The Effects of Self-monitoring with a MotivAider® on the On-task Behavior of Fifth and Sixth Graders with Autism and Other Disabilities

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ABSTRACT

This study examined the effects of self-monitoring on the on-task behavior of three fifth and sixth grade boys with autism and other disabilities. While completing math assignments independently, the students wore an electronic device called a MotivAider® that vibrated at pre-set time schedules prompting the students to self-record whether or not they were on task. A multiple baseline across students design demonstrated a functional relationship of the self-monitoring procedure on increasing on-task behavior. Additionally, all three students maintained high percentages of on-task behavior after the self-monitoring procedure was discontinued.
Keywords: Autism, self monitoring**,** on task behavior, and math

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Introduction

Self-monitoring, the act of observing and recording one's own behavior, has been demonstrated to be an effective behavior change strategy for a range of diverse learners including preschoolers with autism (Strain & Kohler, 1994); elementary students with learning disabilities and ADHD (Maag, Reid, & DiGangi, 1993; Mathis & Bender, 1997); secondary students with learning disabilities (Wolfe, Heron, & Goddard, 2000), behavior problems (O'Reilly**,** Tiernan, & Lacey, 2002), and moderate-severe disabilities (Agran et al., 2005); and adults with mental retardation (Misra, 1992). Additionally, self-monitoring interventions have resulted in increased proficiency with a range of target skills including reading (Jitendra, Hoppes, & Xin, 2000), writing (Stotz, Itoi, Konrad, & Alber-Morgan, 2008), spelling (Harris, Friedlander, Saddler, Frizzelle, & Graham, 2005), math (Dunlap & Dunlap, 1989), vocational skills (Ganz & Sigafoos, 2005), and social skills (Strain & Kohler, 1994).

Several studies have examined the effects of self-monitoring of on-task behavior (e.g., Harris et al., 2005; Mathes & Bender, 1997; Wolf, Heron, & Goddard, 2000). For example, Mathes and Bender (1997) found increased on-task behavior for elementary children with ADHD when they used tape recorded intermittent tones to prompt self-recording of on-task behavior while completing seatwork. Wolfe et al. (2000) found similar results for elementary students with learning disabilities who self-recorded on-task behavior at 1-min time intervals during written expression activities. In addition, Harris et al. (2005) compared the effects of self-monitoring of attention to self-monitoring of spelling study behaviors for six elementary students with ADHD. In the self-monitoring of attention condition, the students recorded whether or not they were on task when they heard an intermittent tone. The self-monitoring of productivity condition required the students to count the number of words correctly practiced. Improvement of on-task behavior was similar in both conditions, but academic performance was improved for four of the six students when they self-recorded their attention to the task. This finding is in contrast to previous self-monitoring research which suggests that children with learning disabilities have better academic outcomes when they self-monitor their academic productivity compared to when they self-monitor their on-task behavior (e.g., Harris, Graham, Reid, McElroy, & Hamby, 1994).

In each of the aforementioned studies, the students were provided with a task to complete, a self-recording form, and an auditory signal (i.e., tape recorded tone) at either fixed or intermittent time schedules. Each time the students heard the auditory signal, they recorded whether or not they were on-task. This approach has been successful for increasing on-task behavior and related task proficiency. However, one disadvantage of this procedure is that the auditory prompts—even with headphones—can be obtrusive and/or stigmatizing in some classrooms. As an alternative to auditory prompts, researchers have begun to investigate the use of tactile prompts to target self-monitoring of desirable classroom behavior (Amato-Zech, Hoff, & Doepke, 2006; Christensen, Young, & Marchant, 2004).

For instance, Christensen et al. (2004) incorporated the MotivAider® into a peer-mediated intervention to increase appropriate classroom behavior with two third graders at risk for emotional and behavior disorders. The MotivAider® (2000) is an electronic device that looks like a pager, can be clipped onto the belt or waist band, and functions as a tactile prompt (i.e., it vibrates). This device can also be programmed to vibrate on a fixed or intermittent time schedule. Specifically, Christensen et al. used the MotivAider® to prompt peers or a teacher at fixed-time schedules to match behavior rating cards with the targeted peers, provide reinforcement to the target peers for appropriate classroom behaviors, and/or provide corrective feedback for inappropriate classroom behaviors. Results indicated that the packaged intervention, which included the use of the MotivAider®, successfully increased appropriate classroom behavior for the target students.

In a more recent investigation, Amato-Zech et al. (2006) examined the effects of self-monitoring of on-task behavior using the MotivAider®. Amato-Zech et al. taught three fifth graders with learning disabilities or behavior disorders to self-monitor their on-task behavior during language arts instruction. The MotivAider® was programmed to vibrate every three minutes to signal the students to mark on their self-recording form either “Yes, I was paying attention,” or “No, I was not paying attention.” Results demonstrated increased on-task behavior from about 50% during baseline to 70%-100% during intervention. To date, only a limited number of published studies have evaluated the effects of the MotivAider® (Amato-Zech et al., 2006; Christensen et al., 2004; O’Callaghan, Allen, Powell & Salama, 2006).

The purpose of this study was to extend the research of Amato-Zech et al. (2006) to children with autism and other disabilities. Similar to Amato-Zech et al., the participants in this study attended a special education classroom and were trained to use the MotivAider® and a self-recording form to monitor their on-task behaviors. In addition to examining the effects of the MotivAider® for a different population of children, this study builds upon previous research by examining student responding during fading and maintenance conditions. Specifically, we asked the following research questions: (1)What are the effects of a self-monitoring intervention using a MotivAider® on the on-task behaviors of elementary students with disabilities completing math assignments? (2) What are the effects of the MotivAider® on maintenance of on task behavior? (3) Can students accurately self-record their on-task behavior?

Method

Participants and Setting

Three boys with disabilities attending a rural school district participated in this study. Adam was a 13-year-old sixth grader, and Joshua and Matthew were both 11-year-old fifth graders. Adam and Joshua were diagnosed with autism. Matthew had a primary diagnosis of cerebral palsy, but also exhibited behaviors associated with autism (e.g., stereotypy). Both Adam and Matthew spent most of their school day in a self-contained special education classroom and attended unified arts (e.g., physical education, art, music) with general education students one period per day. Joshua attended the regular classroom for most of the school day and attended the special education classroom for supplemental instruction in language arts and math (two 50-minute periods per day). Data were collected in the special education classroom on four days each week from 1:00-1:20 while the students completed independent math assignments. During data collection, the classroom was composed of an intervention specialist, a teaching assistant, the experimenter (who was also the primary observer), the three target students, and six other students.

Materials

MotivAider®. A MotivAider® is a pager-like device that clips onto a belt or waistband, and can be programmed to briefly vibrate at fixed- or variable-time schedules. During the baseline and maintenance conditions, the experimenter set her MotivAider® to vibrate every two minutes to prompt her to record when the students were on task. During the self-recording intervention for each student, the experimenter set her MotivAider® to vibrate at the same time as the student's MotivAider®. She placed the devices on her desk, set each device for 2-min and pressed the start button on each device in quick succession so that the MotivAiders® were vibrating within one second of each other. During fading, the students' MotivAiders® were set on variable time schedules, but the experimenter's MotivAider® was still set for 2-min for consistent data recording.

During the intervention phase of the study, each student wore a MotivAider® on his waistband or belt to serve as a prompt to self-record his on-task behavior. The MotivAider® was initially programmed at fixed-time schedules of 2-min. During the fading condition, the MotivAider® was programmed at variable-time schedules of 4-min to 10-min. The standard MotivAider® settings were used for vibration intensity and duration. For two of the three participants, the digital display showed a count down of the time interval in seconds. The digital display was changed to a graphic display for Joshua because he frequently checked the display and talked about how much time he had left. When a graphic display was used, it did not distract Joshua from the task.

Self-recording form. During intervention, each student had a self-recording form on his desk during independent work time. Each time the motivator vibrated, the student recorded either a plus (+) or a minus (–) to indicate "yes" or "no" to the following statements on the self-recording form: "eyes on work," "in my seat," and "doing work." The student had to emit all three behaviors to be scored as on-task for that time schedule.

Definition and Measurement of Dependent Variables

On-task behavior. Data were collected using a 2-min momentary time sampling procedure during 20-min independent seatwork sessions. The momentary time-sampling interval length was based upon direct observation and anecdotal reports provided by the classroom teacher. A momentary time-sampling measurement was selected because it allowed for the direct observation of multiple participants. The experimenter set her own MotivAider® for a 2-min fixed-time schedules. Whenever her MotivAider® vibrated, she observed the students and recorded whether or not they were on-task. A student was recorded as being on-task if he emitted all of the following behaviors: 1) sitting in seat, 2) looking at the assignment, and 3) manipulating materials related to the assignment (pencil in hand, writing or erasing an item, or using a calculator).

Accuracy of self-recording. Accuracy of self-recording was measured by comparing the experimenter's data sheet and the student's self-recording sheet. An agreement was scored if the experimenter and the student both recorded either "on task" or "off task" at the end of corresponding time intervals. Percentage of accurate self-recording was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

Experimental Design and Procedures

A multiple baseline across students design was used to examine the effects of a self-monitoring procedure on the on-task behavior of three students. The following is a description of the procedures for baseline, training, self-recording, fading, and maintenance.

Baseline. Baseline data were collected during math class for all three students. After a 10-15 min period of teacher led instruction, the students were provided with their math assignments and instructed to complete their work. The experimenter recorded on-task and off-task behavior using the 2-min momentary time sampling procedure described above.

Training. Training sessions were conducted individually; each participant entered the intervention condition separately. During two 20-minute training sessions the students were provided with a worksheet, a self-recording sheet, and a MotivAider®. The experimenter explained and modeled how the data sheets were to be marked each time the MotivAider® vibrated. She also wrote the steps for self-recording on the board as follows: (1) Begin doing your work; (2) When the pager buzzes, mark on your self-recording sheet starting with #1 and go in order until #10; (3) + stands for "Yes I am doing this" and – stands for "No I am not doing this"; (4) Remember when it buzzes to be quiet, mark on your sheet and go back to your work until it buzzes again. During training, the MotivAider® was set at a 1-min fixed time schedule. When students demonstrated at least 80% accuracy of self-recording across both training sessions, the self-recording condition was introduced.

Self-recording. After teacher led instruction, the intervention specialist directed all of the students to complete their math assignments. The student was provided with the MotivAider® (set at a 2-min fixed schedule) and a self-recording sheet. He was instructed to wear the MotivAider® on his belt or waistband of his pants. Each time the MotivAider® vibrated, the student wrote either a plus (+) or a minus (–) in the corresponding column indicating if he was emitting each the following behaviors: "eyes on work," "in my seat," and "doing work." A plus had to be written for all three behaviors in order to be considered on-task. At the end of each 20-minute session, the students gave their self-recording data sheets to the experimenter. If the student had a total of three plusses in a column, the experimenter wrote "yes" for that interval. If the student had less than three plusses, the experimenter wrote "no" for that interval. Student behavior was reinforced based on the experimenter's data. If the student was on-task at least 80% of the time, he received a reinforcer (e.g., free time to work on the computer or listen to music). If on-task behavior was less than 80%, the student received feedback on his performance and did not receive a reinforcer. Furthermore, when this occurred, the participant was encouraged to work for it during the next session.

Fading. A fading condition was introduced for all three students simultaneously when they showed high and stable rates of on task behavior. Fading was introduced for all three students at the same time to ensure that there would be adequate time to include maintenance condition for each student. The fading schedules varied across the three students and were based on their individual performance. During the fading condition for Matthew and Adam, the MotivAider® was programmed with variable-time schedules beginning with a VT-2 schedule on the first session of fading. The variable-time schedules on the remaining fading sessions were as follows: VT-4 on the second fading session, VT-6 on the third, VT-8 on the fourth, and VT-10 on the last fading session. On Joshua's third session (VT-6), his on-task behavior decreased to 70%. For Joshua, the MotivAider® was set at a VT-4 schedule for the remaining fading sessions.

Maintenance. In order to determine the extent to which the students would continue to stay on-task without the MotivAider®, a maintenance condition was implemented. Maintenance data were collected each week for three weeks following the last intervention session. During the maintenance phase, all three students worked on their math assignments during independent work time just as they did in baseline, without the self-recording materials.

Interobserver Agreement (IOA)

IOA was assessed on 20% to 25% of the baseline sessions, and 20% to 29% of the intervention sessions. During the IOA sessions, the intervention specialist independently and simultaneously observed and recorded on-task behavior with the experimenter. The experimenter and a second observer calibrated their MotivAiders® by setting them for 2-min and pressing the start button at the same time. Trial by trial IOA data were assessed and calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Mean percent IOA for each student during baseline and intervention. IOA for each student ranged from 73% to 92% during baseline and 98% to 100% during intervention.

Procedural Fidelity

Procedural fidelity data were collected across 21% of the total baseline sessions and 45% of the total intervention sessions across participants. During intervention, the experimenter referred to a 10-step procedural fidelity checklist to ensure consistent implementation of the intervention. The second observer recorded whether or not the experimenter implemented the steps correctly and in the correct sequence. Procedural fidelity was calculated by dividing the number of steps implemented correctly by the total number of steps and multiplying by 100. On each session procedural fidelity was assessed, the experimenter implemented all of the steps in the correct sequence to 100% accuracy.

Figure 1, Next Page

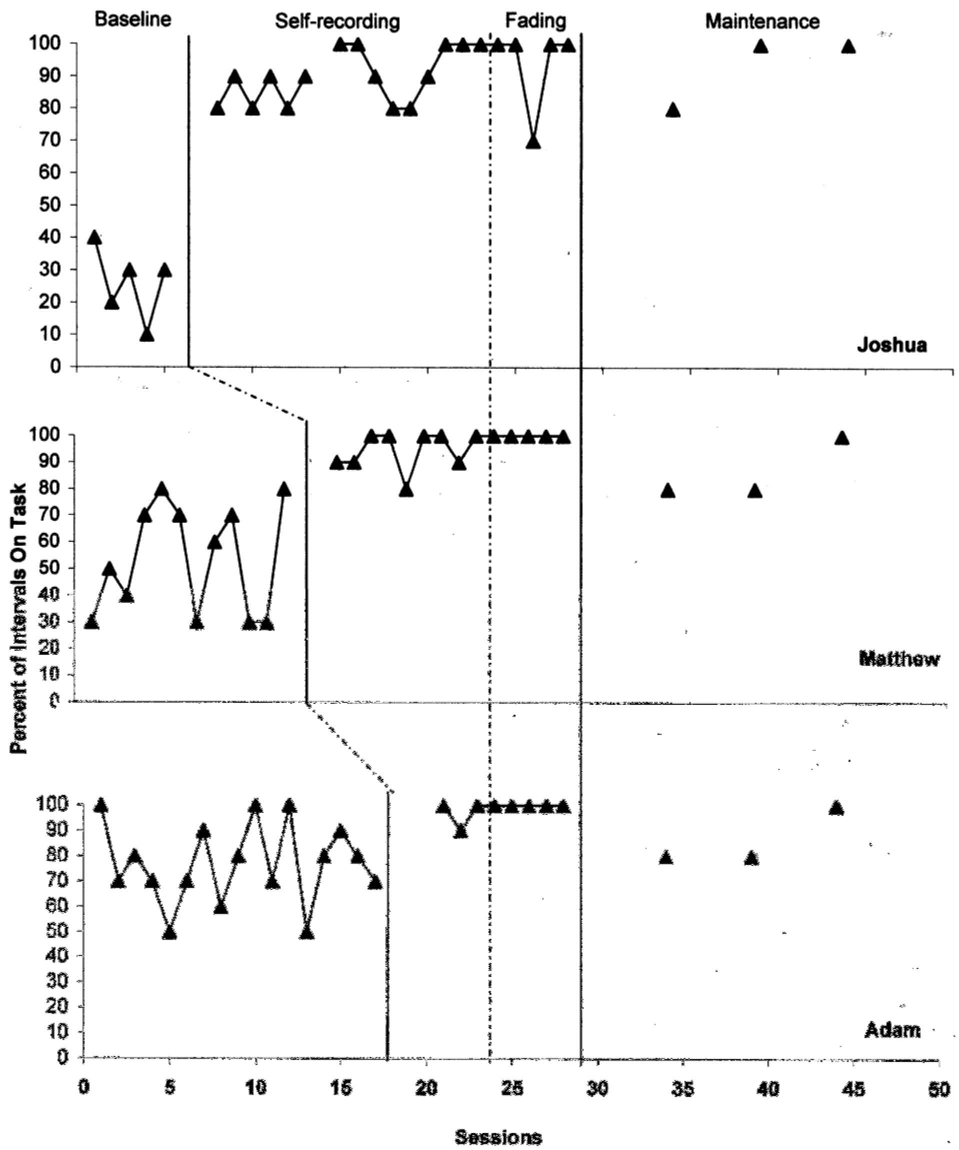

Figure 1. Percent of intervals of on-task during each session for Joshua, Matthew, and Adam

Results

On-Task Behavior

Figure 1 shows the percent of intervals of on-task behavior per session for Joshua, Matthew, and Adam across conditions. During baseline, all three students showed considerable variability. Joshua's mean percent of intervals of on-task behavior was 26% (range: 10% to 40%), Matthew's was 53% (range: 30-80%), and Adam's was 77% (range: 50% to 100%). After they were trained to use the MotivAider® as a prompt to self-record, all three students showed an immediate and substantial increase of on-task behavior ranging consistently from 80% to 100%. Mean percent of on-task behavior was 91% (range: 80-100%) for Joshua, 98% (range: 80-100%) for Matthew, and 97% (range: 90-100%) for Adam. Percent of time on-task behavior improved even more during the fading condition was introduced. With the exception of Joshua's third session in the fading condition, all students were on-task 100% of the time during fading. Additionally, all students continued to demonstrate 80% to 100% on-task behavior during the three maintenance probes.

Accuracy of Self-Recording

Accuracy of self-recording was assessed by comparing the experimenter's data sheet and the students' self-recording sheets. Both Joshua and Matthew's mean self-recording accuracy across all self-recording sessions was 96%, and Adam's mean accuracy across sessions was 99%.

Discussion

The results of this study demonstrate a functional relation of self-monitoring with a tactile prompt on increased on-task behavior. This study supports the findings of Amato-Zech et al. (2006) and extends their research to two children with autism and one child with cerebral palsy. All three students in our study showed immediate and substantial increases of on-task behavior upon initiation of the self-recording intervention. The students in the Amato-Zech et al. study also showed substantial on-task behavior increases, but the effects of their intervention were more gradual.

This study also extends the research of Amato-Zech et al. (2006) by examining the effects of variable time schedules on self-monitoring. Amato-Zech et al. used a 3-min fixed time schedule during all intervention sessions after the first week. In our study, we began intervention by setting the MotivAider® to vibrate at a 2-min fixed time schedule. During this phase, the students exhibited on-task behavior at 80% to 100%. After the fading condition was implemented, each student was placed on a variable time schedules of increasing time segments. With the exception of Joshua's third fading session, all of the students were on task at 100% during every fading session. The increased percentages of on-task behavior are likely the result of the unpredictable recording schedules. If writing a plus (+) functioned as a reinforcer, the outcome of increased on-task behavior supports the principle that behaviors reinforced on intermittent and unpredictable schedules tend to be more robust and resistant to extinction (e.g., Cooper, Heron, & Heward, 2007). Evidence of possible resistance to extinction appears in the final phase of the study where all three students were on-task during 80% to 100% of each of the maintenance sessions.

Limitations and Future Directions

Despite the effectiveness of the intervention across participants, there are several limitations of this investigation. First, although reinforcers were presented contingent upon on-task behavior, the current investigation failed to incorporate an empirical reinforcer assessment to determine the extent to which the contingent rewards functioned as reinforcers. Future research should include a reinforcer assessment prior to implementing an intervention. Second, a momentary time-sampling measurement system was used to record on-task behavior; however, a partial interval time-sampling procedure may have been a more suitable measure because it is more conservative. The utility of the partial interval time-sampling procedure in the classroom should be considered in future explorations. Another limitation related to the data is that Matthew's percent of time on-task showed high variability with an increasing trend during baseline when the self-recording intervention was implemented. Despite this limitation, Matthew's percent of on-task behavior stabilized and was observed at a higher level after the introduction of the intervention as compared to baseline. In addition to these limitations, there were also limitations related to maintenance, generalization, and lack of academic productivity data.

Maintenance. The high percentages of on-task behavior during maintenance may be the result of the fading procedure. Another possible explanation for this outcome is that the presence of the experimenter may have acquired stimulus control over the students' on-task behavior. Because the experimenter trained the students and implemented the intervention for several weeks, the students may have associated her presence with the behavior of staying on task. Future research should attempt to control for this possible effect by videotaping or using additional observers.

Generalization. In this study, due to scheduling limitations, we were unable to assess generalization in other settings as was done in Amato-Zech et al. (2006). Future research should examine generalization to different academic tasks and in different settings. It would also be beneficial to examine the effects of the MotivAider® and self-recording during various instructional arrangements. For example, the effects of tactile self-monitoring can be examined during whole class instruction, small group instruction, cooperative learning groups, or peer tutoring.

Academic Productivity. The most significant limitation of this study is that no data are reported on the completion and accuracy of math assignments. The math worksheets required the students to perform a wide range of computation and reasoning problems that required varying degrees of effort and skill. As such, the students occasionally practiced newly learned skills with intermittent practice of previously mastered skills. Additionally, a new math program was implemented during the middle of the self-recording phase. All of these factors contributed to the inconsistency of the math assignments. For this reason, meaningful conclusions cannot be drawn about the effects of the self-monitoring procedure on academic productivity. Future research should examine the effects of on-task behavior on academic achievement using consistent and appropriately leveled academic materials.

Implications for Practice

All three students were able to accurately self-record their on-task behavior (mean 96% to 99%). Previous research has demonstrated that it is not necessary that students accurately record their behavior in order for the intervention to be effective (e.g., Marshall, Lloyd, & Hallahan, 1993). On-task behavior may increase to acceptable levels even if the child does not self-record accurately. However, if the goal is to increase accurate self-recording, explicit programmed reinforcers should be made contingent on accuracy (i.e., student data matches teacher data; e.g., Rhode et al. 1983) .A faded matching technique can be used to increase and maintain accurate self-recording. When implementing a faded matching technique, the teacher checks the student's self-recording form on an unpredictable schedule and reinforces accurate self-recording. Initially, the teacher checks for accuracy frequently and then gradually thins the schedule over time. Interestingly, when a participant's self-recording was less than 100% accurate, it was found that errors were due to errors of omission (i.e., recording themselves as off-task when they were actually on-task) for one participant while another participant always had errors of commission (i.e., recording themselves as on-task when they were actually off-task).

It would be beneficial for intervention specialists, classroom teachers, and teacher assistants to receive training on how to implement self-monitoring procedures in the classroom. When implementing a self-monitoring intervention, Cooper, Heron, and Heward (2007) recommend teachers provide materials that make self-monitoring easy, provide additional cues and prompts, and reinforce accurate self-monitoring. As demonstrated in the current investigation, the MotivAider ® can effectively contribute to the accuracy of self-monitoring within the classroom. Another benefit for practitioners is the cost effectiveness of this device. When compared to other self-monitoring vibrating devices, the MotivAider® is relatively inexpensive, easy to use, and less obtrusive than other self-monitoring procedures.

References

Agran, M., Alper, S., Cavin, M., Sinclair, T., Wehmeyer, M., & Hughes, C. (2005). Using self-monitoring to increase following-direction skills of students with moderate to severe disabilities in general education. *Education and Training in Developmental Disabilities, 40,* 3-13.

Amato-Zech, N., Hoff, K., & Doepke, K. (2006). Increasing on-task behavior in the classroom: Extension of self-monitoring strategies. *Psychology in the Schools, 43*, 211-221.

Christensen, L., Young, K.R., & Marchant, M. (2004). The effects of a peer-mediated positive behavior support program on socially appropriate classroom behavior. *Education and Treatment of Children, 27,* 199-234.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied Behavior Analysis (2nd Ed.).* Columbus, OH: Pearson Education

Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. *Journal of Applied Behavior Analysis, 22,* 309-314.

Ganz, J., & Sigafoos, J. (2005). Self-monitoring: Are young adults with MR and autism able to utilize cognitive strategies independently? *Education and Training in Developmental Disabilities, 40,* 24-33.

Harris, K., Friedlander, B., Saddler, B., Frizzelle, R., & Graham, S. (2005). Self-monitoring of attention versus self-monitoring of academic performance. *The Journal of Special Education, 39,* 145-156.

Harris, K. R., Graham, S., Reid, R., McElroy, K., & Hamby, R. (1994). Self-monitoring of attention versus self-monitor ing of performance: Replication and cross-task comparison. *Learning Disability Quarterly, 17,* 121–139.

Jitendra, A. K., Hoppes, M. K., & Xin, Y. P. (2000). Enhancing main idea comprehension for students with learning problems: The role of a summarization strategy and self-monitoring instruction. *Journal of Special Education, 34,* 127-140.

Maag, J., Reid, R., & DiGangi, S. (1993). Differential effects of self-monitoring attention, accuracy, and productivity. *Journal of Applied Behavior Analysis, 26,* 329-344.

Marshall, K. J., Lloyd, J. W., & Hallahan, D. P. (1993). Effects of training to increase self-monitoring accuracy. *Journal of Behavioral Education, 3,* 445-459.

Mathes, M., & Bender, W. (1997). The effects of self-monitoring on children with ADHD who are receiving pharmacological interventions. *Remedial and Special Education, 18,* 121-134.

Misra, A. (1992). Generalization of social skills through self-monitoring by adults with mild mental retardation. *Exceptional Children, 58,* 495-508.

MotivAider (2000). Thief River Falls, MA: Behavioral Dynamics.

O'Callaghan, P.M., Allen, K.D., Powell, S., & Salama, F. (2006). The efficacy of noncontingent escape for decreasing children's disruptive behavior during restorative dental treamtment. *Journal of Applied Behavior Analysis,39,* 161-171.

Stotz, K. E., Itoi, M., Konrad, M. & Alber-Morgan, S. R. (2008). Effects of self-graphing on written expression of fourth grade students with high-incidence disabilities. *Journal of Behavioral Education*, *17*, 172-186.

Rhode, G., Morgan, D. P., & Young, K. R. (1983). Generalization and maintenance of treatment gains of behaviorally handicapped students from resource rooms to regular classrooms using self-evaluation procedures. *Journal of Applied Behavior Analysis, 16,* 171-188.

Strain, P. S., & Kohler, F. W. (1994). Teaching preschoolers with autism to self-monitor their social interactions. *Journal of Emotional and Behavioral Disorders, 2*, 78-89.

Wolfe, L. H., Heron, T. E., & Goddard, Y. L. (2000). Effects of self-monitoring on the on-task behavior and written language performance of elementary students with learning disabilities. *Journal of Behavioral Education, 10,* 49-73.

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