring plus reinforcement group increased from an average of 65% at pretreatment to 90% at both post treatment and four week follow-up. In the parent-monitoring plus reinforcement group, pretreatment homework completion levels increased from 67% to 92%, during the post treatment measure, and 91% at the four week follow-up. Teachers reported that the wait-list control group's levels of homework completion remained at a constant 60%.

Meyer et al. (2007) showed an increase in the performance of expected behaviors when self-monitoring was paired with reinforcement. This is consistent with research suggesting that when self-monitoring is paired with rewards the result is a positive change in behavior (Dunlap & Dunlap, 1989; Prater, Joy, Chilman, Temple, & Miller, 1991; Toney, Kelley, & Lanclos, 2003).

Table 5

Self-Monitoring Plus Reinforcement of Academic Performance

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Meyer & Kelley (2007) Between groups, single design with 3 treatment groups.	42, 11-14 year old students in the 6th-8th grades with ADHD. (36 male & 6 female) (Diagnosed by physician.)	Study skills taught and self-monitoring done during homework completion. When 80% of homework checklists were completed, 1 of 3 rewards were given. 93% of the students were taking stimulant medication.	Homework Problem Checklist and Classroom Performance Survey scores improved as well as percent of homework completed.

Self-monitoring plus reinforcement of classroom behavior. The studies for self-monitoring plus reinforcement of classroom behavior focused on increasing on-task student conduct, while at the same time decreasing disruptive behaviors. Four studies focused solely on self-monitoring plus reinforcement of classroom behavior, two of them were performed with students on an elementary level in 2nd to 5th grades, while the other two studies were from the secondary school level using 7th and 8th graders (see Table 6). Thirty students were male and nine were female. One of the studies was done within a general education setting and the other two were done within an institutional setting. The behavior target of these interventions was to reduce off task behavior, by decreasing disruptive behaviors, such as inattention and inappropriate classroom behavior while increasing on-task behavior.

Hoff and DuPaul (1998) performed a multiple probe study, across three settings, on self-monitoring plus reinforcement of classroom behavior with three 4th grade students, two male and one female. All participants were previously diagnosed with ADHD and were not allowed to be medicated during the study. The intervention for two of the three students was performed during math, social studies, and recess. The intervention for the third student was performed during math, reading, and recess. The purpose of this study was to measure the effects of self-monitoring plus reinforcement of classroom behavior on decreasing disruptive behavior within two general education classrooms and during recess.

Table 6

Self-Monitoring Plus Reinforcement of Classroom Behavior

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Barkley, Copeland, & Sivage (1980) Within students reversal design	6 male students with ADHD, Ages 7-10 in the 2nd-5th grade Experimental Classroom. (Diagnosed by study personnel.)	Measures of on-task behavior and activity level. Large Group vs. Individual Work. R+ with exchangeable tokens for accurate self-monitoring. No medication was reported.	Improvement of behavior and attention during individual seatwork, not during group instruction.
Ervin, DuPaul, Kern, & Friman (1998) AB design with R+= token economy.	One 14 year old, 8th grade, male student with ADHD in a specialized educational classroom. (Diagnosed by study personnel.)	Self-monitoring on-task behavior paired with a token economy system across 3 academic areas, math, writing, & science. Points given were converted into token economy system already in place and exchanged for privileges. Students took stimulant medication.	On-task behavior increased with self-monitoring. Math increased 69.1 to 93.1, Writing increased 54.2 to 88.2, and Science increased 78 to 95.1.
Hoff & DuPaul (1998) Multiple probes across 3 settings	Three 9 year old, 4th grade students with ADHD in a General Education Classroom and Recess. (2 males, 1 female) (Diagnosed by study personnel.)	Self-monitoring of behavior, token/economy with verbal teacher feedback, and matching with no verbal feedback. Points earned for extra computer time, free homework pass, or pencils. No meds allowed in the study.	Decrease in disruptive behaviors. With largest change in self-monitoring phase.
Peterson, Young, West, & Peterson (1999) Non-experimental, single group AB	29, 12-14 year old students in the 7th and 8th grades General Education classroom with ADHD. (21 male & 8 female) (Diagnosed by study.)	Prevention Plus social skills program with self-monitoring of social behaviors. Points awarded on trackers bought materials, games, computer time, or snacks. No medication reported.	Students behaved according to teacher expectations by 96%.

This study included four phases which consisted of baseline, token phase with systematic verbal feedback, self-evaluation phase with teacher matching, and matching phase with no verbal feedback. Baseline data were collected within all settings and showed disruptive behavior within math to be 34.35%, reading 28.08%, social studies 31.31%, and recess 30.23%. During the second phase, token phase with systematic verbal feedback, teachers used a Likert rating scale of 0 to 5 (with 0 being totally unacceptable behavior and 5 being excellent behavior) to rate student behavior. Each teacher assessed student behavior every five minutes for 15 minutes. At the end of every five minute rating period, the teacher shared the ratings with the student. When 15 minutes of monitoring was completed, teachers shared the scores with the students and instructed them on why they received their respective scores. Students did not self-monitor at this time as they were learning the expected classroom behaviors. During this phase disruptive behavior decreased to 12.22% for math, 10.48% for reading, 11.01% for social studies, and 8.4% for recess. The third phase included student self-monitoring with teacher matching during three 15 minute sessions. At the end of each session, evaluations were compared between teacher and student with the purpose of rewarding points. When ratings matched, the students received one bonus point, in addition to the points they had already awarded themselves. If the student scores were within one point of the teacher's score, students awarded themselves the points they had selected. When a two point difference occurred between student and teacher rating, no points were earned. Results from phase three show a decrease in disruptive behavior in math to 7.97%, in reading 9.17%, in social studies 8.33%, and in recess 4.07%. The fourth phase of this study, matching with no verbal feedback, continued with the same design as phase three except the teacher gave no verbal feedback unless the student and teacher score varied by more than one point. The purpose of this phase was to include fading of teacher matching through using a

color coded chance system. Students continued to self-monitor 100% of the time and when colors on the board matched, the teacher was required to rate the student. These boards were adjusted for a 75% chance, then a 50% chance, to a 25% chance, to no teacher matching, thus fading the need for teacher verification of the students' self-assessment during the self-monitoring procedure. Results from phase four show disruptive behavior to decrease in math to 9.92%, in social studies 7.71%, and in recess 7.09%; however, in reading disruptive behavior increased to 11.75%.

Results from this study indicate that self-monitoring plus reinforcement of classroom behavior, toward classroom rules, is effective at reducing disruptive behaviors in a structured general education setting and also within an unstructured recess environment. Findings also suggest that children, within the elementary education setting, can effectively self-assess and self-monitor while maintaining treatment effects in the absence of an adult. Teachers and students involved in the study stated that the intervention was effective and acceptable within the general education setting.

The second study conducted at the elementary level (Barkley, Copeland, & Sivage, 1980) was an ABAB design study which consisted of six male students with ADHD behaviors, in an experimental classroom setting. The students were seven to ten years old and there was no report of medication being used in conjunction with this study. The purpose of this study was to see if a self-monitoring procedure with reinforcement could help the students increase self-control in whole group instruction and individual seat work by decreasing levels of activity and misbehavior while increasing on-task behaviors.

Students attended their regular schools during the day and attended the two hour long experimental classroom, four afternoons a week, during an eight week period. This study

included four phases: baseline, treatment phase, treatment reversal, and a second treatment phase. During baseline no self-monitoring procedures were used. Treatment phase included a combination of two 30 minute periods, one group and one individual, while self-monitoring was done at variable intervals via beep tape. Students were required to place a check mark on a recording card if they were following the written classroom rules when the beep occurred. The third phase, or treatment reversal, required the removal of all self-monitoring procedures. During the final phase, self-monitoring was reinstated at a variable interval schedule of one beep every one and a half minutes. The reinforcement within this study included giving the students tokens every time the student's self-assessment agreed with the teacher's assessment. During treatment phases, tokens were used to purchase tangibles within the classroom.

Although no numerical data were shared within this study, graphs show apparent changes within the measured behaviors. The authors of this study suggest that they were effective at decreasing behavior problems and improving on-task behavior during individual seat work but not during whole group instruction. Levels of activity, which were assessed throughout this study via a Timex Actometer attached to the student's ankle, were not affected through the self-monitoring and reinforcement intervention.

Ervin, DuPaul, Kern, and Friman (1998) conducted a self-monitoring plus reinforcement of classroom behavior study with one male, at the secondary level, who was taking medication for ADHD. The student was 14 years old and attending 8th grade in a specialized classroom setting on the campus of Boys' and Girls' Town. This specialized school serves approximately 250 first through eighth grade students with extreme behavior problems. The purpose of this study was to evaluate the success of a classroom based functional behavior assessment and subsequent self-monitoring program with reinforcement, through a token economy system, to

reduce off-task behavior. The outcomes of this study were evaluated through multiple measures. These measures included levels of student on-task behavior, teacher satisfaction ratings, and student satisfaction ratings.

Self-monitoring plus reinforcement was conducted by the student, with teacher matching, within the subject areas of math, writing, and science. The student received points as he accurately self-monitored at the end of each class. When the students' self-monitoring scores matched the teachers score, the student received bonus points. These points were exchanged using the existing token/economy system, and could be used to purchase privileges within the residential campus.

On-task behavior was measured by an independent observer, who was unaware of the nature of the study. These observations occurred at various times throughout the study. Baseline data showed average on-task behavior for math at 69.1%, writing 54.2%, and 78% in science. During the self-monitoring phase on-task behavior increased to an average of 93.1% in math, 88.2% in writing, and 95.1% in science. These scores suggest an increase in on-task behavior through the use of self-monitoring plus reinforcement of classroom behavior. Furthermore, satisfaction surveys showed positive support of the intervention by both the student and the teachers.

Peterson et al. (1999) studied the effects of self-management on generalization of student attention to task within the 7th and 8th grade regular education classrooms. The purpose of this study was to measure the generalization of skills taught within a social skills classroom and self-monitoring with teacher matching throughout multiple classes during the day. Twenty-nine students, who were selected due to their ADHD behaviors, participated in a social skills training program, the Prevention Plus Program (West & Young, 1994) which focused on preventing or

reducing anti-social behaviors of at risk youth. The class was held during one period of the day, while self-monitoring of teacher expected classroom behavior was measured during all other classes throughout the day in conjunction with teacher matching. When the students' self-rating matched the teacher rating the students received extra points, which they were able to spend at the school store.

This study focused mainly on the measurement of the generalization of social skills, learned in the Prevention Plus Classroom, and the success of these students in other classes. Self-monitoring was used to focus the students' behavior on monitoring the specific social skills learned in the Prevention Plus Classroom. When students showed mastery within the Prevention Plus Classroom, through self-monitoring of required social skills, the students were allowed to select one class to add to their self-monitoring checklist. Mastery required students to receive matching top marks on their checklist for five continuous days. Of the 29 students within this study, 24 completed the process of adding all six classes to the self-monitoring checklist. Two students reached this level in five of the six classes; two students maintained within four of six classes; and one student reached this level in three of six classes. Seven of these students became sufficient enough to fade the self-monitoring forms completely and still maintain teacher expectations within their classes.

Before the intervention began and after it was completed, social validity questionnaires, which used a Likert rating scale of 1-5, were used to rate student, teacher, and parent satisfaction regarding the intervention process. Students' ratings of their "perceptions of teachers" increased from 4 to 4.9, teachers' "perceptions of students" increased ratings from 2.8 to 3.3, parents' "perceptions of faculty and staff" increased from 2.6 to 3.9, and students', teachers', and parents' perceptions of "the importance of proper social skills" increased from 4.5 to 5.

In the above studies, self-monitoring plus reinforcement of classroom behavior showed significant increases in on-task behavior and decreases in disruptive behavior in both the elementary and secondary settings. The simplicity of implementing these self-monitoring plus reinforcement procedures and the success shown, suggest that students as young as seven, who struggle with hyperactivity and impulsivity, can accurately self-monitor. The data further suggests that self-monitoring plus reinforcement interventions are effective and should be used with students who struggle with ADHD or similar behaviors.

Self-monitoring plus reinforcement of classroom behavior and academic performance. The studies for self-monitoring plus reinforcement of classroom behavior and academic performance focused on increasing on-task behavior, while at the same time, increasing assignment completion (see Table 7). One study was performed with students at an elementary level in 3rd-4th grade, while the other study was from the secondary level using 8th-11th graders. Seven students were male and one was female. One of the studies was done within a general education setting and the other within a residential treatment setting. The behavior target of these interventions was to increase on-task behavior, reading comprehension and number of assignments completed, by using self-monitoring, reading comprehension probes and homework trackers for incomplete assignments.

Table 7

Self-Monitoring Plus Reinforcement of Academic Performance and Classroom Behavior

AUTHOR/ DESIGN	POPULATION & SETTING	INTERVENTION & MEDICATION	VARIABLES, & RESULTS
Axelrod, Zhe, Haugen, & Klein (2009) Alternating treatment with baseline design	Five 13-16 year old students, in the 8th-11th grade in a residential treatment program (Boys and Girls Town), with ADHD. (4 male and 1 female) (Diagnosed by physician.)	Beep tape and self-monitoring log used during homework. Incomplete assignments were tracked. Participants earned a small reward when their tracking sheet matched the observers tracking sheet with 80% accuracy. 3 students taking medication.	No data for on-task, only graphs. Incomplete assignments as follows: Baseline = 62.12% 3 sec – 3.08% 10 sec – 2.92%
Edwards, Salant, Howard, Brougher, & McLaughlin (1995) Single Subject ABABC with follow-up	Three 7-9 years old, 3rd & 4th grade male students with ADHD in a general education classroom. (Diagnosed by physician.)	Behavioral self-management Token economy Self-monitoring card on desk and prompting by beep tape. Reading accuracy determined by % correct. Rewards included computer time, physical activities, stickers, treats, or instructor time. No medication was reported.	Increased Attention to task and improved reading comprehension.

Edwards et al., (1995) performed a single subject design ABABC study, with follow-up, on three male students within the general education classroom. Participants in this study were in the 3rd and 4th grades, ages seven to nine years old, and previously diagnosed with ADHD by their primary care physician. Medication treatment for ADHD was not reported to have been used by the students within this study. The purpose of this study was to evaluate a self-monitoring program with reinforcement on students with ADHD to see if the intervention would increase on-task behaviors while increasing reading comprehension scores.

The design of this study included the following five phases: Baseline, Self-monitoring plus reinforcement of classroom behavior and academic performance, Return to baseline, Self-monitoring plus reinforcement of classroom behavior and academic performance with fading, and two follow-up probes conducted at 30 and 60 days after phase four was completed. Baseline consisted of normal routines during reading over a two week period with a beep tape, which students were instructed to ignore. Baseline scores show mean on-task behavior to be 30% and reading comprehension accuracy scores to be 20.66%. Phase two, Self-monitoring plus reinforcement of attention and academic performance, required students to self-monitor during reading class at a variable one minute interval. Self-monitoring was verified through teacher matching. In order to receive five points and a happy face sticker, on-task behavior had to be a minimum of 60%; on-task behavior below 40% earned a sad face sticker and resulted in a loss of two points. Reading comprehension was measured, during the same time as on-task behavior, by percent correct on worksheets given during reading time. Students were required to reach the following reading comprehension accuracy scores in order to obtain a five-point reinforcement: first week required scores of at least 40%, second week required scores of at least 50%, and the third week required scores of at least 60%. Results during this phase showed mean on-task scores of 74.66% while mean reading comprehension accuracy scores were 62.86%. Phase three was a return to baseline where previous baseline procedures were followed with the exception that the beep tape during this phase was only audible by the teacher and teacher assistants. During this phase mean scores for on-task behavior was 44.66% and mean scores for reading comprehension was 36.66%. The final treatment phase of this study, phase four, consisted of all aspects of phase two with a fading procedure included. The fading procedure involved gradually increasing the time between beeps, on the beep tape, throughout a three week session. This

fading consisted of gradually adjusting the variable interval from a variable interval of one beep per minute, for the first two days to a beep every ten minutes by the end of the 15 days. Results during phase four show mean on-task behavior was 67.3% and mean reading comprehension accuracy scores was 56.2%. The final phase of the study consisted of two probes which were given to the students at 30 and 60 days after Phase four was completed. During this phase, the intervention was not being used by the students/teachers and all students had returned to pre-intervention classroom procedures. Results from probe one show mean on-task behavior scores of 70% and mean reading comprehension scores to be 56.66%. Probe two, conducted at 60 days, show very similar mean scores with on-task behavior at 71.66% and reading comprehension scores at a mean of 56.66%.

Results from this study show a significant increase in on-task and reading comprehension scores. These results were maintained for students when the intervention was faded and removed. The follow-up portion of this study showed percentages in on-task and reading comprehension scores continued to be higher than baseline results suggesting that when students self-monitor on-task behavior it may lead to increases in academic performance.

Axelrod et al. (2009) conducted an alternating treatment with baseline design study of five students with ADHD within the residential treatment facility of Boys' and Girls' Town. The students consisted of four males and one female, ages 13-16, who had been previously diagnosed with ADHD. Three of the students reported taking medication for ADHD. The purpose of this study was to assess the effectiveness of a three minute and 10 minute interval schedule of self-monitoring plus reinforcement procedure at increasing on-task behavior and academic performance during a daily 30 minute intervention.

The design of this study required each participant to complete four baseline sessions and 20 intervention sessions (10-three minute intervals and 10-ten minute intervals). A token economy program existed before, during, and after this study and was used to reward students for pro-social behavior. During the treatment phase of the study, the token economy program was used to reward the students for on-task behavior. Students were also rewarded for matching staff members' observations with at least 80% accuracy on self-monitoring checklists.

During baseline conditions, students were observed throughout normal homework time. No changes were made to reinforce on-task behavior and academic performance. Data collected for incomplete homework assignments show mean baseline scores to be 62.12%. (Unfortunately, the data for on-task behavior was shown in the form of a line graph and numerical data were not included.) Treatment phases of this study were conducted after the conclusion of four baseline conditions. Treatment conditions included three and 10 minute intervals which were presented to each student in a randomized sequence over 20 sessions. Students were required to listen to a beep tape of either a three or 10 minute interval and self-assess their behavior and record it on a tracking sheet. Numerical data collected for the three minute interval show mean percentage of incomplete homework assignments to be 3.08%. Results for 10 minute interval show mean percentage of incomplete homework assignments to be 2.92%. On-task behavior line graphs show students behavior to be nearly 100% during treatment phases, with very little variation between three or 10 minute intervals.

This study shows very little deviation between three minute intervals and 10 minute intervals of self-monitoring academic performance and on-task behaviors. Furthermore, students and teachers completed satisfaction surveys on which they reported that the intervention was easy to implement, beneficial for students, increased academic productivity during homework

time, and decreased the frequency of incomplete homework assignments. Teachers also indicated that they were very likely to recommend the intervention to other teachers and were also likely to use this intervention with other youth.

Interventions focusing on self-monitoring plus reinforcement of classroom behavior and academic performance show significant increases in on-task behavior and academic success. The ease in which these interventions are conducted suggests that integration within the general education classroom would be easy, inexpensive, effective at increasing student ability, and widely acceptable to all who participate.

Section 3

Conclusion

Implications for School Psychologists

The use of self-management techniques in education is fundamental to student learning and success. The purpose is to teach individuals to manage their own behaviors and acquire skills through the principles of self-management by goal setting, self-monitoring, self-evaluation, self-recording, and self-reinforcement. Although learning these skills are necessary, some people struggle with the acquisition and performance of these skills. Those with executive functioning disorders, such as ADHD, need to learn these skills to support themselves in the process of personal growth and learning. It is imperative that school psychologists have a variety of skills and interventions to support students with executive functioning disorders. These skills should include only those which have been empirically proven to be effective and found to be best practice interventions.

Effectiveness. The studies reviewed show the effectiveness, limitations and implementation strategies of Self-Monitoring, Self-Reinforcement, and Self-Monitoring Plus Reinforcement across ages and grades for students with ADHD and the effectiveness of these interventions in controlling behaviors associated with ADHD including inattention, hyperactivity, impulsivity, academic accuracy, academic performance, and others (See Table 8).

Overall, the seven studies reviewed in which self-monitoring were evaluated showed positive changes in classroom behavior. Participants in these studies were successful at increasing academic performance, productivity and accuracy, and on-task behaviors while evidencing a decrease in classroom disruptions and other unacceptable behaviors. These self-

monitoring studies were performed across students from 3rd to 10th grade and 8 to 15 years old, showing the variety of students which could benefit from these types of interventions.

Table 8

Behavioral Effects for Studies Reviewed

Behaviors	Self-Monitoring			Self-Reinforcement	Self-Monitoring Plus Reinforcement		
	Academic Performance	Classroom Behavior	Classroom Behavior and Performance		Academic Performance	Classroom Behavior	Classroom Behavior and Performance
ACADEMIC PRODUCTIVITY (Amount of Work)	*	–	*	*	*	–	*
Math	*	–	–	–	–	–	–
Reading Comprehension	*	–	–	*	–	–	–
Language Arts	*	–	*	–	–	–	–
Homework Completion	–	–	–	–	*	–	*
ACADEMIC ACCURACY (Quality of Work)	*	–	*	*	*	–	*
Math	*	–	–	*	–	–	–
Reading Comprehension	*	–	–	*	–	–	*
Language Arts	*	–	–	–	–	–	–
ON-TASK/ OFF-TASK	*	*	*	*	*	*	*
DISRUPTIVE BEHAVIOR	–	*	*	*	–	*	–
Attention Seeking	–	*	–	–	–	*	–
Physical Aggression	–	*	–	–	–	*	–
Verbal Aggression	–	*	–	–	–	*	–
Impulsivity	–	–	–	*	–	*	–
Hyperactivity	–	–	–	*	–	*	–

*Found to be effective.

–Not measured within studies.

Studies that evaluated self-monitoring focused on academic performance (accuracy and amount of work completed), classroom behavior (including disruptive behaviors), and the combination of the two were found to be effective at reducing unwanted ADHD behaviors such as classroom disruptions, incomplete work, off-task behavior, and others. Self-monitoring of performance showed success across 3 academic areas while increasing attention, productivity, and accuracy of class work (Shimabukuro et. al., 1999). Self-monitoring of classroom behavior resulted in an increase in on-task behaviors and a decrease in classroom disruptions (Christie et. al., 1984; Mathes et. al., 1997; Stahr et. al., 2006; Stewart et. al., 1992). When students self-monitored a combination of academic performance and classroom behavior, similar results were found as academic productivity and accuracy increased along with on-task behavior while decreasing disruptive behaviors (Barry et. al., 2003; Harris et. al., 2005). One study (Barry et al., 2003) showed generalization of the interventions skills at a one month follow up. While skills at the one month follow up were not at the same level as during treatment phases, as some of the gains were lost, the positive effects were still visible.

The area within self-management, known as self-reinforcement, showed success in reducing behaviors associated with students' ADHD. Overall success was seen through a combination of stimulant medication and self-reinforcement as many ADHD behaviors were extinguished or decreased significantly. Four studies were performed with students in 2nd through 6th grades who ranged in age from 8 to 12 years old. Self-reinforcement focuses on teaching a child to set goals and self-reward when those goals are met. These studies assessed whether self-reinforcement could reduce ADHD behaviors, such as inattention, impulsivity, and hyperactivity. Self-reinforcement was more successful than teacher reinforcement alone at reducing levels of inattention, and increasing accuracy of reading comprehension (Bowers et. al.,

1985). Another study found that using a peer to model appropriate classroom behavior, while both students self-reinforced, was effective at increasing on-task behavior and academic achievement (Fantuzzo et al., 1981). One study assessed the effects of self-reinforcement with stimulant medications and found that the combination of the two was more effective at increasing the accuracy of academic performance than either treatment alone (Chase et al., 1985). The final study found that inattention was best treated with a combination of self-reinforcement and high dose stimulant medication, impulsivity was best treated with self-reinforcement and high dose stimulant medication, hyperactivity was best treated with low dose stimulant medication and self-reinforcement, and academic productivity was best increased through low dose stimulant medication and self-reinforcement (Ajibola et al., 1995). These results are similar to those from other studies which suggest that a combined treatment approach to ADHD is the most effective (MTA Cooperative Group, 2004).

The final area, and the most effective, included the combination of self-monitoring and reinforcement for reducing ADHD behaviors. The studies reviewed assessed three main types of interventions, self-monitoring plus reinforcement of academic performance, self-monitoring plus reinforcement of classroom behavior, and self-monitoring plus reinforcement of academic performance and classroom behavior. The purpose of these studies was to decrease unwanted ADHD behaviors while increasing desired pro-learning behaviors. Self-monitoring plus reinforcement of academic performance showed increases in academic productivity, academic accuracy, homework completion, and on-task behavior (Meyer et al., 2007). Self-monitoring plus reinforcement of classroom behavior resulted in improvements in behavior and attention during individual seat work through decreasing both off-task and disruptive behaviors (Barkley et al., 1980; Ervin et al., 1998; Hoff et al., 1998; Peterson et al., 1999). The final group of

studies, self-monitoring plus reinforcement of academic performance and classroom behavior, showed increases in on-task behavior, academic productivity, academic accuracy in reading comprehension, and homework completion (Axelrod et al., 2009; Edwards et al., 1995). It is important to note that all of the reinforcers within the self-monitoring plus reinforcement studies gave the freedom to the student to choose the desired reinforcer. This made the reward stimulating while still allowing the student to feel in control. Rewards which were not chosen could then be replaced with other rewards that were more pleasing to the students.

Limitations. The studies reviewed contained many limitations which require cautious interpretation by the reader. These limitations include the lack of range in student age, gender, racial diversity of participants, size of the student populations, the short length of the study, and a lack of generalization/maintenance techniques. The average age for students involved in these studies was 10 years old, with the youngest being 7 and the oldest being 16. The average number of students in each study is 7, with the largest study containing 42 students and the smallest containing only 1 student. Only 13 percent of the 130 students involved in these studies were female. Of the students involved, a majority were white, English speaking, males that came from medium to low social economic areas. Although many of these studies did evaluate the effectiveness of major components, such as self-reinforcement versus teacher reinforcement, they did not evaluate minor components, such as beep tape versus belt buzzer. There was also no comparison between Self-Monitoring, Self-Reinforcement, and Self-Monitoring Plus Reinforcement as to which intervention was most effective. With none of the studies lasting longer than 6 months, long term generalization and maintenance techniques are difficult to assess.

Many of these interventions included measures to track the amount of on-task behavior. A limitation to studies which only measure on-task behavior is the common misconception that increasing on-task behavior has the effect of increasing learning and understanding. This is not necessarily true as many students with ADHD also have learning disabilities which complicate their ability to learn. While a student may attend to the lecture and participate in the discussion, conclusions as to whether a student has learned cannot be made until an assessment has been used to measure the amount of learning that has taken place.

A significant area of limitation within many of these studies is with the medications used. Many of these studies are older, and the use of psychostimulant medication has evolved over the past 30 years, with more children now taking medications for ADHD than for any other childhood disorder (American Psychiatric Association, 2000). Many of these medications have an extended release component which will allow a child to receive the needed dose of medication throughout the day without requiring the student to take additional pills. Other changes in medications for ADHD include several non-stimulants not previously available. The addition of these newer medications may have a greater impact on school behavior than the medications used in older studies. It is difficult to know the exact magnitude these newer medications would have on impacting ADHD behaviors when combined with the above studies. It is important to recognize that medication use in the public school setting will almost always be an external variable with regards to classroom interventions. This is because school personnel are not permitted to require parents to medicate their children or make decisions regarding the frequency and dosage of such medication. Parents, students, and their primary care physicians have proprietary control over these decisions and not school personnel.

Suggestions/implications. When evaluating the effectiveness of these interventions it is important to understand that Self-Monitoring Plus Reinforcement contains all aspects of both Self-Monitoring and Self-Reinforcement. Table 8 shows a variety of behaviors and the effectiveness of the reviewed interventions. Although not all behaviors are marked under the Self-Monitoring Plus Reinforcement column, this is not due to its ineffectiveness but the lack of studies that reviewed those behaviors. Based on the studies reviewed, Self-Monitoring Plus Reinforcement is the most effective intervention for these behaviors; however, the type of intervention chosen depends upon the effectiveness of the intervention and other resources available such as amount of teacher, student, and parent involvement. The intervention should also focus on the primary problem and not just address the secondary problems. This would be most effectively accomplished through an analysis of the student's behavior by using a functional behavior analysis and then creating a behavior intervention plan. If the primary problem is within academics, it is important that the intervention focus not only on the student's ability to focus and stay on-task but also on their ability to increase accuracy and productivity, not just productivity alone. The age of the student plays an important part in the success of these types of interventions. As the student becomes older, the difficulties involved in rewarding and motivating the student become more complex (Axelrod et al., 2009). Due to these complications, self-monitoring interventions should be constantly evaluated and modified so they are applicable to the students involved. It is important for the intervention to be individually tailored to the personal motivations of those involved, causing behavior to change.

Behavior change with a student is focused on rewards given when the student performs the expected behavior, or approximations towards that behavior. Student rewards come from receiving incentives that are tailored to the student's individual wants and desires, within reason.

These rewards should be motivating for the student and support the needed change in behavior. Rewards provided to students should be practical and free (or low cost) to the interventionist. This could include many free yet rewarding incentives for students such as extra recess time for the class or a "get-out-of-homework free card." When reviewing these studies it was difficult to draw strong conclusions regarding the effectiveness of the components found therein. When using these interventions to increase on-task behavior, it is important to note that on-task behavior can be increased through a variety of self-monitoring interventions. Verifying that the most important aspects of classroom behavior are also addressed is key to modifying a student's behavior. The aspects of classroom behavior which may coincide with a student being on-task may include measures for academic productivity, academic accuracy, and proper rewards for motivation.

An aspect typically forgotten in the intervention process is the reward or motivation for the interventionist or teacher. Often the teacher's motivation is overlooked as the focus is typically placed on the student; however, lack of motivation on either side can cause the intervention to fail. Motivation for the teacher may include a decrease in paperwork and a way to visually see the student's improvement, which would include a decrease in unwanted behaviors. Behavioral improvements are difficult to see, within the moment, but are easily measured over time through a graphing system. This system would allow the teacher to see improvements in behavior through daily self-recording, completed by the student, thus reducing teacher time and paperwork.

As with many behavioral interventions that are run in the classroom, consistency and proper training are needed for those involved; this includes the classroom teacher, aides, parents, and students. All need to be taught how to use the checklists and their function. Parents,

individuals who are often overlooked in classroom interventions, can be used to help support the expectations taught in the classroom with the student at home. Daily student progress should be recorded through simple checklists which are then sent home to parents so that rewards can be earned at home for meeting parent expectations.

Another aspect which may be difficult to control is the need for proper fading techniques. As with all interventions, fading must occur when the student is ready to accept more responsibility for the intervention or behavior. This can be difficult as the student may digress and the intervention may fail completely. Timing is a key component to the success of the fading process. One study showed that interventions should include long-term treatments (+6 months), instead of short-term (0-6 months), to improve symptoms of ADHD; as a majority of those with short-term treatments seemed to revert back to pre-intervention levels (Hinshaw, 2005). As with all classroom interventions which focus on behavioral interventions, teacher or interventionist consistency is a key component to success. If the intervention is expensive or requires extensive teacher/observer time to maintain it, these interventions are more likely to fail. Successful interventions need to be simple to run, tailored to each individual child, and inexpensive with regards to time and money (Barry & Haraway, 2005).

As with all interventions performed within the classroom, intervention success depends upon the full participation and cooperation of those involved. Educators need simple, quick, and effective tools to conquer these classroom difficulties. If School Psychologists can enter a classroom with a toolbox of interventions to support students, which require little or no support from the teacher, then chances of student success can increase. Interventions, such as those discussed in this review, can function in almost any classroom. They are simple to create and

effective at modifying behavior. These tools should be included in every School Psychologist's tool box and used and perfected with each case that arises.

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