5-5-2020

A comparison of technology based and non-technology based self-monitoring systems towards increasing on-task behavior in students with disabilities

Cindy Steele May

A Comparison of Technology Based and Non-Technology Based Self-Monitoring Systems Towards Increasing On-Task Behavior in Students with Disabilities

Cindy Steele May

A thesis submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In Partial Fulfillment of the Requirements

for the degree of

Master of Education

Department of Education

May 2020

FACULTY COMMITTEE:

Committee Chair: Dr. Sara Snyder

Committee Members/Readers:

Amanda Wadsworth

Dr. Laura Desportes

Dr. Tiara Brown

Table of Contents

List of Figures iii

Abstract iv

I. Introduction 1

II. Literature Review 5
- Technology Based 6
- Non-Technology Based 8

III. Method 11
- Setting 12
- Materials 13
- Data 13
- Design 14
- Procedure 15

IV. Results 18
- Baseline 19
- Intervention 19

V. Discussion 22
- Research Questions 22
- Limitations 23
- Future Research 24

VI. Appendix A: Non-Technology Based Self-Monitoring Checklist 28
VII. Appendix B: Momentary Time Sampling Data Sheet 30
VIII. Appendix C: Technology Based Self-Monitoring Sample 31
IX. Appendix D: Student Questionnaire 32
X. Appendix E: Procedural Fidelity Checklist 33
XI. References 34

List of Figures

Figure 1: Momentary Time Sampling Data of Carley……... 21

Figure 2: Carley's Student Graph……..…….21

Figure 3: Momentary Time Sampling Data of Jasmine ……...…..22

Figure 4: Jasmine's Student Graph…….22

Abstract

The goal of this study is to provide educators, schools systems, behavior analysts and families with a study through single case experimentation to determine if a technology based self-monitoring system is more efficient in increasing on-task behavior for students than a non-technology based self-monitoring system. The researcher will utilize both technology based and non-technology based self-monitoring systems with three middle school students who have an educational eligibility of either autism or an emotional disability. The researcher will collect interobserver agreement with the students as they self-monitor to ensure that each student is utilizing self-monitoring correctly. Both self-monitoring systems will be implemented utilizing an alternating treatment design to help determine a clear pattern of improvement in on-task behavior. The results from this study will allow for a variety of companies and school systems to gain access to data that supports the need for technology in learning environments for students with special needs.

Keywords: Self-monitoring, interobserver agreement, alternating treatment design, technology

A Comparison of Technology Based and Non-Technology Based Self-Monitoring Systems Towards Increasing On-Task Behavior in Students with Disabilities

Introduction

Self-monitoring is the act of observing and regulating one's own behavior in a social or academic context. A person can self-monitor in a variety of ways, including: goal setting, self-evaluation, self-reinforcement, self-punishment, self-instruction and self-recording (Alberto & Troutman, 2017). Within this literature review there are a wide variety of self-monitoring techniques discussed. This give a picture of the importance of both technology-based and non-technology based self-monitoring systems according to individual characteristics and resources available. Self-monitoring is not limited to the classroom setting and it is not only reserved for individuals with disabilities. Self-monitoring can be used for workplace improvement, on-task behavior, specific target behavior replacement and for increased vigilance when an individual requires a systematic medical intervention. Most recently the world of self-monitoring has begun exploring the idea of efficiency while using technology as the catalyst tool for data collection (Bruhn, Vogelgesang, Fernando & Lugo, 2016). There are many different ways that cell-phones, tablets and computers can be used to increase the effectiveness of self-monitoring. This study will focus on both technology and non-technology-based interventions that have been proven effective tools to use when implementing self-monitoring.

Self-Monitoring

Self-monitoring is one of many self-management strategies that have been used, separately and in various combinations, to impact student's regulation of their own behavior. Self-monitoring requires that a student observe, record, and self-evaluate. (Sheehey, Wells & Rowe, 2017). It is

important for all people to learn how to identify and implement appropriate self-monitoring strategies that will aid in increasing the chosen target behavior so that students can maintain and make progress toward prerequisite goals (Ennis & Lane, 2018). Self-monitoring is also an evidence-based teaching strategy that is widely used in the classroom setting as 'best practice' (McDougall, Morrison & Awana, 2012). In addition, all types of students benefit from using self-monitoring techniques regardless of the presences of a disability. (McDougall, Morrison, & Awana, 2012). In order to teach student's how-to self-monitor, the procedure requires two steps:

1. Explicitly teach and model a target behavior.
2. Teach students how to use a selected self-monitoring tool to reflect on their own behaviors or goals (Alberto & Troutman, 2017).

These steps outline appropriately implemented self-monitoring systems regardless of the technological makeup of the system. Data is collected over time to examine the students progress toward their goal. The detailed data is then graphed and used in order to make decisions toward the adjustment of goals, reinforcement schedules and the self-monitoring system that has been in place.

Students with Emotional Disabilities

Emotional Disability is a term that is used to identify an individual with an emotional disturbance or disability and behavioral disorder (Virginia Department of Education, 2019). According to the Virginia Department of Education both federal and state regulations define an emotional disability as an individual's inability to learn which cannot be explained by intellectual, sensory or health factors. The individual also exhibits an inability to maintain

meaningful interpersonal relationships with both peers and teachers and may display inappropriate behavior or feelings under ‘normal’ circumstances (Virginia Department of Education, 2019). An individual with an emotional disability may present with a general mood of depression or unhappiness and they have a tendency to develop physical symptoms of fears associated with problems both at home and at school (Virginia Department of Education, 2019). Students who experience serious emotional, behavioral or intellectual challenges in classroom environments are often the focus of interventions designed to enhance their classroom performance (Dunlap, Clarke, Jackson, Wright, Ramos & Brinson, 1995). To address the behavioral or intellectual challenges of students with emotional disabilities, teachers and specialists implement various behavioral interventions including: choice making, skills training, self-monitoring and extinction (Sutherland, Wehby & Copeland, 2000).

On-Task Behavior

On-Task Behavior in the classroom is vital to student achievement (Karweit & Slavin, 1982). On-task behavior is operationally defined dependent on setting, but it typically involves completing a task while following directions or completing an action, in this case that has been requested by a teacher in a classroom (Karweit & Slavin, 1982). An example of this might be that a teacher asks a class to complete a 10 min Math assignment, the on-task behavior would then be students completing the Math assignment within the 10 min time period. Students with emotional disabilities often exhibit various inappropriate classroom behaviors that present obstacles to their social and academic development, including off-task behavior (Sutherland, Wehby & Copeland, 2000). Research has shown that educators find interventions that takes less time to be more desirable and there is a considerable amount of research that suggests that self-

monitoring meets that criteria when used to increase on-task behavior (Sutherland, Wehby & Copeland, 2000). Technology and non-technology based self-monitoring systems may be utilized to increase on-task behavior. Both methods have been discussed within this study.

Statement of the Problem

Self-monitoring is an evidence-based practice that has been studied from the 1960s to present day (Alberto & Troutman, 2017). There is a considerable amount of data to be discussed in this literature review that suggests that self-monitoring is a beneficial tool for students both with and without disabilities in increasing on-task behavior. (Schardt, Faith, Miller & Bedesem, 2019) As technology develops, the creation of electronic based self-monitoring systems has followed suit (Schardt, Faith, Miller & Bedesem, 2019). However, the problem is that these systems are often pricy and can be broken easily while in use. In addition, in their review of 62 single-case, peer reviewed articles using self-monitoring interventions with cueing components, Mason and Davis (2013) found that self-monitoring interventions have not kept up with technological availability (Wills & Mason, 2014). Furthermore, there is limited research that can be found when comparing and contrasting the strengths and weaknesses of technology based and non-technology based self-monitoring systems. Therefore, there is limited evidence that can be used to advocate for appropriate budgeting when preparing individualized self-monitoring systems for students in the public-school system. This study is designed to advance the use of self-monitoring systems in the educational setting.

Purpose of the Study

The purpose of this study is to compare the efficiency of technology based self-monitoring systems with non-technology based self-monitoring systems toward increasing on-task behavior in students with various disabilities that are served in the public-school system.

As discussed, all types of students benefit from using self-monitoring techniques regardless of the presences of a disability. This study will compare the effectiveness of the presentation of different types of evidence-based, self-monitoring systems. Specifically, this study seeks to examine the following questions:

- Do participants display increased time on-task in the classroom setting when utilizing technology based self-monitoring systems as compared to non-technology based self-monitoring systems?
- Do students prefer technology based or non-technology based self-monitoring systems as tools that are socially valid in increasing on-task behavior in the classroom?

Literature Review

For this study a total of six research articles were identified for inclusion in this literature review. Each article focused on implementing self-monitoring as a behavioral intervention across multiple settings with a wide variety of people. All articles were searched for on the ERIC Educational Database, PSYC Net and the Journal of Applied Behavior Analysis. These articles were supplied by James Madison University and Google Scholar. The database search yielded 283 studies that discussed on-task behavior with self-monitoring systems. When

narrowing the search for appropriate studies the researcher used the following key words and combination of words: self-monitoring, single case, technology based self-monitoring, non-technology based self-monitoring, on-task, multiple baseline design and alternating treatment design, reversal design. The search results were narrowed with terms including on-task, self-monitoring and technology based self-monitoring, six studies were directly relevant to this research study. Out of the six studies, three reported on technology based self-monitoring systems (Schardt, Faith, Miller, & Bedesem, 2019; McDougall, Morrison, & Awana, 2012; Sheehey, Wells, & Rowe, 2017) and the other three reported on non-technology based self-monitoring systems (Petscher & Bailey, 2006; Shimabukuro, Prater, Jenkins, Smith, & Smith, 1999; Peterson,Young, West, & Hill, 2006). All six studies utilized self-monitoring systems in order to increase on-task behavior. In addition, participants in each study had either a learning disability, autism, intellectual disabilities, developmental disability or an emotional disability.

Technology Based Self-Monitoring

Three of the six studies utilized technology based self-monitoring systems to increase on-task behavior. This purpose of the first study was to investigate the effects of a technology based self-monitoring intervention on elementary students' academic engagement during independent work time. This study was done in an urban elementary charter school with three general education teachers and four students between the ages of 8-10 years old who were identified through teacher nomination for having lower rates of on-task behaviors during independent work time. An ABC concurrent multiple baseline across participants design was used in this study (Schardt, Faith, Miller & Bedesem, 2019). A multiple-baseline design is a within-subject design

that uses two or more baselines in a coordinated way to allow control-treatment comparisons both within and across baselines (Johnston & Pennypacker, 2009).

The intervention included ipad minis with the 'CellF-Monitor' application. (Schardt, Faith, Miller & Bedesem, 2019) Students were prompted with a buzzing sound while the screen showed the question, "Are you on task?". Students were then asked to respond on the screen by pressing 'yes' or 'no'. The classroom teachers created a goal for each student. For example, participant one's goal was to be on-task for 80% of the time throughout the session. The students were given a reward once they met their goals. Overall, data indicated an increasing trend in on-task behavior when the Cell-F monitoring application was used for all four participants, though the fourth participant showed much more variability in his willingness to use the program. The study showed positive effects of the Cell-F Monitor application on academic engagement and on-task behavior (Schardt, Faith, Miller & Bedesem, 2019).

The purpose of the second technology based self-monitoring study was to determine the impact that a MotivAider had on students' productivity in academic settings (McDougall, Morrison & Awana, 2012). Participants were one 10th grade student with attention deficit hyperactivity disorder and a 7th grade student with an emotional disability. The study looked at one students' productivity in Algebra and one student in English. An AB Design was used. This type of design is simple because the 'A' sequence is the first condition and the 'B' sequence is the second condition (Johnston & Pennypacker, 2009).

The baseline conditions for both students were participating in class as usual without self-monitoring systems. The intervention phase was implemented and the MotivAider tool vibrated every 90 seconds . A MotivAider is a small self-monitoring device that repeatedly vibrates at the

end of a designated time. The students engaged in self-recording using a paper form to help determine if they were on-task. Overall, results of this study indicated experimental control because there was a significant increase in on-task behavior with the MotivAider. However, the strength of experimental control could be limited by the studies lack of replication of results (McDougall, Morrison & Awana, 2012).

The purpose of the third study was to use a single-subject reversal design to examine the use of tactile cued self-monitoring with self-graphing on the academic productivity of a student with Cerebral Palsy in math in an inclusive first-grade classroom (Wells & Rowe, 2017). The participant was given a worksheet with 15 numbered single-digit addition and subtraction problems and a MotivAider preset to 30-second intervals during a five-min session. At the end of the 30-s the device was deactivated and the participant drew a line under the last problem that he completed during the interval. Overall, the reversal was an A-B-A-B design. The data indicated an increase in math problems completed. However, the authors noted the possibility of a sequence effect in the second baseline (Sheehey, Wells & Rowe, 2017).

Non-Technology Based Self-Monitoring

There were three studies that utilized non-technology based self-monitoring systems to increase on-task behavior. The purpose of the first study was to examine the effects of prompting and self-monitoring with accuracy feedback within a token economy by instructional assistants in an elementary classroom for students with disabilities. (Petscher & Bailey, 2006) Instructional assistants served as the primary participants. Participants were three female instructional assistants with less than 1 year of experience working in their current positions. It

was mandatory that each participant work in a classroom that required behavior support. The treatment package included prompting and self-monitoring with accuracy feedback. It was introduced as a multiple baseline design across behaviors. Students were given tokens every half hour if they exhibited polite words and gestures, respecting classroom order or following directions. The researchers also assessed for interobserver agreement (IOA) of dependent variables and yielded an overall average of all dependent variables for all participants at 96%. Overall, tactile prompting and accuracy feedback improved token-economy implementation for all participants in this study (Petscher & Bailey, 2006).

The second study investigated the effects of self-monitoring on academic productivity and accuracy on the academic performance and on-task behavior of students with learning disabilities and ADD/ADHD (Shimabukuro, Prater, Jenkins, Smith & Smith, 1999). Three male students were taught to self-monitor and self-graph their academic performance for reading comprehension, mathematics and written expression. The data demonstrated stable responding and control of extraneous factors because there was an increase in productivity and accuracy with the implementation of the self-management system. Experimental control was strengthened through an increase in productivity across baselines, the comparison between the baselines makes the change even more evident (Shimabukuro, Prater, Jenkins, Smith & Smith, 1999).

The third and final article included in this literature review utilized a multiple probe research design. This study used self-monitoring, coupled with a student/teacher matching strategy, to improve the classroom social skills of five inner-city middle school students. (Peterson, Young, West & Hill, 2006). Overall, results indicated that self-monitoring and

student/teacher matching interventions led to increases in targeted appropraite social skills and decreases in off-task behaviors for all five students across all class periods (Peterson, Young, West & Hill, 2006). .

Research Gap

There is a considerable amount of data about self-monitoring discussed in this literature review that suggests that self-monitoring is a beneficial tool for students both with and without disabilities in increasing on-task behavior and independence with task completion. As technology develops, the creation of self-monitoring systems has followed suit. (Schardt, Faith, Miller & Bedesem, 2019) However, these systems are often pricey and can be broken easily while in use. For this reason, they are not widely used in public school systems (Wills & Mason, 2014). Furthermore, there is little research that can be found about comparing and contrasting the strengths and weaknesses of technology based and non-technology based self-monitoring systems because technology is a vast, ever-changing and relatively new tool in the world of Applied Behavior Analysis. This study hopes to add to other studies on self-monitoring systems and it hopes to connect technology based and non-technology-based systems to increase our knowledge about them in comparison to one-another.

Significance

The researcher hopes to determine if there is a significant increase in time on-task in the classroom setting when students use technology based self-monitoring systems in comparison to non-technology based self-monitoring systems. Through a single case, alternating treatment design the researcher will systematically implement each type of self-monitoring system to

determine the effects of increasing on-task behavior. This research is significant because there is little research that can be found when comparing the strengths and weaknesses of technology based and non-technology based self-monitoring systems. This means that there is not much evidence that can be used to advocate for appropriate budgeting when preparing individualized self-monitoring systems for students in the public-school system. This study hopes to create a bridge for technology designed to advance the use of self-monitoring systems in the educational setting.

Method

Participants and Selection Criteria

The target population for the study included school-aged students (ages 10-14) with an educational diagnosis of an emotional disability accessing the adapted curriculum. Both male and female students were considered for the research study as well as students of all ethnicities and socioeconomic statuses. Selection criteria for participation in the study included: (a) participating in the adapted curriculum, (b) having an IEP goal to increase on-task behavior, and (c) having educational eligibility of an emotional disability. Exclusion criteria for participation in the study included: (a) inability to utilize an iPad due to a physical disability (b) students without IEP goals targeted toward on-task behavior, (c) twenty or more absences from school prior to the start of the study. The researcher sent home consent forms to two eligible students in the school and obtained written consent from the parents and assent from both students prior to the intervention.

Carley was a twelve-year-old female middle school participant who had been served in a self-contained special education setting since the third grade. Carley met all selection criteria outlined above for participation in this study. As reported by her individualized education program (IEP), she participated in the adapted curriculum, she had an IEP goal to increase on-task behavior and Carley had an educational eligibility of an emotional disability. Carley's IEP also outlined an intellectual disability exhibited by a low average educational diagnostic score through the Woodcock-Johnson IV test.

Jasmine was a thirteen-year-old female participant who had received special education services in the self-contained setting since the age of four. Jasmine met all selection criteria outlined above for participation in this study as reported by her individualized education program (IEP). She was serviced as a student with a primary educational eligibility of an 'Other Health Impairment' (OHI) due to a medical diagnosis of Cerebral Palsy at birth. Jasmine was also serviced as a student with a secondary educational eligibility of an emotional disability. She also participated in the adapted curriculum and had an IEP goal to increase on-task behavior. According to Jasmine's IEP she also exhibited deficits in literacy comprehension, writing and basic math computation.

The researcher was a full-time graduate student working on a Masters of Education degree with a behavior specialist concentration. The researcher was also a licensed K-12 adapted curriculum teacher and had over five years of experience working with students with autism and emotional disabilities. The Board Certified Behavior Analyst (BCBA) from the school where the research was implemented served as a secondary data collector for the study.

Setting

The researcher conducted the study at a local public middle school that serves students from sixth grade to eighth grade in the Southeastern United States. Students that were selected for the study were taught by the adapted curriculum Social Studies teacher in the adapted special education classroom The primary researcher was always in the classroom with the classroom teacher and one paraprofessional for assistance. All phases of the study occurred within the classroom setting with the researcher. The classroom teacher taught class according to usual routine and the researcher implemented baseline and intervention phases of the study within the typical classroom schedule.

Materials

Self-Monitoring Systems. Materials used during intervention included a self-monitoring checklist made by the researcher that required participants to circle an answer to the question, "Are you on task?" every two minutes throughout the class. The checklist had a box with 'yes' and a box with 'no' for students to circle at the end of each time interval. This chart is displayed in Appendix A. Time intervals were measured with a timer in the classroom that made a sound at the end of each two-minute interval. The technology based self-monitoring system was presented on an ipad with an app called 'Self-Monitor: Habit Changer' (Happy Frog, 2019). The app also prompted students with the question, "Are you on task?" every two minutes. An example screenshot of this app is displayed in Appendix C. Students were also presented with assignments less than 40 min in length that were correlated with daily Social Studies content. Different assignments were given daily.

Dependent Measures

The researcher utilized the student's self-monitoring data (listed in Appendix A and Appendix C) to collect data on all trials within each class session. In order to analyze the data, the researcher compared all treatment groups across all participants. This data was exported to Excel and displayed as a line graph equivalent to a traditional Alternating Treatment Design immediately after each session concluded. In regard to statistical analysis, techniques included: frequency, percentage and standard deviation. This data analyzed relationships in which an increase or decrease in on-task behavior was associated with a corresponding type of self-monitoring system. On-task behavior was operationally defined as looking at the materials or teacher as requested, writing numbers or words related to the assigned task and complying with instruction. The researcher also took momentary time sampling data on a fixed interval schedule of 30 seconds for each participant as they displayed on-task behavior, a sample data collection sheet is listed in Appendix B. The researcher circled a 'Y' if participants displayed on-task behavior and an 'N' if participants did not display on-task behavior. All participants were assigned a number to ensure deidentification on all data sheets. Consent forms were stored in a separate records cabinet behind locked doors in the Exceptional Education department.

Design

The researcher utilized a single-case, alternating treatment design to compare efficiency and on-task behavior of participants when a technology based self-monitoring checklist was randomly alternated with a non-technology based self-monitoring system. The alternating treatment design was implemented randomly. Participants received one treatment per class

period, each day. Treatments were chosen daily by a coin flip from participants. There was no set ratio of alternation and a pattern did not emerge throughout the study.

Treatment 1 (Technology Based). Participants were given a self-monitoring system called 'Self-Monitoring: Habit Changer' on an ipad (J. Toole, 2018). The app flashed and prompted students with the question, 'Are you on task?' every two minutes. Each participant recorded his/her own answers by touching the green checkmark or the red 'x'. This information was analyzed within the app. At the end of each session the app gave percentage of trials on-task and graphed the percentage on a line graph within the app.

Treatment 2 (Non-Technology Based). Participants were given a self-monitoring checklist with the question, 'Are you on task?'. Every two minutes a timer went off in the classroom and participants independently recorded their answers by circling the word 'yes' or the word 'no'. This information was analyzed by researchers, exported to Excel and graphed immediately after each session on a line graph.

Procedure

Baseline. The researcher conducted the baseline condition by not implementing a self-monitoring system for five class periods for participant #1 (Carley) and for four class periods for participant #2 (Jasmine). The classroom teacher provided students with regular class assignments and direct instruction. The researcher was present in the classroom for all sessions and also verbally prompted on-task behavior by saying, "Remember to be on-task" at random at least two times per 40 min session. Momentary time sampling data was recorded by the

researcher on each participant at the end of 30 s intervals in regard to their display of on-task behavior.

Training. The researcher administered a training session to each participant prior to the beginning of the study to familiarize them with both types of self-monitoring systems. Participants were told what the self-monitoring system was for and they were taught to report if they were on-task throughout the entire 2 min interval. Students were also shown a 2 min video made by the researcher to teach them how to use the Self-Monitoring: Habit Changer app (J.Toole, 2018).

Intervention. The researcher randomly alternated self-monitoring checklists that were both technology and non-technology based to determine whether participants exhibited on-task behavior at the end of 2 min intervals throughout an entire 40 min adapted curriculum Social Studies class. Participants recorded their own answers on each type of self-monitoring system. At the end of each session percentage of trials where students were on task were immediately graphed into an Excel document. During intervention the researcher also took momentary time sampling data on a fixed interval schedule of 30 seconds for each participant, circling a 'Y' if participants displayed on-task behavior and an 'N' if participants did not display on-task behavior. This data was taken on paper data sheets and an example data sheet can be viewed in Appendix B.

Reliability. The researcher and researcher assistance conducted trials-by-trial interobserver agreement (IOA) on the dependent variable (student responses) by the following formula (Cooper, Heron & Heward, 2007):

$$\frac{\text{Number of trials (items) agreement}}{\text{Total number of trials (items)}} \times 100 = \text{Trial-by-trial IOA \%}$$

The researcher and researcher assistant reviewed sessions in person to determine student accuracy with their own self-monitoring. The results from each data sheet were compared and trial-by-trial IOA with the equation above was used. The researcher and researcher assistant collected IOA data in 20% of all baseline and intervention condition sessions. The minimum acceptable IOA percentage for this study required 80% IOA. If IOA fell below the 80%, the researcher looked at where the noncomparative inconsistencies were and the student was retrained on how to use both self-monitoring systems.

For Carley, the researcher and research assistant collected interobserver agreement (IOA) in person for two baseline and intervention sessions (20% of sessions). Utilizing the formula in the methods section, the researcher and research assistant calculated the IOA to be 86% agreement. For Jasmine, the researcher and research assistant collected interobserver agreement (IOA) in person for two baseline and intervention sessions (20% of sessions). Utilizing the formula in the methods section, the researcher and research assistant calculated the IOA to be 88% agreement.

Procedural Fidelity. The researcher was the sole implementor of all conditions including the baseline, training and all interventions conditions. During intervention the researcher took momentary time sampling data on a fixed interval schedule of 30 s for each participant, circling a ‘Y’ if participants displayed on-task behavior and an ‘N’ if participants did not display on-task behavior. This data was taken on paper data sheets and an example data sheet can be viewed in Appendix B. Procedural fidelity was assessed in 100% of all conditions. The minimum

acceptable percentage for this study required 90% agreeance being implemented correctly. If procedural fidelity fell below 90% for more than two consecutive sessions the researcher retrained the participant on self-monitoring data collection.

For Carley procedural fidelity was taken in 100% of all condition sessions. During the baseline condition procedural fidelity between Carley and the researcher remained above 90%. During the intervention condition procedural fidelity consistently remained above 90% and Carley completed the steps of self-monitoring with 100% accuracy on 2 out of 6 intervention sessions.

For Jasmine procedural fidelity was also taken in 100% of all condition sessions. During the baseline condition procedural fidelity between Jasmine and the researcher remained above 90%. However, during the intervention sessions Jasmine scored 78% procedural fidelity on one non-technology based session. The researcher discovered that Jasmine had marked herself on task for 100% of the 20 trials during that one session. This did not occur again through the intervention condition sessions and Jasmine completed the steps of self-monitoring with at least 90% procedural fidelity for the rest of study.

Due to school closing because of the COVID-19 pandemic the researcher was unable to collect procedural fidelity on data collection. However, the procedural fidelity checklist that was created can be viewed in Appendix E. The researcher collected Interobserver Agreement data with another BCBA at least one time during the baseline condition and one time during the intervention condition.

Social Validity. The researcher assessed social validity by asking each participant to complete a researcher-designed questionnaire. The researcher provided this questionnaire (Appendix D) at the termination of the study. The questionnaire sought to determine how students felt about the implementation of technology based self-monitoring systems, if students would want to learn more about these types of systems and if they would want to utilize them in the classroom setting in the future.

Ethical Approval and Informed Consent

All procedures performed in this study were in accordance with the ethical standards of the institutional review board by James Madison University. The researcher began implementation after acceptance from the review board. The researcher also obtained informed consent from legal guardians for all individual participants included in the study. The researcher also obtained child assent for all individual participants included in the study.

Results

The two research questions that directed the study were (a) do participants display increased time on-task in the classroom setting when utilizing technology based self-monitoring systems as compared to non-technology based self-monitoring systems, and (b) do students prefer technology based or non-technology based self-monitoring systems. The following sections will describe the results for the dependent measures from this study while simultaneously answering the two research questions.

Baseline

Carley participated in a total of five baseline sessions across five school days. During baseline Carley exhibited mid-level and variable data with a decreasing trend for the first three days, an increasing trend on the fourth day and a decreasing trend on day five that began to display mid to low level stabilization. The researcher decided to move to intervention after session five due to a return in a decreasing trend, decreased response efforts from Carley and time constraints.

For Jasmine, baseline consisted of four sessions across four school days. During baseline Jasmine exhibited mid-low level and variable data on the first two days and mid-level data with a slight decreasing trend on days three and four that began to display mid to low level stabilization. The researcher decided to move to intervention because of the overall mid-low stable data from the four baseline days and time constraints.

Intervention

For Carley, the researcher implemented a total of six intervention sessions across six school days. The decision to implement the technology based self-monitoring system on the first day was based on the results of a coin flip. Self-monitoring showed to increase Carley's time on-task regardless of the type of system used from the first intervention session. An increase in on-task behavior was maintained through all intervention sessions. In total Carley engaged in three sessions of technology based self-monitoring and three sessions of non-technology based self-monitoring. Data for technology based self-monitoring across sessions indicated that Carley was on task for an average of three more trials then when she was utilizing a non-technology based self-monitoring system. However, on Carley's third session utilizing non-technology based self-monitoring she began to continue to increase her on-task behavior from the 14 trials observed in

the previous session to 17 trials of on-task behavior. Unfortunately, due to the immediate order of the Virginia state Governor school was suspended on March 13th, 2020 for the remainder of the 2019-2020 school year due to the COVID-19 outbreak. The suspension of school shortened the intervention phase of this study and prevented further data collection.

For Jasmine, the researcher implemented a total of five intervention sessions across five school days. The decision to implement the technology based self-monitoring system on the first day was based on the results of a coin flip. The use of self-monitoring exhibited an increase in Jasmine's time on-task regardless of the type of self-monitoring system used. An increase in on-task behavior was also maintained through all intervention sessions. In total Jasmine engaged in two sessions of technology based self-monitoring and three sessions of non-technology based self-monitoring. During both technology based self-monitoring sessions Jasmine maintained 20 out of 20 trials of on-task behavior. During the first session of non-technology based self-monitoring Jasmine remained on task for all 20 trials. However, she decreased her time on task in session two with 19 trials and session three with 17 trials. Unfortunately, due to the immediate order of the Virginia state Governor school was suspended on March 13th, 2020 for the remainder of the 2019-2020 school year due to the COVID-19 outbreak. The school closing shortened the intervention phase of this study and prevented further data collection.

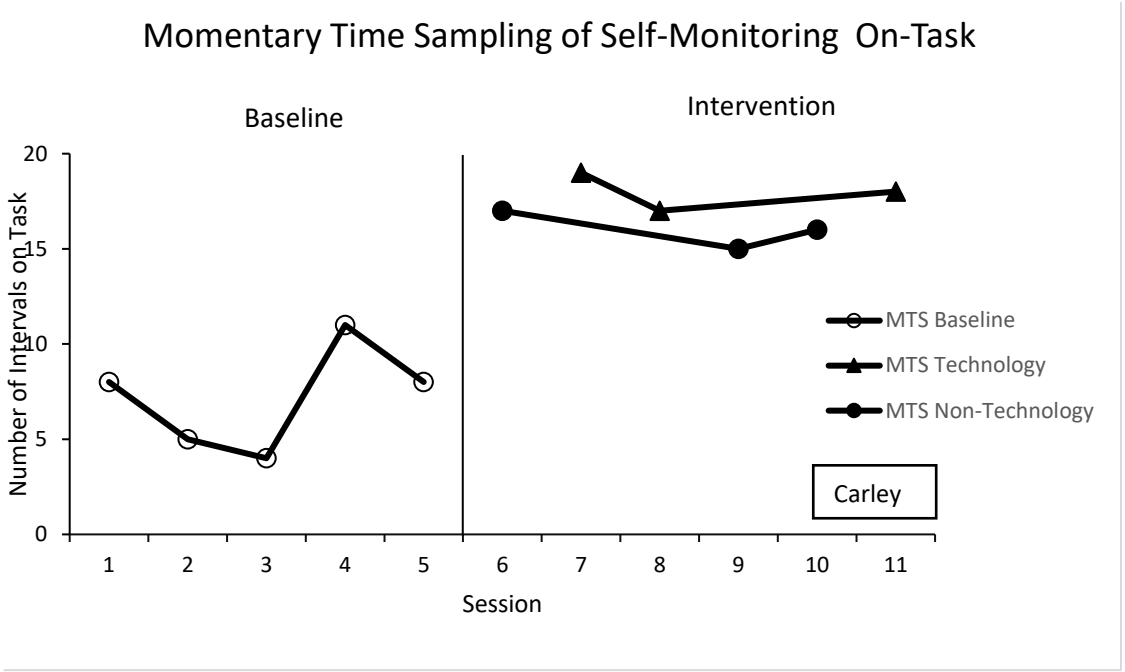


Figure 1. Number of momentary time sampling intervals ta[illegible] Carley during the baseline and intervention conditions.

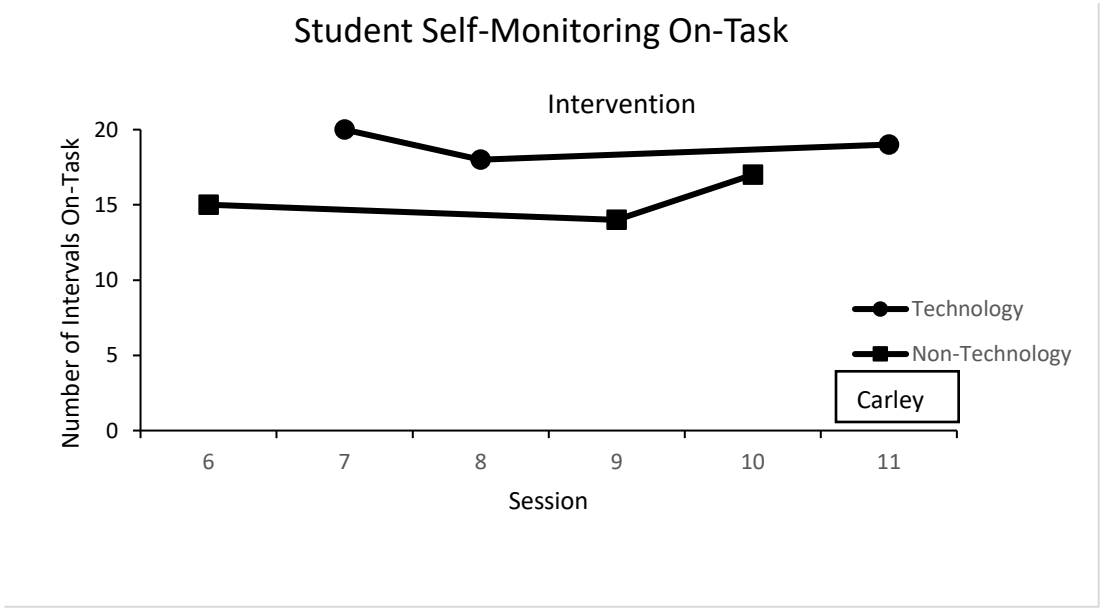
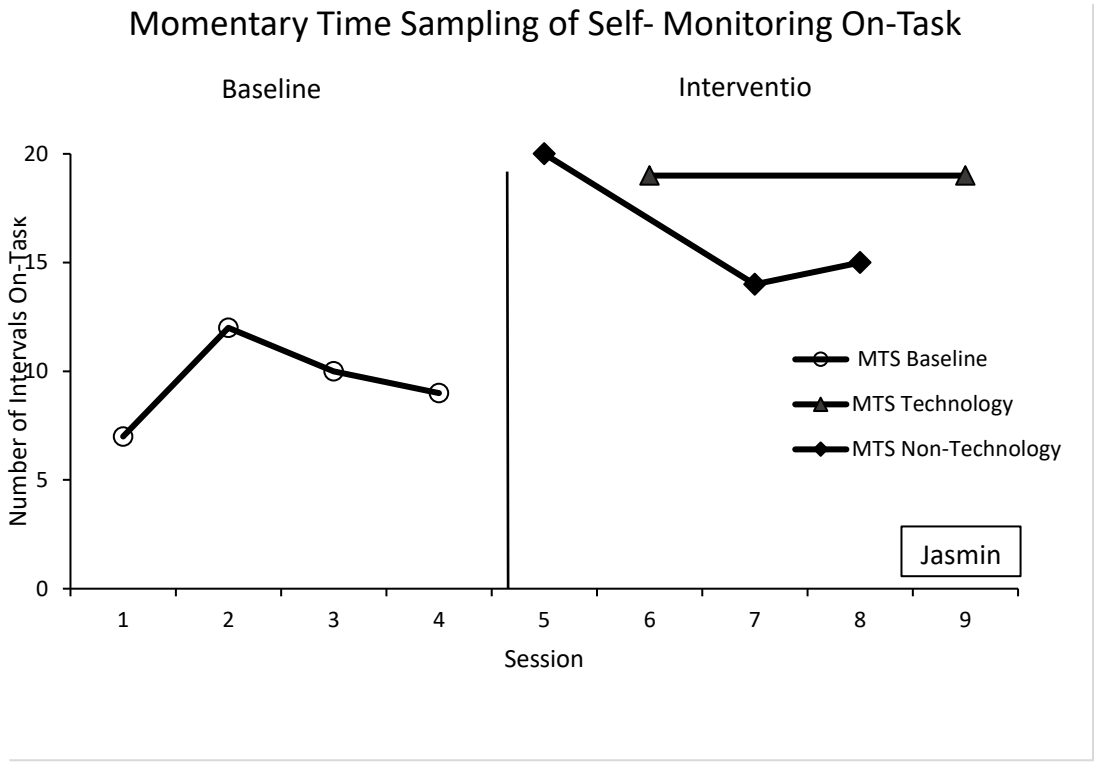


Figure 2. Number of self-recorded intervals on-task in intervention condition for Carley.



Jasmine during the baseline and intervention conditions.

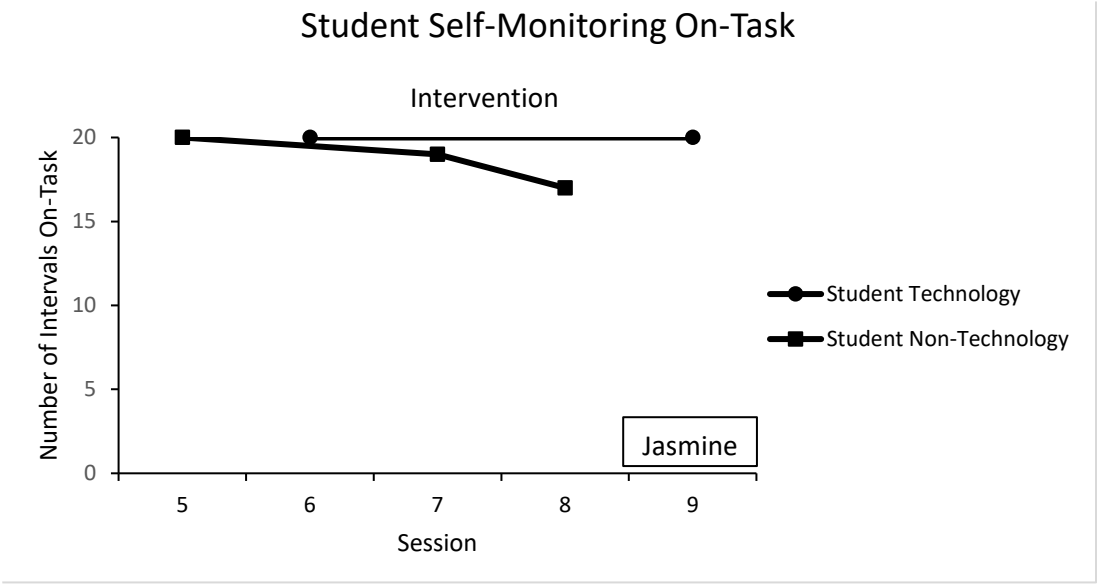


Figure 4. Number of self-recorded intervals on-task in intervention condition for Jasmine.

Social Validity

The researcher did not include a maintenance goal for this study. A questionnaire for the students addressing the social validity of self-monitoring systems was designed for both participants to independently give feedback on both types of self- monitoring systems. However, because of the closing of school due to the COVID-19 pandemic participants were unable to complete the intervention phase of this study in its entirety as well as the questionnaire that addresses the second research questions that is focused on social validity.

Discussion

Research Questions

For the first question, do participants display increased time on-task in the classroom setting when utilizing technology based self-monitoring systems as compared to non-technology based self-monitoring systems, data suggests that the participants in this study did. Carley's results displayed an average of an increase of on-task behavior of three trials per session when using a technology based self-monitoring system. The percentage of trials on task are illustrated by the graph in Figure 1. Jasmine's results also indicated a stable increase in on-task behavior when a technology based self-monitoring system was used. Jasmine remained on task for all 20 trials within both sessions with a technology based self-monitoring system. However, she only remained on-task for all 20 trials for the first of three sessions when utilizing a non-technology based self-monitoring system. The slight variability in the decrease of trials on-task when using a non-technology based self-monitoring system compared to the stability of both sessions with the technology based self-monitoring system indicate favorability of the technology based self-monitoring. It is important to note that data indicates that both participants showed an increased

in on-task behavior simply through the implementation of a self-monitoring system. Both types of self-monitoring systems were effective for both students relative to the lack of interventions that were in place in the baseline conditions.

The second research questions was related to the social validity of the intervention. The questions itself was, do students prefer technology based or non-technology based self-monitoring systems as tools that are socially valid in increasing on-task behavior in the classroom? The researcher was unable to determine an answer to this research question.

Limitations

The researcher notes five main limitations of this study. The first limitation is that the implementation schedule occurred at the end of the school day, every day. Timing of sessions occurred for 40 min between 2:05 PM and 3:00 PM daily. The students were often talkative in classes and participants were easily distracted. Also, Jasmine's IEP required that she leave school daily on special transportation that arrived at the school at 2:55 PM. Jasmine's early dismissal did not prove to be problematic with data collection but the classroom was often disrupted by the paraprofessional that provided Jasmine an escort to her bus.

The second limitation is related to the classroom setting itself. After the third day of baseline data collection the regular Social Studies teacher fell ill and had to take a leave of absence that lasted through the remainder of the study. Her absence meant that several substitute teachers were in and out of the classroom. This created a lack of consistency for students in the classroom and it could have played a role in the consistency of the participants self-monitoring of their own on-task behavior.

Third, the timer for the non-technology based self-monitoring system was loud and it was used for both participants at the same time. Often, when the timer went off Carley expressed that she did not like the noise, she looked up at the classroom teacher, told her what she was working on and then marked whether she was on-task or not. When utilizing the technology based self-monitoring system the timer was low enough so that each participant could continue to work independently.

The fourth limitation is that there were only two participants in this study. Data would be more concrete if the researcher could have included more participants and this issue could be resolved if this study was replicated to include more than two participants. It would also be beneficial if all participants could complete the study for a longer period.

Finally, the request made by the Virginia state Governor to suspend school beginning March 13th 2020 for the remainder of the 2019-2020 school year due to the COVID-19 pandemic meant that this study was not completed as planned. The intervention phase of this study was scheduled to have 8-10 more sessions per participant. More data would have revealed more concrete results for this study. Also, the researcher did not get the opportunity to provide participants with the social validity survey. The lack of results from this survey invalidates the second research question in this study. Further research is needed to determine which type of self-monitoring strategy is most effective for increasing on-task behavior.

Future Research

An area for future research would be a continued comparison of technology based and non-technology based self-monitoring systems. It would be beneficial to replicate this study for a longer period. It would also be interesting to investigate the use of different types of self-

monitoring systems. There are a variety of other types of technology-based elf-monitoring tools, from applications on tablets to the MotivAider.

Another area of potential research could be replicating the study while using participants with both older and younger age ranges. Choosing participants from middle, elementary and high school could yield different results. This would change the complexity of the self-monitoring system and measurement when comparing data.

Self-Monitoring is a beneficial classroom tool that can be implemented through goal setting, self-evaluation, self-reinforcement, self-punishment, self-instruction and self-recording (Alberto & Troutman, 2017). Teachers can implement a variety of self-monitoring systems to students individually or in groups. Self-monitoring generally requires that a student observe, record, and self-evaluate (Sheehey, Wells & Rowe, 2017). This can be taught by choosing a target behavior, explicitly teaching and modeling the target behavior and through teaching students how to use a selected self-monitoring tool to reflect on their own behaviors or goals (Alberto & Troutman, 2017). Self-monitoring in the classroom is a great way to ensure that students are setting goals with the intention of meeting them and it is a functional skill that students could generalize outside of the school setting as they grow and develop.

Appendix A

Self-Monitoring Checklist

Participant Number: _____ Date:_____

2 minutes into class	Are you on task?	Yes	No
4 minutes into class	Are you on task?	Yes	No
6 minutes into class	Are you on task?	Yes	No
8 minutes into class	Are you on task?	Yes	No
10 minutes into class	Are you on task?	Yes	No
12 minutes into class	Are you on task?	Yes	No
14 minutes into class	Are you on task?	Yes	No
16 minutes into class	Are you on task?	Yes	No
18 minutes into class	Are you on task?	Yes	No
20 minutes into class	Are you on task?	Yes	No
22 minutes into class	Are you on task?	Yes	No
24 minutes into class	Are you on task?	Yes	No
26 minutes into class	Are you on task?	Yes	No
28 minutes into class	Are you on task?	Yes	No
30 minutes into class	Are you on task?	Yes	No
32 minutes into class	Are you on task?	Yes	No

34 minutes into class	Are you on task?	Yes	No
36 minutes into class	Are you on task?	Yes	No
38 minutes into class	Are you on task?	Yes	No
40 minutes into class	Are you on task?	Yes	No

Number of Yes:_____ Number of No:_____

Appendix B

Momentary Time Sampling Data: Thesis

Cindy May

Date:_____

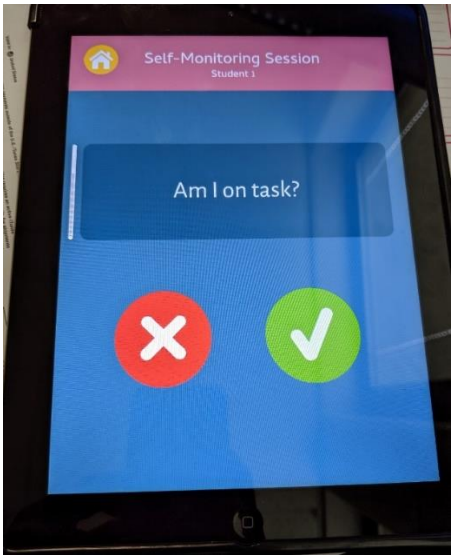
Interval = 30 seconds:

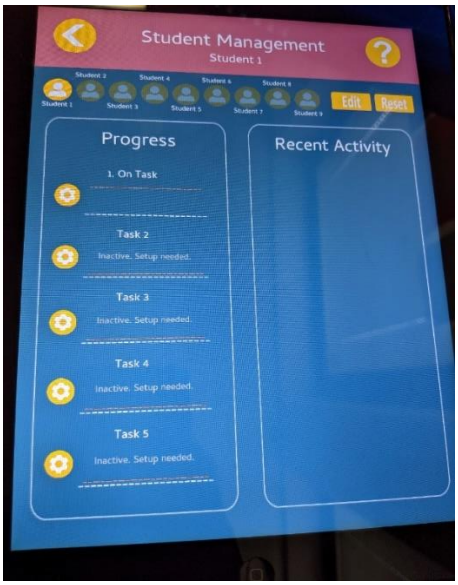
Student #1:____ Start Time: _____ Stop Time:_____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

% of intervals 'Y':_____ % of intervals 'N':_____

Appendix C





Source: Screenshot of the 'Self-Monitoring: Habit Changer' application as it looks on an ipad. Toole, J. (2018). Self-Monitoring: *Habit Changer*. Retrieved from https://www.happyfrogapps.com/contact/. Screenshot from author.

Appendix D

Student Questionnaire

Instructions: Please rate each question according to the scale below:

1-Strongly Disagree 2-Disagree 3-Neutral 4-Agree 5-Strongly Agree

1. I feel like using a self-monitoring system helped me to stay on-task in Social Studies class.
   1 2 3 4 5

2. I liked using the IPAD for my self-monitoring system.

   1 2 3 4 5

3. I liked using the paper based self-monitoring system.

   1 2 3 4 5

4. Which self-monitoring system would you rather use, ipad or paper? Why? (Short Answer)

Appendix E

Researcher Procedural Fidelity Checklist – Intervention

Intervention	**Date:_______**
	1. Have students flip coin
	2. Issue corresponding self-monitoring system
	3. Provide prompt if necessary.
	4. Set self-interval timer
	5. Collect Momentary Time Sampling Data on 30 s intervals
	6. Calculate percent of time on-task at end of 40 min session for both participants

Intervention	**Date:_______**
	1. Have students flip coin
	2. Issue corresponding self-monitoring system
	3. Provide prompt if necessary.
	4. Set self-interval timer
	5. Collect Momentary Time Sampling Data on 30 s intervals
	6. Calculate percent of time on-task at end of 40 min session for both participants

Intervention	**Date:_______**
	1. Have students flip coin
	2. Issue corresponding self-monitoring system
	3. Provide prompt if necessary.
	4. Set self-interval timer
	5. Collect Momentary Time Sampling Data on 30 s intervals
	6. Calculate percent of time on-task at end of 40 min session for both participants

References

Alberto, P., & Troutman, A. C. (2017). *Applied behavior analysis for teachers*. Boston: Pearson.

Beckman, A., Mason, B., Wills, H., Garrison-Kane, L. &Huffman, J. (2019). *Improving Behavioral and Academic Outcomes for Students with Autism Spectrum Disorder: Testing an App-based Self-Monitoring Intervention. Education and Treatment of Children.* West Virginia University Press.

Bruhn, A.L., Vogelgesang, K., Fernando, J. & Lugo, W. (2016). *Using Data to Individualize a Multicomponent, Technology-Based Self-Monitoring Intervention. Journal of Special Education Technology,* 31 (2), 64-76, doi:10.1177/0162643416650024

Cooper, J.O., Heron, T.E., & Heward, W.L. (2007). *Applied behavior analysis (2nd ed.)*. Upper Saddle River, NJ: Pearson Education, Inc.

Dunlap, G., Clarke, S., Jackson, M., Wright, S., Ramos, E. & Brinson, S. (1995*). Self-Monitoring of Classroom Behaviors with Students Exhibiting Emotional and Behavioral Challenges. School Psychology Quarterly*, 10 (2), 165-177

Ennis, R.K., Lane, K.L., & Oakes, P.O. (2018) *Empowering teachers with low-intensity strategies to support instruction: Self-monitoring in an elementary resource classroom. Preventing School Failure: Alternative Education for Children and Youth 62.3*.176-189, doi: 10.1080/1045988X.2017.1408055

Johnston, J., & Pennypacker, H. (2009). *Strategies and Tactics of Behavioral Research.* New York, NY. Routledge.

Karweit, N. & Slavin, R.E. (1982). *Time-On-Task: Issues of Timing, Sampling, and Definition. Journal of Educational Psychology*, 6, 844-851.

McDougall, D., Morrison, C. & Awana, B. (2012). *Students with Disabilities Use Tactile Cued Self-Monitoring to Improve Academic Productivity During Independent Task. Journal of Instructional Psychology*.

Peterson, L.D., Young, K. R., Salzberg, C.L., Ewst, R.P. & Hill, M. (2006). *Using Self-Management Procedures to Improve Classroom Social Skills in Multiple General Education Settings. Education and Treatment of Children (Vol.29).* West Virginia University Press.

Petscher, S.E. & Bailey, J.S. (2006). *Effects of Training, Prompting, and Self-Monitoring on Staff Behavior in a Classroom for Students with Disabilities. Journal of Applied Behavior Analysis*. 39, 215-226.

Schardt, A.A., Miller, F. & Bedesem, P.L. (2019). *The Effects of CellF-Monitoring on Students' Academic Engagement: A Technology-Based Self-Monitoring Intervention. Journal of Positive Behavior Interventions* (Vol.2). 21(1), 42-49, doi: 10.1177/1098300718773462

Sheehey, P.H., Wells, J.C. & Rowe, M. (2017). *Effects of Self-Monitoring on Math Competency of an Elementary Student with Cerebral Palsy in an Inclusive Classroom*. *Preventing School Failure (Vol.61).* 3, 211-219, doi: 10.1080/1045988X.2016.1261268

Shimabukuro, S.M., Prater, M., Jenkins, A. & Edelen-Smith, P. (1999). *The Effects of Self-Monitoring of Academic Performance on Students with Learning Disabilities and ADD/ADHD*. *Education and Treatment of Children (Vol.22*). West Virginia University Press.

Simonsen, B., MacSuga, A.S., Fallon, L.M. & Sugai, G. (2013). *The Effects of Self-Monitoring on Teachers' Use of Specific Praise*. *Journal of Positive Behavior Interventions*, 15 (1), 5-15. doi: 10.1177/1098300712440453

Sutherland, K.S., Wehby, J.H. & Copeland, S.R. (2000). *Effect of Varying Rates of Behavior-Specific Praise on the On-Task Behavior of Students with EBD. Journal of Emotional and Behavioral Disorders. 2-8*.

Toole, J. (2018). *Self-Monitoring*: *Habit Changer*. Retrieved from https://www.happyfrogapps.com/contact/

Wills, H.P. & Mason, B.A. (2014). *Implementation of a Self-Monitoring Application to Improve On-Task Behavior: A High-School Pilot Study*. *Journal of Behavioral Education*, 23, 421-434. doi: 10.1007/s10864-014-9204-x