USING WATCHMINDER TO INCREASE THE ON-TASK BEHAVIOR OF
STUDENTS WITH AUTISM SPECTRUM DISORDER

by

Lisa Finn

A Thesis Submitted to the Faculty of
The College of Education
in Partial Fulfillment of the Requirements for the Degree of
Master of Education

Florida Atlantic University
Boca Raton, FL
August 2013
USING WATCHMINDER TO INCREASE THE ON-TASK BEHAVIOR OF STUDENTS WITH AUTISM SPECTRUM DISORDER

by

Lisa Finn

This thesis was prepared under the direction of the candidate’s thesis advisor, Dr. Rangasamy Ramasamy, Department of Exceptional Student Education, and has been approved by the members of her supervisory committee. It was submitted to the faculty of the College of Education and was accepted in partial fulfillment of the requirements for the degree of Master of Education.

SUPERVISORY COMMITTEE:

R. Ramasamy, Ph.D.
Thesis Advisor

Charles Dukes
Charles Dukes, Ed.D.

John Scott, Ph.D., BCBA-D

Michael Brady, Ph.D.
Chair, Department of Exceptional Student Education

Valerie J. Bristor, Ph.D.
Dean, College of Education

Barry T. Rosson, Ph.D.
Dean, Graduate College

July 19, 2013
ACKNOWLEDGEMENTS

I wish to express my sincere thanks to my husband and my family for their support while conducting this research study. I would like to extend my gratitude to my committee chair and graduate advisor, Dr. Rangasamy Ramasamy, for his time, advice, and guidance throughout the process. I would like to thank my committee members, Dr. Jack Scott and Dr. Charles Dukes, for their valuable input and direction during this study. Also, I would like to thank Elisa Cruz-Torres for her guidance, support, assistance with graphing, proofreading, and for providing input throughout the research and writing process. I am grateful to my school for granting permission for this study to be conducted. Finally, I would like to thank my paraprofessional, Tami Slater, for helping to collect data during the research process. The efforts of everyone involved are greatly appreciated.
ABSTRACT

In this study the effectiveness of WatchMinder™, a vibrating prompt watch, was examined as a component of a self-monitoring intervention package to help students with autism increase on-task behavior during independent seatwork. A multitude of literature since the 1970s has suggested that self-monitoring interventions are integral in increasing task engagement. Tactile prompting devices are a new aspect of self-monitoring interventions, and the limited research has shown that these unobtrusive devices are effective for providing feedback to monitor their behavior. Self-graphing is another component of self-monitoring interventions that has received little attention in the literature. However, many studies recognize the importance for individuals to be active participants in their educational programs by analyzing progress and being a part of the decision making process. This study assessed the use of WatchMinder and
self-graphing on the on-task behavior of four elementary students with autism in the special education setting.
DEDICATION

This manuscript is dedicated to my school for supporting my efforts in continuing education, and my students who inspire me to be a better teacher everyday.
USING WATCHMINDER TO INCREASE THE ON-TASK BEHAVIOR OF STUDENTS WITH AUTISM SPECTRUM DISORDER

List of Tables ..............................................................................................................xi

List of Figures ..........................................................................................................xii

Introduction ...............................................................................................................1

Statement of Problem ...............................................................................................4

Purpose of Study .........................................................................................................5

Research Questions ....................................................................................................5

Literature Review .......................................................................................................7

Self-Monitoring Research and ASD ........................................................................8

Self-Monitoring and On-Task Behavior .....................................................................9

Tactile Prompting for Self-Monitoring .......................................................................9

Self-Monitoring and Self-Graphing for Task Engagement .......................................11

Social Validity and Self-Monitoring .........................................................................12

Method .....................................................................................................................14

Participants ...............................................................................................................14

Selection criteria .......................................................................................................18

Setting .......................................................................................................................18

Materials ...................................................................................................................19

WatchMinder .............................................................................................................19

Participant checklist .................................................................................................21

Adult observer data sheet .........................................................................................21

viii
Data Manager Pro ..............................................................21

Variables .................................................................................22
  Dependent variable ............................................................22
  Independent variable ............................................................22
  Data collection .....................................................................23
  Interobserver agreement ......................................................24
  Treatment integrity .............................................................24

Design ....................................................................................25

Procedures .............................................................................25
  Baseline .............................................................................25
  Training .............................................................................26
  Self-Monitoring ..................................................................27
  Self-Monitoring plus graphing .............................................28
  Fading ...............................................................................29
  Follow-up ..........................................................................29

Results ...................................................................................30
  Baseline .............................................................................30
  Training .............................................................................32
  Self-Monitoring ..................................................................33
  Self-Monitoring Plus Graphing ..........................................33
  Fading ...............................................................................34
  Follow-Up ..........................................................................37

Summary of Findings ..............................................................41

Interobserver Agreement .......................................................42
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural Fidelity</td>
<td>44</td>
</tr>
<tr>
<td>Discussion</td>
<td>46</td>
</tr>
<tr>
<td>Benefits</td>
<td>48</td>
</tr>
<tr>
<td>Social Validity</td>
<td>50</td>
</tr>
<tr>
<td>Limitations</td>
<td>51</td>
</tr>
<tr>
<td>Implications for Future Research</td>
<td>52</td>
</tr>
<tr>
<td>Conclusion</td>
<td>54</td>
</tr>
<tr>
<td>Appendices</td>
<td>55</td>
</tr>
<tr>
<td>Appendix A1. Participant checklist for 2-minute interval phases</td>
<td>56</td>
</tr>
<tr>
<td>Appendix A2. Participant checklist for 5-minute interval phase</td>
<td>57</td>
</tr>
<tr>
<td>Appendix B. Adult Observer Data Sheet</td>
<td>58</td>
</tr>
<tr>
<td>Appendix C. Training Phase Fidelity Checklist</td>
<td>59</td>
</tr>
<tr>
<td>Appendix D. WatchMinder Study Protocol</td>
<td>60</td>
</tr>
<tr>
<td>Appendix E1. Data Manger Pro Screen Shots</td>
<td>61</td>
</tr>
<tr>
<td>Appendix E2. Data Manager Pro Screen Shots</td>
<td>62</td>
</tr>
<tr>
<td>References</td>
<td>63</td>
</tr>
</tbody>
</table>
TABLES

Table 3.1. Demographic Characteristics of Participants ........................................... 17
Table 3.2. On and Off-Task Definitions Across Participants ................................. 23
Table 4.1. Participant Accuracy in Recording ....................................................... 37
Table 4.2. Interobserver Agreement ................................................................. 44
FIGURES

Figure 1. Experimental Results of Self-Monitoring Intervention Across Participants…..40


Introduction

In recent years, the awareness of autism has increased significantly along with the services provided. As a result, many teachers are seeking effective interventions to help their students succeed in school. The American Psychiatric Association (2013) characterizes Autism Spectrum Disorder (ASD) as a neurobiological disorder that affects the brain and how it functions communicatively, socially, and behaviorally. Common characteristics associated with autism include verbal and nonverbal communication deficits, difficulties understanding social cues and processing sensory stimuli, gaps in learning development, intense interests, repetitive actions, and difficulty shifting focus or attention (Doyle & Doyle Iland, 2004). In 2000, the Center for Disease Control and Prevention (CDC) reported the prevalence of autism to be 1:150. By 2008, it had increased to 1:88 (CDC, 2012). With the prevalence of ASD increasing, it is important that effective interventions are designed to meet varying needs of students with ASD.

Individuals with ASD often struggle with focusing and sustaining attention, rapidly retrieving relevant information, managing time effectively, self-monitoring, self-correcting, and sequencing a plan of action (Liss et al., 2001). These skills, collectively known as executive functions, are coordinated in the brain and work together to help a person achieve goals. According to Henry and Bettenay (2010):

Executive functions are the skills necessary for purposeful, goal-directed activity (Anderson, 1998), required for the successful achievement of complex, higher
order cognitive goals, including planning future actions, keeping these plans in mind until executed, problem-solving, self-monitoring to check on progress, mental flexibility, and the ability to inhibit irrelevant actions. (Henry & Bettenay, 2010, p. 110)

In addition to the challenges mentioned above, Gilotty, Kenworthy, Sirian, Black, and Wagner (2002) cited deficits in adaptive behaviors as one of the core areas of impairment for individuals with autism. This can create difficulties with flexibility, planning, and organization, which are foundational executive functioning skills.

When a person is engaged in a task, there are many processes that must work together for the individual to complete it successfully. Planning is required for the person to know what he/she needs to accomplish and the steps for completing it. Self-monitoring skills are needed to regulate what a person is doing as he/she is engaged in a task. Flexibility is necessary so plans can be adjusted as conflicts or unexpected events arise. Organization is key for keeping track of what has already been accomplished and things that still need to be done. Even simple processes such as getting ready for bed or completing a previously mastered math task require a person to use all of these skills. When one or more of these processes fails, it affects a person’s ability to achieve goals (Henry & Bettenay, 2010).

Executive functioning skills develop naturally in most individuals without disabilities. However, those with ASD may require systematic interventions to acquire such a complex set of skills. “In the academic setting, the ability to attend to tasks is a requisite skill for success in school,” (Holifield, Goodman, Hazelkorn, & Heflin, 2010, p. 230). Therefore, individuals with attentional challenges, such as those with ASD or
ADHD, require self-monitoring interventions that target these specific executive functioning skills.

According to Lee, Simpson, and Shrogen (2007), self-monitoring, often synonymous with the term self-management, is a process involved in most aspects of daily life. For example, attending a conference or a staff meeting requires focusing on the speaker and comprehending the information presented. When writing a report for work, or a term paper for school, we monitor ourselves to know when to take breaks, when to press save, or reread to make sure our writing makes sense. Self-monitoring is also involved in many daily living activities such as adding the correct amount of detergent in the washing machine, making sure the iron is unplugged, and ensuring that the household bills are paid on time. Self-monitoring skills are critical for time management, meeting deadlines or due dates, and performing multi-step tasks. Without this fundamental life skill, a person may be left feeling frustrated and unable to keep up with the fast pace of life. Therefore, effective interventions are needed to assist students with autism in developing self-monitoring skills.

Self-monitoring training is a proactive intervention that can be individualized and applied in a variety of settings. Self-monitoring programs are often considered “treatment packages” comprised of several components including self-recording, goal setting, evaluation, graphing/charting, and reinforcement (Briesch & Chafouleas, 2009). Many people with disabilities are not aware of how well they are performing without access to feedback from other individuals (Joseph & Eveleigh, 2011). “Self-monitoring permits students to take responsibility for learning, manage their behavior, and ensure
environmental conditions are appropriate for achieving goals” (Joseph & Eveleigh, 2011, p. 52).

**Statement of Problem**

Many students with disabilities have difficulty monitoring their behavior to remain engaged in independent and group tasks due to a deficit in executive functioning skills and lack of self-awareness. Several research studies have demonstrated that self-monitoring programs are effective for increasing task engagement and work productivity among individuals with a variety of disabilities and age ranges, particularly those with ASD. Increasing on-task behavior has been a target in many research studies since the 1970s. However, most of these interventions have relied on teacher or auditory prompts to cue students to monitor their behavior (Callahan & Rademacher, 1999; Holifield et al., 2010; Koegel & Koegel, 1990; Mancina, Tankersley, Kamps, Kravits, & Parrett, 2000; Parker & Kamps, 2011). These prompts can be obtrusive and stigmatizing to students because they call attention to those who are utilizing them. In addition, teacher and auditory prompts do not lend themselves to generalization across settings since the prompts are not portable. Tactile prompting devices are a more mobile, and unobtrusive solution to the problem. However, there is limited research on the use of tactile prompting devices, such as vibrating watches and pagers, as useful components of self-monitoring interventions. A few studies have shown devices such as MotivAider and WatchMinder™ to be effective tactile prompting devices for increasing “on-task” behavior while students are working independently (Amato-Zech, Hoff, & Doepke, 2006; Green, Hughes, & Ryan, 2011; Van Hulle & Hux, 2006). Furthermore, there is even less research on using self-graphing as a component of self-monitoring programs, although
many studies state that students should be active participants in developing and analyzing their interventions (Anderson & Wheldall, 2004; Briesch & Chafouleas, 2009; Sebag, 2010). Consequently, using tactile prompts and teaching students to graph and analyze their on-task behavior may help create a more meaningful and generalizable intervention program aiming to improve self-monitoring skills. Therefore, there is a need for more research on the newest technologies available for self-monitoring programs including tactile devices and student friendly graphing applications.

**Purpose of the Study**

Many students with autism have difficulty remaining on-task to complete work independently. Various strategies, such as use of prompts and checklists, can help promote self-monitoring skills. The WatchMinder, a vibrating prompt watch, is an effective device for developing self-monitoring skills and increasing task completion during independent work. However, this particular device has not been researched for use during independent work periods in the self-contained classroom setting. The purpose of this study was to (a) evaluate the efficacy of WatchMinder as a means to promote self-monitoring to increase on-task behavior, (b) evaluate the effects of self-graphing using an iPad application, and (c) assess how well participants were able to maintain self-monitoring skills when the intervention was removed.

**Research Questions**

To assess the impact WatchMinder and self-graphing had on on-task behavior, the following research questions were addressed:

1. Will a WatchMinder device increase the on-task behavior of students with ASD?
2. How does self-graphing and immediately analyzing their progress affect the on-task behavior of students with ASD?

3. Will participants maintain self-monitoring skills when WatchMinder is removed?
**Literature Review**

There have been numerous studies that support self-monitoring as a best practice in the field of education. Anderson and Wheldall (2004) analyzed 44 research studies on self-monitoring between 1991 and 2003, and concluded that self-monitoring was effective in helping students increase their attention and on-task behavior. Furthermore, a meta-analysis of 30 studies by Briesch and Chafouleas (2009) provided empirical evidence that self-monitoring interventions had a large effect on school-age participants with various disabilities. They specifically analyzed effective components of self-management interventions including goal setting, self-monitoring, self-evaluation, self-reinforcement, and self-charting. Earlier studies focused on whether the effects of self-monitoring training on attention were more effective than self-monitoring training on productivity (Harris, 1986; Lloyd, Bateman, Landrum, & Hallahan, 1989). These studies were inconclusive as to which method is best; however, both methods were effective in helping students increase appropriate behaviors in the classroom. Later studies have shown positive effects of self-monitoring on a range of target behaviors for individuals with a variety of disabilities and across several age groups, including high school students with multiple disciplinary referrals (Blick & Test, 1987), adults with traumatic brain injury (Van Hulle & Hux, 2006), adults with intellectual disabilities (Green et al., 2011), and school age students with developmental disabilities and learning disabilities (Amato-Zech et al., 2006; Miller, Fitzgerald, Koury, Mitchem, & Hollingsead, 2007; Trammel,
Although these studies demonstrated the positive effects of self-monitoring programs on student behavior, many of them did not address whether participants were able to maintain the target behavior, or generalize their self-monitoring skills to other settings.

**Self-Monitoring Research and ASD**

Many studies have focused on the effectiveness of self-monitoring programs specifically for students with ASD. Such research targeted skills including increasing on-task behavior (Callahan & Rademacher, 1999; Holifield et al., 2010; Legge, DeBar, & Alber-Morgan, 2010), reducing self-stimulatory behaviors (Koegel & Koegel, 1990; Mancina et al., 2000), increasing independence in social settings (Parker & Kamps, 2011), and increasing academic productivity (Soares, Vannest, & Harrison, 2009). A foundational component of each of these interventions was the prompt, which cued participants to monitor their behavior. For example, Holifield et al. (2010) and Parker and Kamps (2011) used verbal prompts given by the teacher or a peer. Callahan and Rademacher (1999), Koegel and Koegel (1990), and Mancina et al. (2000) used auditory prompts such as tape-recorded tones or wristwatches that beeped to cue participants to assess their behavior. While these prompts were effective in training students to self-monitor, they have limited use because of their obtrusiveness, and impracticality for generalization. Lee et al. (2007) completed a meta-analysis of 11 studies focusing on self-monitoring for students with autism, and they concluded that these techniques helped all participants increase behaviors including daily living skills, social interactions, and independent classroom behaviors. Components of the interventions identified in this meta-analysis that made them successful included discriminative training on accurately
assessing the target behavior, use of materials to help students self-record, and self-reinforcement (Lee et al., 2007).

**Self-Monitoring and On-Task Behavior**

One of the most researched behaviors targeted for self-monitoring programs is increasing on-task behavior. Researchers have reported success in this area for students with autism (Callahan & Rademacher, 1999; Holifield et al., 2010; Legge et al., 2010), learning disabilities (Harris, 1986; Lloyd et al., 1989), and for low performing students who were not labeled with a disability (Blick & Test, 1987; Broden, Vance-Hall, & Mitts, 1971). Research for increasing attention to task has occurred within self-contained and general education settings. In the general education setting, Callahan and Rademacher (1999) found that their participant was able to increase his on-task behaviors and independence in the classroom. In the self-contained setting, Holifield et al., (2010) reported that self-monitoring procedures were effective for students with autism who had varying levels of intellectual functioning, and that their academic accuracy increased once self-monitoring was introduced. In each of the studies mentioned above, careful consideration was given to specifically define “on-task” since the term can encompass a wide range of behaviors depending on the subject, setting, and the type of activity he/she is engaged in. However, none of the studies specifically defined what “off-task” meant for the participants. This can be equally important for students to discriminate between what is expected and not expected when they are monitoring themselves.

**Tactile Prompting for Self-Monitoring**

To teach self-monitoring skills, there must be a prompt that cues the individual to assess the target behavior. This is necessary because individuals who require self-
monitoring training do not naturally think about how they are performing. Therefore, an outside prompt is needed to alert the person to assess his/her behavior. There are several ways to prompt an individual to monitor his/her behavior during a self-monitoring program. Some of these include a teacher prompt, an auditory cue such as a tape-recorded tone, or a tactile prompt such as a vibration (Amato-Zech et al., 2006). However, there are limitations when teacher and auditory prompts are used. Teacher prompts take away from the self-monitoring aspect of the intervention because another person is involved. Auditory prompts can be distracting to others and draw attention to the person using them. In addition, if there are multiple people being trained to self-monitor, they must be able to do so using the same interval length. Based on these limitations, tactile prompts can be a more appropriate option because they vibrate rather than beep, and they can be set to meet individual needs (Legge et al., 2010). For example, in a classroom setting, one person can monitor using a one-minute interval, and another person can do the same using a five-minute interval. Furthermore, tactile prompting devices are portable so they may be more practical for facilitating generalization and spontaneous use of acquired skills (Lee et al., 2007).

There is a paucity of research on the use of tactile prompting devices for self-monitoring. WatchMinder, a vibrating wristwatch, is one tactile prompting device that has been researched, but has not been applied in the classroom setting. Van Hulle and Hux (2006) successfully used WatchMinder to teach adults with traumatic brain injuries to remember to take their medications. Green et al. (2011) used WatchMinder to assist adults with intellectual disabilities with task completion and transition skills within the workplace. Another tactile prompting tool called MotivAider, is a pager-like device that
clips to the waistband and is used to provide vibrating prompts so students can monitor themselves (Richards, Taylor, & Ramasamy, 2014). Legge et al. (2010) used MotivAider as a part of a self-monitoring program to help increase on-task behavior for three fifth and sixth grade students with autism. The MotivAider was a successful and unobtrusive prompt device that helped students increase on-task behavior during math, and they were able to maintain on-task behavior once the MotivAider was removed.

Self-Monitoring and Self-Graphing for Task Engagement

Many researchers have recommended goal setting and self-graphing as potentially effective components of self-monitoring programs (Anderson & Wheldall, 2004; Briesch & Chafouleas, 2009; Sebag, 2010). However, few have incorporated self-graphing as a component of self-monitoring programs to increase target behaviors such as task engagement. Trammel et al., (1994) demonstrated that adding a goal setting and self-graphing component to a self-monitoring intervention was successful in helping secondary students with learning disabilities to complete homework assignments. In a meta-analysis, Joseph and Eveleigh (2011) reported that only five of the 16 studies reviewed included a self-graphing component. It is essential that individuals become active participants in their self-monitoring programs because it is a skill they will need to learn to maintain on their own (Briesh & Chafouleas, 2009). Students should be involved in all steps of the self-monitoring process so they can learn to identify struggles, set goals, make plans, and evaluate their own progress (Sebag, 2010). In addition, graphing data may improve participants’ motivation because it provides immediate feedback (Anderson & Wheldall, 2004).
Social Validity and Self-Monitoring

Research points to numerous benefits of self-monitoring programs. Some of those cited in the literature include an increase in self-confidence, motivation, self-control, responsibility, self-awareness, independence, self-reliance, self-regulation, increased academic performance and accuracy, increased maintenance of skills, and ability to generalize across settings (Anderson & Wheldall, 2004; Holifield et al., 2010; Sebag, 2010; Soares et al., 2009; Wilkinson, 2008). The research also points to the fact that self-monitoring interventions are ideal for classroom environments because they place minimal demands on teacher time, require no curricular modifications, and lessen disruptions during class time. Further, students learn new skills, student performance increases, and the intervention could cause a “spill over” effect on other peers (Amato-Zech et al., 2006, Anderson & Wheldall, 2004; Soares et al., 2009). Many studies sought to formally assess social validity and treatment acceptability within their research designs. For example, Amato-Zech et al. (2006) gave students and teachers the Intervention Rating Profile-20 and they rated the treatment acceptability high. Based on the fact that the literature shows self-monitoring interventions to be socially valid and acceptable to participants and teachers, further research is warranted to update and improve self-monitoring programs.

In summary, current literature supports self-monitoring as an effective intervention tool across age, ability level, settings, and behaviors. It has been effective in increasing appropriate behaviors and decreasing inappropriate behaviors. While these interventions vary in the components used to design programs, all studies have shown a significant positive effect on participants. However, there needs to be more classroom-
based research on tactile devices, and on student self-graphing. In addition, maintenance of self-monitoring skills on the target behavior needs to be explored. Thus far, there have been no studies utilizing WatchMinder, self-graphing, and reinforcement to increase on-task behavior in the self-contained setting for students with ASD. Therefore, the purpose of this study was to extend the current literature on the effects of self-monitoring programs for elementary students with ASD. This study also addressed the paucity of research on self-graphing and tactile prompting devices.
Method

Participants

Four participants, Adam, Paul, Tom, and Bill, participated in the study. They were all receiving services for Autism Spectrum Disorder (ASD) and Language Impairment within an autism cluster program at a community elementary school in South Florida. Adam, Tom, and Bill were in third grade and spent the majority of their day in an autism cluster program, but received a portion of their education in the general education setting. Paul was in fourth grade, and he spent all of his school day in the self-contained autism cluster setting. (See Table 3.1 for participant characteristics).

Adam. Adam, a Caucasian male, was 8 years 10 months old at the time of the study. His most recent psycho-education profile was completed in April 2012, and indicated that Adam’s cognitive ability levels were minimally within the low average range based on the Differential Ability Scales-Second Edition (DAS-II). His scores were average compared to same age peers in the areas of letter-word recognition, reading comprehension, and spelling. His scores were lowest in the area of math computation. Adam was working on grade-level curriculum, received reading, math, and writing instruction in the ASD classroom, and attended the general education setting for science and social studies. Adam was able to keep up with the grade-level curriculum with constant verbal reminders to remain focused and engaged in the task. He had difficulty completing work independently due to prompt dependency, and was not aware that
he had gotten off-task.

**Bill.** Bill, a Caucasian male, was 8 years 7 months old at the time of the study. An updated psycho-educational profile was completed in October 2012 and resulted in Bill becoming eligible for ASD services. Prior to the 2012 school year he was labeled as Otherwise Health Impaired (OHI) because of mental health diagnoses including conduct disorder, and oppositional defiant disorder. In addition, Bill was recently diagnosed with bipolar disorder, post-traumatic stress disorder, and major depressive disorder. He was under the treatment of a psychologist during the study but was not taking medication. The Weschler Intelligence Scale for Children-Fourth Edition (WISC-IV) yielded a full scale IQ of 97, and indicated above average oral reading and low average reading comprehension and math computation. Some of the testing could not be completed due to behavioral difficulties and task avoidance. During the study, Bill was accessing the third grade general education curriculum for all academic subjects. He was less than six months below grade level in reading and math, and one year below grade level in writing. He received direct instruction in the ASD classroom for reading, writing, and math, and participated in the general education setting for science and social studies.

Bill had difficulty following directions, adhering to the classroom routine, and initiating and completing tasks. His preoccupation with imaginary games, guns, and violence contributed to his off-task behavior during independent seatwork. Bill responded well to verbal encouragement and token economies that could be cashed in for reinforcers such as drawing time.

**Paul.** Paul, a Hispanic male, was 9 years 10 months old at the time of the study. According to the Differential Ability Test- Second Edition (DAS-2), Paul’s general
cognitive ability score was a 71, which is within the low range at the third percentile. The test revealed average nonverbal reasoning, low average spatial intelligence, and significantly less verbal reasoning ability. Paul spent all of his school day in a self-contained class in the ASD cluster program. He was working on the Access Points curriculum at the Independent and Supported levels. Access Points are benchmarks that allow students with significant cognitive disabilities to access the Florida Sunshine State Standards. There are three levels of Access Points including Participatory, Supported, and Independent. Paul was able to read using decoding skills, add two digit numbers without regrouping, read a short story and answer factual questions by writing words or phrases, and complete spelling or phonics based worksheets. Paul’s verbal skills were limited to simple sentences to express wants and needs.

Paul was reliant on prompts to complete work independently. He frequently left his work area, played with his materials, and laid his head on his desk during seatwork. He often demonstrated problem behaviors including screaming, lying on the floor, and talking to himself. In addition, he required prompting to ask for assistance.

**Tom.** Tom, a Hispanic male, was 8 years 8 months old at the time of the study. His most recent psycho-educational profile was completed in 2009 when he was four years old, and it indicated that Tom had normal intelligence. A full scale IQ of 101 was obtained from the Leiter International Performance Scale-Revised (Leiter-R) which indicated average skills in reasoning, visualization, and spatial skills. Although a considerable amount of time had passed since this test was administered, the results were consistent with Tom’s academic performance during the study. Tom was on-grade level for all subject areas. At the time of the study he received reading and writing through
direct instruction in the ASD classroom, and the rest of his academic instruction in the general education setting. Tom was also diagnosed with ADHD and took medication for it.

Tom was very compliant and followed directions well. However, he demonstrated compulsive tendencies that caused him difficulty with completing tasks. For example, he spent most of his time making sure his answers were sized to fit exactly on the size of the line that was given on the worksheet. He was also highly distracted by activities others were doing in the classroom and often watched others, especially the teacher working with other students, rather than working on his tasks.

Table 3.1

Demographic Characteristics of Participants

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Grade</th>
<th>Ethnicity</th>
<th>Educational Eligibility</th>
<th>IQ</th>
<th>Academic Services ASD</th>
<th>Academic Services Gen. Ed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>8:10</td>
<td>3</td>
<td>Caucasian</td>
<td>ASD, LI</td>
<td>N/A</td>
<td>Reading</td>
<td>Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Writing</td>
<td>Social</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Math</td>
<td>Studies</td>
</tr>
<tr>
<td>Bill</td>
<td>8:7</td>
<td>3</td>
<td>Caucasian</td>
<td>ASD, OHI</td>
<td>97</td>
<td>Reading</td>
<td>Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Writing</td>
<td>Social</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Math</td>
<td>Studies</td>
</tr>
<tr>
<td>Paul</td>
<td>9:10</td>
<td>4</td>
<td>Hispanic</td>
<td>ASD, LI</td>
<td>71</td>
<td>All</td>
<td>Academics</td>
</tr>
<tr>
<td>Tom</td>
<td>8:8</td>
<td>3</td>
<td>Hispanic</td>
<td>ASD, LI</td>
<td>101</td>
<td>Reading</td>
<td>Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Writing</td>
<td>Social</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Math</td>
<td>Studies</td>
</tr>
</tbody>
</table>

Note. LI = Language Impairment, OHI = Otherwise Health Impaired, IQ = Intelligence Quotient. IQ’s were obtained from different evaluations (Bill- WISC-IV; Paul- DAS-2; Tom- Leiter-R). No IQ score was available in Adam’s file.
Selection criteria. This research was approved by the Institutional Review Board at Florida Atlantic University. All participant names were changed to protect confidentiality. Students were eligible for participation in this study if they were diagnosed with ASD, participated in the autism cluster program for at least a portion of the school day, and could demonstrate ability to complete academic tasks at their seats but were highly distractible and required numerous verbal prompts to do so. Students were selected to participate through nomination by their classroom teacher if they met the selection criteria, and if child assent and parent consent were obtained. Nomination was open to all five teachers in the ASD unit at the school; however, only two participated including the author and another teacher. Five students were nominated for selection, and baseline data were taken on all five of them. However, one student was not included in the study after he exceeded 80% or more intervals on-task for five consecutive sessions. Based on the high levels of baseline data, he did not demonstrate a need for the intervention. The four remaining participants continued throughout the study. The students selected for intervention had difficulty completing their work within a given time frame due to off-task behavior. Some students, Adam and Bill in particular, demonstrated problem behaviors such as screaming, lying on the floor, and banging fists on the desk in response to being redirected by the teacher.

Setting

Observation and intervention occurred at a public elementary school located in a suburban, middle class neighborhood in South Florida. It was completed in the author’s classroom within an autism cluster program. Data collection took place during a 30-minute independent work period between 9:15-10:30 AM while the participants were
working on previously mastered work tasks at stand-alone desks located in the central part of the classroom. During this time, other peers were working at various centers around the classroom or in a small group with the teacher. The setting for this study was typical of how an autism cluster class operated with students coming in and out, working on different tasks, and rotating about the room at different times using their individual schedules. For three of the participants, this study took place in their ASD classroom environment. One participant who was not in the author’s class came to the researcher’s classroom for his work session. His teacher assigned seat work based on what he was working on in her class, and he brought his workbasket with him each day.

Materials

The materials used in this study included the WatchMinders, adult and student checklists, and the Data Manager Pro application. The WatchMinders were purchased through the online website, www.WatchMinder.com. Data Manager Pro was purchased through the Apple App Store. The student checklists and adult data sheets were created by the author using Microsoft Word. All materials were located in a cabinet in the classroom and were labeled with numbers one through four. To protect confidentiality, each participant was assigned a number, which corresponded to the watch, checklist, and location for data input in the Data Manager Pro application.

WatchMinder. The WatchMinder is a vibrating prompt watch. It was created by Dr. Lawrence Becker and is a trademark of WatchMinder Inc. It looks like a regular digital sports watch, comes in black and white, and includes 65 preprogrammed messages including “use the bathroom, pay attention, relax, eat, and take medication.” The WatchMinder has two modes: the reminder and the training mode. The reminder mode
can be set to a maximum of 30 times per day and is primarily used to prompt for daily living skills such as eating, taking medication, paying bills, and going to the bathroom. The training mode is used to set a fixed interval from one to 60 minutes that automatically repeats for the duration of time it is set for. It is most common to use this feature when a person needs prompting during a specific task. The training mode was used for the purposes of this study. WatchMinder is currently in its third edition and costs $69.

The WatchMinders are easy to set using the instructions provided in the packaging. The set up involved the time and date, and the training mode. At the beginning of the study, all watches were set in the training mode with the message “PAY ATTN.” They were set to vibrate from 9:00 to 11:00 AM on a repeating 2-minute fixed interval. This time period was chosen because it encompassed all possible times the participants could have been participating in work sessions. This accounted for days when changes needed to be made in the school schedule due to assemblies, early dismissal, etc. When the watches were not being used, the vibration was turned off by pressing the mode button twice and then the buttons next to the words ON or OFF at the bottom of the watch screen. All WatchMinders were calibrated by the researcher each morning before school started so they would vibrate at the exact same time. After 24 hours some watches would be off by a few seconds, so it was necessary to make sure they were calibrated for the most accurate measurement using a momentary time sampling system. In addition, the watches were charged at least once per week to maintain battery life. This was important because if the watch battery died, it required hours of recharging and then needed to be completely reset.
**Student checklist.** In addition to the WatchMinder, each participant was given a checklist on a half sheet of 8 ½ x 11in. white copy paper. The checklist defined specific behaviors that were considered to be “working” and “not working” (see Table 3.2). Participants were required to write the date, choose a reinforcer they wanted to work for, make check marks as the watch prompted them, count the “yes” checks at the end of the session, and circle whether the reinforcer was earned. See Appendix A1 and A2 for sample student checklists.

**Adult observer data sheet.** Both adult observers used a data sheet with columns to collect five sessions worth of data for each participant. Information identifying the participant’s number, observer’s name, phase of the study, interval length, start time, and end time were included at the top of the page. In addition, a definition of the target behavior was written down for easy reference. At the bottom of the page there were spaces for percent of intervals on-task to be written. See Appendix B for the adult observer data sheet.

**Data Manager Pro.** Data Manager Pro is an inexpensive graphing application for iPhone and iPad. It allows for multiple data files to be created on the home screen. Each participant was assigned a file based on a participant number in the researcher’s iPad to maintain confidentiality. After tapping on their assigned file, an input screen allows for data to be entered at the completion of each work session (See Appendix E1). At the bottom of the input screen there is an option to look at a graph of the data (See Appendix E2). The line graph depicts all data that has been entered into the application. There is also an option to set a goal line, which will place a red line across the graph.
Based on the criteria for acceptable performance, the goal line was set at 80% for this study. The Data Manager Pro application costs $1.99.

Variables

**Dependent variable.** The dependent variable in this study was on-task behavior. On-task was defined for each student based on the actions required during the work period (see Table 3.2). During data collection, a participant was considered to be on-task if he was demonstrating any of the behaviors listed on his checklist as “working” when the watch vibrated. It was important to define on and off-task for each participant because the definitions needed to help the participants learn to differentiate between on and off-task when they were taught to self-monitor. An example of on-task could be the participant reading a short passage, or writing the answer to a comprehension question when the watch vibrated. A non-example of on-task could have been the participant beginning to read or write after the watch went off. To be considered on-task, the participant must have been engaged in one of the activities listed on his checklist as “working” when the watch vibrated.

**Independent variable.** The independent variable in this study was the self-monitoring intervention program, which included the WatchMinder, a checklist, self-graphing using Data Manager Pro, and a reinforcer. At the start of each session, the participant retrieved his watch and checklist from the classroom cabinet. After writing the date and the reinforcer he was working for, the participant retrieved his independent work basket which contained two reading worksheets for Adam, Tom, and Bill, or a packet of previously mastered reading and math tasks for Paul. Then the participant would turn the vibration on and begin working. When the watch went off, the participant
was taught to ask himself, “What am I doing right now?” and then check “yes” or “no” accordingly on the checklist. After becoming proficient with using the WatchMinder to self-monitor, self-graphing was added to the intervention. This additional component of the intervention package involved using an iPad application called Data Manager Pro to graph the results of each session.

Table 3.2

*On and Off-Task Definitions Across Participants*

<table>
<thead>
<tr>
<th>Participant</th>
<th>On-Task</th>
<th>Off-Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>Reading, Writing the answers, Raising hand for help, Putting work in finished basket</td>
<td>Looking around the room, Staring at paper, Rolling pencil on desk, Calling out</td>
</tr>
<tr>
<td>Bill</td>
<td>Reading, Writing the answers, Raising hand for help, Putting work in finished basket</td>
<td>Looking around the room, Drawing pictures on work, Staring at paper</td>
</tr>
<tr>
<td>Paul</td>
<td>Writing, Cutting, Gluing</td>
<td>Out of seat, Making noise, Looking around the room, Playing with materials</td>
</tr>
<tr>
<td>Tom</td>
<td>Reading, Writing the answers, Raising hand for help, Putting work in finished basket</td>
<td>Looking around the room, Looking at the teacher, Staring at paper</td>
</tr>
</tbody>
</table>

Data collection. Data were collected for this study using a momentary time sampling system. When the WatchMinder vibrated, it cued the student to assess what he was doing at that moment, and then record it on his checklist. During the training, self-monitoring, and self-monitoring plus graphing phases the watch was set to a 2-minute
fixed interval, and it displayed the message “PAY ATTN” (pay attention) when it vibrated. The participants recorded a total of 15 times during the 2-minute interval phases. During the fading and maintenance phases the watch was set to a 5-minute fixed interval. The participants recorded a total of six times during the 5-minute interval phases. In addition to the cue that occurred at each interval, the watch also vibrated 30 seconds after each interval as a “reminder”. This was a part of the factory settings for the WatchMinder and could not be turned off. To account for this vibration, since it was not a part of the 2 or 5-minute interval, students were instructed to color in a box on their checklist at the end of each line and then continue working (see Appendix A1 and A2).

**Interobserver agreement.** Interobserver Agreement (IOA) was completed by the author and the classroom paraprofessional. Both adults wore WatchMinders synchronized to the participant watches. During baseline, training, intervention, and follow up phases they collected data on whether or not participants were on-task. During the self-monitoring, self-monitoring plus graphing, and fading phases they also collected data on whether or not students accurately monitored themselves. IOA was completed for approximately 40% of sessions for each participant. It was calculated by dividing the number of agreements by the number of agreements plus disagreements.

**Treatment integrity.** To ensure that each participant was trained to self-monitor in the same way, an 11-item checklist was completed by the classroom paraprofessional for 28% of the training sessions (see Appendix C). A step was marked as not applicable if the student was able to complete the step independently. For example, once the student was able to retrieve the watch and checklist from the cabinet on his own, the author did not continue to show him how to do so during training in subsequent sessions.
Design

This study used a multiple baseline design across participants. The order in which participants received the intervention was based on stabilization of baseline data. The intervention was introduced to Adam first, because his baseline data were stable but slowly declining after the fourth session. After each participant was introduced to the training phase, the next participant with at least four stable baseline data points received the intervention. The criterion of having four stable baseline data points was chosen because it meets the standard established by Kratochwill et al. (2010) for at least three data points per phase. Also, if the data trend prior to intervention was low or declining, it was most ethical to begin the intervention. In the case of Tom, the intervention was introduced although his baseline data were erratic in hopes that the intervention would help him be more consistent with staying on-task, and because continuing baseline for such an extended time without intervention was unnecessary.

This study consisted of multiple phases. After baseline, participants entered a training phase, followed by self-monitoring, self-monitoring plus graphing, fading, maintenance, and follow-up. The need for this many phases was warranted to completely answer the research questions. See Appendix D for the study protocol.

Procedures

Baseline. During baseline, the participants were observed to measure the percentage of intervals they were on-task during the independent work period without the use of WatchMinder or a checklist. They were expected to sit at their desks and complete the assigned work located in their independent work baskets. The teacher and classroom paraprofessional gave verbal prompts for redirection as they normally would have.
Data collection began once the student retrieved his workbasket and sat down at his desk to work. The adult observers wore WatchMinders set to a 2-minute fixed interval and using the definitions of on-task for each student, they marked a + if the student was on-task when it vibrated, or a – if the student was off-task. It was possible to collect data on the students using this method because not all participants completed their work session at the same time, so the observers were able to look at the students at the moment the watch went off without needing a round-robin system to accurately observe each participant. The criterion for moving to the next phase was at least four stable baseline data points after the training phase was implemented for the previous participant.

Training. The purpose of the training phase was to teach students to accurately self-monitor. During this phase, the WatchMinder was introduced to each participant as well as the procedure that he would follow for completing each session. Training included an 11-step procedure (see Appendix C), and involved fading verbal prompts and increasing distance from the participant while he monitored himself and completed work tasks. This procedure for systematically fading prompts and proximity was used to ensure participants would learn to self-monitor accurately.

According to the participants’ individual schedules, when it was time to complete independent work, they were instructed to retrieve the WatchMinder and checklist from the cabinet where they were stored and get their workbaskets. Two of the four participants were able to put the watches on their wrists independently, and two required assistance. After writing the date and a reinforcer on the checklist, the participants were instructed to activate the vibration and begin working. Participants had the freedom to choose any reinforcer except food items. Some common reinforcers included playing the
Angry Birds board game, extra computer time, playing MineCraft on the iPad, and drawing time.

On the first day of training, each participant was asked to verbalize what he was doing each time the watch went off, and mark it on his checklist accordingly while the adult stood next to him. In subsequent days, the procedure was faded by asking the student to verbalize what he was doing when the watch vibrated until the adult was watching from across the classroom. As each participant demonstrated proficiency with completing each training step for two consecutive sessions, instruction was no longer given on that step. The criterion for moving to the next phase was five consecutive sessions of 100% accurate recording regardless of the percentage of time that was measured to be on-task.

The training phase was one of the most important aspects of the self-monitoring intervention because participants needed to be able to accurately assess whether or not they were on-task. There has been some debate as to whether accuracy in self-monitoring is necessary for students to increase attention to task (Anderson & Wheldall, 2004). However, the focus of this study was training students to accurately self-monitor.

**Self-Monitoring.** The self-monitoring phase consisted of the participants wearing a WatchMinder and independently completing the same steps that were taught during the training procedure. The watch was set to the 2-minute interval. Participants were responsible for retrieving their watches and checklists from the cabinet, putting the watch on or asking for help, writing the date and the reinforcer they were working for, turning on the vibration, and monitoring themselves for 30 minutes. At the end of 30 minutes, the participants independently counted their “yes” checks, placed their
checklists and watches in the correct location, and retrieved the reinforcer if it was earned. The criterion for moving on to the next phase was five consecutive sessions of at least 80% or more intervals on-task.

**Self-Monitoring plus graphing.** The purpose of self-monitoring plus graphing was to assess whether adding a graphing component to the intervention package would contribute to an increase in on-task behavior compared to only using the WatchMinder and a checklist. All procedures during the self-monitoring plus graphing phase were the same as those in the self-monitoring phase. However, at the end of the session, the participants were instructed to graph their data point on an iPad application called Data Manager Pro. This application allowed the participants to track their progress (see Appendix E for screen shots of the application). At the conclusion of the session, the participants converted the number of intervals measured on-task into a percentage by looking at a percentage chart posted on the inside of the cabinet where the watches were stored. Each participant was able to input the percentage, touch “Graph,” and it automatically produced a graph of his progress (see Appendix E2). At that time the participant brought the iPad to the author who checked to make sure it was entered correctly. Prior to students entering this phase, the author inputted participant data into the application so they would be able to compare their current progress with what they had done previously. This application also allows a goal line to be put into the graph. This was set at 80% for each participant since the criteria for success at each phase was 80% or more intervals on-task. The participants moved onto the next phase in the study after five consecutive sessions of 80% or more responding.
Fading. The purpose of the fading phase was to decrease the amount of feedback participants received from the watch with the hypothesis that they would be able to maintain high levels of task engagement. During this phase, all procedures were the same as the previous phase, including the graphing, except the WatchMinders were set to a 5-minute fixed interval rather than 2-minutes. As with other phases, the participants met criteria for this phase if they demonstrated five consecutive sessions of on-task behavior for 80% or more intervals.

Follow-up. In the follow-up phase, maintenance was assessed because the ultimate goal in teaching students to self-monitor is that they will be able to do it without prompting of any kind (Wilkinson, 2008). It was important the WatchMinder was faded as soon as possible so students didn’t become dependent on it. Therefore, after participants showed success with the watch being set to a longer interval, the WatchMinder and checklist were removed. Adult observers continued to keep data on each participant’s on-task behavior for five consecutive sessions following the removal of the WatchMinder. Two additional follow-up probes were collected one week apart beginning one week after the five consecutive follow-up sessions. During this phase, all conditions matched the baseline phase. Participants did not wear the WatchMinder, use the checklist, or receive reinforcement at the conclusion of their work session.
Results

This study sought to examine the effects of using the WatchMinder to increase on-task behavior during independent seatwork for students with ASD. To study the effect of the intervention across four participants, a multiple baseline design was used. The study consisted of six phases, except for Adam who required additional fading phases due to instability of data observed after an illness. Multiple phases were necessary for this study for several reasons. First, training was needed to ensure that participants could accurately monitor their behaviors. Second, separate self-monitoring and self-monitoring plus graphing phases were necessary to address the second research question, which asked about the effect of adding a self-graphing component to the self-monitoring program. Third, a fading phase was needed to decrease the number of prompts the participants received so that maintenance of the skill would be most probable. Students participated in the study for between 47 and 71 sessions, which is approximately nine to 14 weeks. See Appendix D for the study protocol across phases.

Baseline

During baseline, the mean percentage of on-task behavior across all participants was 28.2% (range = 21.5 - 41.3%). The self-monitoring intervention was introduced to Adam after four sessions because his performance was stable with a range of 20 - 27% and a mean percentage on-task of 23.5%. Adam’s off-task behaviors were characterized
by looking around the room, staring at his paper, rolling his pencil on his desk, and calling out. He became easily frustrated when verbally prompted to get back to work, and demonstrated problem behaviors including hitting his desk as a result of receiving numerous prompts.

Baseline data were collected for Bill for 14 sessions. His mean percentage of on-task behavior was 21.5% (range = 7 - 40%). Bill demonstrated off-task behaviors including looking around the room, drawing pictures on his work, and staring at his paper. Many times at the beginning of the work session, Bill would say, “This is too hard,” or “I can’t do this, it’s too much writing.” He would begin working but would become off-task within a few minutes and start drawing pictures on his work.

Paul was introduced to the intervention after 21 sessions of baseline data collection. During the first nine sessions, the data trend was variable. Although for four of those nine sessions he was on-task 60% or more of the time, the behaviors he displayed during the intervals off-task, such as screaming, laying on the floor, and knocking things off of his desk, were highly disruptive to the classroom environment. By the tenth session, Paul’s data started to show stability at a much lower level. The intervention was implemented after session 21 in keeping with the staggered start of the multiple baseline design. As his data trend started to stabilize, the intervention was being implemented with Bill. The mean percentage of on-task behavior for Paul during baseline was 28.2% (range = 0 - 80%).

Tom was the fourth participant to receive the intervention, which was introduced in session 33. Tom’s baseline data was very erratic ranging from 7 - 100% throughout the 32 baseline sessions. For the first 10 sessions, his percentage of on-task behavior
ranged from 7 - 87%. From sessions 11 - 23 it started to stabilize between 7 and 27%, just as the intervention was being implemented with Paul. Right before winter break, Tom’s baseline data improved for one session (60%), and then went back down (33%). Within two days following winter break, Tom reached 100% on-task but quickly plummeted to 13% on the fifth subsequent session. Due to the quick drop in percentage of on-task behavior during those five sessions, the intervention was implemented. This decision was made in hopes that Tom’s on-task behavior would become more stable during the intervention conditions. Tom’s mean percentage of on-task behavior during baseline was 41.3% (range = 7 - 100%). See Figure 1 for results across all participants during baseline and all phases.

**Training**

There was an immediate increase in all participants’ on-task behavior during the first session the WatchMinder was introduced. Participants spent between 10 and 13 sessions in the training phase and the mean percentage on-task across participants was 93% (range = 86.2 - 96%). The training procedure was effective for teaching the participants to monitor their behavior accurately, and all participants were able to do so within a short period of time. Adam showed the greatest variability in on-task behavior during the training phase (60 - 100%). However, it was still significantly higher than his baseline average (23.5%), and he was monitoring himself accurately, which was the criteria for moving to the next intervention phase. During this phase, the mean for Adam’s on-task behavior was 86.15% (range = 60 - 100%), Bill 94.5% (range = 80 - 100%), Paul 95.3% (range = 80 - 100%), and Tom 96% (range = 87 - 100%).
Self-Monitoring

As participants moved into the self-monitoring phase, they were all able to increase their percent of on-task behavior from the training phase. The mean percentage of on-task behavior during this phase across participants was 96.8% (range = 93.9 - 98.6%). The mean for Adam was 93.9% (range = 73 - 100%), Bill 96% (range = 93 - 100%), Paul 98.6% (range = 93 - 100%), and Tom 98.6% (range = 93 - 100%). Adam was the only participant who required more than five sessions to meet the criterion of five consecutive sessions of 80% or more intervals on-task. Although he needed 13 sessions to meet the criterion, he only had two sessions at 73% that did not meet the requirement.

During this phase, all participants continued to record their behaviors accurately. Recording accuracy was measured during two of the five sessions for Bill, Paul, and Tom, and six of the 13 sessions for Adam. Adam recorded accurately 95.5% of the time, Bill 96%, Paul 96%, and Tom 100%. See Table 4.1 for a summary of recording accuracy percentages across the self-monitoring, self-monitoring plus graphing, and fading phases.

Self-Monitoring Plus Graphing

When the graphing component was added to the self-monitoring intervention package, on-task behavior continued to increase across participants to a mean of 97.3%. The mean percentage of intervals on-task for Adam was 92.2% (range = 80 - 100%), which was slightly lower than the self-monitoring phase (93.9%). The mean percentage of intervals on-task for Bill was 97.2% (range = 93 - 100%), Paul 100%, and Tom 100%.

Recording accuracy was measured during two sessions for each participant with a mean of 97.3% (range = 93.3 - 100%). Although participants’ data were stable in the
previous phases, adding the graphing component resulted in further stability and increased on-task behavior across three of the four participants.

**Fading**

The purpose of the fading phase was to extend the interval set on the WatchMinder so participants would receive prompts from the watch less often. During this phase, the watch was set at a 5-minute fixed interval and participants completed the same steps with the checklist and graphing, except there were only six intervals rather than 15 (See Appendix A2). The mean percentage on-task for all participants in this phase was 95.2% (range = 87.6 - 100%). Bill was able to increase his on-task behavior from the previous phases and maintained 100% intervals on-task during all five sessions. Tom was able to maintain 100% of intervals on-task as he did in the self-monitoring plus graphing phase. Paul’s mean percentage was 96.3% (range = 67 - 100%) for combined sessions, although there was only one session at 67% and the rest were at 100%. This drop could have been due to the student not feeling well since he was absent from school the day before and his teacher reported that he was still lethargic and had a cough.

Adam required three separate fading conditions throughout the study after the self-monitoring plus graphing phase. He completed his first fading phase within five sessions with a mean of 93.2% on-task. Up until this point in the intervention, Adam’s school attendance was regular, and he was in good health.

As Adam moved into the follow-up phase, his on-task behavior plummeted from 100% to 50% within two sessions. At this time, he became very ill with the flu and was absent on and off for the next five weeks, a total of 24 school days.
When he returned from the first week of absences, Adam was given a booster session in which he wore the watch set at a 5-minute interval and conditions matched those in the fading phase. This decision was made because it had been an extended period of time since he received the intervention and data from the previous two sessions without the watch decreased from 100% to 50%. Adam was able to immediately increase his on-task behavior to 100% during the booster session. It was originally decided that Adam would only receive one booster session when he returned to school. However, after the session he became ill again and was absent for another week. Because he was only present for one day, it was decided that he would repeat the entire fading phase in hopes of getting him back to where we was before he became ill.

When he returned to school, the data started to show a pattern of ups and downs ranging from 67% to 100% on-task over the next 9 sessions. After the tenth session in the second fading phase, he became ill again and was absent for another week of school. Due to variability in his on-task behavior before he was sick and the extended period of time without using the watch, it was decided that the fading phase would continue when he returned. Unfortunately, data continued to decline (100% to 50%) over the next three sessions when he returned to school. When the fading-2 phase was discontinued, Adam’s mean percentage on-task was 83.3% (range = 50 - 100%).

Based on the downward trend of data when he returned to school and the variability prior to that absence, it was decided to give Adam another booster session by setting the WatchMinder back to a 2-minute interval. This decision was made in hopes that giving more feedback from the watch would help get him back on track before the cycles of illness began. Within this set of booster sessions, the first session resulted in an
increase in on-task behavior to 80%. Since the data increased but was lower than the previous average performance, a second session was given. That session resulted in 100% of intervals on-task.

After the two booster sessions, Adam began his third fading phase. He was present in school throughout the entire phase and was able to meet the criterion of at least 80% intervals on-task in five sessions. The mean percentage of on-task behavior during the fading-3 phase was 86.4% (range = 83 - 100%). Overall, Adam’s mean percentage on-task across all three of his fading phases was 87.6% (range = 83.3 - 93.2%).

Data were collected on participants’ recording accuracy during fading for two sessions for Bill and Tom, three sessions for Paul, and ten sessions for Adam. Paul’s recording accuracy remained at 100% for the fading phase, and Bill and Adam were able to increase to 100% accuracy. Recording accuracy decreased slightly for Tom to 91%. Participants were able to monitor themselves accurately throughout the self-monitoring, self-monitoring plus graphing, and fading phases with a mean percentage overall of 97.3% (See Table 4.1).
Table 4.1

*Participant Accuracy in Recording*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Self-Monitoring</th>
<th>Self-Monitoring + Graphing</th>
<th>Fading</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>95.5</td>
<td>93.2</td>
<td>100</td>
<td>96.2</td>
</tr>
<tr>
<td>Bill</td>
<td>96</td>
<td>96</td>
<td>100</td>
<td>97.3</td>
</tr>
<tr>
<td>Paul</td>
<td>96</td>
<td>100</td>
<td>100</td>
<td>98.7</td>
</tr>
<tr>
<td>Tom</td>
<td>100</td>
<td>100</td>
<td>91</td>
<td>97</td>
</tr>
<tr>
<td>Total</td>
<td>96.9</td>
<td>97.3</td>
<td>97.8</td>
<td>97.3</td>
</tr>
</tbody>
</table>

*Note.* Percentages have been rounded to the nearest tenth.

**Follow-up**

The purpose of the follow-up phase was to assess participants’ ability to maintain high levels of on-task behavior without the use of the WatchMinder and checklist. The mean percentage of on-task behavior across participants for the follow-up phase was 84.3% (range = 76.2 - 91.1%). All participants showed they were able to maintain some of their on-task behavior, but the percentage of task engagement was lower in this condition than the previous intervention phases. However, each participant’s mean during this phase was still significantly higher than baseline.

Bill was the first to enter the follow-up phase. His first session without the watch showed a slight decline in on-task behavior (93%) from the fading phase (100%). However, he was able to maintain his ability to stay on-task for 100% of intervals over the next four sessions. In the first follow-up probe Bill’s on-task behavior decreased to 67%, but increased again to 100% for the last probe. His mean percentage of on-task behavior in the follow-up phase was 91.1% (range = 67 - 100%).
Paul was able to maintain his skills for the first three sessions of the follow-up, but in session four and five his on-task behavior decreased. Due to the decrease, one additional session of consecutive follow-up data was collected to assess whether the trend would continue or return to previous levels. In the next session, his on-task behavior returned to 100%. However, in the probe session one week later, he only demonstrated on-task behavior during 50% of intervals. In addition, problem behaviors that Paul exhibited during baseline began to re-emerge each session without the WatchMinder. Therefore, it was decided to give Paul one booster session in which he would wear the watch set to the 5-minute interval and assess his performance. Immediately after asking Paul to get his watch and checklist, the problem behaviors diminished and he completed all of his work with 100% of intervals on-task. In the final follow-up probe he was able to maintain his on-task behavior at 100%. Paul’s mean percentage on-task during this phase was 81.7% (range = 50 - 100%), which is above the criterion of 80% set for each phase.

Tom’s data showed more variability in the follow-up phase than any of his intervention phases with a mean of 88.1% (range = 83 - 100%). While this percentage of on-task behavior is highly acceptable because it meets the 80% criterion set in the study protocol (see Appendix D), he had four sessions at 83%, which had not occurred since the beginning of the training phase.

When the WatchMinder intervention was removed for Adam, his percentage of on-task behavior decreased in comparison to other phases. Adam participated in two follow-up phases during the study. The first phase resulted in two sessions before he became ill and was moved back into the fading phase. The second follow-up phase occurred over seven sessions. Adam’s mean percentage of on-task behavior across both
follow-up phases was 76.2% (range = 50 - 100%). In the second follow-up phase, the first session without the intervention was most difficult for Adam as he was only on-task for 50% of the intervals. He was concerned about not wearing the watch and asked to see the researcher’s data when he completed his session. After showing him the adult observer data, he was less anxious about working without the watch and was able to increase his on-task behavior over the next four sessions to a range of 83 - 100%. He demonstrated a slight dip in performance (67%) for the next probe, but for the final session he increased again to 83%. Although the mean percentage of on-task behavior was lower than other intervention phases, none of the data points overlapped with his baseline data.
Figure 1. Experimental results of self-monitoring intervention across participants

Note. BL=Baseline, SM=Self-Monitoring, SM+G=Self-Monitoring Plus Graphing, F=Fading, F2=Fading 2, F3=Fading 3, B=Booster Session, FU=Follow Up. * = Session break due to prolonged illness. Adam was the only participant to receive the F2 and F3 phases.
Summary of Findings

Based on the results presented above, a clear functional relationship has been established between this self-monitoring package and the participants’ ability to remain on-task during an independent work period. This meets the criteria set by Horner et al. (2005) for demonstration of a functional relation by having at least three replications, and an immediate increase in the dependent variable with manipulation of the independent variable.

All participants demonstrated low levels of on-task behavior prior to the intervention, and an immediate increase in on-task behavior was noticed on the first day the program was implemented. The percentage of on-task behavior increased even more with the addition of the self-graphing component across all participants. Furthermore, all participants were able to maintain high levels of on-task behavior when the interval on the WatchMinder was extended to five minutes. The results of the maintenance phase showed a higher percentage of on-task behavior for each participant than baseline, but not as high as in the phases when they were wearing the watches. Follow-up data confirmed a slight decrease in performance after an extended time without using the watch. However, their on-task behaviors were still considerably higher than at the beginning of the study.

Experimental control was demonstrated in this study once the intervention was implemented with each participant and there were no prolonged spillover effects on other participants. As the intervention was implemented for Adam, Bill’s baseline continued to be stable which showed another participant using the WatchMinder did not affect him. Paul’s baseline levels elevated for two sessions and then continued to decline. However,
Paul and Adam’s work periods only overlapped for 15 minutes, and Paul started his session before Adam each day. He did not see when Adam was being trained to use the WatchMinder. In addition, Paul’s baseline data had already showed variability before the intervention was implemented with Adam. There could have been some reactive effects from Tom when the intervention was introduced to Adam because their sessions occurred at the same time, and his percentage of on-task behavior increased for four sessions following implementation with Adam. However, it did not last long as his baseline data quickly decreased to below 27% for an extended period of time. There were no spillover effects on Paul or Tom when the intervention was implemented with Bill. As the intervention was introduced to Paul, Tom’s baseline data regained its variable trend. This could have been a spillover effect, but it is difficult to discern if that is the case due to the variable trend in Tom’s baseline data from the beginning.

**Interobserver Agreement**

Interobserver agreement (IOA) was calculated between the author and a second observer, the classroom paraprofessional, for approximately 40% of sessions for all participants. IOA was calculated by adding the number of agreements divided by the number of agreements plus disagreements for each session. Prior to collecting IOA data, the paraprofessional was trained and practice sessions were conducted until both observers agreed for 100% of intervals for each participant. Data for IOA were collected using the same participant watch settings: 2-minutes for baseline, training, self-monitoring, and self-monitoring plus graphing; and 5-minutes for fading, maintenance, and follow-up. (See table 4.2 for IOA results).
Adam. IOA was completed for 32% of Adam’s sessions. Overall agreement for all of Adam’s sessions was 94.4%. IOA for each phase was as follows: baseline 86.7% (range = 87 - 100%), training 90% (range = 80 - 100%), self-monitoring 97.3% (range = 93 - 100%), self-monitoring plus graphing 100%, fading 92.5% (range = 67 - 100%), and follow-up 100%.

Bill. IOA was completed for 41% of Bill’s sessions. Overall agreement for all of Bill’s sessions was 94.8%. IOA for each phase was as follows: baseline 85.3% (range = 67 - 100%), training 98.3% (range = 93 - 100%), self-monitoring 96.7% (range = 93 - 100%), self-monitoring plus graphing 96.7% (range = 93 - 100%), fading 100%, and follow-up 91.7% (range = 67 - 100%).

Paul. IOA was completed for 40% of Paul’s sessions. Overall agreement for all of Paul’s sessions was 96.9%. IOA for each phase was as follows: baseline 93.3% (range = 67 - 100%), training 91.1% (range = 80 - 100%), self-monitoring 100%, self-monitoring plus graphing 100%, fading 100%, and follow-up 97.2% (range = 83 - 100%).

Tom. IOA was completed for 40% of Tom’s sessions. Overall agreement for all of Tom’s sessions was 95.2%. IOA for each phase was as follows: baseline 83.6% (range = 67 - 100%), training 97.8% (range = 93 - 100%), self-monitoring 96.7% (range = 93 - 100%), self-monitoring plus graphing 100%, fading 100%, and follow-up 93.1% (range = 83 - 100%).
Table 4.2

*Interobserver Agreement*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Training</th>
<th>Self-Monitoring</th>
<th>Self-Monitoring +Graphing</th>
<th>Fading</th>
<th>Follow-Up</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>86.7</td>
<td>90</td>
<td>97.3</td>
<td>100</td>
<td>92.5</td>
<td>100</td>
<td>94.4</td>
</tr>
<tr>
<td>Bill</td>
<td>85.3</td>
<td>98.3</td>
<td>96.7</td>
<td>96.7</td>
<td>100</td>
<td>91.7</td>
<td>94.8</td>
</tr>
<tr>
<td>Paul</td>
<td>93.3</td>
<td>91.1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>97.2</td>
<td>96.9</td>
</tr>
<tr>
<td>Tom</td>
<td>83.6</td>
<td>97.8</td>
<td>96.7</td>
<td>100</td>
<td>100</td>
<td>93.1</td>
<td>95.2</td>
</tr>
<tr>
<td>Overall</td>
<td>87.2</td>
<td>94.3</td>
<td>97.7</td>
<td>99.2</td>
<td>98.1</td>
<td>95.5</td>
<td>95.3</td>
</tr>
</tbody>
</table>

*Note.* Percentages have been rounded to the nearest tenth.

**Procedural Fidelity**

To maintain fidelity with which the intervention was implemented, a second observer, the classroom paraprofessional, took data on the author as she implemented the WatchMinder intervention program with two of the four participants. A checklist containing the 11-step training procedure was used for the first six sessions of training for Paul and Tom (see Appendix C). Since this procedure required the trainer to decrease verbal prompts and proximity, some of the steps were not applicable as the training procedure progressed based on student need. For example, on the first day of training, the step “Monitors the student as he records with decreasing proximity” was not applicable because in the first session the author remained next to the participant. In addition, the step that says “Asks student to verbalize what he was doing when the watch went off and then check yes or no accordingly” was not applicable as the training period progressed because this was a part of fading verbal prompts as participant became
proficient with monitoring himself accurately. Of all steps that were applicable over the 12 sessions for both participants, 100% percent of the steps in the training procedure were completed accurately.
Discussion

This study was conducted to answer three research questions. The first question was whether WatchMinder was an effective prompting device for increasing the on-task behavior of students with autism. Based on the functional relationship that was demonstrated through replicated results across all four participants, it is clear that for these particular students with autism, the WatchMinder was an effective self-monitoring tool that contributed to increased on-task behavior. All four participants were able to increase work productivity and independence in the classroom. However, further research is needed to generalize these results.

The second question sought to determine the degree to which self-graphing and immediately analyzing progress had an effect on a student’s ability to increase on-task behavior. Compared to the self-monitoring phase, the addition of the graphing component contributed to a slight increase in on-task behavior for all participants except Adam whose mean percentage on-task dropped slightly from 93.8% to 92.2%. Since the amount of on-task behavior was already above 90% for each participant, there was not a lot of room for improvement when the graphing component was added. Tom and Paul were able to increase on-task behavior to 100% in the self-monitoring plus graphing phase of the study. In the subsequent fading phase, participants continued to graph their results as the interval on the watch was lengthened. They sustained high levels of task
engagement, and with the exception of one data point, Bill, Paul, and Tom were able to continue with 100% intervals on-task during the fading phase. All participants verbally expressed that they liked graphing their results and were enthusiastic about discussing how well they were doing. Based on this information, the addition of the self-graphing component could have contributed to the increase in on-task behavior. However, it also could have been attributed to the participants becoming more comfortable and proficient with self-monitoring. Further research on the addition of this component is needed to determine the full effect of adding the graphing component into the intervention package.

The third research question asked whether participants would be able to maintain self-monitoring skills when WatchMinder was removed. According to the data, all participants were able to maintain their self-monitoring skills and their on-task behavior at a much higher level than during baseline. However, there was a decrease in the mean percentage of on-task behavior during the maintenance phase than previous intervention phases. Paul and Tom’s maintenance data showed more variability during maintenance than any of the intervention phases. In addition, when the intervention was removed, Paul’s problem behaviors began to redevelop as they did during baseline. The follow-up sessions revealed the same type of variability and decrease in on-task behavior for each participant.

Based on the information yielded from the maintenance and follow-up data, a few assumptions can be made. First, the self-monitoring program could have been faded out too quickly. A longer fading procedure may have been more effective in helping participants maintain their self-monitoring skills. In the future, one way to alter the procedure could involve reducing the number of days per week the participants wear the
watches. This may help participants maintain the high levels of on-task behavior they demonstrate in other intervention phases. Second, this may be the type of intervention that only lends itself to maintenance for a short period of time. Many individuals with autism require repetition and retraining of specific skills to retain them. Therefore, some students may need a booster session every few weeks or once a month to help them maintain their self-monitoring skills. The effectiveness of a booster session was demonstrated with Paul during the follow-up phase. Immediately after putting the watch on he was able to complete his work and the problem behaviors dissipated within minutes. In the three days following the booster session he was able to maintain high levels of task engagement without problem behaviors. Two booster sessions were also used with Adam after his cycles with illness when data became variable. After returning to the 2-minute interval for two sessions, he was able to move back to using the 5-minute interval successfully.

**Benefits**

Self-monitoring is a lifelong skill that can be used in almost every facet of our daily lives. There were numerous benefits to using this self-monitoring package in the classroom. First, it cut down the number of verbal prompts the author needed to give to her students. This allowed her more time to focus on the students she was teaching in a small group, and it reduced problem behaviors that occurred from giving numerous prompts to the same students. Often times, low rates of on-task behavior can cause students to get in trouble more often, and receiving continuous prompts from the teacher can be stigmatizing (Anderson & Wheldall, 2004). By using WatchMinder as the prompting tool instead of the teacher, the participants in this study may have felt less
frustrated and more successful. Also, the WatchMinders were made available to all students in the class, which made it even less stigmatizing.

In many classrooms teachers take the full responsibility for grading and reporting progress. However, when students become active participants in their educational programs and are more accountable for their performance, there is a greater need to self-manage effectively. This causes an increase in motivation, responsibility, self-reliance, and independence, which are skills all teachers should help students develop. This self-monitoring intervention placed responsibility on the students to be accountable for completing their work. The components of this intervention required students to be responsible for retrieving and caring for their materials, putting things back when they finished their sessions, analyzing progress, and self-reinforcing based on performance. It allowed the participants to become stakeholders in their education (LoPresti, Bodine, & Lewis, 2008). Based on their results in each session and by looking at the graphing application, the participants were asked to gauge how well they were doing and explain how they could do better the next time. Therefore, the intervention promoted development of character traits and skills the participants can use for a lifetime.

Another benefit to this type of self-monitoring program is the ease with which classroom teachers are able to implement it. Since students are responsible for monitoring themselves, it takes the pressure off of the teacher to be “in charge.” Amato-Zech et al. (2006) cited minimal teacher demands or curricular modifications to be a benefit of self-monitoring programs. With fewer demands on the teacher, and more responsibility on the students, the WatchMinder intervention is ideal for classroom environments. It is also manageable for general education environments when there are a
large number of students to monitor. However, it is especially ideal for a special education classroom because of varying student schedules and activities.

**Social Validity**

Tactile self-monitoring programs such as the one used in this study can be considered socially valid interventions because they are unobtrusive and contribute to a drastic increase in acceptable classroom behavior. Because the WatchMinder vibrates rather than beeps, most other students in the classroom are unaware of the watch going off. It also allows multiple students to wear watches based on their individual needs. One student can wear a watch that vibrates every two minutes, and another can wear one set to vibrate every five or ten minutes. Also, since the WatchMinder looks like a regular sports watch, it does not make the person wearing it stand out amongst others. In addition to being an unobtrusive prompting device, the data from this study, as well as others that investigated tactile prompting devices, showed a drastic increase in socially acceptable classroom and community behaviors (Green et al., 2011; Legge et al., 2010; Van Hulle & Hux, 2006). In the classroom setting, when on-task behavior of a few students increases, the dynamic of the classroom changes and more learning can occur for everyone. Lessons flow better because of not having to stop and redirect students, and more content can be covered.

Because the author was also the special education teacher for three of the participants in this study, and had known all of them previously, she was able to observe an increase in self-awareness, and self-confidence in all four boys. Problem behaviors stemming from frustration from being called out to stay on-task diminished and the participants often said things like, “Look how good I am doing today” to other adults in
the classroom. The other students in the room who were not participating in the study were also very supportive and encouraging to the participants when they were sharing results.

Lastly, it is possible that after developing self-monitoring skills, some students may be able to increase the amount of time they spend in general education classes. For example, once Tom learned to be aware of the specific behaviors he demonstrated that were off-task, he was able to complete more work independently. Tom will be entering a general education classroom full time before the end of the school year. This may not be solely a result of the WatchMinder intervention; however, it played a huge role that helped him gain the few skills he needed to help him keep up in the general education setting.

**Limitations**

There were several limitations to this study. One limitation was the fact that two of the four participants had been previously exposed to the WatchMinder during the previous school year. Adam and Tom wore the WatchMinder for a period of time, but the intervention programs did not target increasing on-task behavior during an independent work session. Tom used the watch in the reminder mode to help him know when to turn in assignments. Adam wore the watch during small group reading lessons to address the target behavior of staying with the group during a teacher led discussion.

Limitations that could not be controlled for included winter break, and student illness. Winter break did not appear to have an effect on the data for Adam, Bill, and Paul who had already been introduced to the intervention program. Tom’s baseline data was impacted for a few days when he returned from break. During the study, all
participants missed at least two days due to illness. However, Adam missed a total of 24 days of school due to a virus. After he began the cycle of illness, his data were much more variable.

In addition, there are several limitations the WatchMinder itself presents. First, there is a reminder vibration that goes off 30 seconds after the prompt for the interval being measured. This was a factory setting and could not be turned off. It can create confusion for participants because if they use the checklist each time the watch goes off, it isn’t actually measuring the interval the watch is set to. To overcome this limitation, the student checklist can be configured so participants respond each time it goes off. The participant would check “yes” or “no” the first time, and then color in a small box next to it when the reminder goes off (see Appendix A). Second, the WatchMinder has precise charging procedures. If it is not charged properly and loses battery power, it takes several hours to recharge and reset. The battery indicator does not always show when it needs to be charged. Therefore, it is important to keep track of the last time the watches were charged and to make sure they are in fact charging once plugged in. Third, there is only an option for a fixed interval on the WatchMinder. However, a variable interval may be more effective so students cannot anticipate when the watch will go off. Legge et al. (2010), Holifield et al. (2010), and Amato-Zech et al. (2006) also called for the need for a variable interval schedule so behaviors would be more resistant to extinction.

Implications for Future Research

The limited research on WatchMinder and other tactile prompting devices such as MotivAider are promising. The results have demonstrated these self-monitoring
programs are effective, socially valid, and can be replicated. However, there are many aspects of these programs that will require more research.

Future research should examine the effects of different fading procedures on participants’ ability to maintain self-monitoring skills for an extended period of time. Various fading procedures including extending the time interval and extending the number of days the watch is worn per week should be compared. It will be important to discern how long students are able to maintain these skills to predict whether booster sessions are likely to be needed throughout a person’s lifetime to help him/her maintain this essential skill.

Since there are many components that can make up a self-monitoring intervention package, the effect of specific components in conjunction with WatchMinder should be examined. For example, the effect of reinforcement being a part of the intervention package should be assessed. It is possible that there are added motivating operations in place when the reinforcer component is added and it may affect the magnitude of the behavior change. Another component that should be researched is the effect of the self-graphing on the percentage of on-task behavior. In this study, self-graphing contributed to an increase in on-task behavior, but it was not clear that the self-graphing and analysis component was the only thing that caused the increase since participants were also becoming more comfortable and proficient with the self-monitoring procedures.

The results of this study as well as others should also be extended to other behaviors and settings. Future research should examine the effect of students with autism using WatchMinder in the general education setting for large group lessons. Since many students with autism struggle to participate in general education classes due to difficulty
focusing and keeping pace with the group, this may be an effective intervention for teaching those students the specific behaviors required for task engagement in a large group setting and how to monitor themselves in that environment.

Finally, generalization of self-monitoring skills should be researched. Future research should look at generalization of self-monitoring skills to other subject areas, from individual to small group settings, from small group instruction to whole group instruction, and across target behaviors. This will be important because the ultimate goal should be teaching a skill the individual would be able to use for a lifetime.

**Conclusion**

Many individuals with autism lack executive functioning skills required to complete tasks independently. Self-monitoring is an essential life skill that, when taught systematically, can help improve independence in the classroom and in daily life. A multitude of research has demonstrated that self-monitoring interventions are effective for people with a variety of age ranges and disabilities including elementary age students with autism. The research on tactile prompting devices such as WatchMinder is limited especially in the classroom setting. However, the results of this study demonstrated that WatchMinder is an effective component of a self-monitoring package for helping students with autism increase on-task behavior during independent work sessions. While the results were dramatic, maintenance of self-monitoring skills after the intervention was removed was less impressive, yet well above baseline level. Therefore, further research is needed to examine the sustainability of self-monitoring skills as well as generalization to other settings.
Appendices
## Participant Checklist for 2-minute interval phases

**Student Number:** __________

**Date:** __________________

I am working for: ________________________________

Directions: I will check off yes if I was working when the watch buzzed. I will check no if I was not working.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

**Working is:**
- Reading
- Writing the answers
- Raising my hand for help
- Putting my work in the finished basket.

**Not working is:**
- Looking around the room
- Staring at my paper
- Rolling my pencil on my desk
- Calling out

Number of yes checks ______/15. I need to earn at least 13/15 yes checks to earn my reward.

Did I earn it? Yes No
Appendix A2

Participant Checklist for 5-minute interval phase

Student Number: _____  Date: ________________

I am working for: ______________________________________

Directions: I will check off yes if I was working when the watch buzzed. I will check no if I was not working.

1. ____ yes  ___ no  □  
2. ____ yes  ___ no  □  
3. ____ yes  ___ no  □  
4. ____ yes  ___ no  □  
5. ____ yes  ___ no  □  
6. ____ yes  ___ no  □  

Number of yes checks ______/6. I need to earn at least 5/6 yes checks to earn my reward.

Did I earn it?  Yes  No

Working is:

1. Reading
2. Writing the answers
3. Raising my hand for help
4. Putting my work in the finished basket.

Not working is:

1. Looking around the room
2. Staring at my paper
3. Rolling my pencil on my desk
4. Calling out
Appendix B

Adult Observer Data Sheet

Student Number: _______  Observer: ______________________________

Research study phase: ___ baseline       ___ intervention       ___ fading       ___ follow-up

Interval length: ______________  Start time: ____________  End time: ____________

Target behavior: _______________________________________________________________________

Directions: Mark a + if the behavior was observed or a – if the behavior was not observed at the moment the interval ends.

<table>
<thead>
<tr>
<th>Interval Date</th>
<th>Interv al Date</th>
<th>Interv al Date</th>
<th>Interv al Date</th>
<th>Interv al Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
<td>1.</td>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
<td>2.</td>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
<td>3.</td>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
<td>4.</td>
<td>4.</td>
<td>4.</td>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
<td>5.</td>
<td>5.</td>
<td>5.</td>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
<td>6.</td>
<td>6.</td>
<td>6.</td>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
<td>7.</td>
<td>7.</td>
<td>7.</td>
<td>7.</td>
</tr>
<tr>
<td>8.</td>
<td>8.</td>
<td>8.</td>
<td>8.</td>
<td>8.</td>
</tr>
<tr>
<td>9.</td>
<td>9.</td>
<td>9.</td>
<td>9.</td>
<td>9.</td>
</tr>
<tr>
<td>10.</td>
<td>10.</td>
<td>10.</td>
<td>10.</td>
<td>10.</td>
</tr>
<tr>
<td>11.</td>
<td>11.</td>
<td>11.</td>
<td>11.</td>
<td>11.</td>
</tr>
<tr>
<td>15.</td>
<td>15.</td>
<td>15.</td>
<td>15.</td>
<td>15.</td>
</tr>
</tbody>
</table>

Data Summary

Total (+) _____/15  Total (+) _____/15  Total (+) _____/15  Total (+) _____/15  Total (+) _____/15

Percent on task:  Percent on task:  Percent on task:  Percent on task:  Percent on task:
### Training Phase Fidelity Checklist

**Student Number ____**

<table>
<thead>
<tr>
<th>Observer Initials</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shows student how to get checklist and watch from the closet.</td>
<td></td>
</tr>
<tr>
<td>Makes sure student writes the date and what he is working for on the checklist.</td>
<td></td>
</tr>
<tr>
<td>Reviews the criteria for “on” and “off-task” on the checklist.</td>
<td></td>
</tr>
<tr>
<td>Asks student to verbalize what he was doing when the watch went off and then check yes or no accordingly.</td>
<td></td>
</tr>
<tr>
<td>Instructs student to shade in the check box when the reminder vibration occurs.</td>
<td></td>
</tr>
<tr>
<td>Monitors the student as he records with decreasing proximity.</td>
<td></td>
</tr>
<tr>
<td>Intervenes if the student inaccurately records for two consecutive intervals.</td>
<td></td>
</tr>
<tr>
<td>Instructs student to count yes checks at the end of the session.</td>
<td></td>
</tr>
<tr>
<td>Discusses accuracy of recording with the student.</td>
<td></td>
</tr>
<tr>
<td>Shows student where to put the watch and checklist at the end of the session.</td>
<td></td>
</tr>
<tr>
<td>Provides reinforcement if earned according to the requirements on the student checklist.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D

WatchMinder Study Protocol

<table>
<thead>
<tr>
<th>Phase</th>
<th>Protocol/Criteria</th>
</tr>
</thead>
</table>
| Baseline| **Student**: No watch  
            **Observers**: Wear a watch set to 2-minutes  
            • Mark + or – based on target behavior when watch goes off.  
            **Criteria**: 4 consecutive sessions of stable baseline |
| Training| See training checklist.  
            **Student**: Wear a watch set to 2min  
            **Observers**: Wear a watch set to 2 min.  
            • Mark + or – based on the accuracy of the student recording.  
            • If student accurately marks yes or no, mark a +, if not mark -  
            **Criteria**: 5 consecutive sessions of 100% accuracy in recording |
| Self-Monitoring | **Student**: wears watch set to 2 min.  
            **Observers**: Wear a watch set to 2 min,  
            • Mark + or – based on the accuracy of the student recording.  
            • If student accurately marks yes or no, mark a +, if not mark -  
            **Criteria**: 5 consecutive sessions of 80% or higher on-task. |
| Self-Monitoring+ Graphing | **Student**: Wear watch set to 2 min.  
            • Graph percentage of intervals on-task at the completion of the session.  
            **Observers**: Wear a watch set to 2 min.  
            • Mark + or – based on the accuracy of the student recording.  
            • If student accurately marks yes or no, mark a +, if not mark -  
            **Criteria**: 5 consecutive sessions of 80% or higher on-task. |
| Fading  | **Student**: Wear watch set to 5 min.  
            • Graph percentage of intervals on-task at the completion of the session.  
            **Observers**: Wear a watch set to 5 min.  
            • Mark + or – based on the accuracy of the student recording.  
            • If student accurately marks yes or no, mark a +, if not mark -  
            **Criteria**: 5 consecutive sessions of 80% or higher on-task. |
| Follow-up| **Student**: No watch  
            **Observers**: Wear watch set to 5 minutes.  
            • Record on/off task as done in baseline for 5 consecutive sessions.  
            • After 5 days of monitoring, continue observing using a probe once a week for 2 weeks.  
            • Show results to student at the completion of the session.  
            • No reinforcer will be earned.  
            • During session, student will receive praise as usual from the teacher. |
Appendix E1

Data Manager Pro Screen Shots

Note. Dates are listed with the most recent first and in the formation day/month/year.
Appendix E2

Data Manager Pro Screen Shots
References


