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The Effects of Technology Based Self-Monitoring Across General Education Settings for Students with Behavior Disorders

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THE EFFECTS OF TECHNOLOGY BASED SELF-MONITORING ACROSS GENERAL EDUCATION SETTINGS FOR STUDENTS WITH BEHAVIOR DISORDERS

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ABSTRACT

This dissertation consists of three articles investigating the effects of technology-based self-monitoring to decrease off-task behaviors and increase academic engagement in students who have behavior disorders. Previous literature has examined the effects of technology-based self-monitoring in special education and alternative placements. Unfortunately, there is a lack of investigation with technology-based self-monitoring in general education settings. Together these three articles will clearly determine the effects of technology-based self-monitoring in general education settings specifically for students with behavior disorders.

The first article (Chapter 2) determines the effects of technology-based self-monitoring on decreasing disruptive behaviors and increasing academic engagement in a student with an Emotional Behavioral Disability (EBD). The second article which is (Chapter 3) evaluates the same effect in a student with Attention Deficit Hyperactivity Disorder (ADHD). Articles 1 and 2 both use a multiple baseline design across three general education settings. The third article (Chapter 4) will present the data from Articles 1 and 2 and provide insight into how school districts and teachers can implement self-monitoring into tier 1, 2, and 3 practices to increase academic productivity and decrease disruptive behaviors.

DEDICATION

First and foremost, my dissertation is dedicated to my grandfather who believed in me the most and encouraged me to reach for my dreams. Although he cannot celebrate this huge accomplishment, I know he is looking down with the greatest grin.

Second, my dissertation is dedicated to my former students who instilled in me a passion and drive to seek opportunities for success for all, no matter ability or disability.

And finally, my dissertation is dedicated to my future students who will one day be in the field and make a difference of their own. I seek to instill in them a love and passion ofeducation, particularly in the field of special education.

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Without my former k-12 students, the thought of pursuing this degree would have never come to mind. Because of you, I was able to see the difference I could make in the lives of students, and

in turn, wanted to pass this along to future teachers. Through this, I am able to reach more students than I could ever imagine.

I offer my greatest appreciation to my family and friends. Thank you for your support and guidance in this process. When this road was lonely and dark, you provided light. Now that I'm finished with this daunting task, I can't wait to hang out!

NOMENCLATURE

AE	Academic Engagement
ADHD	Attention Deficit Hyperactivity Disorder
APA	American Psychological Association
BD	Behavior Disorder
CEC	Council for Exceptional Children
DB	Disruptive Behavior
EBD	Emotional Behavioral Disability
SCD	Single Case Design
WWC	What Works Clearinghouse

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CHAPTER I

INTRODUCTION

TO THE

DISSERTATION

It is crucial for students to remain academically engaged during tasks in the classroom for them to reach their academic potential (Christensen, Reschly, Appleton, Berman-Young, Spanjers, & Varro, 2008; Higgins, Williams, & McLaughlin, 2004). The negative impact of disruptive behavior on student academics has been well documented (Cullinan, Evans, Epstein, & Ryser, 2003; Lane, Little, Menzies, Lambert, & Wehby, 2010; McEvoy & Welker, 2000; Otero & Haut, 2016), but these studies have left still unanswered questions of effective strategies for teachers, classrooms, and students. It has traditionally been more difficult for a student with behavioral needs, to engage in academic tasks than it is for their typically developing peers. In addition, students with behavioral disorders have been proven more likely to exhibit disruptive behaviors than their peers, as they often exhibit gaps in self-control, behavioral skills, and academic skills (Haydon, Hawkins, Denune, McCoy, & Basham, 2012). While there are research-based interventions have been developed that promote academic engagement and decrease off-task behaviors, there is not a one-size-fits-all solution for teaching students with behavior disorders has not been found. Rather than work to alleviate problematic classroom behaviors, the emphasis has been to move students to different settings (Mihalas, Morse, Allsopp, & Alvarez McHatton, 2009; Quinn,

Rutherford, Leone, Osher, & Poirier, 2005). Therefore, effective and efficient procedures to implement in general education classrooms must be identified in order increase academic engagement and decrease disruptive behaviors in students with behavior disorders (e.g. Emotional Behavioral Disorder or Attention Deficit/Hyperactivity Disorder) must be identified.

Legislation. Today's educational system faces significant challenges meeting the needs of all students through systemic school and district-wide requirements (Freeman, Sugai, Simonsen, & Everett, 2017). Special education mandates have changed throughout the years with amendments to Individuals with Disabilities Education Act in 2004 and 2006 (Freeman et al., 2017). The fundamental goal of the Individuals with Disabilities Education Act (IDEA) was to improve post-secondary outcomes of students with disabilities, specifically enhancing components of the individualized education plan (IEP) and the disciplinary process (Freeman et al., 2017). Services provided to students with disabilities have also been required to be based upon peer-reviewed research with the intent of providing students with the best practices available (Valentino, 2006). There were only minor changes to disciplinary processes in IDEIA, which details that students may not be excluded from services because of disciplinary actions, but requires that special education services will be granted to all students with disabilities who are age-eligible and have received suspension or expulsion (Weber, 2015).

Most recently, IDEIA (2004) and Every Student Succeeds Act (ESSA, 2016) placed further emphasis on improving educational outcomes, as each focus

on strong academic expectations within a common rigorous curriculum. These mandates required state and local accountability with high stakes measures; they imposed consequences for teachers and sanctions for schools when all students have not achieved proficiency in reading and mathematics, and when schools failed to meet state standards (Yell, Katisyannis, & Shiner, 2006). Naraian , Ferguson, and Thompson (2012) interpreted these mandates as a "legislative vision of improved outcomes for all students with disabilities within inclusive models of education" (p. 722). This is a common interpretation and represented a trend towards placement in general education settings of students with disabilities, including those with emotional behavior disorders (EBD) and attention deficit hyperactivity disorder (ADHD) (McLeskey, Landers, Williamson, & Hoppey, 2010). The general education environment has become more accessible to students with disabilities because of the least restrictive environment (LRE) mandate (McLeskey et al., 2010). It is apparent to special educators that students with disabilities have been capable of achieving more than educators believed possible in previous years. Specifically, general education placements for students with EBD and ADHD became more prominent from 1990 to 2007; for example, students with EBD in general education settings increased 105% during those years (McLeskey et al., 2010). In contrast to previous literature, McLeskey and colleagues (2010) noted another significant finding: the more restrictive placements decreased by 25% from the year 1990 to 2007. Currently, the trend is continuing in a positive direction as 47.1% of students with EBD and 65.6% of students served under the category of other health impairment are educated in the

general education environment for the majority of the day (Office of Special Education Programs [OSEP], 2017).

The Individuals with Disabilities Education Improvement Act (IDEIA, 2004) mandates a free appropriate public education (FAPE) in the least restrictive environment (LRE) for all students with disabilities. The exact nature of LRE has been challenged since the first adoption of P.L. 94-142 in 1976. Some argued the provision of LRE means that all students would be educated in the general education setting with supports and services, and others argued that LRE is specific to individual student needs and necessitates instruction that cannot be provided in a typical classroom.. The IDEIA requires a continuum of placements ranging from the most restrictive (e.g., residential placement) to the least restrictive (e. g., general education setting with no additional supports) with placement decisions based on the individual needs of the child. This has not been equated to all students receiving all services in a general education setting.

Regardless of the intent of the law and court decisions supporting a continuum of services, the trend has continued toward general education settings for all students. Beginning with the General Education Initiative in the 1980s and the Inclusive Schools Movement of the 1990s and continuing with the reauthorization of IDEIA in 2004, legislation has increasingly emphasized the importance of educating students with disabilities withtheir non-disabled peers in general education settings. The Regular Education Initiative (REI), first formally introduced in 1986, supported full inclusion as a social reform movement (Kauffman & Hallahan, 1995). In addition, the Inclusive Schools Movement of the 90s encouraged inclusive

practices with the support of partnerships and collaboration between general and special educators (Muscott, 1995).

Additionally, Every Student Succeeds Act (ESSA) was created with hopes of bridging the gap between policy makers and educators (Fennell, 2016). Likewise, the U.S. Department of Education has provided a deeper appreciation for teacher leadership and the teacher's voice than in the past with this mandate (Fennell, 2016). A continued accountability measure has included high-stakes testing in math, language arts, and science at the state level. ESSA has continued to work within the mandates of IDEIA in ensuring educational services to students with disabilities but with a greater focus on educational accountability, inclusion, and quality for all students.

Inclusion

A significant trend and shift toward inclusion has provided greater opportunities to individuals with disabilities and research has supported the benefits for students with and without disabilities (Hunt & Goetz, 1997; Lipsky & Gartner, 1996). However, the effectiveness of interventions and accommodations has remained an understudied area, especially for students with behavior disorders. Previous research has not distinguished among different types of disabilities or has only focused its analysis on a single disability type. Furthermore, research has suggested that behavior disorders are more detrimental than other disabilities to students' abilities to function in school (Bradley, Doolittle, & Bartolotta, 2008; Kern, Hilt-Panahon, & Sokol, 2009).

Creating inclusive classrooms has involved demanding responsibilities for

students with disabilities and emphasized the need for more independence with their work (Bryan & Burstein, 2004; Falkenber & Barbetta, 2013). Increased classroom expectations leave students with behavioral difficulties unprepared to succeed in the general education setting (Cooper & Valentine, 2001; Falkenber & Barbetta, 2013). Hence, by implementing self-monitoring in the general education classroom, disruptive behaviors for students with behavior disorders could be improved.

History of Self-monitoring

Self-monitoring (SM) was an intervention based out of the early writings of Bandura (1969, 1977). Generally, this intervention has been defined as a multistage process consisting of student-directed evaluation and recording of relevant behavior (Mace, Belfiore, & Huchinson, 2001) commonly implemented so the student takes responsibility for their own behavior and increase academic engagement and decreased disruptive behavior (Broden, Hall, & Mitts, 1971; Reid, Trout, & Schartz, 2005). Furthermore, self-monitoring includes a technique that requires students to observe and record their behavior (Reid et al., 2005). Decades of research have revealed positive outcomes using the self-monitoring intervention, showing encouraging results for students identified with various disorders including diagnoses of ADHD and EBD (Mooney, Ryan, Uhing, Reid, & Epstein, 2005; Vogelgesang, Bruh, Coghill-Behrends Kern, Troughton, 2016; Webber Scheuermann, McCall, & Coleman, 1993).

Throughout the years, there have been many ways in which researchers have taught students to self- monitor (Gulchak, 2008). Earlier studies taught students to self-monitor using eye-contact with a learning stimulus based on

students' work completion (Crum, 2004; Gulchak, 2008; Kern & Dunlap, 1994;). Further, research studies have focused on monitoring various behaviors including talking without permission, out of seat, or verbal and physical aggression (Freeman & Dexter-Mazza, 2004; Gulchak, 2008; Smith, Young, West, Morgan, & Rhode, 1988). Other studies measured dangerous classroom behaviors examples include running, fighting, spitting, and aggression toward other students (Gulchak, 2008; Lam, Cole, Shapiro, & Bambara, 1994; Ninness & Fuerst, 1995;). Self-monitoring has been successfully taught to a wide variety of students, including students without disabilities, students who exhibit giftedness, and students who are autistic (Gulchak, 2008; Rock, 2005) as well as students who are at-risk for behavioral problems (Gulchak, 2008; Mitchem, Young, West, & Benyo, 2001; Wood, Murdock, & Cronin, 2002)**.** Additionally, this intervention has been effective for students with ADHD, learning disabilities, and emotional disabilities (DuPaul, Eckert, & McGoey, 1997; Gulchak, 2008; Harris, Eriedlander, Saddler, Erizzelle, & Graham, 2005; Reid et al., 2005).

Self-monitoring, as an intervention for students with EBD, has a strong research base and has proven an effective tactic for students to overcome significant behavior problems, such as their ability to stay on task (Carr & Punzo, 1993; Gulchak, 2008; Harris et al., 2005; Reid, Trout, & Schartz, 2005; Rock, 2005). Self-monitoring has multiple stages that includes both observing and recording behavior (Gulchak, 2008; Mace, Belfiore, & Hutchinson, 2001). Students must first note the occurrence or non-occurrence of the target behavior, then self- record in terms of being on-task or off-task during instructional time, and finally, students

should self-graph their work productivity and off-task behavior as self-graphing is important for the overall self-monitoring intervention (Gulchak, 2008). This intervention requires students to take responsibility for their own behaviors, which can, in turn, be generalized across settings (Davies & Witte, 2000; Denune, Hawkins, Donovan, Mccoy, Hall, & Moeder, 2015). Being able to self-monitor has proven indicative of students becoming independent and taking responsibility of their own behavior (Falkenber & Barbetta, 2013; Porter 2002; Rutherford, Quinn, & Mathur, 1996; Vaughn, Bos, & Schumm, 2000). Student engagement has been imperative in achieving positive outcomes within classrooms, indicating the importance of educators implementing procedures that effectively reduce disorderly behaviors in order to prepare these students to be successful in general education classrooms by implementing procedures that effectively reduce disorderly behaviors (Christensen et al., 2008; Denune, et al., 2015; Higgins, Williams, & McLaughlin, 2001).

Wood and colleagues (2002) conducted a study where students were taught to monitor their academic functioning across three settings, which resulted in increased academic performance, even in classes where the intervention was not fully implemented. Studies that involve self-monitoring have usually been conducted in alternative settings. Mooney and colleagues (2005) reviewed literature and examined 22 self-monitoring studies with 73% being conducted in public schools; however, none met inclusion criteria, and none were set in a general education classroom. In another review of relevant studies, McDougall (1998) reported that there was a need for self-monitoring studies to be conducted in general education settings since 240 studies were conducted with only 14 of

those involving students with disabilities in general education settings.

Researchers have found that self-monitoring behavior has many advantages. The first major advantage has been the immediate feedback gained with guidance that can be used for behavior improvements (Falkenber & Barbetta, 2013; Freeman & Dexter-Mazza, 2004; Karvonen et al., 2004). Additionally, students were actively engaged with this process which, in turn, increased their investment in this system (Blick & Test, 1987; Falkenber & Barbetta, 2013; Firman, Beare, & Loyd., 2002; Hughes, Ruhl, Schumaker, & Deshler, 2002). Self- monitoring has proven cost effective and relatively easy to implement without impeding instructional time and allowing time for other day-to-day responsibilities (Agran, Snow, & Swaner, 1999; Carr & Punzo, 1993; Falkenber & Barbetta, 2013). With these benefits, self-monitoring is a viable option for students with disabilities in general education classrooms (Falkenber & Barbetta, 2013).

The current study expands the research base to determine the effectiveness of technology based self- monitoring, to decrease disruptive behavior and increase academic engagement of two students in an inclusive general education environment, participating in the general education curriculum.

Technology and Self-Management

Federal legislation has emphasized the need for data-based decisions to drive educational decision making and instruction, as well as the amount of services provided to a student with a disability (ESSA, 2016; NCLB, 2001; IDEIA, 2004). Teachers and researchers acknowledge the need for simplifying data collection through the use of technology-based devices to address academic and

behavioral goals (Wagner, Scott, &
Galliers, 2006); however, few empirical studies have explored the possibilities.

Self-monitoring has a robust research base; however, technology can add an important advancement to self-monitoring research (Vogelgesang et al., 2016). As noted in other fields (i.e. medical field), technology has yielded positive findings, which can encourage educational stakeholders to expect similar results with technology usage in schools (Bruhn, Vogelgesang, & Fernando, 2016; Schardt, Miller, & Bedesem, 2018; Vogelgesang, et al., 2016; Wills and Mason, 2014). Technology has provided an efficient tool for data collection and monitoring progress within the self-monitoring intervention (Glasgow, Bull, Piette, Steiner, 2004; Vogelgesang, et al., 2016). Conversely, paper-based self-monitoring requires data to be collected and analyzed manually. Since 2008, the literature base has grown regarding technology-based self-monitoring though there is a continued need for exploration (Vogelgesang et al., 2016). It has been hypothesized that a self-monitoring technology-based intervention (e.g. CellF-Monitoring), will provide opportunities for students to self-monitor in multiple settings (i.e., library, playgrounds, cafeteria, hallways, etc.) or multiple content areas.

There are multiple promising studies that used technology for self-managing behavior and increasing academic engagement. Wills and Mason (2014) conducted a study using the I-connect application on a tablet to improve on-task behavior of secondary students with disruptive behavior. Results were similar to previous findings indicating that participants showed an improvement in on-task behavior (Harris et al., 2005; Reid et al., 2005; Wills & Mason, 2014).

Additionally, Schardt and colleagues (2018) conducted a study using the CellF-Monitoring application on iPads. Participants in this study self-monitored their behavior using the application and disruptive behavior decreased significantly. Vogelgesang and colleagues (2016) explored technology based self-monitoring using the *SCORE IT* application. Student participants showed an increase in academic engagement (Vogelgesang et al., 2016). Results showed that the *SCORE IT* application could, in fact, be utilized in a classroom other than *READ 180* and could be effective for increasing students' academic engagement in a wide range of settings (Vogelgesang et al., 2016).

Statement of the Problem

According to Wills (2014) and other researchers, majority of students identified with behavioral disorders have been placed in general education settings, especially for science instruction which indicates the need for additional investigation to determine the effectiveness of self-monitoring within this setting. Few SCD studies have been completed to evaluate the effectiveness of self-monitoring students who display disruptive behaviors across general education settings through the use of technology.

Purpose of the Study

The purpose of this study is to determine whether or not technology based self-monitoring increases academic productivity in general education students with students with behavioral disorders.

Research Questions

Article 1 research questions:

1. What are the teacher's perceptions and to what extent is the self-monitoring iPad app, CellF- Monitoring, acceptable for use in an elementary classroom for a student with EBD (i.e. social validity)?
2. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve on-task behavior of elementary students with EBD?
3. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve academic accuracy of elementary students with EBD?

Article 2 research questions:

1. What are the teacher's perceptions and to what extent is the self-monitoring iPad app, CellF- Monitoring, acceptable for use in an elementary classroom for a student with ADHD (i.e. social validity)?
2. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve theacademic engagement of elementary students with ADHD?
3. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve academic accuracy of elementary students with ADHD?

Hypothesis

There will be a significant impact on students' behavior and academic engagement across general education settings with the implementation of technology based self-monitoring.

METHODS

Participants and Setting

One teacher-student dyad (i.e. 1 teacher and 1 student) will serve as participants in the study. Data will be collected in the general education classrooms located in an elementary school in the Southeastern part of the United States. Students will be selected based on disability category of Emotional Behavior Disorder (EBD) and Attention Deficit Hyperactive Disorder.

Measures

DV and IV. Academic engagement and disruptive behaviors will be measured using the CellF- Monitoring App. Academic engagement is determined if the student: (a) was reading, writing, or talking with the teacher/teaching assistant/peer about the assignment, (b) did not direct visual attention to anything other than the task for more than five seconds at a time, and (c) remained in the designated area (Harrison, Evans, Baran, Khondker, Press, Wasserman, Noel, & Belmonte, in review, in review). Disruptive behavior (DB) is defined as behavior that prevents students from attending to the task appropriately (Bruhn & Watt, 2012; Bruhn et al., 2017). Examples of DB include speaking out of turn, using

materials incorrectly, not complying with assignment directions, and leaving the assigned area. All behaviors will be measured during independent work or assignment times using interval recording.

IOA. Interobserver agreement is a measure of the degree to which two researchers observe and agree on the occurrence and non-occurrence of behavior. IOA will be assessed throughout each phase of the study and calculated using the percentage agreement formula:

Agreement/Agreement + Disagreement

Additionally, the percentage agreement is used to determine whether there is an exact match between the two investigators (Vannest et al., 2013). The two examiners will complete direct observations and track behaviors for a minimum of 20% of each phase observed by the lead researcher. As indicated by *What Works Clearinghouse* (2010) 20% is an appropriate percentage to guarantee reliability.

Social Validity. The social validity of the intervention will be measured at the end of the study with the use of a questionnaire adapted from Kern & Gresham (2002), the School Intervention Rating Form. Both the teachers and students will be asked to complete the social validity questionnaires (see Appendix A & B). Both questionnaires are rating scales to evaluate the students' understanding of the intervention, the "ease" of the intervention, the likability, and helpfulness of the intervention. Students rated items on a seven-point Likert scale ranging from most favorable to least favorable ratings.

Research Design and Analysis

Single case refers to the participant or small group of participants under

investigation (Smith, 2012). The goal of single case experimental design (SCD) is to determine whether a causal or functional relationship exists between a researcher-manipulated independent variable (IV) and a meaningful change in the dependent variable (DV) (Horner, et al., 2005), thus measuring the effect on the participant. SCD are systematically repeated over time and used as a means to assess intervention outcomes (Horner et al., 2005; Kratochwill, 2007; Kratochwill & Levin, 2010). Application of SCD has expanded through using current design guidelines and reporting standards (e.g. What Works Clearinghouse, American Psychological Association, and Council for Exceptional Children) in efforts to identify high-quality research and evidence-based interventions for practitioners to use in the classroom.

Multiple-baseline Design. In order to achieve the most desirable results, a multiple-baseline design will be conducted using a baseline phase and an intervention phase across three settings. A multiple-baseline approach is most preferred in this circumstance in order to investigate the effects of self-monitoring among varying settings.

TauU. In this study, TauU, an effect size, will be calculated to estimate the effects of the intervention (Bowman-Perrott et al., 2015). TauU was selected as it is a robust effect size that corrects for the baseline trend frequently found in single case studies (Bowman-Perrott et al., 2015; Parker et al., 2011). Benefits of TauU's nonparametic approach, which combines nonoverlap of data and trend, include uniformity with visual analysis, the ability to apply to short data sets, appropriateness with any SCD, and the ability to control for trend in baseline

(Parker et al., 2011). TauU is useful for studies with phases that include only three or four data points and have a trend line shift (Bowman-Perrott et al., 2015). TauU originated from Kendall's Rank Correlation and Mann-Whitney *U* (Bowman-Perrott et al., 2015). Whereas group design effect sizes are calculated between groups, TauU is calculated between phases (Bowman-Perrott et al., 2015). The goal is to calculate an effect size designed for the intricacies of data collected through single case design methodology.

What Works Clearing House Standards. *What Works Clearinghouse* (2010) put forth standards in order to identify evidence on the effectiveness of an intervention or practice. If the following standards aremet, then the study can qualify for an evidence-based practice. The standards are listed below: (a) The researcher must have systematically manipulated the independent variable; (b) Interobserver agreement for the dependent variable(s) must be calculated by at least two trained examiners for 20% of the sessions; (c) There must be no less than three attempts to demonstrate an intervention effect; (d) The data must demonstrate a pattern indicating the need for change (e.g. baseline data points); (e) The researcher must attain three or more data

points within each phase; (f) The data points indicate a trend moving toward a therapeutic direction or there is an immediate effect as determined by the last data point in the baseline phase and the first data point in the intervention phase; (g) The researcher describes the design of the study in detail (h) The study provided at least three opportunities for an effect determining the presence of a functional relationship; (i) The effect size presents as strong or moderate; (j) Replication has occurred by three research teams in various locations and

five research papers explore the same intervention (Kratochwill, Hitchcock, Horner, Levin, Odom, Rindskopf, & Shadish, 2010).

Council for Exceptional Children Quality Indicators. The Council for Exceptional Children (CEC) developed eight quality indicators to ensure studies are methodically sound and to guide the field in what would constitute as an evidence-based practice. The eight quality indicators are as follows: (a) Context or setting: The study provides sufficient information regarding the context or setting; for example, type of school, geographical location, and curriculum; (b) Participants: The researcher provides ample information to adequately identify the population of the study; (c) Intervention agent: The role of the intervention is described in detail as well as describing training that is administered to the examiners; (d) Description of practice: The study provides detailed information regarding the practice or intervention so that replication can easily occur; (e) Implementation fidelity: Reliability measures are in place; for instance, there are observations and checklists to ensure treatment fidelity; (f) Internal validity: The researcher is in control of the independent variable, and different phases of the study are described (e.g. baseline or intervention phase); (g) Outcome measures/dependent variables: The study has a protocol in place for internal reliability and interobserver agreement. Also, the study reports the effects of the intervention on all measures of the outcome; (h) Data analysis: The data must be analyzed properly including a graph that clearly represents the outcome (e.g. trend, level, and data overlap) (Cook, Rao, & Collins, 2017).

Visual Analysis Standards. The visual analysis can be evaluated by six characteristics

as follows:(a)Level refers to the value of the dependent variable. If a functional relationship exists the levels are comparable in identical conditions and across various settings; (b) Trend can either be increasing or decreasing with reference to the slope. Depending on the dependent variable, researchers expect a continuous increase in trend; however, on other occasions an immediate behavior change is expected; (c) Variability refers to the different sessions data value; if there are no trends in the data, variability can be represented as the range of values; for example, 15-25% of intervals. Studies involving interventions tend to target changes in level (with or without changes in trend), but variability is indicative of a functional relationship between variables; (d) Overlap refers to the degree to which data are identical in level across conditions and can be rated by describing the degree to which data overlap occurs between conditions. Commonly, more overlap suggests that a functional relationship between variables is non-existent; (e) Consistency is noted when data is similar *within conditions* and *across condition changes* at varying degrees; (f) Immediacy refers to the confidence in the existence of a functional relation and is improved when behavior change occurs simultaneously with condition changes. However, if delayed changes are (a) consistent across conditions, and (b) expected a priori, they are less disputable (Horner, Halle, McGee, Odom, & Wolery, 2005).

Summary

Research has indicated that self-monitoring has an impact on academic engagement for students who have intense disruptive behaviors (Vogelgesang, et al., 2016). Studies have revealed that self-monitoring is an effective strategy for students with behavior disorders to increase their academic engagement and decrease disruptive behavior (Wills & Mason, 2014) in special education settings.

However, Wills and Mason (2014) also believed that more research is needed to understand the impact that self-monitoring has on students with behavior needs in general education settings. Thus, the current study seeks to identify to what extent the use of self-monitoring through technology impacts problematic behavior in students with behavior disorders across general education settings.

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CHAPTER 2 (ARTICLE 1)

AN SCD TECHNOLOGY BASED SELF-MONITORING INTERVENTION FOR A STUDENT WITH EBD

Students who engage in disruptive behavior are at risk for a multitude of negative outcomes both in life and in school (Otero & Haut, 2016); furthermore, academic engagement was strongly correlated with academic performance (Gettinger & Ball, 2008; Otero, & Haut, 2016). Behavior problems cost teachers instructional time because of recurring interruptions that impede learning (Imeraj et al., 2013; Otero & Haut, 2016). Students who have behavior difficulties face adversity throughout home and school settings involving conflicts with teachers, peers, parents, and siblings (Kauffman & Landrum, 2009; Menzies, Lane & Lee, 2009; Walker, Ramsey, & Gresham, 2004). Disruptive behavior impacts learning, instructional time, and makes it less likely for students to succeed academically (Ling, Hawkins, & Weber, 2011). Specifically, students with emotional and behavioral disorders (EBD) engage in higher rates of disruptive and off-task behaviors than typically developing peers and are more likely to be educated in alternative placements (Smith, Katsiyannis, & Ryan, 2011).

Students with EBD exhibit inappropriate behavior, academic learning problems, and poor interpersonal relationships (Landrum et al., 2003) leaving these

students underserved in the K-12 classroom setting (Mihalas et al., 2009). Teachers often do not have the necessary preparation to serve students with an emotional disability effectively (Mihalas et al., 2009), resulting in a more restrictive environment placement. A solution used by too many schools is to address behavior through punishments, (i.e. in-school and out of school suspensions, expulsions, or referrals to alternative settings) (Denune et al., 2015) and to exclude students from classroom settings because of intense disruptive behaviors rather than implementing positive measures to keep these students in school (Lane, Wehby, & Barton-Arwood, 2005; Mihalas et al., 2009).

Research supports the use of School-Wide Behavior Interventions and Support (SWPBIS) as a positive measure to decrease disruptive behavior for students with EBD (Bunch-Crump & Lo, 2017). This system is an empirically based school-wide method that consists of three support levels with hopes of producing more socially acceptable behaviors for struggling students (Bunch-Crump & Lo, 2017; Office of Special Education Programs Technical Assistance Center on Positive Behavior Interventions and Supports, 2015). Check-In Check-Out (CICO) and self-monitoring are interventions that have been used alongside SWPBIS as a means of supporting students who display disruptive behavior in classroom settings. CICO and self-monitoring have been indicative of positive results in supporting students' behavioral needs in various classroom settings (Bunch-Crump & Lo, 2017; Campbell & Anderson, 2008; March & Horner, 2002; Miller, Dufrene, Sterling, Olmi, & Bachmeyer, 2015; Swoszowski, McDaviel, Jolivette, & Melius, 2013). Research has indicated that schools using these

methods have fewer disciplinary referrals and are less likely to use exclusionary practices (Bradshaw, Mitchell, & Leaf, 2010; Bunch-Crump & Lo, 2017).

The need for implementation of evidence-based practices in general education classrooms to decrease disruptive and off-task behavior for students with EBD has increased because recent statistics show that 43% of these students receive their education in general education classrooms for the majority of the day (Cook et al., 2017; U.S. Department of Education, National Center for Education Statistics, 2015). In order to provide adequate support to students with EBD, the development and practice of skills used to increase academic engagement and encourage more desirable social behaviors must be implemented (Denune et al., 2015).

Self-monitoring to Improve Academic Productivity

Effective and efficient strategies are needed for increasing academic productivity and decreasing disruptive behaviors in students with EBD so they can be successful and productive in general education settings. One such strategy is self-monitoring. SM has been found to be an effective intervention used by teachers (Allen & Blackston, 2003; Briere et al., 2015; MacSuga & Simonsen, 2011) and in classroom settings (Bruhn & Watt, 2012; McLaughlin & Truhlicka, 1983) with a variety of behaviors.

Bruhn and Watt (2012) integrated self-monitoring into a reading intervention. The participants in their study were two girls who struggled with reading and behavioral difficulties. Researchers investigated the functional relationship between self-monitoring, academic engagement, and problematic

behavior of two students participating in a reading intervention using an ABAB withdrawal design. The results indicated that the self-monitoring component was indeed effective in a *READ 180* classroom. This study extended research completed by McLaughlin (1984), McLaughlin et al. (1982) and McLaughlin & Truhlicka (1983) which included only male students in the previous studies.

Gulchak (2008) emphasized that self-monitoring is a useful intervention for students with and without disabilities to improve attention and on-task behavior. Within this study, Gulchak used a baseline, intervention, and withdrawal design. The participant was an eight-year-old student with emotional and behavioral disabilities. The study took place in a classroom with a handheld computer as the self-monitoring device used. Results suggested that the participant's on-task behavior improved significantly, and the effect of the self- monitoring intervention was immediate. Gulchak's findings followed previous lines of research indicating that elementary aged students can, in fact, learn to self-monitor efficiently (Heins, Lloyd, & Hallahan, 1986; Maag, Reid, & DiGangi, 1993; Rock, 2005; Gulchak, 2008).

While research has demonstrated the effectiveness of SM, technology can add an important advancement to this strategy (Vogelgesang et al., 2016). Wills and Mason (2014) conducted a study using the I-connect application to improve on-task behavior of two high school students with disruptive behavior. This study included a baseline and intervention design with a withdrawal component to understand the effects of the connect application on frequent off-task behaviors. Both participants showed an improvement in on-task behavior; however,

participant one showed a sizeable immediate result from the baseline phase to the intervention phase. Results are indicative of prior literature (Harris et al., 2005; Reid et al., 2005; Wills & Mason, 2014) and extend the literature base as noted: (1) secondary students who participate in a self- monitoring intervention is uncommon; (2) researchers refrained from using a secondary intervention; (3) longer intervals were utilized in this study; and (4) the study took place in a general education high school classroom.

Additionally, Schardt and colleagues (2018) conducted a study using the CellF-Monitoring application which is compatible on iOS devices. This study focused on students who exhibited lower rates of on-task behavior as determined by the Direct Behavior Rating Scales completed by the teacher. Researchers used an ABC multiple-baseline design across participants. Results suggested that the student participants displayed higher rates of academic engagement as indicated by the visual analysis through analyzing the immediacy of the effect, level, trend, and low incidents of data overlap.

Research has recognized positive behavioral impacts of implementing a self-monitoring intervention for students with EBD. However, educators are often faced with confusing and conflicting information about the numerous strategies and interventions that are considered evidence based; therefore, it is crucial in determining if interventions using technology to SM can be useful for students with EBD in inclusive environments.

Purpose

The purpose of the present study was to examine the effectiveness of

technology-based self-monitoring on increasing attending to task of an elementary student with EBD. Three distinguishing factors of this study were: (1) the participants were identified under the category of EBD but placed in a general education classroom; (2) the participants will be taught to use technology-based self-monitoring; and (3) the intervention will take place across 3 content areas in the general education setting.

Research questions: What are the teacher's perceptions and to what extent is the self-monitoring iPad app, CellF- Monitoring, acceptable for use in an elementary classroom for a student with EBD (i.e. social validity)?

1. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve on-task behavior of elementary students with EBD?
2. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve academic accuracy of elementary students with EBD?

METHOD

Participants

Student. The participant in this study was an elementary age student (e.g. fourth-grade) who was determined eligible for special education services under the category of EBD as verified through his Individual Education Program (IEP). The participant was selected as the LRE was a general education classroom for three content areas (i.e. reading, math, and writing class).

Nathan was a 9-year-old white male who was nominated for participation

by the principal because of his eligibility of EBD. Teachers indicated the need to prompt Nathan multiple times to begin assignments and continued to prompt him to stay on task. Nathan was defiant to teachers by refusing to complete his work, regardless of the daily task. Defiance was most prevalent throughout the independent work. Additionally, during independent work time, Nathan was off-task by either putting his head down on his desk and going to sleep or getting out of his seat and exploring different parts of the classroom. Further, teachers indicated that Nathan struggled with self-control. For example, he had altercations with his classmates across the room during whole group instructional time. However, Nathan did have access to a behavior intervention room when necessary. Nathan was able to go the behavior intervention room when he had anger related outbursts (i.e.altercation with peers or the teacher). Going to the behavior intervention room could be both his choice and/orthe teacher's direction. In the behavior intervention room, Nathan had the opportunity to remove himself from the classroom, take a time out and talk to the teacher about the incident. During this time, Nathan would typically sit and wait for time to pass. This time allowed him to decompress and calm down prior to returning to class. The teacher in the behavior intervention room would decide when Nathan could return back to class.

Setting. The present study was conducted in 2019 in an elementary school in the mid-south region of the United States in a fourth-grade general education classroom. The school served approximately 690 students.

The student population of the school is comprised of 73.1% White, 23.8% Black, and approximately 2% Hispanic, and 56.2% of students who qualify for

free and reduced lunch.

Educational services were provided to this student through a co-teaching model. Special educators worked in general education classrooms participating in various co-teaching strategies including station teaching, co-teaching, one-teach, one-assist, and parallel teaching.

Measures

Dependent Variables. In this study data were collected on two dependent variables: disruptive behavior and academic engagement. Definitions and examples of academic engagement and disruptive behavior have been adopted from previous literature and are discussed below.

Academic engagement. (AE) Academic engagement (AE), as defined in previous literature, occurs during the independent practice component of a lesson when the student is actively engaged by (a) reading, writing, or talking with the teacher/teaching assistant/peer about the assignment, (b) did not direct visual attention to anything other than the task for more than five seconds at a time, and (c) remaining in the designated area (Harrison et al., in review). The current study defined AE as the student actively attended to the assigned task and followed pre-determined classroom rules and procedures. Additional examples of AE included: speaking with the teacher or special education teacher about the assignment, using materials appropriately, and completing assignment as expected. On-task behavior was defined as being oriented toward the teacher or the task. The student was actively listening to directions, responding verbally by asking questions or non-verbally by nodding. The student asked for help in the appropriate manor (Allday

& Pakurar, 2007). Also, academic accuracy was noted as determined by the teacher by permanent products and determined by the number of items completed correctly divided by the number of items given multiplied by 100 (Hollifield, Goodman, Hazelkorn, & Heflin, 2010).

Observation Procedures. Partial interval recording was used to measure on-task behavior. Fifty- minute reading, math, and writing classes were divided into five-minute intervals and each student was prompted ten times each class period to self-monitor. At the sound of a tone and flashing on an iPad, the student's behavior was coded as either on-task or off-task. Teachers prompted student when he appeared off- task or requested help. If prompting occurred, the student marked as off-task. If the student was not prompted by the teacher and felt he was on-task, on-task would be marked. In addition to the student self-monitoring, the researcher also observed for on-task or off-task behaviors and recorded based on observations for each interval. Behaviors that occurred during the interval were marked dichotomously 0=no; 1=yes.

Disruptive behavior (DB) has previously been defined as behavior that prevents students from attending to the task appropriately (Bruhn & Watt, 2012; Bruhn et al., 2017). Examples of DB include speaking out of turn, using materials incorrectly, not complying with assignment directions, and leaving the assigned area.

Independent Variable: *CellF-Monitoring*. The application CellF-Monitoring is an app used for self- monitoring that is compatible with iOS-based devices (Schardt, Miller, & Bedesem, 2018). Intervals are interchangeable

requiring students to self-monitor their on-task behavior during independent work time. The interval depended on the frequency of disruptive behavior and the amount of independent work time during general education classes. The participant was observed 50 minutes in each subject area. The class periods were divided into ten intervals. After each interval, there was an audio and visual cue from the app. Then, the student clicked 'yes or no' on the iPad to answer the question: Are you on task? To track the overall percentage of student behavioral progress, the percentage can be calculated at the conclusion of each class period.

Interobserver agreement (IOA) and reliability. Prior to collecting data on academic engagement, a graduate student received reliability training. There was a one-hour training session on data collection procedures and identifying disruptive behaviors. Academic engagement and disruptive behavior were defined explicitly and modeled in videos. There was a practice session to which 90% reliability was achieved for two consecutive sessions to be considered reliable. The interval-by-interval method was used to calculate IOA using the formula:

Agreement/Agreement + Disagreement.

This formula was used to determine the percentage agreement between the two trained examiners (Vannest et al., 2013). During the study, IOA was collected in at least 20% of all sessions across phases (i.e. baseline and intervention phase) for all student participants. As indicated by *What Works Clearinghouse* 20% of sessions in each phase is sufficient to guarantee reliability. The lead researcher trained a research assistant first consisting of discussing the definitions of on-task and off-task behavior. Then, the two raters had iPads with the CellF- Monitoring

application downloaded on them and watched videos selecting on-task or off-task behavior on the application discussing the behaviors that differed using partial interval recording to get reliability.

Inter-observer agreement was collected for on-task and disruptive behaviors for 27% of the sessions across all phases of the study for this participant based on research team availability. IOA was collected using partial interval recording as well as the interval-by-interval method to code reliability estimates. Then, the percentage agreement was calculated between the two researchers using the formula: *Agreement/Agreement + Disagreement*. The overall average IOA for Nathan was 90% with a range from 90% to 100% for the co-observed sessions.

Fidelity. According to Cooper, Heron, and Heward (2007), treatment integrity involves the degree to which the intervention is implemented as intended. These authors note that, without fidelity, results of an intervention can be inaccurately interpreted. Fidelity of intervention was directly observed during all of the sessions. There were no observable times when the application's use was distracting to the student, peers, and/or teachers. Additionally, the baseline phase remained consistent with normal classroom routines. Treatment acceptability and unobtrusiveness of the intervention was also assessed.

Social Validity. Social Validity, derived from the behavior analysts' field, measures the acceptability of the intervention (Foster & Mash, 1999). The School Intervention Rating Form (SIRF; Kern & Gresham, 2002) was adapted for a teacher and student measurement (see Appendix A & B). The SIRF gained an in-depth

understanding of the likability and helpfulness of the intervention from the teacher's and student's perspective (SIRF; Kern & Gresham, 2002).

The SIRF is a questionnaire comprised of a 7-point Likert type scale used to gather social validity of the self-monitoring intervention. This questionnaire also included two open-ended questions: (a) What changes have you noticed in your student's classroom performance (b) What were some of the barriers of the intervention (SIRF; Kern & Gresham, 2002). Scores range from 7-77 with higher scores indicating high social validity. After the last intervention session, the students and teachers completed this rating form and social validity was calculated.

Single Case Design and Data Analysis

This study used single-case design (SCD) which involves the study of one or more individuals (Vannest, Davis, & Parker, 2013). SCD is used to address change within an individual rather than comparing the individual to a control group (Parker, Vannest, & Brown, 2009). Baseline data is used to compare behavior between the baseline phase and the intervention phase (Parker, Vannest, & Brown, 2009). For this particular study, SCD methodology was used to understand the relationship between self-monitoring and academic productivity in a student with EBD.

Multiple-baseline Design. In order to achieve the most desirable results, a multiple-baseline design was conducted using a baseline phase and an intervention phase across three general education settings. The reason that a multiple-baseline approach was most preferred in this case was to investigate the effects of self- monitoring among varying settings.

To determine the existence of a functional relation between the CellF-Monitoring iPad application and academic engagement, a multiple-baseline design across general education settings was used. Results evaluated the effectiveness of the CellF-Monitoring iPad application to increase academic productivity in a student with EBD. Phases included baseline, training, and intervention. Training phases were staggered across settings. The phase lengths were determined by the What Works Clearinghouse standards (Kratochwill et al., 2010).

TauU. The primary method for evaluating the effects of the intervention was the visual examination of the percentage of academic engagement of the participant across settings. Additionally, TauU was used to quantify the effectiveness of the self-monitoring intervention across the general education settings. TauU was calculated between the baseline and intervention phase for each of the three settings and then combined.

Calculations were completed using the online TauU calculator (Vannest, Parker, & Gonen, 2011). All three effect sizes were combined using the two-weighted feature in the TauU calculator.

Standards

The WWC, CEC, and Visual Analysis standards were considered and met when designing and implementing the intervention of this study. Justification for meeting each standard is discussed below.

WWC. The WWC evidence-based standards are considered met if the minimum requirement for each standard was met. The standards are as follows: (a) The first standard required the intervention to be systematically manipulated by the

researcher. This requirement was met because, upon attaining the appropriate amount of data points in the baseline phase, the researcher determined when the intervention was implemented, which was during the general education classes (b) The next requirement states that the outcome variables should be measured by more than one researcher. This standard was attained because the researcher and research assistant completed inter-observer agreement for at least 20% of sessions in each phase meaning both the baseline phase and intervention phase; (c) Next, it is required that multiple baseline design studies to take place across three different settings (i.e. reading, writing, and math); (d) The next standard required studies to have a minimum of five data points in each phase which was considered met because five data points was exceeded within each phase; (e) The next standard indicated that the trend must be moving in a therapeutic direction. This standard was met because of the last data point in the baseline phase and the first data point in the intervention phase which indicates an immediate effect. Additionally, the trend is moving in a positive direction; (f) The researcher provided three opportunities to demonstrate a functional relationship in three general education settings; (g) The next standard required the researcher to describe the study in detail which was completed in the previous sections of the paper (i.e. multiple baseline design across three general education settings); (h) The effect size presented as a moderate effect indicating that this standard was met due to the effect size estimation.

CEC. The Council for Exceptional Children put forth standards that identify a study as being methodologically sound. The standards are considered met if all components of the standard are met minimally.

(a) Context and Setting: The first standard required a description on the program,

geographic location, and physical layout etc. This standard was met as the program was described previously, which was a general education classroom that implemented the co-teaching model; (b) Participants: The demographics of the participant are described to meet the second indicator. The researcher confirmed the disability as EBD that was determined by IEP paperwork; (c) Intervention Agent: The intervention agent was the researcher. The general education teacher and students were both trained in the delivery of the intervention, but the researcher implemented the intervention; (d) Description of practice: The description of the intervention and how it was implemented was explicitly stated in the procedure section. The participant was prompted to select 'yes or no' to answer the question of being on-task or off-task using partial interval recording for five-minute intervals.

This information will allow easy replication of this study; (e) Implementation fidelity: Observations of each intervention session took place to ensure treatment fidelity; (f) Internal validity: The researcher was in control of the independent variable or intervention for each session. Additionally, each phase of the study (i.e. baseline and intervention) was described in detail, and lasted the appropriate amount of time, and had the proper amount of data points to meet this quality indicator; (g) Outcome measures/dependent variables: The researcher exceeded the requirement of 20% inter-observer agreement within each phase. IOA was observed for 27% of observations across all phases of the study to equal 90% overall IOA. In addition, the researcher reported the effects of the intervention; (h) Data analysis: A graph reported the results of the visual analysis in the results section indicating the trend, level, and data overlap etc. The effect size reported as

strong or moderate using TauU.

Visual Analysis Standards. The visual analysis can be assessed using six standards: (a) Level: this standard was met because the levels of the visual analysis were comparable across the baseline and intervention phases across three general education settings (i.e. reading, math, and writing); (b) Trend: The standard addressing trend was considered met because of the trend that is moving in a positive or therapeutic direction; (c) Variability: The variability standard was considered met because of the consistency and lack of variability as well as the observations of the participant's performance and the prediction that can occur over time; (d) Overlap: This standard was considered met due to the fact of little overlap from one phase to the next indicating a functional relationship; (e) Consistency: Due to the consistency of data points during the intervention phase across conditions, conclusively there was a causal relationship between the independent variable and dependent variable; (f) Immediacy of the effect: As noted by the last data points during the baseline phase and the first data points in the intervention phase, there was an immediate effect of the self-monitoring intervention.

Procedure

An IRB application was reviewed through the University of Mississippi's Institutional Review Board by the lead author and approved (Protocol # 19x-030). The researcher meet with the building principal to obtain permission. In addition, the researcher explained research plans, including the population and purpose for the study. Then, the researcher meet with the teacher who was asked to take part in

the study.

Recruitment. The teacher was asked by the principal to identify a student who was EBD and had behavioral difficulties in the general education setting. The building principal then sought parental approval to disclose eligibility information to the researcher. Once the student was identified, a consent form was sent home. Accordingly, parents provided informed consent to allow their child to be invited to participate in the study. Students also provided assent. The case manager provided the researcher with IEP documentation to ensure that the student's primary special education ruling was EBD.

Baseline. Baseline data was collected for at least five class sessions or until stability is achieved. Off- task behaviors were recorded through direct observation using the iPad application CellF-Monitoring. If there is an unexpected increase or decrease in the student's behavior, the baseline phase will be prolonged to guarantee that stability is achieved.

The baseline condition remained consistent of normal classroom routines and procedures. In this elementary school, teachers taught in pairs meaning one teacher was responsible for math and science while the other teacher taught Language Arts and social studies. Each class had parallel rules in an effort to keep rules consistent across all subject areas. Both teachers utilized Class Dojo as a classroom behavior management system. During this condition, students were observed during independent work and teacher led instruction.

In math class, students sat in desks arranged in row formation that were assigned by the teacher. The teacher began each day by outlining the day's

activities which consisted of whole group instruction and small group centers. If students were participating in small group centers, following directions students arranged themselves at the appropriate center. Class time lasted anywhere from 50-75 minutes.

In reading, the students sat in rows assigned by the teacher. Daily procedures and routines remained the same during the baseline condition. The teacher began each day by outlining objectives which consisted of whole group instruction and independent practice. Class time lasted approximately 50 minutes.

In writing, students participated in a variety of instructional exercises with class time lasting 50 minutes, but that time could vary depending on the day's activities. The desks were arranged in row formation and were assigned by the teacher.

Intervention. Prior to the intervention phase there was a training phase that consisted of modeling and practicing using the iPad application. On-task and off-task behaviors were modeled and discussed. There was an in-depth practice session using the CellF-Monitoring application. Once the student had an opportunity to ask questions and felt comfortable with the application, the intervention was implemented the following day.

During this phase, typical classroom routines and procedures remained the same with the only change being the use of the CellF-Monitoring application. The intervention phase was staggered within general education settings to ensure the change that occurred is a result of the intervention. Intervention lasted 12 class meetings in math, eight class meetings in writing, and 6 class meetings in reading.

Data Collection

Partial interval recording was used through behavioral observations during independent practice. The student self-monitored their behavior every five minutes within their fifty-minute math, writing, and reading classes having 10 opportunities to self-monitor each class period. The use of the CellF-Monitoring application was used to determine the frequency of behaviors as defined as disruptive behavior in previous studies during each session of this research study. On-task behavior is adapted from

Visual Analysis

A summative visual analysis of a line graph was displayed to determine if the behavior (dependent variable) changed in a significant way and if the change occurred as a result of the independent variable (self- monitoring); moreover, the visual analysis was helpful in determining the immediacy of the effect (Bruhn et al., 2017).

The quantity of data overlap that occurs is important as well (Kratochwill et al., 2010) since there must be at least three stable data points to illustrate a trend including the first baseline as well in the second baseline. In addition, there should be three points of overlap in the intervention phase (Martella et al., 2013).

RESULTS

Social Validity Measure

Upon completion of the intervention, both the teachers and participating student completed an adapted version of The School Intervention Rating Form (SIRF; Kern & Gresham, 2002-2007). The teacher's scores from the SIRF

indicated high social validity. They understood the intervention, found the intervention acceptable, and were willing to implement the intervention in their classrooms. Both teachers summed scores were 56/77, indicating that the intervention was viewed favorably. Along with the quantitative scores on the SIRF, the open-ended questions provided evidence that teachers saw CellF-Monitoring as a useful intervention as noted by the increase in work productivity. Additionally, teachers documented that their student was truly reflective of his behavior which benefited the student behaviorally. In sum, both general education teachers indicated that the intervention was valuable in their classrooms due to the increase in work productivity and academic engagement.

The participating student completed the student version of the SIRF (SIRF; Kern & Gresham, 2002- 2007). The SIRF indicated that the student understood the intervention, and that CellF-Monitoring was easy to implement in clases. However, the participant indicated that the intervention made him feel slightly uncomfortable. As noted in the comment section, it helped him pay attention, but there was not always enough desk space to hold the iPad as well as a Goggle Chromebook and a folder for the classes, respectively.

On-task Behavior

Results indicated statistically significant differences between baseline and intervention for Nathan with a moderate combined effect of TauU .65[CI90%.36, .94] (p = .00). The range of on-task behavior in baseline was 0% to 80% with a mean of 31%; the range for intervention was 0% to 100% with a mean of 72%.In math, the range of Nathan's on-task behavior in baseline was 0% to 40% with a

mean of 25% and during the Self- Monitoring intervention was 10% to 100% with a mean of 76%; researchers found that on-task behavior in math increased with a large effect of.82; [CI90%.33, 1.00] (p = .01). In writing, the range of on-task behavior in baseline was 0% to 80% with a mean of 29% and during intervention was 0% to 100% with a mean of 68%; on- task behavior increased with a small effect .59 [CI90% .08, 1.00] (p = .06). In reading, the range of on-task behavior in baseline was 0% to 60% with a mean of 36% and during intervention was 30% to 100% with a mean of 72% indicating that on-task behavior in reading increased with a small effect .53 [CI90% .03, 1.00] (p = .08). Visual analysis of the MBD graph for Nathan shows a functional relationship by assessing trend, level, immediacy of effect, variability, consistency, and overlap (see Figure 1).

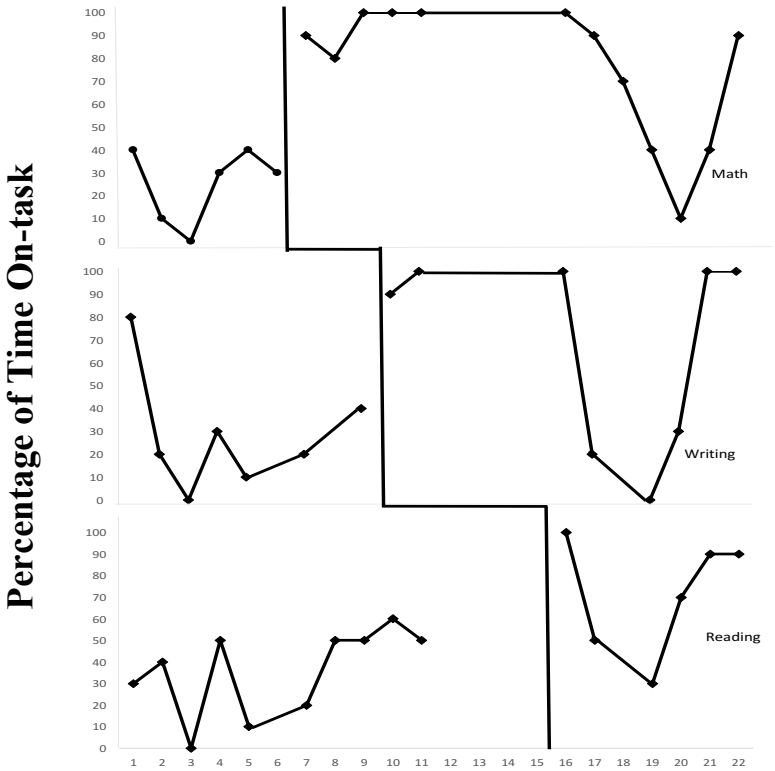

Figure1 1. Nathan On-Task Behavior

Baseline (mean)	Intervention (mean)
25%	76%
29%	68%
36%	72%

Visual Analysis. From the baseline phase to the intervention phase, Nathan exhibited an increase in level, trend, and variability as indicated by the mean, slope, and range between the two phases. Additionally, there was an immediate effect of the intervention due to the increase in time on-task after the introduction of the intervention. Also, there was significant overlap between the baseline phase and intervention phase as well as consistency of data points within phases indicating a causal relationship.

Academic Accuracy. Results indicated differences between baseline and intervention for Nathan with a small combined effectof TauU .29; [CI90%.00, 1.00] (p = .47). Nathan's overall academic accuracy increased in general education classes. The range of academic accuracy during the baseline phase was 0% to 105% with a mean of 56%; the range for interventions was 5% to 103% with a mean of 78%. In math, during baseline the range of Nathan's academic accuracy was 20% to 105% with a mean of 63% and during the SM intervention the range was 5% to 103% with a mean of 81%. Researchers found that academic accuracy in math increased with a small effect of .12; [CI90% .00, .66] (p = .69). In writing during baseline, the range was 7% to 77% with a mean of 42%; and during the self-monitoring intervention 52%. Researchers found that academic accuracy in writing increased with a large effect of 1.00; [CI90% 0, 1.00] (p = 1.00). In reading the range during baseline was 58% to 67% with a mean of 62%; and during the self-monitoring intervention 75%. Researchers found that academic accuracy in reading increased with a large effect 1.00; [CI90% .00, 1.00] (p = .22). The visual analysis of the MBD graph for Nathan's academic accuracy is illustrated below (see Figure 2).

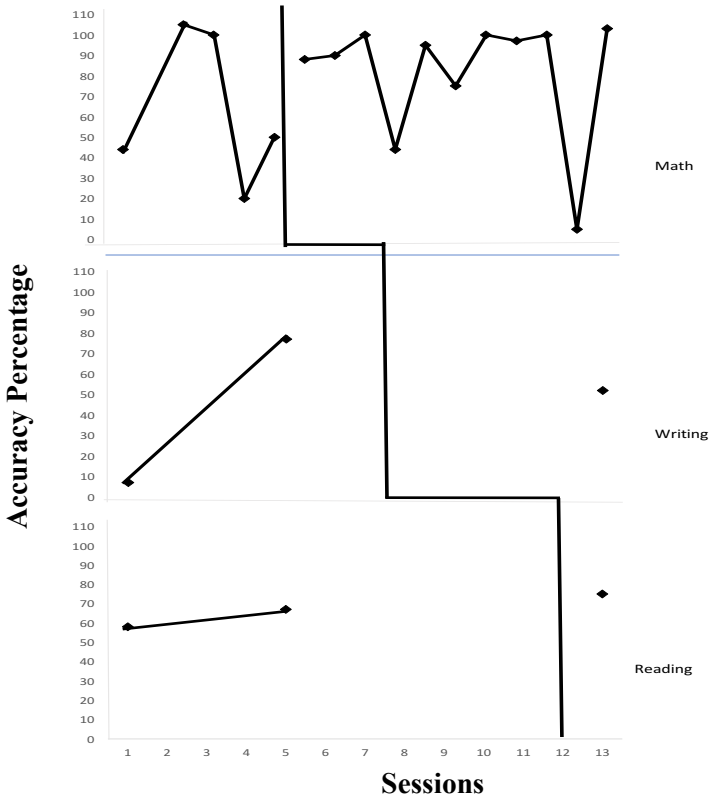

Figure 2. Nathan Academic Accuracy

Baseline (mean)	**Intervention (mean)**
63% (n = 5)	81% (n = 11)
42% (n = 2)	52% (n = 1)
62% (n = 2)	75% (n = 1)

Visual Analysis. From the baseline phase to the intervention phase, Nathan showed a very small increase in level, trend, and variability as determined by the mean, slope, and range. With few grades taken in reading and writing it is hard to determine whether there is an immediate effect, overlap, as well as consistency between phases. There was very little increase in accuracy between the baseline and intervention phase.

DISCUSSION

The purpose of this SCD study was to investigate the effect of the iOS application CellF-Monitoring on an elementary student with EBD across three general education settings. There were several findings that are worthy of discussion. First, the overall moderate effect for on-task behavior as calculated by TauU was

.65[CI90%.36, .94] (p = .00) indicated an increase in on-task behaviors and an increase in academic engagement that can be attributed to the CellF-Monitoring iPad application. This study supports years of self-monitoring research that have produced positive results of reducing disruptive behavior and increasing academic productivity for students of all ages and with various disabilities applied in diverse school settings (Bruhn & Watt, 2012; Bedesem & Dieker, 2014; Graham-Day et al., 2010; Gulchak; 2008; Schardt, 2018; Wills &

Mason, 2014).

This study also investigated the teachers and the participating student's perception of the intervention through the social validity measure. The social validity measure indicated that the self-monitoring intervention was acceptable in

the general education classrooms. The intervention was rated positively in all categories pertaining to the intervention itself. In addition, there were not any times that the intervention was distracting to the teachers or other students in the classroom. The teachers and the student participant found the intervention easy to implement as well as understandable. However, the student participant did indicate that the intervention made him feel somewhat uncomfortable due to having the iPad on his desk constantly as well as other required materials. He noted that he did not always have enough desk space because there was often a Google Chromebook as well as the mandatory binder on his desk depending on the class.

On-task behavior is crucial to a student's academic performance and is correlated with success as indicated by study skills and overall academic productivity (Harris, Friedlander, Saddler, Frizelle, & Graham, 2005; Otero & Haut, 2015). This is essential due to the fact that independent seat work accounts for approximately 30% of the school day during general education classes which is often the least restrictive environments for students with EBD (Denune et al., 2015; Rock & Thead, 2009). In this study, during the baseline phase the participant was academically engaged for 50% or less of the time during independent work time with the exception of one preferred activity in writing. After the introduction of the intervention, Nathan showed an increase in time on-task in all subjects; however, there were several outliers. Following a three-day weekend Nathan was on-task for 10% of the fifty-minute math period. Additionally, after an unstructured Valentine's Day with parties occurring that afternoon, the next day Nathan's on-task percentage dropped to 0% in writing and 30% in reading which could also

account for the fact that two tests in each were assigned. Following the outliers, percentages increased to 90% and 100%.

The visual analysis indicated an increase in academic engagement determined by the immediacy of effect as well as the increase in level, trend, and variability. Additionally, there was significant overlap and consistency which indicated a functional relationship. However, for this participant there is very little correlation between on-task behavior and improved grades. Nathan spent one entire week day in the Quest program where he participated in enrichment activities. Even though he participated in the Quest program he could easily become overwhelmed which resulted in disruptive and off-task behavior. In reading and writing, there were multiple tests assigned each Friday. Through observations, the participant was overwhelmed and would shut down. Often times, the tests were not completed resulting in zeros or incomplete assignments. In math, Nathan worked well in the teacher led center, but if he was presented with lengthy diagnostic tests on Accelerated Math or lengthy assignments in general, he would avoid work by staring at the worksheet or computer screen. He would often be asked to stay inside from recess or activity period to complete missing work.

Results of using the technology-based self-monitoring intervention support previous findings in this area (Schardt et al., 2018; Vogelgesang, 2016; Wills & Mason 2014). This study extends the literature base in several ways: first, there were not any reinforcement strategies included, second this study was conducted in fourth grade general education classrooms – which is a rare setting for self-monitoring research, third the use of an iPad application was used to deliver the

self-monitoring intervention, and fourth an accuracy percentage was gathered after each assignment.

Limitations

This study suggested that using the CellF-Monitoring application in different general education settings could increase on-task behavior which has the potential to impact academic accuracy. The findings of this study aligned with previous findings indicating that the CellF-Monitoring application yields an increase in percentage of time on-task during independent work time for a fourth-grade student with EBD. However, this study was not without limitations. First, the present study was limited to one student with EBD. Due to the small sample, we cannot generalize that CellF-Monitoring will produce positive findings for all students with EBD. Secondly, it was limited by the inconsistency in how frequently the intervention was implemented due to the participant's removal from the general education classroom (i.e. in school suspension). There were several days (n = 2) where the student was suspended due to a behavioral incident. Third, the study was conductedover a short period of time. Although on-task behavior can change immediately, academic accuracy could potentially take a longer time to impact. Fourth, the present study did not include generalization or maintenance probes to understand the lasting effects of this application across general education settings. Finally, this application was not understood completely, so it is inconclusive in determining whether or not the CellF- Monitoring application provides advantages of technology-based self-monitoring interventions in comparison with non-technology-based self-monitoring interventions.

Future Research

Although technology-based self-monitoring is in its early stages, the CellF-Monitoring application displayed positive findings across three general education settings. Further research investigating technology-based self-monitoring will likely continue to demonstrate positive findings and encourage the use oftechnology-based self-monitoring interventions. Future studies should include the use of technology-based self- monitoring interventions in general education settings with the continued push for inclusion of students with EBD (Hunt & Goetz, 1997; Lipsky & Gartner, 1996). Moreover, future research should investigate the lasting effects of self-monitoring for students with EBD over an extended time. Although this study met the standards set by What Works Clearinghouse, future researchers should consider replication to deem CellF-Monitoring as an evidence-based practice. In order to understand the long-term effects of the CellF-Monitoring intervention future research should include a generalization and maintenance phase.

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CHAPTER III [ARTICLE 2]

AN SCD TECHNOLOGY-BASED SELF-MONITORING INTERVENTION FOR A STUDENT WITH ADHD

Attention deficit/hyperactivity disorder (ADHD) was found to be a neurobiological disorder that impaired the functioning of approximately 10% of children and adolescents; this number increased 6% over the course of 20 years (Xu, Strathearn, Liu, Yang, Bao, 2018). Additionally, ADHD has been associated with elevated risk of poor academic outcomes in school-age youth. Within school settings students who were diagnosed with ADHD could be co-morbidly affected with behavioral disorders or a learning disability (Mathes & Bender, 2007). Frequently, these students received special education services in the general education setting (DaVilla, Williams, & MacDonald, 1990; Mathes & Bender, 2007). School-aged children with ADHD often had problems in many areas of school (Barkley, 2006; Gureasko-Moore, DuPaul & White, 2007). Behavioral deficits usually surfaced early appearing in peer relationships, lack of academic achievement, and not complying to teacher directions, as well as difficulty attending to organizational management tasks (Vile Junod, Du- Paul. Jitendra, Volpe. & Lorah, 2006; Robin, 1998; Gureasko-Moore et al., 2007). Lack of ability to maintain attention was associated with inadequate work habits, and the inability

to manage their own behaviors (Hughes, Ruhl & Peterson, 1988; Reid & Harris, 1993).

Previous research indicated self-monitoring provided a way for students with ADHD to reduce their off- task and disruptive behavior (Shimabukuro, Prater, Jenkins, & Edelen-Smith, 1999). Researchers also noted the positive effects that self-monitoring has on academic productivity. Findings of studies investigating the effects of academic productivity was likely to improve students' on-task behavior for students with learning disabilities, attentional disabilities, and behavioral disorders (Shimabukuro et al., 1999). Additionally, researchers indicate the need of further investigation of self-monitoring academic productivity on academic accuracy (Shimabukuro et al., 1999).

Self-monitoring to Improve Academic Productivity for Students with ADHD

Recently, Vogelgesang and colleagues (2016) explored technology based self-monitoring using the *SCORE IT* application. Participants were 11-year old students who were diagnosed with ADHD or were at-risk for ADHD. Researchers identified academic engagement as following teacher directives, working on assigned tasks, and using materials appropriately (Vogelgesang, Bruhn, Coghill-Behrends, Kern, Troughton, 2016). The primary purpose of this study was to determine if there is a functional relationship between *SCORE IT* and academic engagement in students who have attentional difficulties (Vogelgesang et al., 2016). There was a baseline and intervention phase with a maintenance segment in this study. All participants showed an immediate effect with change in their academic engagement while the intervention was being manipulated (Vogelgesang

et al., 2016). This study indicated that the *SCORE IT* application could, in fact, be utilized in a classroom other than *READ 180* and could be effective in a wide range of settings (Vogelgesang et al., 2016).

Researchers advised that future research should include the study of continuous implementation of an intervention; for example, researchers should employ in group designs or multiple baseline designs to determine the effects of the intervention.

Another promising study was conducted by Graham-Day et al. (2010) with high-school aged students in study hall. All of the students were diagnosed with ADHD, and it was reported that they were taking medication. This research study utilized an alternating treatment design which alternated conditions between baseline, self-monitoring, and reinforcement. Results in this study were consistent to other self-monitoring studies (e.g. Crum, 2004; Graham-Day et al., 2010; Gureasko-Moore et al., 2006; Harris et al., 2005; Hughes et al., 1989; Kern & Dunlap, 1994; Levendoski & Cartledge, 2000; Maag et al., 1993; Mathes & Bender, 1997; Reid et al., 2005; Wolfe et al., 2006; Wood et al., 1998; Wood et al., 2002). All students showed improvement with academic engagement during the self-monitoring reinforcement phase with candy being the requested reinforce, although self-monitoring alone was enough to increase academic productivity substantially.

However, the chimes that were used as audiotaped self-monitoring cues were reported to be distracting to participants. Graham-Day and colleagues (2010) suggest that students with ADHD need explicit instruction about independent work when participating in a study hall class.

Historically, studies involving self-monitoring of academic productivity to increase on-task behavior in various student populations have resulted in positive findings when applied in different school settings (Koegel et al., 1995; Smith & Sugai, 2000). Reid, Trout, and Schartz (2005) investigated self-monitoring strategies for students with ADHD and obtained a combined effect size greater than 1.0 for these interventions with emphasis on increasing academic productivity and decreasing disruptive behavior. Self-monitoring has been successful for students with attentional deficits though there is a continued need for additional investigation.

Purpose

The purpose of the present study was to examine the effectiveness of technology-based self-monitoring on increasing academic productivity of an elementary student with ADHD. Three distinguishing factors of this study were: (1) the participant was identified under the category of ADHD but placed in a general education classroom; (2) the participants was taught to use technology based self-monitoring; and (3) the intervention took place across 3 content areas in the general education setting.

Research questions:

1. What are the teacher's perceptions and to what extent is the self-monitoring iPad app, CellF- Monitoring, acceptable for use in an elementary classroom for a student with ADHD (i.e. social validity)?
2. To what extent does the use of the self-monitoring iPad app, CellF-

Monitoring, improve on-task behavior of elementary students with ADHD?

3. To what extent does the use of the self-monitoring iPad app, CellF-Monitoring, improve academic accuracy of elementary students with ADHD?

METHOD

Participants

Student. Alisa was a fourth-grade student who was nominated for participation due to her eligibility for special education services under the category of Other Health Impairment – ADHD as determined by the IEP team. Reportedly, Alisa was not taking medication for ADHD. She receives majority of her instruction in a general education classroom (i.e. reading, math, and writing classes) with the support of a special education teacher for 30 minutes daily. She is often distracting to other students by making noises or sitting under her desk. Alisa also receives occupational therapy services to meet her sensory processing needs.

Setting. The present study was conducted in an elementary school in the mid-south region of the United States that comprised of third, fourth, and fifth grades. The student population of the school are as follows: 73.1% White, 23.8% Black, and approximately 2% Hispanic, and 56.2% of students who qualify for free and reduced lunch.

Measures

Dependent and Independent Variables. The dependent variables were disruptive behavior and academic engagement. Academic engagement and

disruptive behaviors were analyzed using the CellF- Monitoring application App during independent practice. On-task behavior was defined as being oriented toward the teacher or the task. The student was actively listening to directions, responding verbally by asking questions or non-verbally by nodding. The student asked for help in the appropriate manor (Allday & Pakurar, 2007). Also, academic accuracy was noted as determined by the teacher by permanent products and determinedby the number of items completed correctly divided by the number of items given multiplied by 100 (Hollifield, Goodman, Hazelkorn, & Heflin, 2010).

Academic engagement (AE) Harrison et al. (in press) determined academic engagement as: (a) the student was reading, writing, or talking with the teacher/teaching assistant/peer about the assignment, (b) the student did not direct visual attention to anything other than the task for more than five seconds at a time, and (c) the student remained in the designated area.

Disruptive behavior (DB) has previously been determined as any behavior that prevents students from attending to the task appropriately (Bruhn & Watt, 2012; Bruhn et al., 2017). Examples of DB include speaking out of turn, using materials incorrectly, not complying with assignment directions, and leaving the assigned area.

Independent Variable: CellF-Monitoring. The CellF-Monitoring application was an application that was compatible on iOS devices (i.e. iPhone, iPad, and an iPad touch) (Schardt, Miller, & Bedesem, 2018). Intervals were interchangeable and could be changed to cater to independent work time and the frequency of disruptive behavior in each general education class. At the conclusion

of each interval, there was an audio and visual cue that prompted the student participant to answer the question, "Are you on-task?" by choosing either 'yes or no' on the iPad. Overall percentage of on-task behavior could be tracked at the conclusion of each session.

Interobserver agreement (IOA) and reliability. Prior to data collection on academic engagement, a graduate student received a one-hour reliability training. Data collection procedures were explained specifically. The lead researcher trained the graduate student to identify academic engagement and disruptive behavior. There was a practice session to which 90% or greater for two consecutive sessions was achieved to be considered reliable. The interval-by-interval method was used to calculate IOA using the formula:

Agreement/Agreement + Disagreement.

Percentage agreement was attained between the two examiners (Vannest et al., 2013). IOA was calculated in at least 20% of all sessions across phases (i.e. baseline and intervention phase) for all student participants. IOA for Alisa ranged from 90% to 100%. The overall IOA was 98%.

Fidelity. Treatment integrity was defined as the degree to which that the intervention is carried out as expected (Cooper, Heron, and Heward, 2007). The intervention could be interpreted incorrectly without fidelity. The fidelity of the intervention was directly observed during all of the intervention sessions. The intervention did not appear distracting to students, teachers, or peers. Prior to the intervention condition, the baseline phase remained consistent with normal classroom routines and procedures. The treatment acceptability and

unobtrusiveness of the intervention was also assessed.

Social Validity. Social Validity measured to what extent the intervention was accepted as determined by the participants, which was derived from the behavior analysts' field (Foster & Mash, 1999). The School Intervention Rating Form (SIRF; Kern & Gresham, 2002) was adapted for a teacher and student measurement (see Appendix A & B). The SIRF will provided a comprehensive understanding of the likability and helpfulness of the self-monitoring intervention as determined by the participants (SIRF; Kern & Gresham, 2002).

This rating scale consisted of a 7-point Likert type scale used to collect social validity of the intervention. Scores ranged from 7-77 with the higher scores indicating high social validity. There were two open-ended questions included: (a) What changes have you noticed in your student's classroom performance (b) What were some of the barriers of the intervention (SIRF; Kern & Gresham, 2002). Following the final intervention setting, teachers and students completed the SIRF and social validity was estimated.

Single Case Design and Data Analysis

Single-case design (SCD) was defined as the study of one or more individuals (Vannest, Davis, & Parker, 2013) that is used to understand change within an individual rather than comparing the individual to a control group (Parker, Vannest, & Brown, 2009). There was a baseline phase and intervention phase, which are used to compare behavior within the two phases (Parker, Vannest, & Brown, 2009). For this particular study, SCD methodology was employed to interpret the causal relationship between self-monitoring and academic productivity

in a student with ADHD.

Multiple-baseline Design. A multiple-baseline design was conducted using a baseline condition, training session and an intervention condition within three general education classes. The effects of self- monitoring was investigated across three settings.

In order to determine the existence of a functional relationship between the CellF-Monitoring iPad application and academic engagement, a multiple-baseline design across three general education settings was employed. Results indicated the effectiveness of implementing the intervention across general education settings in a student with ADHD. A baseline, training, and intervention setting was used where the phases were determined by stability and What Works Clearinghouse (Kratochwill et al., 2010).

TauU. Visual analysis was the primary method for understanding the effectiveness of the technology- based self-monitoring intervention suggested by the level, trend, stability and immediacy of the effect TauU was calculated between the baseline and intervention session for each of the three settings and then combined to correct for positive baseline trend to ensure that the intervention was the reason for an increase in baseline data. Calculations were completed using the online TauU calculator (Vannest, Parker, & Gonen, 2011. All three effect sizes were combined using the two weighted feature in the TauU calculator.

Standards

The WWC, CEC, and Visual Analysis standards were considered and met when designing and implementing the intervention of this study. The standards and

justification for meeting each standard were explained below:

WWC. The standards will have been deemed met if the minimum requirement is attained. (a) The standard was met as determined by the manipulation of the intervention. The researcher determined when theintervention took place in the general education classes as determined by the data points collected; (b) The second standard was considered met because of the interrater component and having achieved at least 20% of co-observed sessions during each phase of this study; (c) Multiple baseline design studies were required to take place in different settings. This standard was met due to the setting being a math, writing, and reading class; (d) Five data points were required to be attained for this standard to be met. This standard was considered met because five data points were surpassed in each phase of the present study; (e) The trend was moving in a therapeutic direction as determined by the last data point in the baseline phase and the first data point in the intervention phase indicating an immediate effect; (f) The researcher demonstrated multiple opportunities for a functional relationship because of the study taking place across three general education settings; (g) The next standard required the researcher to describe the components of the study in detail which was done throughout the paper (e.g. multiple baseline design across general education settings); (h) To meet the next standard the effect size is presented in the results section which is a strong effect as determined by TauU.

CEC. The Council for Exceptional Children created standards to ensure that single case design studies are methodically sound. The standards were considered met if each requirement was met at a minimum. (a) Context and Setting: This standard required a description on the program, geographic location,

and physical classroom layout etc. These topics were explained specifically in the methods section of the study; (b) Participants: The participants were described specifically and the researcher ensured that the participant was receiving services under OHI-ADD/ADHD clarified by IEP paperwork; (c) Intervention agent: The intervention agent was the researcher meaning the researcher implemented the intervention; however, the teachers and students were trained in intervention implementation; (d) Description of Practice: This standard was met as it was described specifically in the procedure section of the study. The student participant was prompted every five minutes to answer the question "Are you on task?"; (e) Implementation fidelity: The researcher observed each session to ensure that the intervention was implemented with fidelity. Additionally, the research did not observe the intervention being distracting to peers or the teacher; (f) Interval Validity: The researcher remained in control of the intervention sessions, and each phase of the study lasted the appropriate amount of time. Additionally, the required number of data points were collected in each phase, indicating that this indicator was met; (g) Outcome Measures Dependent Variables: IOA was met greater than the minimum of 20% of each phase; the effects of the intervention was reported; (h) Data Analysis: visual analysis indicating trend, level, and data overlap etc. as well as the effect size were reported as strong using TauU.

Visual Analysis Standards. Each standard must have met the minimum requirement to be considered met. The six standards and justification of meeting each standard were listed below (a) Level: The levels of the visual analysis were

comparable across the baseline and intervention phases for the three subjects; (b) Trend: As indicated by the last data point in the baseline phase and the first data point in the intervention phase the trend was moving in a therapeutic direction, meeting this standard; (c) Variability: There was little variability meeting this standard as well as the observation of the participant's performance and the prediction occurring over time; (d) Overlap: There was little overlap between phases indicating that there was a functional relationship present; (e) Consistency: There was a consistency with the data points during the intervention phase within the different classes revealing the existence of a causal relationship; (f) Immediacy of the effect: The last data point in the baseline phase and the first data point in the intervention phase suggested that the effect of the intervention is immediate.

Procedure

The Institutional Review Board at The University of Mississippi provided approval and oversight of the study (Protocol #19x-30). The researcher discussed the research study with the building principal to gain permission. Upon approval, the researcher explained the targeted population and goals for the study. The principal identified a general education teacher who had students with attentional deficits in her classroom to take part in the study.

Recruitment. The teacher nominated a student who is OHI - ADHD and had behavioral difficulties in the educational environment. Parental approval was attained in order to disclose eligibility information to the researcher. A consent form was sent home to which the parents will provided informed consent to allow their child to participate in the study. Additionally, the researcher explained the

expectations of the study to the students to get assent. The students had the opportunity to ask any further questions before beginning the study. The case manager provided the researcher with IEP documentation to ensure that the student participant was receiving special education services under OHI – ADHD.

Baseline. Baseline conditions involved typical classroom routines during the participant's math, reading, and writing general education classes. The inclusive classroom included students who had various needs including academic, social, and behavioral disabilities. Classes lasted approximately 50 minutes with varying instructional requirements. The dependent variables, AE and DB were recorded through direct observation and the CellF-Monitoring application.

The three general education classes were arranged in row formation and seating was pre-determined by the general education teacher. Each class was parallel in terms of rules and procedures to keep them consistent among subject areas. The two general education teachers used Class Dojo as a behavior management system for *all* students. The class periods started with outlining an agenda of the day's activities. Each day included a variety of instructional activities: center work, independent work, and whole group instruction.

Intervention. Prior to the intervention phase there was a training phase that consisted of modeling and practicing using the iPad. On-task and off-task behaviors were modeled and discussed. There was a practice session, and once the students had an opportunity to ask questions the intervention was implemented the following day. Upon completion of the training session, the intervention session

took place. The technology- based self-monitoring intervention were implemented once the students exhibited proficiency using the CellF-Monitoring application. The intervention phase was parallel to the baseline condition in terms of the rules and procedures in the participant's math, reading, and writing classes. The only change during the intervention phase was the implementation of the self-monitoring intervention through the use of the CellF-Monitoring application. The intervention phase was staggered in the general education classes. The intervention phase lasted at least five sessions. As in the baseline condition the participant's AE and DB were analyzed and scored.

Data Collection

Interval recording was used through direct observations during independent practice. The interval recording was dependent on the frequency of disruptive behaviors. The CellF-Monitoring application was used to determine the frequency of disruptive behaviors according to previous literature. The lead researcher trained a research assistant in data collection procedures to meet the requirements of IOA. The research assistant's training first consisted of discussing the definitions of on-task and off-task behavior. Then, the two raters had iPads with the CellF-Monitoring application downloaded on them and watched videos selecting on-task or off- task behavior on the application using partial interval recording to get reliability. The instances that the two raters disagreed on the behavior were identified and discussed.

Visual Analysis

To determine if the disruptive behavior (dependent variable) changed in a

significant way with the use of the independent variable CellF-Monitoring, a visual analysis was displayed to determine the immediacy of the effect, trend, and stability (Bruhn et al., 2017). Each phase will consisted of three data points to illustrate a trend.

RESULTS

Social Validity Measure

At the conclusion of the last intervention session**,** both the classroom teachers and the student participant completed The School Intervention Rating Form (SIRF; Kern & Gresham, 2002). The teacher's scores indicated high social validity, and they found the intervention to be helpful and relatively easy to implement in classes. The teacher's summed scores were 56/77 meaning that the teachers viewed the intervention favorably. Accompanying the quantitative scores, the open-ended questions were indicative of a noticed increase in academic productivity. Additionally, teachers noted that this participant was sincerely reflective of her work. Conclusively, both teachers found the intervention to be helpful in their classrooms due to an increase in academic productivity and academic engagement.

The participating student completed the student version of The School Intervention Rating Form (SIRF; Kern & Gresham, 2002). The SIRF determined that the participant understood the intervention and that the intervention was easy to implement in general education classes. However, the student participant noted that the beeps were annoying if she was reading a good book. Additionally, the participant noted in the open-ended questions that the intervention helped her do better in her classes.

On-Task Behavior

Results indicated statistically significant differences between the baseline and interventions for Alisa with a strong combined effect of TauU .96 [$CI_{90\%}$ [.69, .1.00]) (p = .00). The range of on-task behavior in baseline was 0% to 90% with a mean of 38%. The range of interventions was 40% to 100% with a mean of 90%. In math, during baseline the range of Alisa's on-task percentage was 0% to 50% with a mean of 19% and during the Self-Monitoring intervention was 40% to 100% with a mean of 83%; researchers found that on-task behavior in math increased with a large effect of .98 [$CI_{90\%}$ .52, 1.00] (p = .00). In writing, the range of on-task behavior during baseline was 0% to 90% with a mean of 40% and during the self-monitoring intervention was 60% to 100% with a mean of 94%; on-task behavior increased with a large effect .92 [$CI_{90\%}$ .44, 1.00] (p = .00). In reading, the range of on-task behavior during baseline 10% to 80% with a mean of 48%, and during the intervention the mean was 100% indicating that on-task behavior in reading increased with a large effect 1.00 [$CI_{90\%}$ .51, 1.00] (p = .00). Visual analysis of the MBD graph for Alisa shows a functional relationship by assessing trend, level, immediacy of effect, variability, consistency, and overlap (see Figure 1).

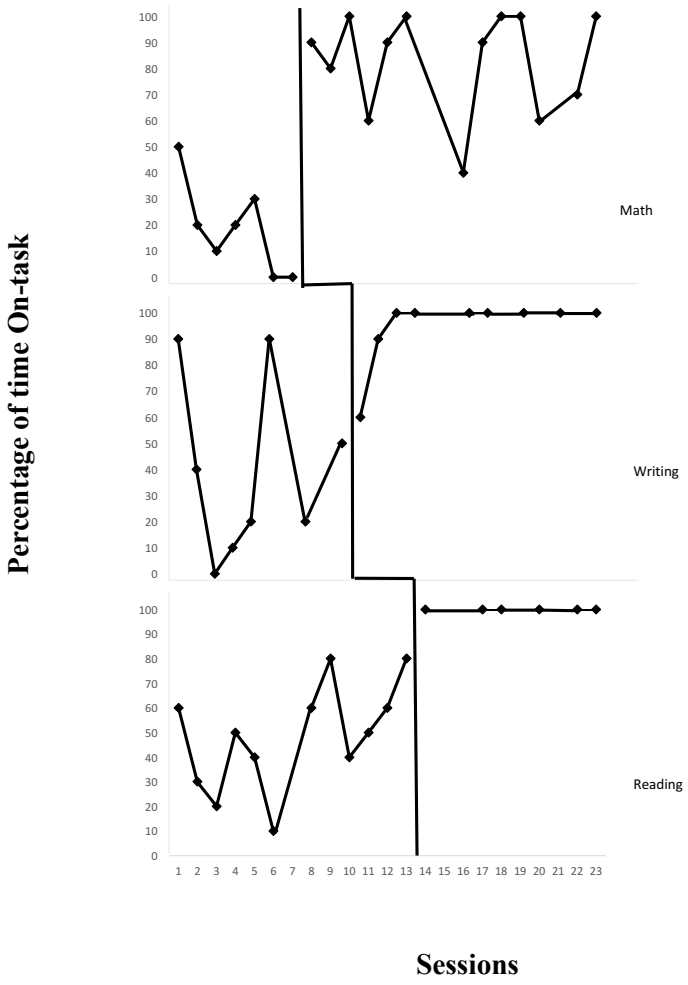

Figure 3. Alisa On-task Behavior

Baseline (mean)	Intervention (mean)
19%	83%
40%	94%
48%	100%

Visual Analysis. As determined by the mean, slope, and range, Alisa exhibited an increase in level, trend, and variability from the baseline to intervention phase. There is also an immediate effect determined by the last data points in the baseline phase and the first data points in the intervention phase. Additionally, there is significant overlap between phases as well as consistency of data points indicating the presence of a functional relationship.

Academic Accuracy

Academic Accuracy results determined differences between baseline and intervention phases for Alisa with a small combined effect of TauU .44 [$CI_{90\%}$.22, 1.00] (p = .27). Alisa's overall academic accuracy increased in her core general education classes (e.g. math, writing, and reading). In math, during baseline the range of academic accuracy was 70% to 100% with a mean of 86%, and during the math intervention the range was 62% to 100% with a mean of 86%. Researchers found that academic accuracy in math increased with a small effect .02 [$CI_{90\%}$.49, .52] (p = .96). In writing, during the baseline the range of Alisa's academic accuracy was 78% to 89% with a mean of 83% and during the self-monitoring intervention 93%. Researchers found the academic accuracy in writing increased with a large effect 1.00 [$CI_{90\%}$.34, .1.00] (p = .22). During the baseline in reading, the range was 74% to 84% with a mean of 79% and 95% during the implementation of the self- monitoring intervention. Researchers determined that reading increased with a large effect 1.00 [$CI_{90\%}$.34,
.1.00] (p = .22). The visual analysis of the MBD for Alisa's academic accuracy is displayed below (see Figure 2).

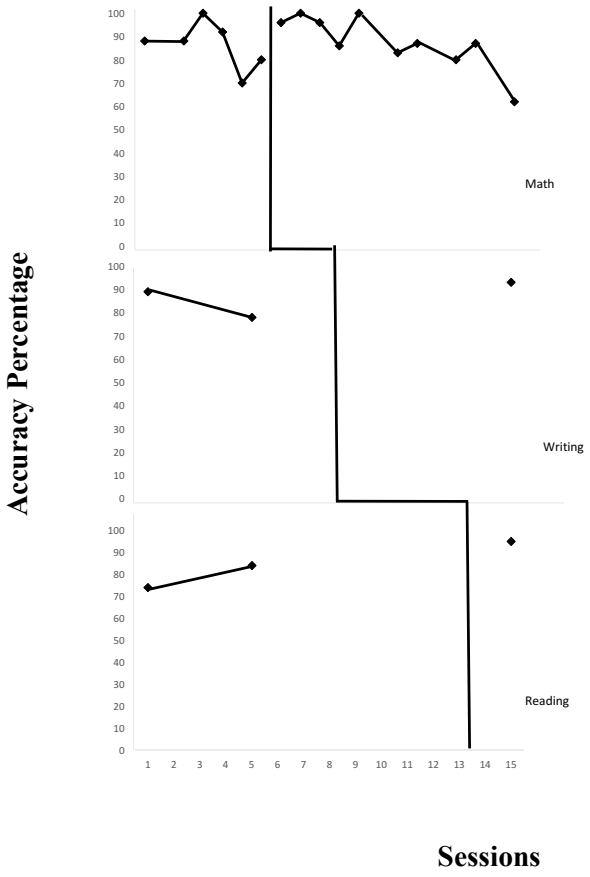

Figure 4. Alisa Academic Accuracy

Baseline (mean)	Intervention (mean)
86% (n = 6)	86% (n = 10)
83% (n = 2)	93% (n = 1)
79% (n = 2)	95% (n = 1)

Visual Analysis. There was a very small increase in level, trend, and variability indicated by the mean, slope, and range. There were very few grades taken in reading and writing making it hard to determine the immediacy of the effect, overlap, and consistency between the baseline and intervention phases. Alisa's academic accuracy increased a very small amount between phases.

DISCUSSION

This study examined the effect of the iPad application CellF-Monitoring on an elementary student with ADHD across three general education settings. Several findings are worthy of discussion. The overall large effect for on-task behavior was calculated by TauU .96 [$CI_{90\%}$ [.69, .1.00]) (p = .00). There was a significant difference in Alisa's on-task behavior in the baseline and intervention phases and this can be attributed to the CellF-Monitoring iPad application. Similar findings have occurred in self-monitoring research in that this intervention has reduced disruptive behavior, and in turn increased academic productivity for students of all ages and disabilities (Bruhn & Watt, 2012; Bedesem & Dieker, 2014; Graham-Day et al., 2010; Gulchak; 2008; Schardt, 2018; Vogelgesang et al., 2016; Wills & Mason, 2014).

This study investigated the participating teachers and student's perception of the intervention through a social validity measure, The School Intervention Rating Form [SIRF] (Kern, & Gresham, 2002–2007).

Teachers indicated that the CellF-monitoring intervention was acceptable and easy to implement in the core classes. There were no observable times that the

intervention appeared distracting to other students or teachers in the classroom. Additionally, the intervention was understood by both parties. The student did reveal that the beeping from the iPad application was annoying when reading a good book, however self-monitoring helped her do better in her classes. She also noted that using this iPad app even helped her with honesty in that she had to select yes or no for being on-task. Students with ADHD received services in the general education environment for majority of the day, increasing the need for students to exhibit on-task behavior which was crucial to academic achievement (Harris, Friedlander, Saddler, Frizelle, & Graham, 2005; Otero & Haut, 2015). Remaining productive during independent seat work tasks was necessary due to the fact that independent work accounts for 30% of the school day within general education classrooms. During the baseline phase, Alisa experienced high levels of off-task behavior. When assigned independent seat work, she would often play with her pencil pouch, look around the room, or lay sideways in her desk. There were several days that Alisa was not on-task any of during the fifty- minute academic blocks. In math, the 0% of on-task behavior accounted for being assigned independent seat work for the entire fifty-minutes, whether that was Accelerated Math on the Google Chromebook or a math worksheet. In reading and writing, Alisa worked well when completing a preferred activity that included reading or a writing activity that included research using the Google Chromebook. However, when assigned multiple assignments in both reading and writing Alisa become overwhelmed especially on test days usually occurring on Fridays. During the intervention phase, Alisa displayed higher rates of on-task behavior especially in

reading and writing. Alisa's on-task behavior fell to 40% in math after being absent on the previous Friday; whereas, in reading and writing her on-task percentage did not fall below 60% during interventions.

As indicated by the visual analysis, there was an increase in on-task behavior determined by the immediacy of effect and an increase in level, trend, and variability. Additionally, there was substantial overlap and consistency which denoted the presence of a causal relationship.

Alisa was on grade level academically; however, she could become overwhelmed when presented with a large amount of independent work. She would shut down by putting her head down and by crying. Her academic accuracy increased slightly from the baseline to intervention phase. When Alisa would become overwhelmed and shut down, she would be asked to stay in during recess and non-academic periods to complete missing assignments. Conclusively, Alisa was capable of completing grade level assignments; however, this varied if she was out of her normal routine or if she was overwhelmed. This study provided similar findings to previous self-monitoring research (Gulchak; 2008; Schardt et al., 2018; Vogelgesang, 2016; Wills & Mason 2014). The present study extended the research base in the following ways: first, an accuracy count was attained following each assignment; second, the setting of this study was fourth grade general education classes - a rarity for self-monitoring research; third, reinforcement was not included in any phase of this study; and finally an iOS iPad application was the self-monitoring method used.

Limitations

This study suggested that self-monitoring using the iPad application CellF-Monitoring across general education settings increased on-task behavior in a student with ADHD. The findings of this study were similar to previous findings involving self-monitoring, indicating an increase in time on-task for a fourth-grade student with ADHD. This study was not without limitations. First, the sample was small and cannot be assumed that this self-monitoring method would be effective for all students with ADHD. Next, the intervention was implemented inconsistently due to absences (n = 2) and scheduling conflicts. Third, generalization or maintenance phases were not included to determine the lasting effects of the intervention. Fourth, this application was not yet understood completely, so it was undecided whether or not the CellF-monitoring intervention provided advantages of technology-based self-monitoring in comparison to paper-based self- monitoring.

Future Research

Technology-based self-monitoring was in its early stages, and continued investigation in special education and general education settings was badly needed in order to investigate the critical components of self-monitoring research. Future research should continue to explore technology-based self-monitoring as a way to increase on-task behavior and decrease disruptive behavior. Additionally, future research should continue to include achievement measures within the study design (e.g. assignment completion and assignment grades). Although this study met the requirements of What Works Clearing House, researchers should consider

replication of this study in order to deem CellF-monitoring an evidence-based practice. Additionally, future research could include a generalization and maintenance phase in order to understand the lasting effects of the intervention. Due to a large number of students with ADHD in the general education environment to meet LRE, researchers should continue to conduct studies in this environment. Self-monitoring has proven effective in core classes indicating the need for future studies to extend into non-academic settings such as: physical education, art, and music.

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CHAPTER IV [ARTICLE 3]

MODIFYING STUDENT BEHAVIORS THROUGH THE USE OF TECHNOLOGY-BASED SELF- MONITORING INTERVENTIONS

As a first-year teacher Mrs. Stanford struggled daily with managing disruptive classroom behavior. Mrs. Stanford had a student named David in her sixth-grade general education English class who received special education services for an emotional behavioral disability. He frequently displayed off-task and disruptive behavior; for example, David was often out of his seat, shooting paper balls into the trash can, putting his head down or going to sleep. There have been many failed attempts at providing behavior supports for David. Mrs. Stanford decided that the best way for David's behavior to improve was to teach him to take responsibility of his own behavior through a self-management system. She researched and thought that the best way for David to self-manage is by using an application on his cell phone.

Purpose Statement

The purpose of this article is to provide insight into how school districts and teachers can implement self-monitoring into their tier 1, 2, and 3 practices

to increase academic productivity and decreasedisruptive behaviors.

What is Self-Monitoring and How Technology can help?

Self-monitoring was developed as a self-management intervention that was commonly used in classrooms. Self-monitoring enabled students to observe their own behavior and determine if the target behavior took place, record its presence, and modify their own behavior (Cooper, Heron, & Heward, 2007; Hager, 2018). Students could be taught to self-monitor either academic or behavioral skills. Examples of behavior that could be used for self-monitoring were making positive statements to peers or staying in a designated area. Examples of an academic skills to self-monitor would be the number of days per week homework is turned in and completed or number of problems answered correctly on a timed math fact sheet. The table below illustrated the steps of the self-monitoring process.

Table 1 Steps to Implementing Self-Monitoring in Classrooms

Steps to adapting self-monitoring procedures	Implementation Considerations
Step 1:	Determine if your student has the prequisite skills needed to be able to self- monitor.

Step 2:	Define the target behavior.
Step 3:	Consider, what device and application your student use to self-monitor.
Step 4:	Consider an interval schedule for self-monitoring (e.g. 5 minutes).
Step 5:	Consider if your student would benefit from monitoring their behavior for the entire academic block or for a specific amount of time within the academic block.

Step 6:	Self-monitoring, itself, is effective, but in the beginning you may want to consider additional reinforcement and feedback when the student is meeting goals accurately and following classroom procedures.
Step 7:	Finally, allow time for the student to demonstrate and practice the procedures in authentic settings before implementation.

Educators were increasingly integrating technology practices into classrooms daily. Educators were required to make data-based decisions and using technology available on iOS and Android applications provided a means of data collection. Technology data collection in the form of self-monitoring has been used in the medical field (e.g. C25K, Fitbit, Lose It!, My Fitness Pal, and Headspace) to help individuals monitor caloric intake, heart rate, or amount of steps taken each day. This has improved habit change resulting in positive results for patients

(Vogelgesang, Bruhn, Coghill-Behrends, Kern, & Troughton, 2016). Such outcomes have occurred in the medical field indicating that similar situations can take place in classrooms (Vogelgesang et al., 2016). Self-monitoring using technology has many advantages with the first being simplifying data collection.

There are self-monitoring applications that are commercially available and ready to use. However, several considerations have been taken into account including: device availability, data storage, and cost.

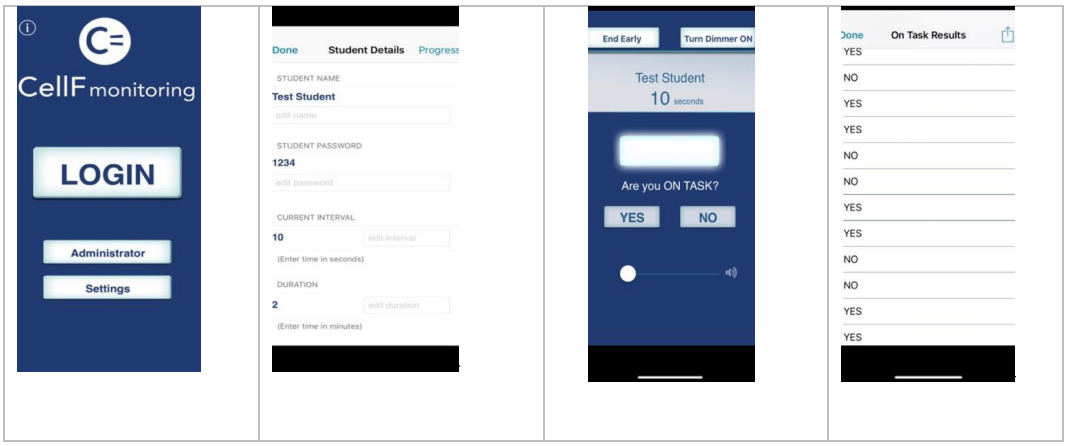
Table 2 Commercially Available Self-Monitoring Applications

App	General Information	Potential Barriers
CellF- Monitor (Free)	• Can be used by students or teachers using the administration feature or student login • Capability of changing intervals • Can be used on all iOS compatible devices • Vibrates and flashes to notify students to self- monitor • User friendly and can be used across general education settings • Can view whether the student was on-task at various intervals	• Incapable of inputting other behaviors to be monitored. Have to monitor on-task. • Teacher must calculate on-task percentage.

CellF-Monitor 2 (Free)	• Can be used by students and teachers because of the administrative setting or student login • Includes a visual unlike the CellF-Monitor version • User friendly and can be used in various academic settings	• Cannot view the intervals at the conclusion of a session.
SCORE IT ($5.99)	• Can be used in Read 180, System 44, or iRead classrooms • Students and teachers rate behavior after each instructional activity. • Behaviors are interchangeable. • Multiple behaviors are able to be monitored at the same time. • Provides easy to read graphs to monitor behavior progress.	• SCORE IT can only be used in Read 180, System 44, and iRead classrooms that have various instructional activities. • Intervals are 10 minutes and cannot be changed.

Self- Monitor: Habit Changer (Free)	• Behaviors can be adjusted for different students. • The interval periods are interchangeable. • User friendly • Provides a visual timer • Provides a behavior mastery percentage at the conclusion of each session.	• Students can only monitor one task at a time. • The app must remain open for alerts; closing out of the application will pause self-monitoring.

Figure 5. CellF-Monitoring Application Screenshots



CellF-Monitoring application. Research indicated that students with behavior disabilities (e.g. ADHD and EBD) benefited from taking responsibility of their behavior (Vogelgesang et al., 2016). The CellF- Monitoring application had the capability of assisting students in becoming self-aware of their academic and behavior goals. This app was free of charge in the App Store (Figure 3). This application was available on any iOS device; for example, iPad, iPod touch, and iPhone. Intervals were self-determined, which catered to the student and the

frequency of the disruptive behavior. Results could be emailed to teachers or stored in the device for teachers to collect results at the end of each self-monitoring session.

Figure 6. CellF-Monitoring 2 Application

CellF-Monitoring 2 Application. Similar to the CellF-Monitoring application, this app allowed students to monitor their academic and behavior goals. This application had a reward based visual graph for the student to view during the self-monitoring sessions; for instance, if the student's on-task behavior was below 90% the visual bar w change to yellow or if the student was below 70% the on-task bar would change to red. This app required a login and password for results to be sent to the participating teacher. Multiple students could be logged in on different devices using this application to self-monitor and connected to the teacher's account. The program generated a graph to show the student's results of the last three self-monitoring sessions. Additionally, there was a toolbar that

changes colors based on ‘yes or no’ responses. This provided feedback to the student as they self-monitored. A limitation of this application was that it will only save one session per student daily.

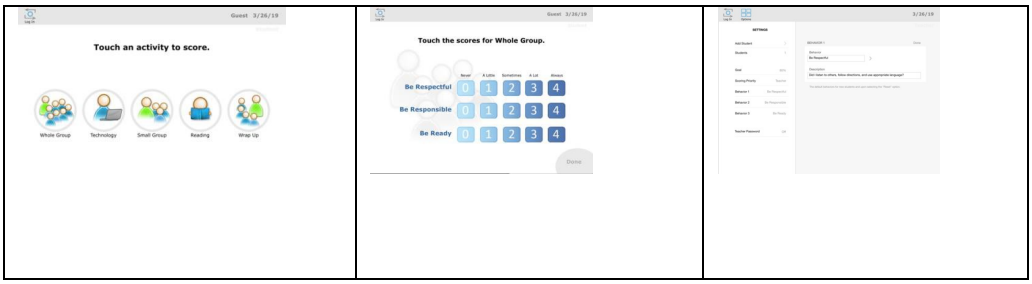


Figure 7. SCORE IT Application

SCORE IT Application. The SCORE IT application was compatible on all iOS devices and was specifically designed for Read 180, System 44, and iRead programs. This app has been proven effective for increasing time on-task for elementary and middle school students in structured settings (Bruhn et al., 2015; Vogelgesang et al., 2016). Students as well as teachers were able to rate their behavior as well as teachers can rate student’s behavior using the same scale with comparison capability between raters. Students and teachers could collaboratively set behavior goals to track progress and generate graph to illustrate the results.

Figure 8. Self-Monitor: Habit Changer

Self-Monitor: Habit Changer. This application was free and commercially available in the App Store and in the Google Play store for Android devices. This application was user friendly in that the application was easy for users to navigate. Students were able to focus on and master one behavior before moving to another. Interval lengths were adjustable to cater to the needs of the students. Nine students could be entered in the app with up to five different behaviors measured per student. The app provided calculated percentages at the conclusion of each session that showed the percentage that the student has mastered the specific behavior (i.e. completing assignments). There was also a line graph included as a visual toward behavior mastery.

Self-Monitoring Technology Data Collection as part of the Multi-tiered System of Supports

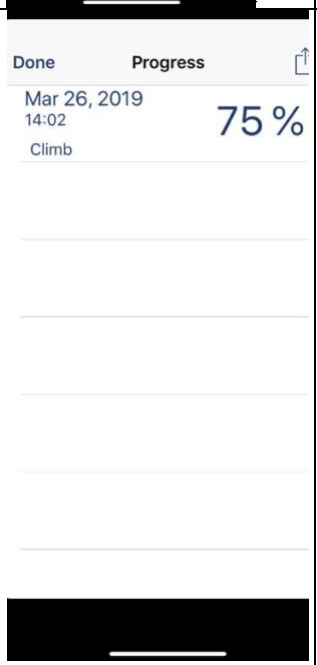
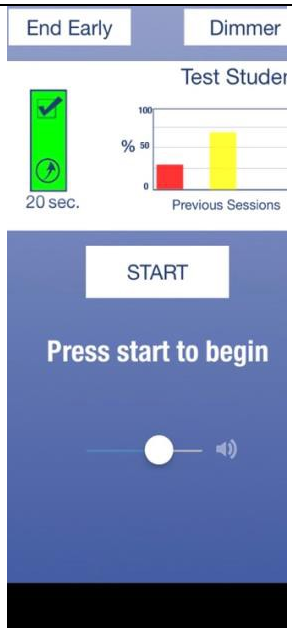
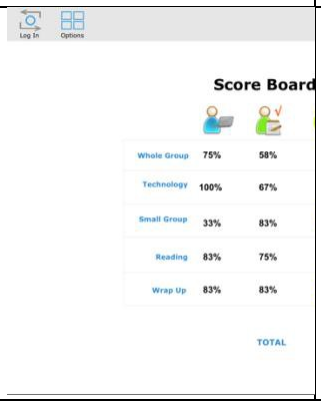
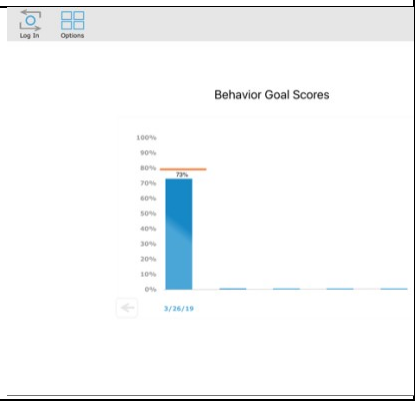
The Multi-Tiered Systems of Support had many key components. The first component was data-based decision making, universal screening, continuous progress monitoring, and implementation fidelity. Implementation fidelity referred to the degree to which an intervention was carried out. Districts organized support teams to ensure treatment fidelity as well as to discuss and make data-based decisions. Second, MTSS involved evidence-based practice which referred to practices that have been replicated and have a causal relationship that have been demonstrated with adequate effect sizes. Additionally, MTSS focused on maximizing academic and behavioral success for all students. The data-driven

decisions were based upon student performance or the decision to move students to more intense individualized support. Collecting behavioral data could have been problematic; however, technology could have minimized problems with behavioral data collection (Freeman, Sugai, Simonsen, & Everett, 2017).

Data collection was an essential part of the Multi-tiered Systems of Support, and technology could provide a way to simplify data collection. The use of technology was an instrument for data collection and analysis for continuous progress monitoring. Data reports were instantly available through the applications mentioned previously, and the teacher's time was protected from completing additional data reports. On the CellF-Monitoring application there was a screen showing what the student selected (e.g. yes or no) at the conclusion of each session; teachers could calculate the on-task percentage based on the intervals. The CellF-Monitoring 2 application provided a percentage at the conclusion of each session as well as a graph showing the previous session scores. SCORE IT provided scores from the student and teacher as well as a graph showing where students were in meeting behavior goals. Similar to the CellF-Monitoring applications, the Self-Monitor: Habit Changer application provided teachers a percentage following each self-monitoring session and included a simple line graph to see student progress.

Figure 9. Progress Monitoring Screenshots

Application	Data Reports	Graphs/Visuals Within the Application

CellF- Monitoring		NA
CellF- Monitoring 2		
SCORE IT		

Self- Monitor: Habit Changer		NA

SUMMARY

There were many self-monitoring applications that were available for students to monitor their behavior and academic goals, but teachers must have taken several considerations into account. First, teachers should have considered how they will teach students to self-monitor. Next, teachers should have considered what device was available, and third what app fits the desired setting. Fourth, the storage on the device and cost of the device and application should also have been taken into consideration. Within the general education environment, the need for support was increasingly significant for students with disabilities, which indicated the need for teachers to know and understand strategies that were quick, easy to implement and that minimized data collection time. Technology-based self-monitoring provided teachers a way of collecting data and ongoing progress monitoring. However, it was crucial that teachers explicitly teach students how to self-monitor using apps to ensure success.

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CHAPTER V FINAL THOUGHTS

The purpose of this dissertation was to present evidence of the effectiveness of self-monitoring across general education settings. The two single case design studies evaluated social validity and on-task behavior, and also considered academic accuracy in two students with behavior disorders. One student participant was diagnosed with an Emotional Behavioral Disability (EBD) and the other student is diagnosed with Attention Deficit Hyperactivity Disorder (ADHD). Participating teachers and students found the intervention useful and appropriate in classroom settings. The self-monitoring intervention was viewed favorably. Results from the visual analysis and statistical analysis indicated that self-monitoring using technology was an effective intervention in general education classrooms when attempting to increase academic productivity in students with EBD or ADHD. Statistical analysis through TauU indicated statistically significant results for improving on-task behaviors. Academic accuracy took longer to see improvements; however, there was a slight increase in academic accuracy in both student participants.

The third article, Chapter IV, provided teachers with several applications that could be used for students to self-monitor both academics and behaviors. Apps had the potential to keep students engaged while promoting independent and responsible behaviors. The technology apps allowed teachers and schools to

address multiple behaviors with one efficient intervention.

Appendices

APPENDIX A

Self-Management Intervention Rating Form – Student Version

(Adapted from the School Intervention Rating Form Kern & Gresham (2002)

Please complete the following questionnaire. For each item, please check the number that best indicates your feelings about the selected intervention and the results of the intervention on your school performance.

	1 Not at all	2	3	4 Some what	5	6	7 Very Well
How well do you understand self-monitoring?							
How easy was self-monitoring for you to do?							
How much did you like to self- monitor?							
Were there things you did not like about the self-monitoring?							
Did self-monitoring help to improve how you do in school?							
Did anything about self-monitoring make you feel uncomfortable?							

Additional comments:

APPENDIX B

Self-Management Intervention Rating Form – Teacher Version

(Adapted from the School Intervention Rating Form Kern & Gresham (2002)

Please complete the following questionnaire. For each item, please bubble the number that best indicates your feelings about the intervention, self-monitoring. and the results of the intervention on your student(s) behavior. Please answer the open-ended questions at the end of this form in detail.

	1 Not at all	2	3	4 Some what	5	6	7 Very Well
How clear is your understanding of self-monitoring after having children use it in your classroom?							
How acceptable did you find this intervention to be regarding your concerns about your students?							
How willing were you to allow this student to use the intervention?							
Given your student's behavioral problems, how reasonable did you find the intervention?							

Were there disadvantages in implementing the intervention?							
How likely is the intervention to make permanent improvements in your student?							
How much time was needed to carry out this intervention?							
How effective was this intervention?							
How disruptive was it to the class for the student to use the intervention?							
How much did you like the procedures used in self-monitoring?							
How willing were you to modify your class routine for the student to carry out the intervention?							

What changes have you noticed in your student's classroom performance?

What were some of the barriers to implementation?

VITA

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