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EVALUATING THE DIFFERENTIAL EFFECTS OF USING A TECHNOLOGY-BASED ANTECEDENT INTERVENTION IN COMPARISON TO A TECHNOLOGY-BASED TREATMENT PACKAGE

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THESIS

A thesis submitted in partial fulfillment of the

requirements for the degree of Master of Science in the

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By

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ABSTRACT OF THESIS

EVALUATING THE DIFFERENTIAL EFFECTS OF USING A TECHNOLOGY-BASED ANTECEDENT INTERVENTION IN COMPARISON TO A TECHNOLOGY-BASED TREATMENT PACKAGE

This study investigated the differential effects of using non-contingent reinforcement in the form of attention as an antecedent intervention in comparison to using non-contingent reinforcement in addition to self-monitoring as a treatment package. A multi treatment single case research design was utilized in this study. Levels of student's on-task behavior were measured to evaluate the differential effects of an antecedent intervention in comparison to the combination of an antecedent and consequent intervention. This study also only used treatments that were technologically delivered to the participants.

KEYWORDS: non-contingent reinforcement, non-contingent attention, technology-based interventions, self-monitoring, multi treatment design

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04/24/2023

EVALUATING THE DIFFERENTIAL EFFECTS OF USING A TECHNOLOGY-BASED ANTECEDENT INTERVENTION IN COMPARISON TO A TECHNOLOGY-BASED TREATMENT PACKAGE

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INTRODUCTION

Students with behavioral support needs require interventions that allow them to learn how to independently function with autonomy; so that students can make their own decisions and follow through with those decisions. Being able to function independently is an essential skill that is oftentimes targeted in the special education classroom for students with disabilities. Behavioral intervention packages are recommended for students with disabilities to assist with increasing independence, decreasing challenging behaviors, and increasing participation in their natural environments (Sugai et al., 2000). Specifically, behavioral intervention treatment packages may focus on independence for the student, which would mean the student is able to begin, work on, and complete an activity or task without the need for assistance and/or prompting from another person (Hume et al., 2014).

Behavioral intervention treatment packages usually include interventions that focus on altering antecedent variables in the environment or manipulating consequential environmental factors. This is done in effort to alter, replace, or increase the frequency of the behavior a student is engaging. For a child who is receiving behavioral support services to maintain and generalize the skills they are taught, it is vital for the recommendations, whether they are altering the antecedent or consequence environmental factors, to promote more independence and over time require less frequent adult support (Rosenbloom et al., 2019). An antecedent intervention that has a large body of literature backing its effectiveness in reducing challenging behavior across contexts is non-contingent reinforcement (NCR; Ritter, et al. 2017). When a NCR strategy is in place, individuals consistently have access to reinforcement,

regardless of the behavior they are engaging in; therefore, the individual does not need to engage in challenging behaviors in order to gain access to what had been previously maintaining their behavior. This is because they have become satiated on the environmental factor that was previously motivating them to engage in the challenging behavior, therefore decreasing the need to engage in that challenging behavior due to the unmet need becoming met. This strategy has been shown to effectively decrease challenging behavior without an increase in other challenging behaviors for middle school and elementary school aged students with disabilities in special education classrooms (Tomlin et al., 2012). NCR also has been shown to be easier to implement than other antecedent interventions across settings, but specifically in educational settings, due to reinforcement being delivered based on a fixed schedule rather than being based on the student's behavior (Choi, 2006).

Ritter et al. (2017) completed a meta-analysis on the use of NCR for reduction of challenging behavior. The results indicated that NCR is an empirically based intervention for the reduction of problem behavior across numerous settings and topographies. The meta-analysis also specifically looked at the differences in effectiveness regarding the function of challenging behavior. According to the results of the analysis, NCR was effective across all four behavioral functions (i.e., positive reinforcement in the form of access to tangibles or attention, negative reinforcement in the form of access to escape, or automatically maintaining contingencies), but more effective when the behavior was maintained by a socially mediated contingency. Even more specifically, when the behavior was maintained by positive reinforcement in the form of access to attention, NCR had a larger effect in decreasing the occurrence of the

behavior than when the behavior was maintained by positive reinforcement in the form of access to tangible or negative reinforcement in the form of access to escape.

Using NCR based on the function of a student's challenging behavior has been shown to decrease the occurrence of a targeted behavior (Ritter et al., 2017). When attention is the identified function of the behavior, and NCR is the treatment being implemented to decrease the frequency of the behavior, the treatment would be considered NCR in the form of attention (NCA). NCA has been shown to be an effective procedure in classrooms and is a preferred behavioral intervention strategy for educators due to its feasibility to implement, effectiveness, and having little-to-no cost (Noel et al., 2019). NCA has been used to effectively decrease disruptive behavior, and increase on-task behavior (e.g., Jones et al., 2000; Riley et al., 2011; Tomlin et al., 2012).

NCR and more specifically, NCA, have been shown to be effective antecedent interventions for increasing classroom engagement for students with disabilities, though, no literature was discovered by the researcher that delivered NCA via technology. An evidence-based, consequence intervention strategy that has been shown to be effective in increasing on-task behaviors in academic settings is the use of self-monitoring (e.g., Bruhn et al., 2014; Mithaug et al., 2003; Wills & Mason 2014). When using self-monitoring students are responsible for collecting data on their own behavior(s). Being responsible for the data collection on their behavior(s), students are better equipped to cogitate on the outcomes related to their behavior(s), which in turn causes them to take more control over their actions and the behavioral contingencies in their lives (Kumm et al., 2021). Self-monitoring may also include teaching the student

to differentiate between when they are or are not engaging in the target behavior so that they may correctly monitor their behaviors and provide themselves with reinforcement when appropriate (Hume et al., 2014). Self-monitoring has been shown to increase independence in students with disabilities and decrease prompt dependency and reliance on others (Rosenbloom et al., 2019).

Utilizing technology to implement a self-monitoring strategy has also been shown to complement the effectiveness of the strategy. The use of technology in an educational setting has been steadily increasing, and its use can be translated to intervention programs as well. Using technology for data collection may be more feasible for students than using traditional materials like paper and a pencil (Rosenbloom et al., 2019). Using technology also increases the social validity and significance of the intervention by considering the way the intervention would be viewed by the public (Wills & Mason, 2014).

Wills and Mason (2014) tested the use of a self-monitoring intervention in which prompting, and data collection were completed via technology for two highs school students with disabilities in effort to increase their on-task behavior in the classroom. The results indicated an increase in on-task behavior. Rosenbloom et al. (2019) evaluated using self-monitoring via technology to increase on-task behavior and task completion in the classroom while decreasing disruptive behavior for four adolescents with disabilities. All four participants showed an increase in on-task behavior and task completion, while two showed a decrease in disruptive behavior. Kumm et al. (2021) evaluated increasing engagement in academic activities with high school students with disabilities. They evaluated this through the feasibility of using

technology to implement a self-monitoring strategy for teachers and students. They also evaluated whether the students felt the intervention was socially valid. The results indicated an increase in academic engagement for three of the four participants. The intervention was able to be implemented with high fidelity. The results also showed that participants rated the intervention to have high social validity.

There have been numerous studies that have evaluated the effectiveness of NCA as an antecedent intervention and the effectiveness of technology-enhanced self-monitoring as a consequent intervention, but limited literature that compares the relative efficacy of these interventions. Therefore, the purpose of this study was to determine if combining antecedent and consequent interventions (i.e., NCA with self-monitoring) would have a larger impact on the occurrence of on-task behavior for students with disabilities, when compared with an antecedent-alone intervention (i.e., NCA). An additional purpose of this study was to extend the existing literature on the use of technology to enhance interventions that are already evidence-based.

Research questions include:

1. What are the differential effects of technology-enhanced NCA alone versus technology-enhanced NCA with self-monitoring, for on-task behavior in students with disabilities?
2. What are the differential effects of technology-enhanced NCA alone versus technology-enhanced NCA with self-monitoring, for on-task behavior in students with disabilities?

METHOD

Participants

Students

In order for a student to be selected for participation in the study, they had to meet the following inclusion criteria: (a) a student must have been currently receiving special education services through their school district; (b) the participant must have been an adolescent enrolled in school (c) the identified student must have had the ability to complete independent work, but previously demonstrated difficulty with remaining on-task; and (d) the student had to have a history of engaging in off-task behavior during academic work. For the purpose of inclusion criteria, off-task behavior was defined as a student leaving their designated workspace, refusing to begin a task, or disengaging with the task they were assigned. To meet the off-task criteria, a student would need to orient away from the task materials for longer than 5-s or engage with the materials in a way that was not productive towards them finishing the task. To participate in this study, the student's off-task behavior needed to be hypothesized as maintained by positive reinforcement in the form of access to attention. Whether or not a student met the inclusion criteria was partially based upon the teacher interview (discussed in the Screening section), but also based on observational data.

Students were excluded from participating in the study if they met any of the following criteria: (a) the student was participating in another research study that may interfere with this study at the time this study was taking place; (b) the student frequently engaged in aggression, self-injurious behavior, or other behaviors of concern

that would necessitate a more intensive intervention; (c) the student was physically unable to use a tablet or tolerate the use of headphones, and/or (d) the student had missed more than nine school days in the last nine weeks. Four students were identified as eligible to participate in the study out of the 16 total students in the classrooms from which students were recruited (discussed further in the *Settings and Materials* section). Consent from the guardians and assent from the student was obtained for Michael, Dante, and Leo. Consent was obtained for Ralph due to him being his own guardian.

Michael

The first participant, Michael, was a male that was 18 years old at the time of the study. Michael had a diagnosis of catatonia and autism spectrum disorder. Michael primarily communicated vocally and through gestures. His sentences consisted of approximately 2-6 words. An example of his communication would be verbally emitting the sentence "IPad please". He was in 11th grade and spent the majority of the school day in a classroom that served students with moderate and severe disabilities (MSD). He participated in specials in general education classes, such as gym and pottery. Michael was considered to be on-task when he remained seated in his designated workspace with his feet on the floor while looking at the assigned work, and engaged with the materials in a way that allowed him to accomplish the tasks. Michael was considered to be off-task when he stood, jumped, attempted to leave the designated work space, closed his eyes, pulled his clothing over his face, tapped his feet or hands, or looked around the room while vocally stimmed (i.e. laughing, groaning, moaning, humming) thus not engaging with the materials in a way that allowed him to accomplish his tasks after he had been directed to engage in tasks. Michael's independent tasks consisted of

math equations, typing personal information, and vocational tasks such as folding laundry or shredding recycling paper.

Ralph

The second participant, Ralph, was a male that was 18 years old at the start of the study and turned 19-years-old during the study. Ralph had a diagnosis of traumatic brain injury, intellectual disability, and a visual impairment. Ralph communicated vocally. He was in 11th grade and spent the majority of the school day in a classroom that served students with MSD. He participated in gym in general education classes. Ralph was considered to be on-task when he remained seated in his designated work area and was engaged with the task materials by interacting with them as directed. He also could not be engaged in verbal interactions with himself or others. Ralph was considered to be off-task when he verbally interacted with himself or others, engaged with materials not related to the task, or was not physically holding and/or manipulating the task-related items as directed. Ralph's independent tasks consisted of completing task boxes (e.g., sorting, matching, identifying).

Leo

The third participant, Leo, was a male that was 15 years old at the time of the study. Leo had a diagnosis of autism spectrum disorder. Leo primarily communicated vocally. He was in 9th grade and spent half of the school day in a classroom serving students with MSD. He participated in specials, language arts, and math in general education classrooms. Leo was considered to be on-task when he remained seated in his designated workspace, his laptop was only being used for the purpose of completing the task directions, he was actively engaged with the task materials by looking at them and

using his hands to complete his work. Leo was considered to be off-task when he used his laptop to watch non-assigned videos and not completing his work, he left his designated workspace, he stared away from his work for longer than a few seconds, or when he manipulated the materials in a way that did not help him further complete the task. Leo's independent tasks consisted of completing task boxes (e.g., sorting, matching, identifying).

Dante

The fourth participant, Dante, was a male that was 18 years old at the time of the study. Dante had a diagnosis of autism spectrum disorder. Dante primarily communicated vocally and through gestures. He was in 11th grade and spent the entire school day in a classroom serving students with MSD. Dante was considered to be on-task when he remained in his designated workspace with his feet on the floor and while actively looking at his work and engaging with the materials in a way that allowed him to accomplish his tasks. Dante was considered to be off-task when he stood, jumped, attempted to leave was designated work space, closed his eyes, tapped his feet or hands, flicked his neck, played with his hair, hit his legs, rubbed his legs or arms, or looked around the room while vocally stimming (e.g., laughing, groaning, moaning, humming). Dante's independent tasks consisted of math equations, typing personal information, and vocational tasks such as folding laundry or shredding recycling paper.

Others

In one of the classrooms, the primary teacher was a Caucasian female. There were also three paraprofessionals present in the room during the sessions. Two were Caucasian females and one was a Caucasian male. In the second classroom, the two primary

teachers were Caucasian females. There were also five Caucasian female paraprofessionals and three Caucasian male paraprofessionals present in the second classroom. In all classrooms, the primary teacher or the researcher was the person who presented the instructions to the participant at the beginning of each observation session.

The researcher was a 23-year-old Caucasian female. She was a second-year graduate student studying Applied Behavior Analysis. Her undergraduate degrees were in Psychology and Sociology. She had two years of experience working with the pediatric population and with people with disabilities prior to the beginning of this study. The researcher was also the primary data collector, and secondary data collectors were students in the same graduate Applied Behavior Analysis program (i.e., three students and a professor). The secondary data collector collected data for interobserver agreement (IOA) data of the dependent variables, and fidelity data on the researcher and teacher(s) implementing the procedures. This study was completed as a partial requirement of her graduate degree.

Settings and Materials

This study took place in two classrooms serving students with MSD in one public high school in a southeastern state in the US. This study took place in each student's independent workstation within their classroom. The materials that were necessary for this study included headphones, recordings of a preferred person providing praise, a tablet or other technological device with the iConnect App (Willz et al., n.d.) downloaded, and academic work (e.g., computer, calculator, writing utensil, worksheets, task boxes).

Using the data from the paired stimulus preference assessment (see methods section below), the researcher contacted four preferred people for each participant and asked them to create a 10 min recording of themselves providing praise to the student on a variable interval schedule of 30 s (about 20 vocalizations per recording). The preferred people were instructed to provide general praise, that consisted of phrases such as “You are such a great student!”, “You are doing such a good job at school today”, or “I love when you work hard on your schoolwork”. The researcher presented multiple modalities to create these recordings to the identified preferred persons, such as using a voicemail, a video with a black screen, or using the voice memos feature on Apple devices.

The app iConnect is an app that was designed to be used by students for the purpose of self-monitoring. When being used, the app provides a chime on a set schedule, then prompts the student to report whether or not they are on-task by flashing the question on the screen and providing the student two buttons to choose “yes” or “no”. The app had intervals set to go off once every min at which time the student reported if they were on-task or not. iConnect allows the student to track their own progress towards meeting goals by allowing them access to their own data.

Dependent Variables and Measurement Systems

Three dependent variables were measured in this study: (a) on-task behavior, (b) task completion, and (c) task accuracy of attempted steps of a task. The researcher was interested in whether or not on-task behavior would increase through the use of the independent variables. On-task was defined as: a student remained in their designated workstation and continuously engaged with their academic task demands. This

consisted of looking at their work, using the materials as directed, and attempting to complete the entire activity. Examples of on-task behavior included a student holding their writing utensil and answering problems, sorting materials for a task box, or answering reading comprehension questions on their Chromebook. Non-examples included sitting at their desk with their head down or doodling on their worksheet.

On-task behavior was measured using momentary time sampling (MTS). The data collector observed the participant during a 10-min observation window with 10-s intervals. 10-s intervals were chosen because the accuracy of the measure of the true value of the behavior increases with a smaller interval (Ledford, J. R., & Gast, D. L. 2018). In order for a session to be used in the results of this study, the session had to last for at least 8-m and not exceed 10-m. At the final second of each interval, the data collector recorded whether the participant was engaged in on-task behavior. If the participant was on-task, the data collector recorded a plus on the data sheet for that interval. If the participant was not on-task, the data collector left that interval blank or recorded a (-). The data collector only marked that the participant was on-task if the participant was on-task at the end of the 10-s interval. At the completion of the session, the researcher counted the number of intervals the participant was on-task, divided that number by the total number of intervals in the session, and multiplied that number by 100 to calculate the percentage of on-task behavior for that session.

MTS was selected to measure this variable due to its feasibility to use and its accuracy. MTS provides a measure of behavior that is consistent with continuous measurement systems (Powell et al., 1975), and provides data that is closer to the true value of the behavior when in comparison to partial interval recording (Meany-Daboul

et al., 2007). A continuous measurement recording system would have been challenging to utilize due to the nature of the behavior being measured.

A secondary dependent variable that was measured in this study was task completion. A task was considered to be complete when a student finished all of the necessary steps, start to finish, as outlined by written or verbal instructions (e.g., directions on worksheet, task direction from teacher). Task completion was measured through the academic work assigned to the student, which yielded a permanent product (e.g., worksheet, task box). Task completion was recorded as the percentage of completed steps for the number of assigned steps in the academic task. The academic tasks assigned for this study were work the students would typically be completing during their school day. This percentage was found by dividing the total number of completed steps by the total number of possible steps, then multiplying by 100.

Task accuracy was another secondary dependent variable measured in this study. A task was considered to be completed accurately if the attempted steps were completed in a correct manner. Task accuracy was measured by the percentage of correct responses for the task, which was found by evaluating the responses created on the permanent product of the assigned academic work for the observation period. Total correct responses were divided by the total number of attempted correct responses and total number of attempted incorrect responses, then multiplying by 100.

Experimental Design

The experimental design used for this study was a multitreatment design (MTD); (Ledford & Gast, 2018). The design conditions were implemented as ABCBC or ACBCB depending on randomization of the participants, where the A condition was

a baseline condition, the B condition included NCA, and the C condition included NCA and self-monitoring. The researcher conducted a component analysis with reversible behaviors as the dependent variables.

This design allowed for the comparison of the effect of using (a) one antecedent intervention to the use of (b) an antecedent and consequent intervention together as a treatment package. This design allowed for the comparison of the two conditions. When considering feasibility across the study implementers and the classroom staff, MTD was a better choice than some other single-case designs. Not having to remove the device used for self-monitoring from the participants to alternate using self-monitoring was a consideration when choosing a design, as well as having a set plan for each day with little changes throughout the day.

In a MTD, each participant served as their own control. To control for threats to internal validity, the order that interventions were introduced (i.e., B or C) was counterbalanced. To control for history threats, the caregivers and teachers were informed of the details of the student's participation in the study to try and ensure that no external factors would influence the student's on-task behaviors. Interobserver agreement data and procedural fidelity data were collected throughout each condition during the study to control for instrumentation threats and procedural infidelity. The conditions were kept as short as possible to control for participant maturation. There were 5 to 8 data sessions in each condition, and the condition length was pre-determined and randomized to control for instability and cyclical variability, while also reducing the bias when visually analyzing the data. Multi treatment interference was controlled for by replicating each condition twice per participant.

Procedures

Screening

Determining if a student met criteria for inclusion was completed through an informal observation of each student in their classroom, as well as through teacher report of their current skill repertoire. The researcher reviewed their attendance records, and reports of the episodes of challenging behavior that had occurred previously during the school year. The researcher collected narrative observational data on possible participants to hypothesize if their off-task behavior was maintained by access to attention during the informal observation(s). The researcher also completed an informal discussion with the teacher regarding prior instances of the student engaging in off-task behavior to gather more data about a possible hypothesis of the function of the student's behavior.

The researcher completed an unstructured teacher interview to discuss the participant's off-task behavior and their skill repertoire at the time of the study. During the interview, the researcher asked for details about what on-task behavior and off-task behavior looked like specifically for each student, and what environmental factors were relevant to the student's behavior. The researcher also had the teacher complete the Problem Behavior Questionnaire (PBQ; Lewis, Scott, & Sugai, 1994) to help create a stronger hypothesis for the function of the behavior. The PBQ is a 15-question assessment that uses a Likert scale that ranges from 0 Never to 6 Always. The questions help to form results that indicate a possible function(s) of a student's behavior.

Michael's PBQ results indicate his off-task behavior was maintained by adult attention. Ralph's PBQ results indicate his off-task behavior was maintained by

escaping adult interaction, as well as access to attention from adults. Leo's PBQ results indicate his off-task behavior was maintained by peer and adult attention, escaping adult interaction, and setting events. Dante's PBQ results indicate his off-task behavior was maintained by accessing peer and adult attention.

During the screening process, the researcher and classroom teacher also ensured that the student could tolerate and would provide verbal assent for wearing headphones. They did this by verbally asking if the student was okay with wearing headphones, and upon receiving verbal assent, provided headphones to the student to wear to observe any adverse reactions.

Preference Assessment

After it was confirmed that the student met all inclusion criteria and consent and assent was obtained, the researcher conducted an indirect paired stimulus preference assessment to determine a hierarchy of preferred people for the student. This was done by going through a list of people the student frequently interacted with (e.g., parents, teachers, peers) and asking the student "Do you like when person A gives you compliments or when person B gives you compliments?" and recording the student's responses. At the end of the assessment, the researcher totaled the number of times a student chose a person and listed them in order of highest to lowest selected. The data collected from this assessment indicated who some preferred people were for the student, and those people created a voice recording of them giving the student praise about every 30-s for the NCA portion of this study. The recordings were 10-m long to match the 10-m session observation window.

Baseline

The length of the observations in baseline was 10-m, broken up into 10-s intervals. A session had to last a minimum of 8-m to be included in the results. During the baseline condition, the student was given work to complete independently, and did not receive any prompting to complete it or remain on-task. The teacher explained the expectations of and instructions for the task, then observed from a distance or helped other students. The researcher instructed the teacher and paraprofessionals that the only time an adult was to interact with the student once the 10 min observation had begun was if safety became a concern. If the student asked a question about the academic task, then the teacher would tell the student in a neutral tone to finish the task to the best of his/her ability, and that she would help them in a few minutes. The goal of the baseline sessions was to get an accurate measurement of the percentage of intervals the student was on-task, and how much of the task they could and would complete without any prompting. At the completion of the 10 min observation, the teacher provided behavior specific praise and allowed the student to take a break or be done with the academic work if they chose to do so.

Intervention

The two intervention conditions consisted of one in which the student was completing academic tasks while receiving NCA using technology, or in which the student received NCA through technology plus using a self-monitoring app.

NCA, Condition B

The student was given approximately 10-m worth of academic work to complete independently for each observation. The amount of work appropriate was determined by the teacher. In order for a session to be used in the results of this study, the session had

to last for at least 8-m and not exceed 10-m. This work was of similar difficulty to the work that was given during baseline sessions. The teacher explained the expectations to the student and answered any questions the student had about the assignment prior to the start of the observation. The student chose which person of the four adult attention recordings they wanted to listen to during the work session. The teacher then gave the student access to their headphones and began to play one of the recordings once the data collector indicated they were beginning the interval. The teacher then removed their attention to the student until the observation was complete. If the student asked a question about the academic task during the observation, the teacher would tell the student in a neutral tone to finish the task to the best of his/her ability, and that she would help them in a few minutes. The other staff in the room were instructed to not engage with the student during the observation, and the other students should be engaged in their own independent work. MTS data were collected by the researcher on on-task behavior for the duration of the 10 min observation. If the student finished the task more than 1 min early, the teacher gave the student more academic tasks that were similar in difficulty and content to fill the rest of the observation window.

At the completion of the 10 min observation, the teacher provided behavior specific praise and allowed the student to take a break or be done with the academic work if they chose to do so.

NCR and Self-Monitoring, Condition C

This intervention condition was implemented in the same way as condition B, NCA, with the addition of the student using a self-monitoring app on a device. The student still utilized headphones and had a recording playing of praise from a preferred

person during independent work time. The teacher began the session in the same format, and other people present in the classroom restricted attention from the student once the directions had been placed for the academic work that was to be completed during the observation. Prior to the start of the first session, the participant and the researcher completed a training session with the app so that the student was able to confidently utilize it during the actual intervention sessions. This consisted of the researcher verbally explaining how to use the app with the student, then having them start a session and modeling how to use it. The researcher then implemented a trial observation with the student and teacher to ensure the student was able to utilize the app. If the student self-reported whether they were on-task or not for 8/10 prompts, they moved on to condition C sessions. If they did not meet the criteria, the researcher re-trained with the student until they were able to meet criteria.

Prior to the start of a session, the researcher set up the app for the session and placed the device in the participant's work area (e.g., on their desk, next to their Chromebook). Prior to the start of the session, the researcher would instruct the student to use the self-monitoring device during the session and wait for an attention response from the student in the form of acknowledging their understanding that they were to use the app throughout the session. Occasionally, participants did not interact with the app for every interval during the sessions. Throughout the session, the researcher would prompt the student to utilize the app at the completion of the first two intervals if needed. If the student still did not independently utilize the app for the third interval, the researcher would pause the session and give them a reminder to use the app. Following the reminder, the researcher did not redirect the student to use the app any further.

Social Validity

A questionnaire was developed and presented to the students and teachers at the completion of the study that asked them to evaluate if their participation in the study was beneficial and enjoyable. The questionnaire was presented in the form of a survey and was emailed to the teachers. The researcher completed the survey in person with the participants. The survey consisted of 6 questions and used a Likert scale for responding to the questions in the teacher version. The Likert scale was from 1 (very much) to 5 (not at all) for all 6 questions. When the questions were presented to the students, they were instructed to simply respond "yes" or "no" to the questions. The questions inquired about whether the teacher/participant wished to continue using any aspect of the intervention, if they would participate in another study of similar nature if given the chance, and if they generally enjoyed participating in this study.

Interobserver Agreement (IOA)

IOA data were collected across every condition for every participant for at least 20% of the sessions meeting 80% agreement. The IOA data collector was trained by the researcher giving them data sheets and explaining how to fill them out. The researcher provided each data collector a copy of the operational definitions of on and off task for each participant. The researcher also reviewed how to collect MTS data before a session. They collected data following the same procedures as the researcher did while collecting the primary data for the study. The point-by-point method was used for each session in which IOA data were collected. Once the data were collected, the researcher compared the number of intervals they agreed on. The formula used to find the percentage of agreement was the number of agreements divided by the total number of

intervals multiplied by 100. This agreement needed to be at least 80% in order for the study to be rigorous and have high internal validity.

Procedural Fidelity (PF)

PF data were collected across 20% of sessions in every condition on the teacher and researcher behavior. They collectively had to receive a score of 80% or higher in order to meet criteria. If the teacher did not meet this criterion, the researcher provided feedback on their performance and answered any questions they had. A checklist was developed and used to evaluate if the teacher was correctly implementing the steps for all conditions. The secondary data collectors collected fidelity data on the teacher and researcher. The formula to evaluate the percentage of correct steps completed by the teacher was the number of behaviors observed divided by the number of behaviors planned for, then multiplied by 100. A checklist was also developed to monitor the researcher's behavior for training the student to use the iConnect app, as well as explaining procedures to the teachers. PF data were collected across 20% of sessions in every condition on the researcher's behavior. The researcher had to receive a score of 80% or higher to meet criteria. If the criteria were not met, the training must be repeated.

Reliability Results

For Michael's condition A sessions, IOA data were taken for 40% of sessions. The percentage of IOA was 99.5%. PF data were taken for 20% of sessions. The percentage of PF was 87%. For condition B, IOA data were taken for 27.3% of sessions. The percentage of IOA was 96 %. PF data were taken for 27.3% of sessions. The percentage of PF was 97.3%. For condition C, IOA data were taken for 27.3% of sessions. The

percentage of IOA was 97.3%. PF data were taken for 27.3% of sessions. The percentage of PF was 92.3%.

For Ralph's condition A sessions, IOA data were taken for 20% of sessions. The percentage of IOA was 96.6%. PF data were taken for 20% of sessions. The percentage of PF was 93.3%. For condition B, IOA data were taken for 25% of sessions. The percentage of IOA was 96.6%. PF data were taken for 25% of sessions. The percentage of PF was 98.3%. For condition C, IOA data were taken for 23% of sessions. The percentage of IOA was 99%. PF data were taken for 23% of sessions. The percentage of PF was 87%.

For Leo's condition A sessions, IOA data were taken for 20% of sessions. The percentage of IOA was 93%. PF data were taken for 20% of sessions. The percentage of PF was 84.6%. For condition B, IOA data were taken for 25% of sessions. The percentage of IOA was 99%. PF data were taken for 25% of sessions. The percentage of PF was 88%. For condition C, IOA data were taken for 20% of sessions. The percentage of IOA was 98.6%. PF data were taken for 20% of sessions. The percentage of PF was 98.1%.

For Dante's condition A sessions, IOA data were taken for 20% of sessions. The percentage of IOA was 98.3%. PF data were taken for 20% of sessions. The percentage of PF was 86.6%. For condition B, IOA data were taken for 23% of sessions. The percentage of IOA was 99.6%. PF data were taken for 23% of sessions. The percentage of PF was 94.1%. For condition C, IOA data were taken for 25% of sessions. The percentage of IOA was 93.3%. PF data were taken for 25% of sessions. The percentage of PF was 98.1%.

RESULTS

Visual analysis was used to evaluate the differential effects of NCA and NCA plus self-monitoring. The visual analysis for each participant's data included an analysis of results within and between conditions, trend, level, variability, overlap, consistency of data across similar conditions, and immediacy of effect.

The conditions labeled A were baseline conditions. The conditions labeled B were the conditions in which the participant only had access to NCA via headphones. The conditions labeled C were the conditions in which the participant had access to NCA via headphones and the self-monitoring app (iConnect). Michael and Dante completed independent work during sessions that consisted of either math equations, practicing typing their personal information, or various vocational tasks. The work type is differentiated on the graphs by marker symbol. Sessions in which the participant completed math problems are marked with a circle. Sessions in which the participant completed typing tasks are marked with a square, and sessions in which the participant completed a vocational task are marked with a triangle. Ralph and Leo completed various types of task boxes (e.g., sorting, counting, matching) during each independent work session.

Michael

Figure 1 depicts Michael's on-task behavior throughout the duration of this study. All of Michael's conditions had a pre-set length. Michael started with five baseline condition sessions, then began receiving NCA. He completed six sessions in condition B. He then began completing sessions in the C condition. He completed five sessions before moving on to the second set of B condition sessions. He completed five sessions in this

condition. The last condition Michael completed was a second set of condition C sessions. He completed six sessions in this condition.

Michael's On-Task Data

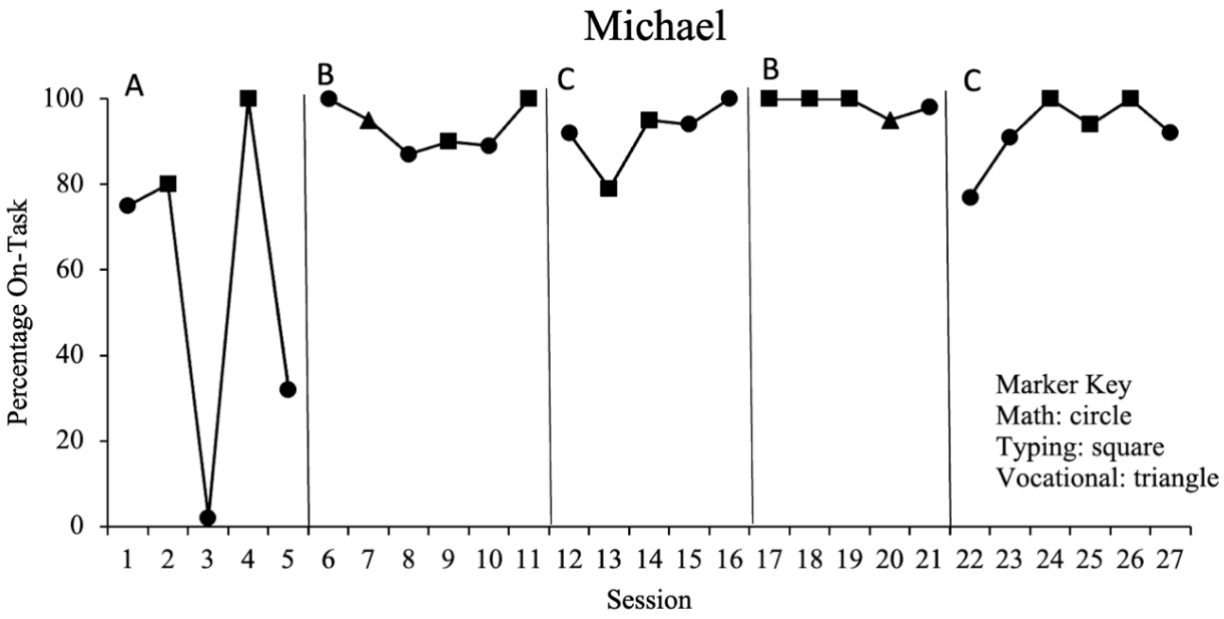


Figure 1 *Michael's On-Task Data*

Michael's baseline data (condition A) was variable with no consistent trend or level. When he began condition B sessions, his data became more stable and stayed at a high level for the entirety of the condition. The first three data points have a slightly decreasing trend in a contratherapeutic direction and the last three data points in the condition have an increasing trend in a therapeutic direction. Technically, there is high overlap between the baseline data and the condition data, but that is due to an outlier data point of 100% on-task behaviors during baseline. The remainder of the baseline data points fall below 80%, which does not overlap with condition B data. There is an evident, immediate change in Michael's percentage of on-task behavior once he began completing independent tasks during condition B sessions.

From the first condition B sessions to the first set of condition C sessions, there was a slight decrease in his percentage of on-task behavior during sessions, but the trend accelerated in a therapeutic direction. The data points for the entirety of the condition remained at a high level and the data had very little variability. All but one data point in this condition overlapped with the lowest data point in the previous condition.

From the first set of condition C sessions to the second set of condition B sessions, there was no immediate change. The data were more stable in the second set of condition B sessions in comparison to the first set of condition B and condition C sessions. The data remained at a high level for the entirety of the second set of condition B sessions. The data were stable for the whole condition. The data points from both sets of B conditions are similar. Both are stable and at a high level with a drastic increase in on-task behavior in comparison to the baseline sessions.

There was an immediate effect when changing from the second set of condition B sessions to the second set of condition C sessions. The percentage of on-task behavior decreased between conditions. For the first three data points in the condition, there was a stable, increasing trend in a therapeutic direction. The final data points were slightly variable, but overall, the data remained at a high level. The data points from both C conditions were similar in the fact that the data were high level, and slightly more variable in comparison to the data from the B conditions. Overall, there were no differential effects when comparing NCA with NCA plus self-monitoring.

Michael's task accuracy and task completion data are depicted in Figure 2 below. Task accuracy is shown with open markers, while task completion is shown with filled

markers. The condition lengths are the same as the condition lengths reported above for measuring on-task behavior.

Michael's Task Completion and Task Accuracy Data

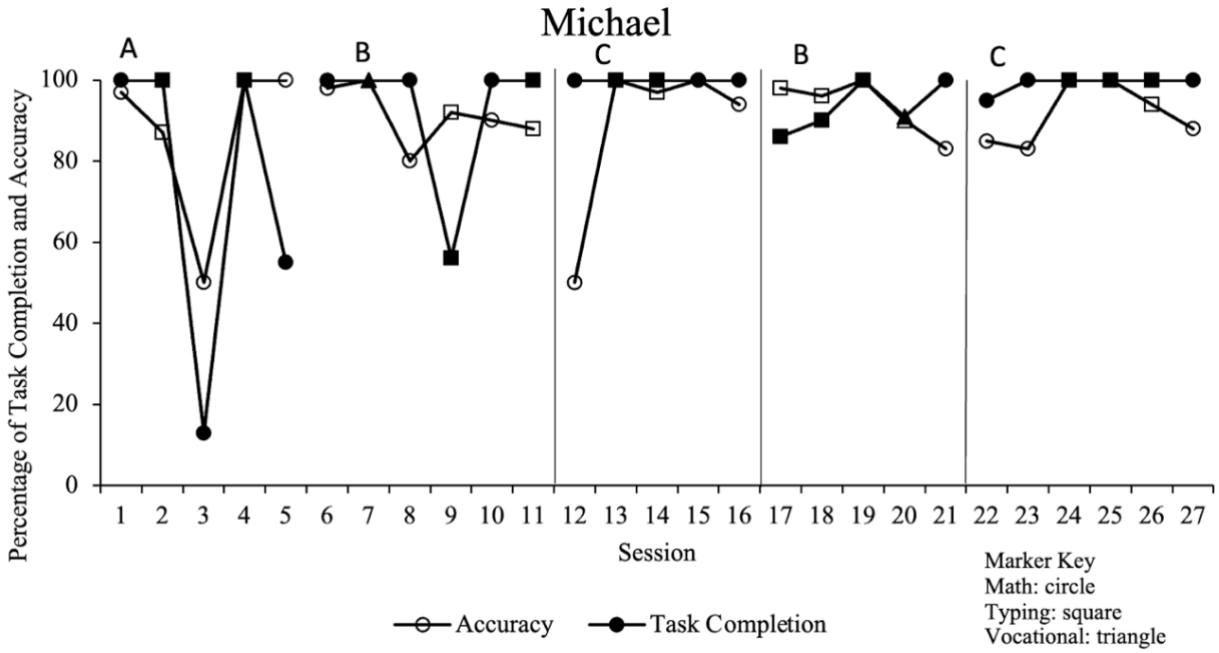


Figure 2 *Michael's Task Completion and Task Accuracy Data*

Michael's baseline percentage of task completion data were variable. Three of the baseline data points were high level, while one was mid-level and one was low. Michael's baseline percentage of task accuracy data were also variable. The first three data points had a decreasing trend in a contratherapeutic direction, then the trend changed direction and was increasing in a therapeutic direction for the final two baseline data points. The data were mostly high level, with one data point that was middle level.

There was no immediate change in the data pattern when Michael began condition B sessions for task accuracy, but there was a significant level change from mid to high for task completion. The data in condition B was at a high level for both

dependent variables for the first three data points in the condition. The task completion data had an outlier data point for the fourth data point in the condition. The rest of the task completion data points are stable at 100% for the condition. The task accuracy data path has a slightly decreasing trend in a contratherapeutic direction for most of the condition.

There was no immediate change for task competition between the first set of condition B sessions and the first set of condition C sessions. All task completion data points remained stable at a high level for the entirety of the condition. For task accuracy, there was an immediate decrease in level for the first data point, but the data then immediately went up to high level for the second data point and for the remainder of the data in this condition. The data had slight variability but was stable at a high level for the entirety of the condition.

Between the first set of condition C sessions and the second set of condition B sessions, there was a slight change in the data for both task accuracy and task completion. The percentage of task completion decreased slightly, and the percentage of task accuracy increased slightly. The task completion data had an increasing trend in a therapeutic direction, while the task accuracy data path had a decreasing trend in a contratherapeutic direction. The data for both variables was high level and slightly variable; however, the data for both variables were more stable for this condition than the previous B condition.

Between the second set of B condition data and the second set of C condition data, there was not an immediate change for either data path. The task completion data were high level and stable for the entirety of the condition. The first set of condition C

data and the second set of condition C data were similar in that they both were stable and high level with no visible trend. The task accuracy data were high level but variable throughout this condition. The task accuracy data in the first set of condition C data were more stable than in the second set, but overall, the data were similar in that almost all data points were high level. Overall, both conditions showed an increase in task accuracy and completion in comparison to the baseline data from condition A. For task completion, condition C showed a more drastic and stable increase than condition B.

Ralph

Figure 3 displays Ralph's on-task behavior throughout this study. All of Ralph's conditions had a pre-set length. Ralph also started with five baseline sessions, then began receiving NCA while using the self-monitoring app (condition C). He completed eight sessions in condition C. He then began completing sessions in the B condition. He completed five sessions before moving on to the second set of C condition sessions. He completed five sessions in this condition. The last condition Ralph completed was a second set of condition B sessions. He completed seven sessions in this condition.

Ralph's On-Task Data

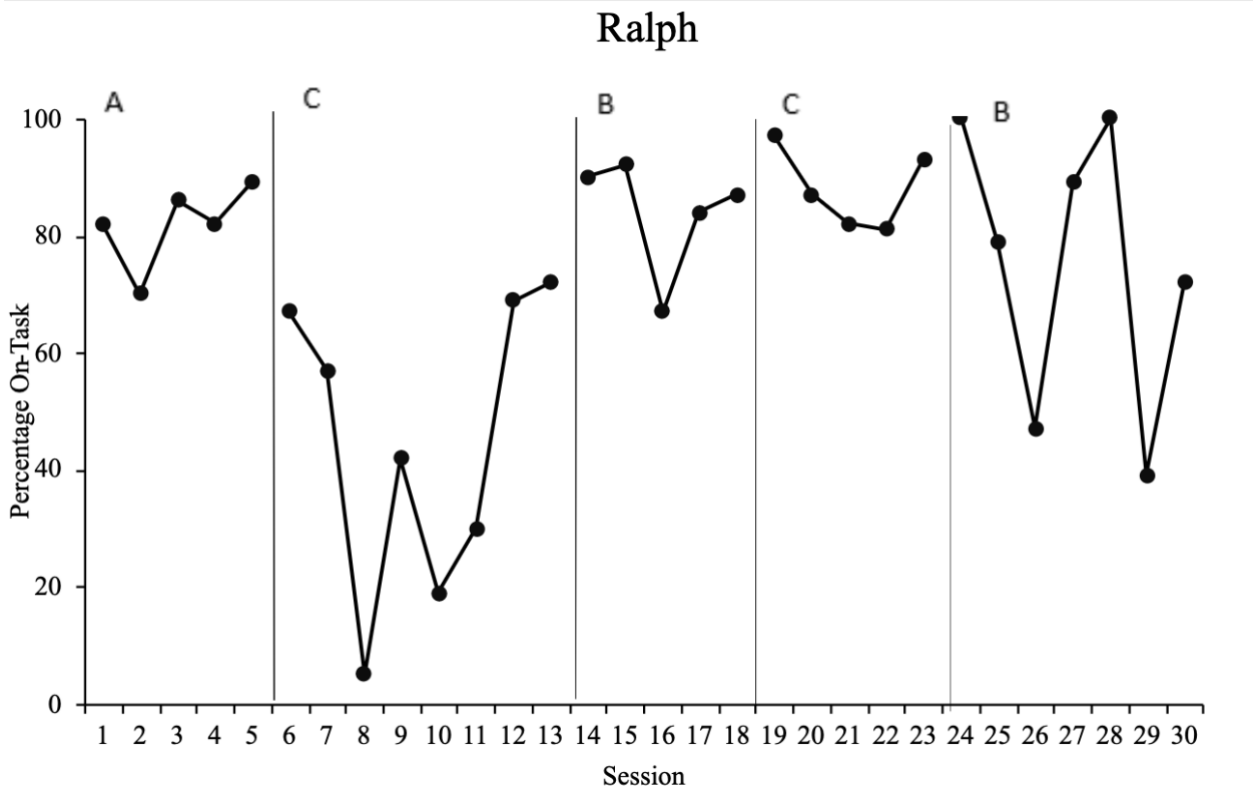


Figure 3 *Ralph's On-Task Data*

Ralph's baseline data were variable with an increasing trend in a therapeutic direction. The data started at a mid-level but increased to a high level. There was an immediate effect between the baseline condition and the first C condition. The data dropped to a mid-level, then a low level, then went back to a mid-level. Within the condition, the data were variable. There was a decreasing trend in a contratherapeutic direction for the first three data points, then an increasing trend in a therapeutic direction for the final five data points.

Between the first set of C condition data points and the first set of condition B data points there was an immediate increase in Ralph's on-task behavior. The data for the entirety of the condition was mid-high level and variable. There again was an immediate increase in Ralph's on-task behavior between the first set of condition B data

points and the second set of condition C data points. The data were high level for the entirety of the second set of condition C data points. The first four data points had a decreasing trend in a contratherapeutic direction, while the final three had an increasing trend in a therapeutic direction. The data from the second set of condition C sessions was more high level in comparison to the first set, meaning the percentage of on-task behavior for this condition was inconsistent.

Between the second set of condition C data and the second set of condition B data there was an immediate decrease in Ralph's percentage of on-task behavior. For the first three data points of the condition, the data path had a decreasing trend in a contratherapeutic direction. The following three data points of the condition had an increasing trend in a therapeutic direction. The data were highly variable for the remainder of the condition. The data ranged from high-low level throughout the entirety of the condition. The data from the first B condition in comparison to the second B condition were inconsistent due to the large increase in variability. There was high overlap for both B conditions, and for the second C condition. Overall, Ralph's results did not produce a stable increase in on-task behavior in either condition.

Ralph's task accuracy and task completion data are depicted in Figure 4. Task accuracy is shown with open markers, while task completion is shown with filled markers. The condition lengths are the same as the condition lengths reported above for measuring on-task behavior.

Ralph's Task Completion and Task Accuracy Data

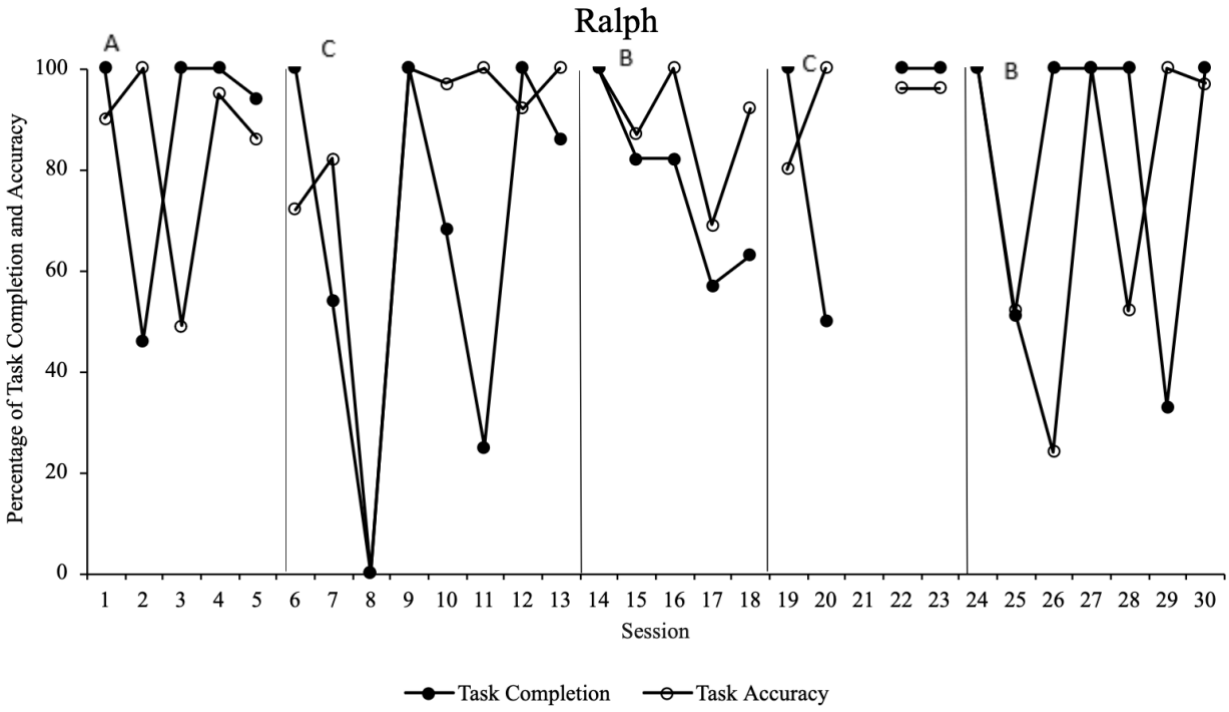


Figure 4 *Ralph's Task Completion and Task Accuracy Data*

The baseline results for task accuracy for Ralph were highly variable, while the results for task completion were stable with the exception of one outlier data point in the condition. For both task accuracy and completion, the data were primarily high level with one data point being low level in the condition. Between the baseline condition and the first C condition there was an immediate decrease in task accuracy, but not a significant immediate change in task completion for the first data point. The data did quickly decrease in a contratherapeutic trend for the first three data points in the condition for task completion. Following those data points, the data were highly variable for the remainder of the condition. For task accuracy, the first three data points were highly variable, but the data stabilized at a high level for the final five data points in the condition.

There was not an immediate, significant change in the data between the first C condition and the first B condition for either variable. The task accuracy data were variable with a decreasing trend in a contratherapeutic direction. All data were mid-high level. The task completion data had a decreasing trend in a contratherapeutic direction. The data started at a high level, but the condition ended with the data at mid-level. There was an immediate increase in task completion between the first set of condition B data and the second set of condition C data. There was not an immediate difference for task accuracy. Task accuracy had an increasing trend in a therapeutic direction for the first two data points in this condition, while task completion had a decreasing trend in a contratherapeutic direction for the first two data points. The data from session 21 is missing for both variables due to unforeseen classroom circumstances. The final two data points in this condition for both variables were stable and high level. It is difficult to compare the data from the first set of condition C data to the second due to the missing data points, but the data were more stable and high level in the second C condition than the first. The results are similar for both the first and second conditions.

There was no immediate difference in the data between the second C condition and the second B condition. The task accuracy data had a stable decrease in a contratherapeutic direction and went from a high level to a low level for the first three data points. The data were high level and stable for the remainder of the condition with the exception of one data point. The task completion data were high level and stable with the exception of two data points. Both the task accuracy data and the task completion data were inconsistent across both B conditions. The task completion data were more variable in the first B condition, and overall had a decreasing trend while in

the second B condition, the data were relatively high level and stable. Overall, neither conditions B or C made a significant, stable increase in Ralph's task accuracy or task completion percentage.

Leo

Figure 5 shows Leo's on-task behavior for the duration of the study. All of Leo's conditions also had a pre-set length. Leo began the study with five baseline condition sessions, then began receiving NCA (condition B). He completed six sessions in condition C. He then began completing sessions in the C condition. He completed eight sessions before moving on to the second set of B condition sessions. He completed six sessions in this condition. The last condition Leo completed was a second set of condition C sessions. He completed seven sessions in this condition.

Leo's On-Task Data

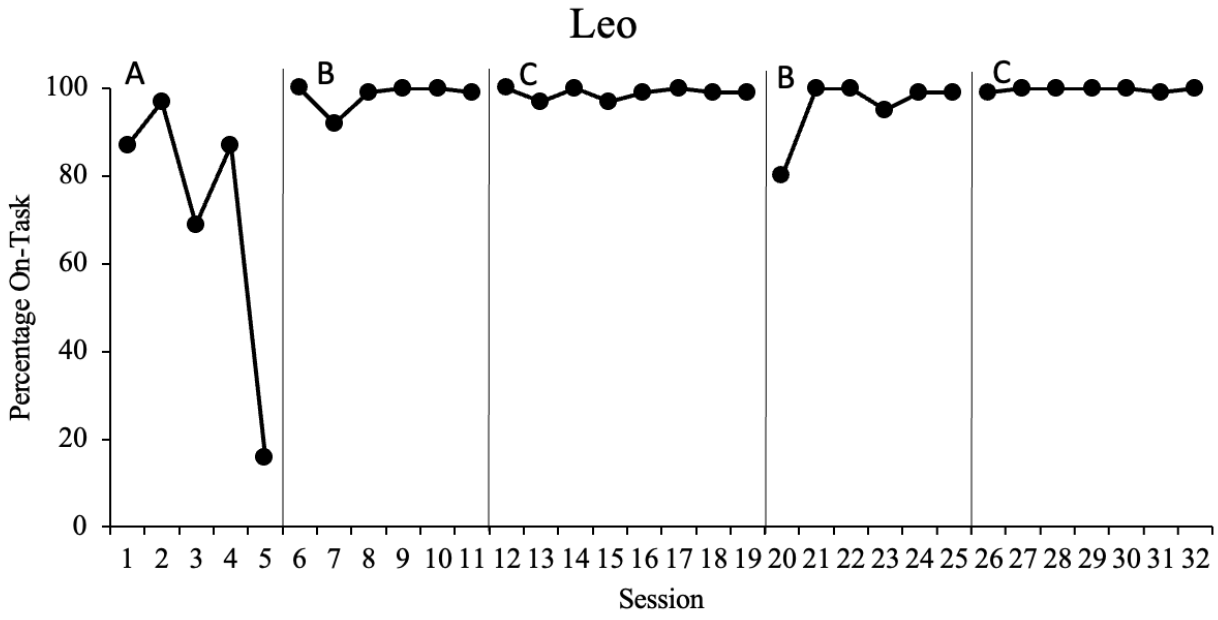


Figure 5 *Leo's On-Task Data*

Leo's baseline data for on-task behavior were variable with a decreasing trend in a contratherapeutic direction. The data began at a high level, but gradually decreased to a low level by the completion of the condition. Between the baseline condition and the first set of condition B data, there is an immediate increase in Leo's percentage of on-task behavior. The data in the first set of condition B data remained at a high level and were stable for the entirety of the condition. There is high overlap due to one outlier data point in the baseline data path. If that data point at 100% was not taken into consideration, then there is only one data point that has overlap with the baseline data in this condition. There was no immediate change in the data between the first set of condition B data and the first set of condition C data. The data in the first set of condition C were stable and at a high level for the entirety of the condition. There was a slight change in Leo's on-task behavior between the first C condition and the second B condition. His percentage of on-task behavior decreased for the first data point in the condition but increased again by the second data point. The data remained stable at a high level for the remainder of the condition. There is high overlap in this condition due to the large data range. The data in this condition were all above baseline levels except for one baseline session. There was no immediate change in the data between the second set of condition B data and the second set of condition C data. The data in the set of condition C were stable and at a high level for the entirety of the condition. Overall, both conditions were effective in stabilizing and increasing Leo's on-task behavior. Technically, his percentage of on-task behavior was more stable in the C condition than in the B condition.

Leo's task accuracy and task completion data are shown in Figure 6. Task accuracy is shown with open markers, while task completion is shown with filled markers. The condition lengths are the same as the condition lengths reported above for measuring on-task behavior.

Leo's Task Completion and Task Accuracy Data

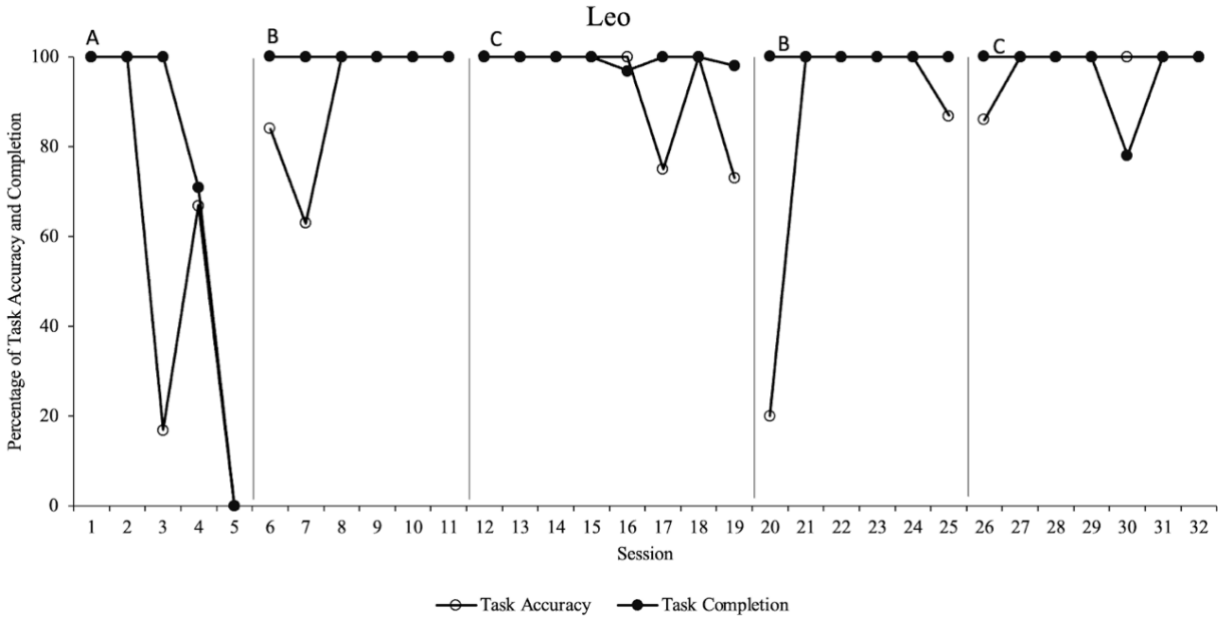


Figure 6 *Leo's Task Completion and Task Accuracy Data*

Leo's baseline data for task completion was high level and stable for the initial three data points in the condition, but then sharply decreased in a contratherapeutic direction for the final three data points in the condition to a low level. Leo's baseline data for task accuracy were highly variable for the entirety of the condition with a decreasing trend in a contratherapeutic direction. Data started at a high level but decreased to a low level throughout the condition.

There was an immediate change in responding between the baseline condition and the first B condition for each variable. Leo's task completion was stable and high

level for the entirety of the condition. His task accuracy data were variable for the first three data points, but the data path stabilized at a high level for the final four data points. Between the first B condition and the first C condition, there was no immediate difference in Leo's responding for either variable. The task completion data were stable and high level for the entity of the condition, while the task accuracy data were stable and high level for the first five data points in the condition. The final four task accuracy data points in the condition were variable but remained at a high level. Between the first C condition and the second B condition, there was no immediate difference in Leo's responding for task completion, but there was for task accuracy. The task accuracy data dropped to a low level but returned to a high level by the second data point and remained stable at high level for the rest of the condition. The task completion data were stable at a high level for the entire condition. Between the second B condition and the second C condition, there was no immediate difference in Leo's responding for either variable. The data path for both variables was stable at a high level for the whole condition.

This data shows that the interventions were successful in increasing and stabilizing Leo's task accuracy and task completion percentages. The interventions were more successful for increasing his task completion than his task accuracy but made a significant difference for both variables.

Dante

Figure 7 depicts Dante's on-task behavior during the study. All of Dante's conditions had a pre-set length. Dante initially began the study with five baseline sessions, then began receiving NCA and using the self-monitoring app (condition C).

He completed six sessions in condition C. He then began completing sessions in the B condition. He completed five sessions before moving on to the second set of C condition sessions. He completed six sessions in this condition. The last condition Dante completed was a second set of condition B sessions. He completed eight sessions in this condition.

Dante's On-Task Data

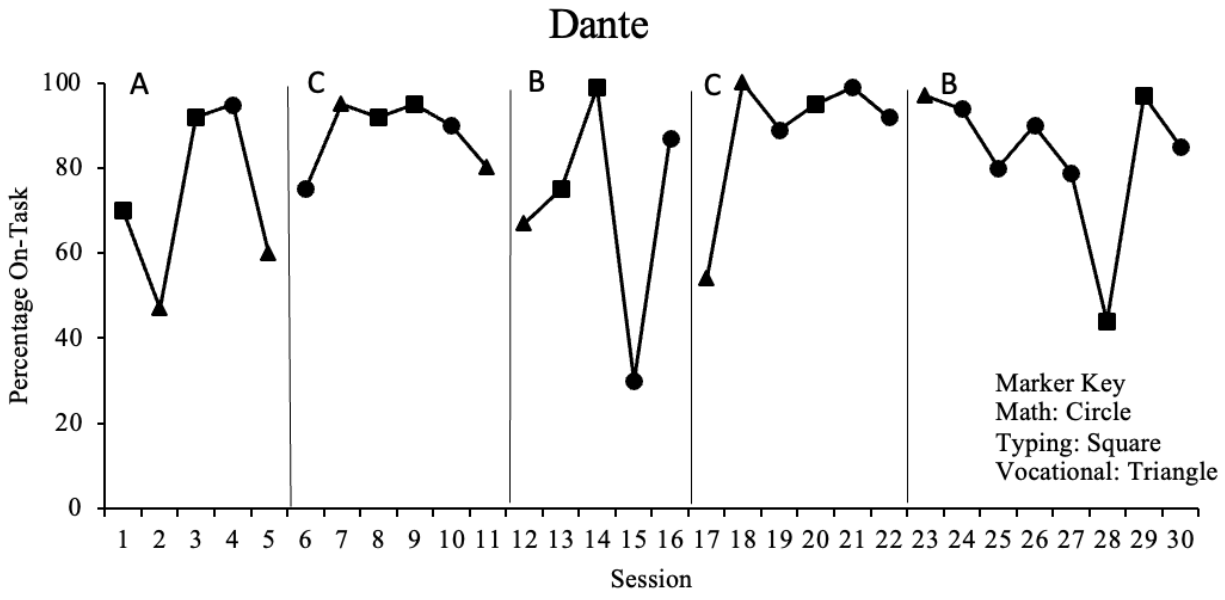


Figure 7 *Dante's On-Task Data*

Dante's on-task behavior data were variable with an accelerating trend in a therapeutic direction. The data ranged from being mid to high level during the baseline condition. Between the baseline condition and the first set of condition C data, there was an immediate increase in the percentage of on-task behavior. The data in the first C condition were high level and slightly variable. The trend in between the first two data points was increasing, but from the second data point to the last data point of the condition, the trend is decreasing in a slight contratherapeutic direction. The data were

more stable than in baseline. There was an immediate decrease in Dante's responding between the first B condition and the first C condition. The first three data points in the B condition had an increasing trend in a therapeutic direction. The data were variable for the remainder of the condition. Four of the data points were mid-high level while the fourth data point was at a low level.

Between the first B condition and the second C condition there was an immediate decrease in Dante's on-task behavior. The data path then remained slightly variable, but the level went from mid to high. The data path remained at a high level for the rest of the condition. The trend was slightly decreasing in a contratherapeutic direction for the final five data points in the condition, but overall was stable. In comparison to the first set of C condition data, the data paths are consistent.

Between the second set of condition C data and the second set of condition B data, there was not an immediate change in Dante's responding. The data were variable with a decreasing trend in a contratherapeutic direction. Six out of seven data points were high level, while one of the data points were mid-level. In comparison to the first set of condition B data, both data paths are variable and mostly mid-high level. The data in the second set of condition B were more stable at a high level, but overall, the data were consistent across both B conditions. There was high overlap across all conditions. Overall, condition C was more effective in stabilizing and increasing Dante's on-task behavior.

Dante's task accuracy and task completion data are shown in Figure 8. Task accuracy is shown with open markers, while task completion is shown with filled

markers. The condition lengths are the same as the condition lengths reported above for measuring on-task behavior.

Dante's Task Completion and Task Accuracy Data

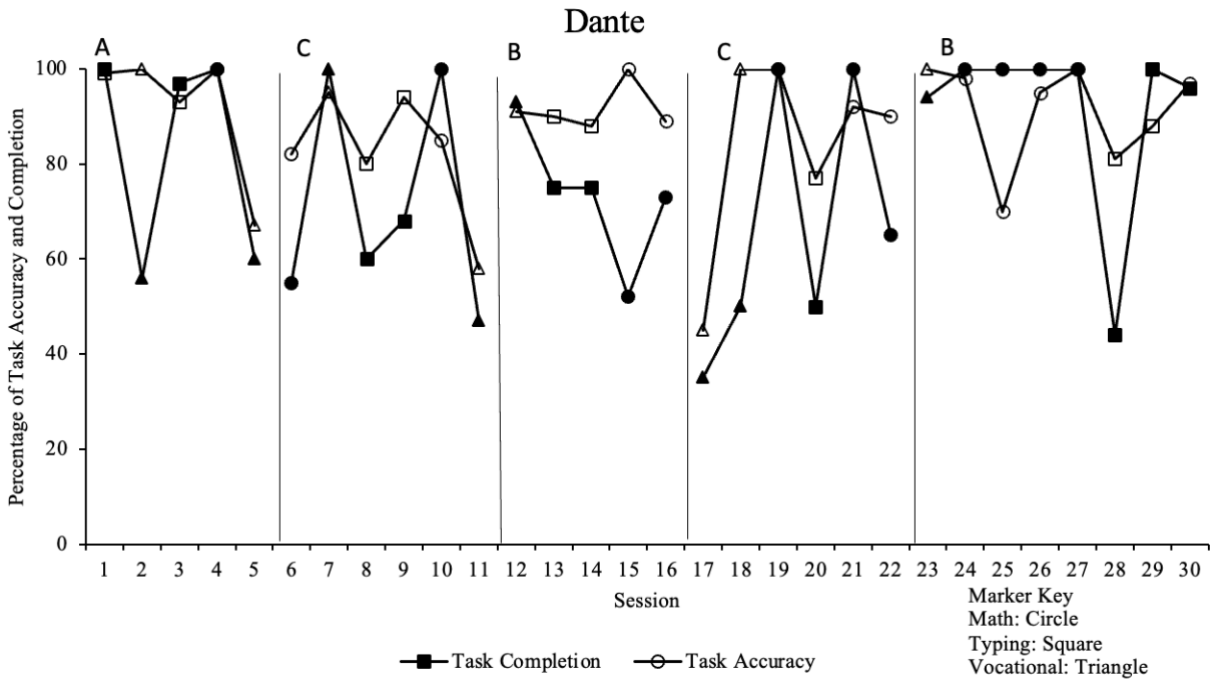


Figure 8 *Dante's Task Completion and Task Accuracy Data*

Dante's task completion baseline data were variable and mid-high level for the entire baseline condition. Dante's task accuracy data were slightly variable for the first four data points in baseline and at a high level. The final data point was mid-level and created a decreasing trend in a contratherapeutic direction. Between the baseline condition and the first C condition, there was not an immediate change in the data for task completion, but the task accuracy percentage increased in a therapeutic direction. The task completion data in the first C condition were mid-high level and variable. The task accuracy data in the first C condition were variable and mostly high level with the

exception of the last data point in the condition. The task accuracy data had a decreasing trend in a contratherapeutic direction.

There was an immediate change in the data between the first C condition and the first B condition for both variables. For both variables, the percentages increased between conditions. The task completion data had a variable, decreasing trend in a contratherapeutic direction for the first B condition. All data points were mid-high level. The task accuracy data were slightly variable at a high level with a small decreasing trend in a contratherapeutic direction.

Between the first B condition and the second C condition, there was an immediate decrease in responding for both variables. Both variables had a variable data path for the second C condition. The task accuracy data started with an increasing trend in a therapeutic direction but changed after three data points to a decreasing trend in a contra therapeutic direction. The first data point was low level, but all data points following the first data point were mid-high level. The first three task completion data points had an increasing trend in a therapeutic direction, but the following three data points had a variable trend. All data points were mid-high level except for the first data point which was low level. In comparison to the first C condition, the task completion data were consistent while the task accuracy data was similar but more variable in the second C condition.

Between the second C condition and the second B condition, there was an immediate increase in task accuracy and completion. The task completion data were stable and high level for the first five data points, but variable for the final two. The sixth task completion data point was low level while all the other data points were high

level. The task accuracy data were variable throughout the entire condition, but all data points were mid-high level. In comparison to the first B condition, the task accuracy data were consistent but more variable, while the task completion data were higher in level and more stable. Overall, condition B was more effective for increasing Dante's percentage of task completion, but neither intervention type was significantly effective in increasing Dante's task accuracy or completion.

DISCUSSION

The results of this study are consistent with existing literature in the efficiency of utilizing NCR to increase on-task behavior in academic settings (Choi, 2006). Research has shown that providing teacher delivered NCA can improve on-task behavior; this study shows that using technology as the delivery method of the NCA does not change the effectiveness of it (Riley et al., 2011). The researcher was interested in the differential effects of NCA using technology in comparison to that along with the use of self-monitoring across all dependent variables. Both interventions are empirically backed and used in academic settings.

The results indicate that accessing NCA through technology increased and/or stabilized on-task behavior for all four participants. Regardless of which intervention the participants were exposed to first, adding in the self-monitoring app in addition to NCA increased the percentage of on-task behavior for three participants in comparison to baseline. In comparison to condition B, it did not create a significant change for the other three (Michael, Ralph, and Leo); this suggests that the least intrusive intervention is NCA alone and should be utilized when trying to increase on-task behavior due to success in both conditions. NCA also increased task completion for three participants. Adding in the self-monitoring app increased task completion for two participants. Task accuracy improved or stabilized in the B condition for two participants, and three participants in condition C.

Overall, allowing students access to NCA via technology may help increase their time engaged in academic activities, though it will depend on what specifically

motivates each individual student. The results do not indicate that utilizing a self-monitoring app is always necessary to increase on-task behavior but can be a helpful tool when the current intervention is not producing satisfactory results. Allowing students access to NCA via technology may help increase their percentage of task completion as well, although again it will depend on what specifically motivates each individual student.

While comparing the differential effects between condition B and condition C, condition B was more effective in increasing and stabilizing on-task behavior for half of the participants. Condition C was more effective in increasing task completion and accuracy for two participants. For one other participant, condition C was more effective for increasing on-task behavior, but condition B was more effective for increasing task accuracy and completion. For the fourth participant, condition C was more effective for increasing on-task behavior and task accuracy, but condition B was more effective for increasing task completion.

Taking social validity of behavioral interventions into account, continuing with only NCA through headphones would be in the best interest of the participants if feasible because it is the lesser intrusive and prompt dependent intervention of the two interventions in this study. If the data were evenly variable across both B and C conditions, using the least intrusive intervention would be more socially valid and beneficial for him as a student.

Social Validity Results

Teachers

The six-question survey was emailed to the teachers at the completion of the study. Overall, all of the teachers that completed the form rated their experience and enjoyment of participating in the study highly. They also reported that the use of NCA delivered via headphones, as well as the visual and auditory prompting via the self-monitoring app was seemingly beneficial for their students that participated in the study. They reported that they were highly likely to continue the use of the recordings with the participants, but less likely to continue the use of the self-monitoring app. When asked if they would be willing to participate in a study of similar nature again in the future, the teachers responded that they would be highly likely to do so.

Participants

The six-question survey was verbally presented to the participants at the completion of the study in the form of a casual conversation. When asked if they enjoyed participating in the study, every student responded "yes". All of the students also responded "yes" when asked if they enjoyed utilizing the headphones during their sessions. Three of four students reported enjoying the use of the self-monitoring app while they were working. Three students responded "no" when asked if they would like to continue using the headphones, as well as the app, in the future when asked to do work. Three students reported that they would be willing to participate in a study similar to this one again in the future.

Limitations and Directions for Future Research

There were a few limitations within this study. One limitation being the repetitiveness of the tasks during the sessions may have impacted the student's willingness to complete work. As the student's mastered the tasks overtime and were given more work

to complete during the session, it may have decreased their motivation to remain on-task and finish their work. The student's also may have increased their tolerance for independent work after being asked to work independently so many times throughout the duration of this study. Another limitation of this study was the relatively low rates of off-task behavior during the baseline sessions. The participants were nominated by their teachers who reported them having high rates of off-task behavior, but the baseline data did not indicate consistent high rates of off-task behavior. In the future, it may be beneficial to include participants with a higher percentage of time spent off-task during independent work sessions. Rates of off-task behavior could be more strictly included in the inclusion criteria. Another interesting point is the PBQ results for multiple participants indicating off-task behavior was maintained by escaping adult interaction, as well as access to attention from adults. The specific form of reinforcement used in this study would likely be more powerful for students that were primarily motivated by forms of attention and not any form of escape.

One limitation specific to Ralph was his vision impairment. His vision impairment made it difficult for him to utilize the self-monitoring app. There is a possibility that he would have had different results if the device screen were bigger and brighter. He also listened to a NCA recording that included himself and a paraprofessional frequently, which seemed to distract him during sessions. It was not intended for this participant to be included on the recording. While listening to one of the recordings, it is possible to hear him in the recording talking to other students and repeating the praise phrases the preferred person was saying while creating the recording. A suggestion for using this intervention moving forward would be for the

recordings to only include other people, not recordings that have the participants themselves as well. This study only included preferred people from the school environment. A suggestion for continued research would be to give the student's the option of having preferred people from other aspects of life create a NCA recording for them.

Another limitation of this study was the difficulty identifying a preferred person. Using the PSPA did not appear to produce accurate results. Moving forward, the assessment should be done in a more private space, not the classroom, or a preferred person should be identified via interviews.

A limitation of this study was not randomizing the tasks Michael and Dante completed. It potentially could have been a threat that Michael did not complete any vocational tasks during baseline sessions or in C sessions. It also cannot be said with confidence that each type of task was of similar difficulty. The teacher did select the work to try and make the sessions more ecologically valid for the students.

In the future, it would be useful to do a similar study but testing different forms of prompting (replace iConnect visual/audio prompts with a different form of prompting) and different forms of NCR, such as being given tangibles like tokens. It also may be interesting to test these same interventions in different settings, such as in general education classes. Another suggestion is to vary the type of work tasks more frequently to control for the possible lack of motivation to complete the assigned tasks during sessions.

Implications for Practice

Providing attention from a preferred person via headphones during times when the student should be engaged academically allows for the teacher to divide attention amongst all students in the classroom. The student in need of attention to maintain being on-task comes into contact with reinforcement in an independent manner and possibly avoids the feeling of deprivation. Having technology provides prompting for the student to remain on-task also allows the classroom staff to have more flexibility with their time because they do not need to provide as much prompting to the student when the app does it for them. These interventions also increase autonomy for the participants which will be valuable for them in their lives now, but also moving forward. It is socially valid and extremely important to make an effort to increase the independence of students. These interventions give the students the chance to be independent and complete tasks assigned to them. This skill transfers to later life as well when they are in the workforce and given assigned tasks. More likely than not, they will be expected to independently complete the tasks assigned to them (Hume et al., 2014). Overall, the results of this study are promising when considering the use of NCA delivered to a student via technology in effort to increase on-task behavior and task completion.

APPENDECIES

Appendix 1

Baseline Data Sheet

Participant	Date	Condition	Session		Work Type
			/		

Rachel explains what trials should be like in general	
Rachel explains that the staff should limit interaction with the student as much as possible	
Rachel helps the teacher identify 10 mins worth of independent tasks	

Rachel asks the teacher if she has any questions	

Teacher lets student know that it is time to complete some independent work		
Teacher tells them where to get materials/ prepares materials		
Teacher tells them to sit in seat		
Teacher explains directions		
Teacher does not interact with student during 10-min observation		If teacher interacts with student, tally here:

Rachel keeps track of time/intervals	
Rachel collects data during 10-min observation	

Momentary Time Sampling

0:00-0:10	0:10-0:20	0:20-0:30	0:30-0:40	0:40-0:50	0:50-1:00

1:00-1:10	1:10-1:20	1:20-1:30	1:30-1:40	1:40-1:50	1:50-2:00

2:00-2:10	2:10-2:20	2:20-2:30	2:30-2:40	2:40-2:50	2:50-3:00

3:00-3:10	3:10-3:20	3:20-3:30	3:30-3:40	3:40-3:50	3:50-4:00

4:00-4:10	4:10-4:20	4:20-4:30	4:30-4:40	4:40-4:50	4:50-5:00

5:00-5:10	5:10-5:20	5:20-5:30	5:30-5:40	5:40-5:50	5:50-6:00

6:00-6:10	6:10-6:20	6:20-6:30	6:30-6:40	6:40-6:50	6:50-7:00

7:00-7:10	7:10-7:20	7:20-7:30	7:30-7:40	7:40-7:50	7:50-8:00

8:00-8:10	8:10-8:20	8:20-8:30	8:30-8:40	8:40-8:50	8:50-9:00

9:00-9:10	9:10-9:20	9:20-9:30	9:30-9:40	9:40-9:50	9:50-10:00

Rachel lets the teacher know when time is up	
Rachel provides behavioral specific praise to the teacher/staff	

Upon completion of the work period, the teacher provides verbal specific praise for working	
Teacher allows them access to reinforcement (E.G., tablet, bean bag chair, toy car, watching videos)	

Intervals On-Task	Total Intervals	Percentage On-Task

# task instructions possible	# task instructions attempted	# task instructions completed correctly

Teacher's Behaviors Completed:	/7
Rachel's Behaviors Completed:	/8
Total PF:	/15

Session notes:

Appendix 2

NCA Data Sheet

Participant	Date	Condition	Session		Work Type
			/		

Rachel explains/reminds what trials should be like in general	
Rachel explains that the staff should limit interaction with the student as much as possible	
Rachel helps the teacher identify 10 mins worth of independent tasks	

Rachel asks the teacher if she has any questions	

Teacher lets student know that it is time to complete some independent work		
Teacher tells them where to get materials/ prepares materials		
Teacher tells them to sit in seat or go to the designated workspace		
Teacher explains directions		
Teacher/Rachel provides the student with headphones and gets the recording ready		

Teacher tells the student to begin their work and Rachel starts the recording		
Teacher does not interact with student during 10-min observation (unless safety becomes a concern)		If teacher interacts with student, tally here:

Rachel keeps track of time/intervals	
Rachel collects data during 10-min observation	

Momentary Time Sampling

0:00-0:10	0:10-0:20	0:20-0:30	0:30-0:40	0:40-0:50	0:50-1:00

1:00-1:10	1:10-1:20	1:20-1:30	1:30-1:40	1:40-1:50	1:50-2:00

2:00-2:10	2:10-2:20	2:20-2:30	2:30-2:40	2:40-2:50	2:50-3:00

3:00-3:10	3:10-3:20	3:20-3:30	3:30-3:40	3:40-3:50	3:50-4:00

4:00-4:10	4:10-4:20	4:20-4:30	4:30-4:40	4:40-4:50	4:50-5:00

5:00-5:10	5:10-5:20	5:20-5:30	5:30-5:40	5:40-5:50	5:50-6:00

6:00-6:10	6:10-6:20	6:20-6:30	6:30-6:40	6:40-6:50	6:50-7:00

7:00-7:10	7:10-7:20	7:20-7:30	7:30-7:40	7:40-7:50	7:50-8:00

8:00-8:10	8:10-8:20	8:20-8:30	8:30-8:40	8:40-8:50	8:50-9:00

9:00-9:10	9:10-9:20	9:20-9:30	9:30-9:40	9:40-9:50	9:50-10:00

Rachel lets the teacher know when time is up	
Rachel provides behavioral specific praise to the teacher/staff or student	

Upon completion of the work period, the teacher provides verbal specific praise for working	
Teacher allows them access to reinforcement upon completion of the work period (E.G., tablet, bean bag chair, toy car, watching videos)	

(work period is end of observation OR when student completes task, dependent on teacher request)

Intervals On-Task	Total Intervals	Percentage On-Task

# task instructions possible	# task instructions attempted	# task instructions completed correctly

Teacher's Behaviors Completed:	/9
Rachel's Behaviors Completed:	/8
Total PF:	/17

Appendix 3

NCA + Self-Monitoring Data Sheet

Participant	Date	Condition	Session		Work Type
			/		

Rachel explains/reminds what trials should be like in general	
Rachel explains that the staff should limit interaction with the student as much as possible	
Rachel helps the teacher identify 10 mins worth of independent tasks	
Rachel gets iConnect ready for student or assists them and ensures it is ready to go	

prior to beginning the 10-min work session	
Rachel asks the teacher if she has any questions	

Teacher lets student know that it is time to complete some independent work		
Teacher tells them where to get materials/ prepares materials		
Teacher tells them to sit in seat		
Teacher explains directions		

Teacher/Rachel provides the student with headphones and gets the recording ready		
Teacher tells the student to begin their work and starts the recording		
Teacher does not interact with student during 10-min observation unless for safety reasons		If teacher interacts with student, tally here:

Rachel keeps track of time/intervals	
Rachel collects data during 10-min observation	

Momentary Time Sampling

0:00-0:10	0:10-0:20	0:20-0:30	0:30-0:40	0:40-0:50	0:50-1:00

1:00-1:10	1:10-1:20	1:20-1:30	1:30-1:40	1:40-1:50	1:50-2:00

2:00-2:10	2:10-2:20	2:20-2:30	2:30-2:40	2:40-2:50	2:50-3:00

3:00-3:10	3:10-3:20	3:20-3:30	3:30-3:40	3:40-3:50	3:50-4:00

4:00-4:10	4:10-4:20	4:20-4:30	4:30-4:40	4:40-4:50	4:50-5:00

5:00-5:10	5:10-5:20	5:20-5:30	5:30-5:40	5:40-5:50	5:50-6:00

6:00-6:10	6:10-6:20	6:20-6:30	6:30-6:40	6:40-6:50	6:50-7:00

7:00-7:10	7:10-7:20	7:20-7:30	7:30-7:40	7:40-7:50	7:50-8:00

8:00-8:10	8:10-8:20	8:20-8:30	8:30-8:40	8:40-8:50	8:50-9:00

9:00-9:10	9:10-9:20	9:20-9:30	9:30-9:40	9:40-9:50	9:50-10:00

Rachel lets the teacher know when time is up	
Rachel provides behavioral specific praise to the teacher/staff or student	

Upon completion of the work period, the teacher provides verbal specific praise for working	

Teacher allows them access to reinforcement (E.G., tablet, bean bag chair, toy car, watching videos)	

(work period is end of observation OR when student completes task, dependent on teacher request)

Intervals On-Task	Total Intervals	Percentage On-Task

# task instructions possible	# task instructions attempted	# task instructions completed correctly

Teacher's Behaviors Completed:	/9
Rachel's Behaviors Completed:	/9
Total PF:	/18

Appendix 4

Problem Behavior Questionnaire

Problem Behavior Questionnaire

Respondent Information

Student _____ DOB _____ Grade _____ Sex: M F IEP: Y N

Teacher _____ School _____

Telephone_____ Date _____

Student Behavior: Please briefly describe the problem behavior(s)

Directions: Keeping in mind a typical episode of the problem behavior, circle the frequency with which each of the following statements is true.

	Percent of the time						
	Never	10%	25%	50%	75%	90%	Always
1. Does the problem behavior occur and persist when you make a request to perform a task?	0	1	2	3	4	5	6
2. When the problem behavior occurs do you redirect the student to get back to task or follow rules?	0	1	2	3	4	5	6
3. During a conflict with peers, if the student engages in the problem behavior do peers leave the student alone?	0	1	2	3	4	5	6
4. When the problem behavior occurs do peers verbally respond or laugh at the student?	0	1	2	3	4	5	6
5. Is the problem behavior more likely to occur following a conflict outside of the classroom (e.g., bus write-up)?	0	1	2	3	4	5	6
6. Does the problem behavior occur to get your attention when you are working with other students?	0	1	2	3	4	5	6
7. Does the problem behavior occur in the presence of specific peers?	0	1	2	3	4	5	6
8. Is the problem behavior more likely to continue to occur throughout the day following an earlier episode?	0	1	2	3	4	5	6
9. Does the problem behavior occur during specific academic activities?	0	1	2	3	4	5	6
10. Does the problem behavior stop when peers stop interacting with the student?	0	1	2	3	4	5	6
11. Does the behavior stop when peers are attending to other students?	0	1	2	3	4	5	6
12. If the student engages in the problem behavior do you provide one-to-one instruction to get student back on task?	0	1	2	3	4	5	6
13. Does the problem behavior cease if you stop making requests or end an academic activity?	0	1	2	3	4	5	6
14. If the student engages in the problem behavior, do peers stop interacting with the student?	0	1	2	3	4	5	6
15. Is the problem more likely to occur following	0	1	2	3	4	5	6

Source: Lewis, T.J., Scott, T.M., & Sugai, G. (1994). The problem behavior questionnaire: A teacher-based instrument to develop functional hypotheses of problem behavior in general education settings. Diagnostique, 19, 103-115. Reprinted with permission.

unscheduled events or disruption in class routines?

Problem Behavior Questionnaire Profile

Directions: Circle the score given for each question from the scale below the corresponding question number (in bold).

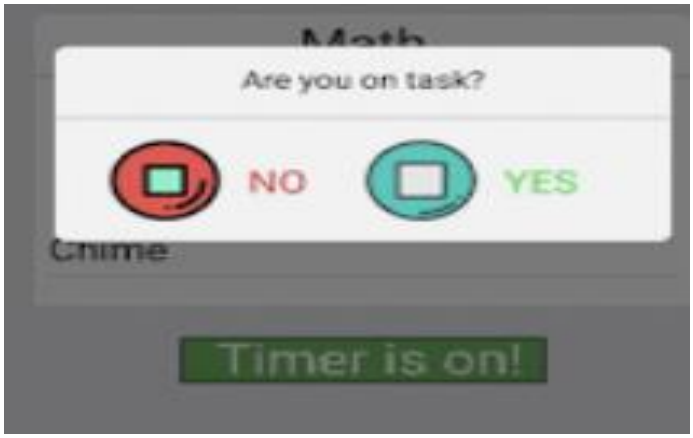
In interpreting the completed student profile, any item circled at the three (3) or above level represents a potential hypothesis (or explanation) for the student motivation to engage in the problem behavior. If two or more are circled at the three (3) or above level in any of the five categories, it suggests a primary hypothesis.

Peers						Adults						Setting Events		
Escape			Attention			Escape			Attention					
3	**10**	**14**	**4**	**7**	**11**	**1**	**9**	**13**	**2**	**6**	**12**	**5**	**8**	**15**
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Lewis, Scott, and Sugai (1994)

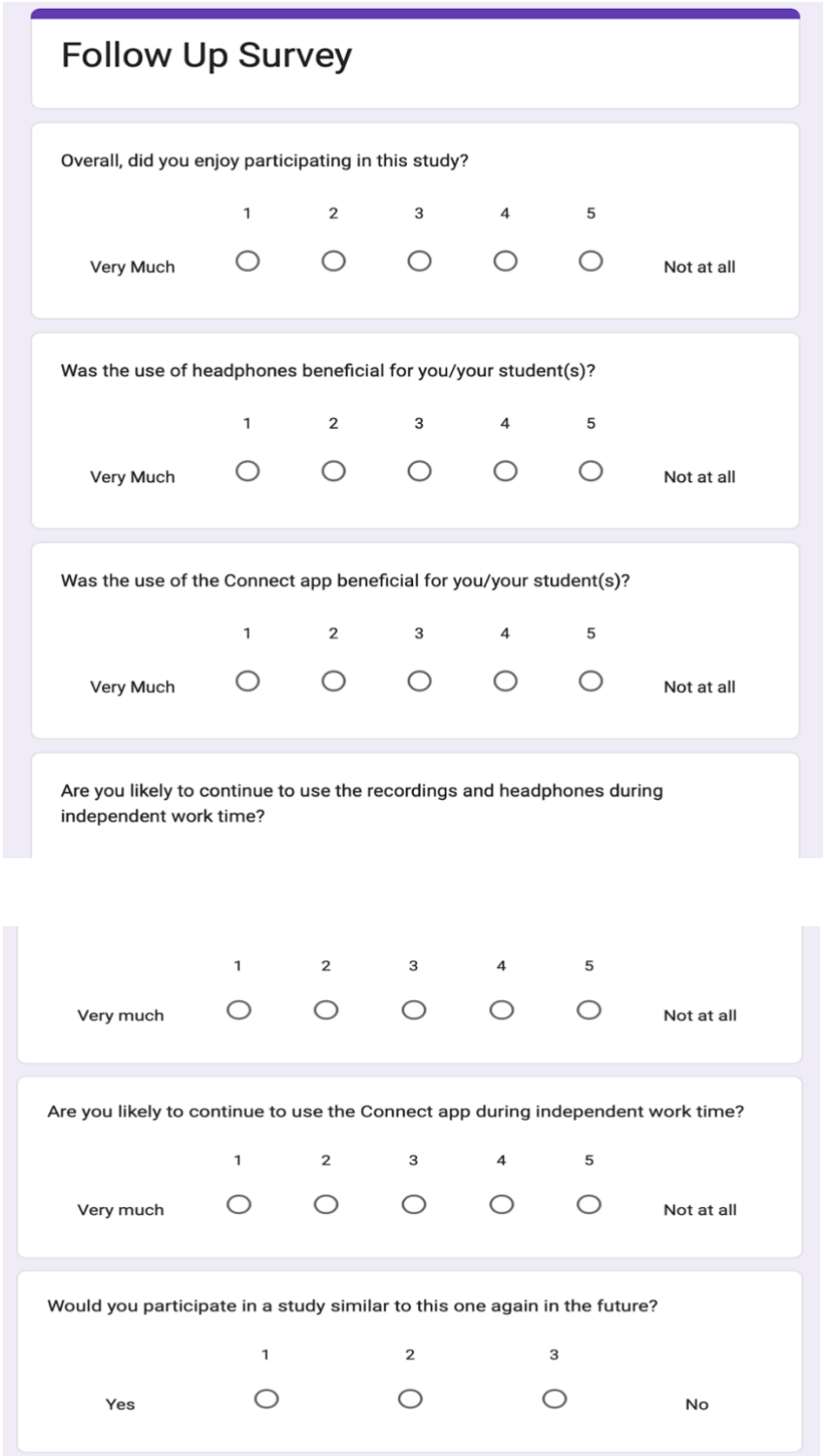
Appendix 5

iConnect Prompt



Appendix 6

Social Validity Follow Up Survey



Follow Up Survey

Overall, did you enjoy participating in this study?

	1	2	3	4	5	
Very Much	○	○	○	○	○	Not at all

Was the use of headphones beneficial for you/your student(s)?

	1	2	3	4	5	
Very Much	○	○	○	○	○	Not at all

Was the use of the Connect app beneficial for you/your student(s)?

	1	2	3	4	5	
Very Much	○	○	○	○	○	Not at all

Are you likely to continue to use the recordings and headphones during independent work time?

	1	2	3	4	5	
Very much	○	○	○	○	○	Not at all

Are you likely to continue to use the Connect app during independent work time?

	1	2	3	4	5	
Very much	○	○	○	○	○	Not at all

Would you participate in a study similar to this one again in the future?

	1	2	3	
Yes	○	○	○	No

REFERENCES

Bruhn, L. A., Vogelgesang, K., Schabilion, K., Waller, L., & Fernando, J. (2015). "I don't like being good!" Changing behavior with technology-based self-monitoring. *Journal of Special Education Technology, 30*(3), 133–144. https://doi.org/10.1177/0162643415618911

Choi, J. (2006). Effects of classroom applications of extinction vs. noncontingent reinforcement on attention seeking challenging behavior. ProQuest Dissertations Publishing.

Hume, K., Boyd, B. A., Hamm, J. V., & Kucharczyk, S. (2014). Supporting independence in adolescents on the autism spectrum. *Remedial and Special Education, 35*(2), 102–113. https://doi.org/10.1177/0741932513514617

Jones, K. M., Drew, H. A., & Weber, N. L. (2000). Noncontingent peer attention as treatment for disruptive classroom behavior. *Journal of Applied Behavior Analysis, 33*(3), 343–346. https://doi.org/10.1901/jaba.2000.33-343

Kumm, S., Talbott, E., & Jolivette, K. (2021). A technology-based self-monitoring intervention for secondary students with high-incidence disabilities. *Journal of Special Education Technology, 36*(3), 141–151. https://doi.org/10.1177/01626434211004450

Ledford, J. R., & Gast, D. L. (2018). *Single case research methodology: Applications in special education and Behavioral Sciences*. Routledge, Taylor & Francis Group.

Lewis, T. J., Scott, T. M., & Sugai, G. (1994). The problem behavior questionnaire: A teacher-based instrument to develop functional hypotheses of problem behavior in general education classrooms. *Diagnostique, 19*(2-3), 103-115.

Meany-Daboul, M. G., Roscoe, E. M., Bourret, J. C., & Ahearn, W. H. (2007). A comparison of momentary time sampling and partial-interval recording for evaluating functional relations. *Journal of Applied Behavior Analysis, 40*(3), 501–514. https://doi.org/10.1901/jaba.2007.40-501

Mithaug, D. K., & Mithaug, D. E. (2003). Effects of teacher-directed versus student-directed instruction on self-management of young children with disabilities. *Journal of Applied Behavior Analysis, 36*(1), 133–136. https://doi.org/10.1901/jaba.2003.36-133

Noel, C. R., Rubow, C. C., & Wehby, J. H. (2018). Using noncontingent reinforcement to reduce perseverative speech and increase engagement during social skills instruction. *Education & Treatment of Children, 41*(2), 157–168. https://doi.org/10.1353/etc.2018.0006

Powell, J., Martindale, A., & Kulp, S. (1975). An evaluation of time-sample measures of behavior. *Journal of applied behavior analysis, 8*(4), 463–469. https://doi.org/10.1901/jaba.1975.8-463

Riley, J. L., McKevitt, B. C., Shriver, M. D., & Allen, K. D. (2011). Increasing on-task behavior using teacher attention delivered on a fixed-time schedule. *Journal of Behavioral Education, 20*(3), 149–162. https://doi.org/10.1007/s10864-011-9132-y

Ritter, W. A., Barnard-Brak, L., Richman, D. M., & Grubb, L. M. (2018). The influence of function, topography, and tetting on noncontingent reinforcement effect sizes for reduction in problem behavior: A meta-analysis of single-case experimental design data. *Journal of Behavioral Education, 27*(1), 1–22. https://doi.org/10.1007/s10864-017-9277-4

Rosenbloom, R., Wills, H. P., Mason, R., Huffman, J. M., & Mason, B. A. (2019). The effects of a technology-based self-monitoring intervention on on-task, disruptive, and task-completion behaviors for adolescents with autism. *Journal of Autism and Developmental Disorders, 49*(12), 5047–5062. https://doi.org/10.1007/s10803-019-04209-4

Rubow, C. C., Noel, C. R., & Wehby, J. H. (2019). Effects of noncontingent attention on the behavior of students with emotional/behavioral disorders and staff in alternative settings. *Education and Treatment of Children, 42*(2), 201-224. https://www.jstor.org/stable/26623054

Sugai, G. M., Horner, R. H., Dunlap, G., Hieneman, M., Lewis, T. J., Nelson, C. M., Scott, T., Liaupsin, C., Sailor, W., Turnbull, A. P., Turnbull, H. R., Wickham, D., Wilcox, B., & Ruef, M. (2000). Applying positive behavior support and functional behavioral assessment in schools. *Journal of Positive Behavior Interventions, 2*(3), 131–143. https://doi.org/10.1177/109830070000200302

Tomlin, M., & Reed, P. (2012). Effects of fixed-time reinforcement delivered by teachers for reducing problem behavior in special education classrooms. *Journal of Behavioral Education, 21*(2), 150–162. https://doi.org/10.1007/s10864-012-9147-z

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*(4), 421–434. https://doi.org/10.1007/s10864-014-9204-x

Willz, H., Buzhardt, J., & University of Kansas. (n.d.). *Stepping Up Technology Enabled Self-Monitoring For High School Students with Disabilities*. I-Connect. Retrieved April 7, 2023, from https://iconnect.ku.edu/wp-content/uploads/2019/03/Stepping-up-Presentation-.pdf

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