5-2015

An Evaluation of an iPad-Based Activity Schedule

Kassidy Stuart Reinert
Utah State University

AN EVALUATION OF AN iPAD-BASED ACTIVITY SCHEDULE

by

Kassidy Stuart Reinert

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Special Education and Rehabilitation

Approved:

Thomas Higbee, Ph.D. Major Professor	Tyra Sellers, Ph.D. Committee Member
Kimberly Snow, M.Ed. Committee Member	Mark R. McLellan, Ph.D. Vice President for Research and Dean of the School of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

2015

ABSTRACT

An Evaluation of an iPad-Based Activity Schedule

by

Kassidy Stuart Reinert, Master of Science

Utah State University, 2016

Major Professor: Thomas S. Higbee, Ph.D.
Department: Special Education and Rehabilitation

Children with autism often engage in repetitive behaviors and may not engage appropriately with leisure activities. Visual activity schedules are an effective way to promote independence and teach appropriate task engagement. Previous researchers have found that activity schedules are not only effective in teaching a range of skills, but also have been shown to reduce problem behavior. Paper-based activity schedules, while inexpensive and fairly easy to prepare, can be cumbersome. Socially, activity schedule books may also be stigmatizing. This study investigated the effectiveness of using an iPad to teach visual activity schedule following with preschoolers with autism. Findings from the current study add to previous research showing that technology-based activity schedules are an effective way to teach young children to engage in leisure activities independently. We also evaluated participants' preferences for the iPad-based schedule versus the binder-based schedule and found that the iPad-based schedule was preferred for two of three participants.

(54 pages)

PUBLIC ABSTRACT

An Evaluation of an iPad-Based Activity Schedule

by

Kassidy Stuart Reinert

A visual activity schedule is a set of pictures or words that can be used to teach an individual with disabilities to complete a set of tasks. These schedules can help individuals with disabilities to become more independent and complete tasks appropriately. Children with autism often engage in behaviors that are repetitive or not appropriate when playing. Visual activity schedules have been used to teach a variety of skill and teach appropriate play. Typically, activity schedules are paper based; this study examines the use of an activity schedule taught on an iPad. This study included three young boys with a diagnosis of autism who were attending a university-based early intervention preschool. This study found that technology-based activity schedules are an effective way to teach play and the technology-based activity schedule was preferred for two of the three participants.

ACKNOWLEDGMENTS

First I would like to thank my advisor, Dr. Thomas Higbee, for all of his supervision, feedback, and support through the process of completing this study. The completion of this study and my master's degree would not have been possible without him. I would also like to thank my committee members, Tyra Sellers and Kimberly Snow, for the encouragement and assistance during this study.

I am so grateful for all the wonderful support I was given from the ASSERT preschool management team from the ideas of possible studies to the completion of my thesis. Thank you Matthew Brodhead, Nina Gerencser, Bethany Contreras, Azure Pellegrino, Lorraine Becerra, Stéphanie Cousin, and Kylee Lewis, for all of your support. I would also like to specifically thank Jessica Akers for teaching me to love research and including me on her projects. Thank you Lyndsay Nix, DeVanie Hatfield, and Amy Heaps for all of the assistance in recording sessions and collecting data—without you I would not have completed this study.

I am incredibly grateful for my husband, my parents, and family for always believing in me and encouraging me. Colin, thank you for all of your patience and moral support. Bodie, thank you for being a wonderful little research assistant.

Kassidy Stuart Reinert

CONTENTS

LIST OF FIGURES

CHAPTER I

INTRODUCTION

A visual activity schedule is a set of pictures or words that prompt an individual to engage in specific behaviors (McClannahan & Krantz, 1999, p. 3). Activity schedules are an effective way to teach individuals with disabilities a variety of skills (Carson, Gast, & Ayers, 2008; MacDuff, Krantz, & McClannahan, 1993). Previous studies have used activity schedules to teach work tasks (Carson et al., 2008), prompt independent play for children with autism (MacDuff et al., 1993), and promote peer engagement during play for children with autism (Betz, Higbee, & Reagon, 2008). Visual activity schedules are an effective way to promote independence and teach appropriate task engagement (Koyama & Wang, 2011).

Paper-based activity schedules, usually created using three-ring binders, while inexpensive, can be difficult and time intensive to create and prepare. Socially, these books could also be stigmatizing (Carlile, Reeve, Reeve, & DeBar, 2013). Creating a less stigmatizing and more easily accessible activity schedule may increase the likelihood that parents and teachers would have access to this evidence-based technology.

Technology is becoming a popular way to teach children with autism (Stromer, Kimball, Kinney, & Taylor, 2006). Five studies (Carlile et al., 2013; Dauphin, Kinney, & Stromer, 2004; Gourwitz, 2014; Kimball, Kinney, Taylor, & Stromer, 2004; Stromer et al., 2006) examined the use of technology-based activity schedules to teach activity schedule following. These studies demonstrated the effects of technology, including iPods, to increase on task behavior (Carlile et al., 2013), videos to increase dramatic play

(Dauphin et al., 2004), and iPads to increase time on task and decrease transition time during centers (Gourwitz, 2014). Many of the studies examining the use of technology-based activity schedules include participants over the age of 5 (e.g., Gourwitz, 2014) and many use a Microsoft PowerPoint presentation on a computer (e.g., Rehfeldt, Kinney, Root, & Stromer, 2004). Stromer et al. noted that while these interventions are effective, the lack of portability could be seen as a disadvantage. No studies, based on my review, have used a standard format of an activity schedule (a single picture representing an activity on a page) in combination with technology with young children with autism, who were 5 years old or younger. With the advent of tablet-based computers, such as the iPad, issues of portability are no longer a concern. Given the success of the standard, binder-based activity schedules and the potential for improving the ease of use and reducing the stigma that could be achieved by using an iPad-based activity schedule, additional research in this area seems warranted. The fact that other, computer-based, activity schedules have been effective also suggests that extending this technology to the iPad seems like a logical next step. To more fully understand the related research in this emerging area, I performed a computer-assisted literature search and review.

CHAPTER II

LITERATURE REVIEW

During my search for articles I searched multiple sources, including Google Scholar and EBSCO Host database (ERIC and Psych Info) using the search terms *activity schedules, tablet activity schedule, iPad activity schedule, technology-based activity schedule, technology autism, autism activity schedules, preschool activity schedule*. I also reviewed articles recommended by doctorate students and committee members. Also, I used Google search engine, Apple iTunes ® and Google Play Store ® to search for relevant applications. I included the landmark study by McDuff et al. (1993) to describe the original activity schedule research. Next, I reviewed Gourwitz (2014) and Carlile et al. (2013)—studies examining the use of technology-based schedules.

MacDuff et al. (1993) first investigated the effects of photographic activity schedules on on-task and on-schedule behavior of children with autism. Four boys diagnosed with autism, ranging in age from 9 to 14 years, were selected as participants in the study. The participants resided at a group home and participated in an intervention program. The study was conducted at the group homes where the participants resided. All participants depended on caregivers' verbal prompts to complete leisure activities, housework, and self-help tasks. In addition, all participants exhibited severe language deficits and engaged in disruptive behavior. Prior to this study, all participants had experience with a photographic activity schedule to teach lunch preparation or how to access a preferred beverage. None of the participants had been taught leisure skills or other activities using a photographic activity schedule.

The activity schedules used during the study consisted of a three-ring binder with six white pages in page protectors. In the center of each of the six pages was a picture that depicted a homework or leisure activity. All photographs included the item or activity, with a plain background. Some of the activities that were included in the first three pages were Lincoln Logs®, Lego Blocks®, Tinker Toys®, and handwriting worksheets. The remaining three pages included photographs of a snack, puzzle, and TV.

During all sessions, the activity schedule was placed approximately 1 m away and directly in front of the seated participant. All depicted materials were also present during all sessions and conditions. The researcher stated the initial instruction, "Everyone look at me; please find something to do." This instruction remained the same during all conditions. A multiple baseline across participants' design was used to examine the effects of the activity schedule taught using manual prompts to increase on-task and on-schedule behavior. Data were collected for on-schedule and on-task behaviors using a 60 s momentary time sampling procedure during the 60-min sessions.

Baseline sessions consisted of the initial instruction and no additional instructions or prompts were provided. If the student engaged in disruptive behavior, it was ignored. During teaching conditions, researchers used graduated guidance, involving only manual prompting from behind, to prevent and decrease errors. Once a participant was on-task and on-schedule 80% of the time or more, the teacher began to fade physical proximity. Teaching sessions discontinued when the participant maintained at 80% on-task levels or better after fading for five consecutive sessions. During maintenance sessions, no prompts were given, but the teacher was still present. During resequencing pictorial

schedules, four of the six activities were reordered, with the exception of snack and TV. In the generalization condition, two of the original six pictures were replaced with two novel, but similar leisure activities.

During baseline, three of the four participants engaged in variable on-task behavior. The other participant did not engage in on task behavior, with the exception of two sessions, where engagement was at 10% or below. None of the participants engaged in any on-schedule behaviors during baseline sessions. On-task behavior was defined as (a) looking at any appropriate play or work materials, (b) visually attending to their photographic schedules, (c) manipulating play or work materials, or (d) transitioning between one activity and another. Once the teaching condition was introduced, percentages of on-task and on-schedule intervals increased to at or above 90% of intervals. During maintenance, resequencing, and generalization, data remained high and stable for on-task behavior and on-schedule behavior. During these sessions, on-task and on-schedule behavior remained at or above 90%. These findings suggest that the activity schedule, with graduated manual guidance, was effective in teaching participants to engage in on-task and on-schedule behaviors.

Using the most effective and efficient teaching procedures can assist classroom teachers in including students with autism in their classrooms, while still being able to attend to other students needs as well. Gourwitz (2014) conducted a study comparing paper-based and iPad-based visual schedules to increase on task behavior and decrease transition time during literacy centers in and inclusive k-1st classroom. For the iPad-based visual schedule, the Choiceworks Visual Support System was used. The Choiceworks

Visual Support System displays the visual activity schedule in two vertical columns. Between the two columns a timer is displayed for any timed activity. The column on the left was titled “First I need to” and the column on the right was titled “All done.” When the first activity’s time limit was reached the picture in the left column automatically moves to the right column. After completing the schedule, the participant was able to select from two preferred items displayed at the bottom of the screen. The paper-based schedule consisted of a direct copy of the Choiceworks Visual Support System display printed on a piece of paper. Pictures were placed in the left column titled “First I need to” on Velcro tabs and the participant would move the completed activities to the “All done” column when completed. This display was identical to the electronic version of the schedule, with the exception of the timer. During the paper-based schedule, the teacher controlled the timer. The participants were three boys who were 5, 6, and 7 years old. All participants had a special education label of autism spectrum disorder. Sessions were approximately 60 min. An alternating treatments single-subject design was used to determine if one schedule was superior to another.

For all sessions, data were collected for on-task behavior and duration of transition time. On-task behavior was measured using a 10-s whole interval recording (Cooper, Heron, & Heward, 2007). Duration recording (Cooper et al., 2007) was used to examine duration of transition time. Data collection began when the students were instructed to go to four small group literacy centers.

Prior to baseline, participants chose their two most preferred edibles. These edibles were delivered at the end of the session. During baseline sessions, data were

collected on on-task behaviors and duration of transition time without any schedule. The participants, prior to intervention, could manipulate the schedule with 100% accuracy for two of three trials. During treatment sessions, participants were randomly assigned to use either the paper-based visual schedule or iPad-based visual schedule, with no more than two sessions in a row of each schedule. Participants independently used the schedules during treatment sessions.

For all three participants, the iPad-based visual schedules increased the percentage of intervals of on-task behavior compared to baseline. For two participants, the iPad-based visual schedule was superior to the paper-based visual schedule, while for one participant the paper-based visuals schedule was superior. Baseline data for duration of transition were not stable. For two participants, no differences between iPad and the paper-based visual schedule were observed. The duration of transitions was consistently lower for one participant when using the iPad-based visual schedule.

While paper-based and iPad-based visual schedules may be equally effective for some students, Carlile et al. (2013) suggested that an iPod touch was more socially acceptable, highly preferred, discreet, and portable than the book-based activity schedule. Four 8-to 12-year-old children with autism were taught to follow an iPod-based activity schedule. All participants had previous experience interacting with an iPod touch, were able to set and respond to timers, and follow a book-based activity schedule. All sessions were conducted in the participants' self-contained classroom. Data were collected on the independent tasks of the activity schedule and were examined in a multiple probe across participants' design.

A 4G iPod was used during the study. The photo album and timer on the iPod were used as the schedule. Each activity was a timed activity and had a timer image in the lower right corner. The participant was taught to exit the album and enter the timer app on the iPod. The timer was preset to 2 min and the participant started the timer and then engaged with the task. Once the timer went off, participants returned to the photo album, stopped the timer, and advanced to the next activity page using a left to right swiping motion or tapping an arrow. The paper-based activity schedule, which was used only during a social validity measure, was an identical printout of the iPod activity schedule. Activities for each participant were selected based on the results of a multiple stimulus without replacement preference assessment. The researcher presented fifteen items to the participant delivered the instruction: "Pick one."

Sessions began with an instructor telling the student to "Go Play." During baseline, no prompts were provided and sessions were terminated if the student did not begin to engage with the activity schedule within 5 min. During baseline, no participants engaged with, or completed, the schedule. Similar to MacDuff et al. (1993), physical prompts were used to teach during the intervention condition. In addition to physical or manual prompts, progressive time-delay procedures and reinforcement were also used during intervention. For all participants, the number of correctly completed components increased during intervention. The mean percentage of correctly completed components during intervention increased to 92-95.8%. Mastery of all components was reached after 10-14 sessions. During generalization probes, completed during intervention one participant's percentage of correctly completed components increased to 100%, while the

other two participants' percentage of correctly completed components increased to 50% and 57%. Percentage of on-task behavior also increased for each participant. During baseline, participants were on task 0% to 40% of the time, while during intervention time on task increased to 85% to 100% of the time. At the 2-week, 1-month, and 3-month maintenance checks, all participants correctly completed 100% of their schedules. Two were on task for 100% of the time during all three maintenance checks while the other two were on task for 80% of the time during the 2-week check and 90% for the 1-month and 3-month check.

To assess for preference, participants were given five opportunities to select the activity schedule they preferred. Both schedules were set in front of the participant and they were told to choose one. Three participants selected the iPod-based activity schedule 100% of the time and one participant selected the iPod-based activity schedule 80% of the time.

The social validity portion of this study was extensive. Four groups were included in the social validity measures. These groups included undergraduate students, grade-equivalent peers, the participant's classroom instructors and teachers, and member of the community. Undergraduate students watched two videos, one pre- and one post-intervention and were asked to rate if the child was appropriately structuring their time. Post-intervention videos were rated the child as appropriately structuring their time. Peers found the intervention to be acceptable and fair for their peer to learn with an iPod even if they were not able to. Teachers and instructors reported that they were willing to implement the iPod-based activity schedule and did not find it disruptive. Community

members rated the iPod-based activity schedule as more typical of peers and acceptable in the community than the three ring binder activity schedule.

In a related study, Markham, Giles, and Kanoujiya (2015) compared the efficiency and preference for tablet and book-based activity schedules. Participants included three boys who were 3 to 5 years of age with a diagnosis of autism. The study was conducted in a partitioned area of an early intervention clinic. The tablet activity schedule was paired with a blue tablecloth and the book activity schedule was paired with a red tablecloth. Two pictures were presented to the participant: a book with a red background and a tablet on a blue background. The researcher then provided a verbal prompt "Choose your activity schedule." Once the participant selected the stimulus, they were then exposed to the treatment conditions associated with that stimulus. After completing the schedule, two of the participants were given access to a preferred activity and praise while one participant was given additional edibles for sitting and completing the schedule.

The tablet-based activity schedule consisted of eight steps, while the book schedule consisted of 11 steps. Each schedule consisted of two closed-ended tasks, such as an inset puzzle. The tablet-based activity schedule used the iPad's album to display the photos of activities. The activities were presented on a blue tablecloth. The book-based activity schedule was a three-ring binder with printed pictures of each activity on a red tablecloth.

Two dependent variables were examined during the study, the percentage of independent correctly completed steps as well as trials to mastery. Mastery criteria for the

schedules were two consecutive sessions at 100%. During intervention, the schedule was taught using total-task chaining and most-to-least prompting. For all participants, the percentage of correctly completed components during baseline was between 0% and 15%. For two participants, acquisition occurred more quickly during the book activity schedule. One participant reach mastery criteria faster during the tablet-based activity schedule but the schedule following behavior did not maintain. For two of the three participants, the tablet-based activity schedule was selected more often.

One possible limitation is the procedures for assessing preference include the concurrent chains preference assessment with stimulus pairing. While this is an effective research procedure, this protocol also adds a level of complexity that is not needed to assess the student's preference for the modality of activity schedule. Another possible limitation of this study was the number of steps in the task analysis for the binder and iPad-based activity schedules were not equal. The tablet-based schedule consisted of eight steps while the book-based schedule consisted of 11 steps. The number of activities in the activity schedules in this study may also be a limitation. Each participant was required to complete only two tasks. Most activity schedules involve a larger number of tasks.

Activity schedules have been shown effective in teaching on-task behavior to individuals with disabilities (MacDuff et al., 1993) and may be preferred to paper/book-based schedules (Markham et al., 2015). While some studies have examined schedule following on an iPad or iPod with older students (Carlile et al., 2013; Gourwitz, 2014), studies are needed to examine technology-based activity schedule following for young

children with autism (Koyama & Wang, 2011). When interventions are equally effective client preference can be considered (Luczynski & Hanley, 2009), more studies are needed to examine if preferred interventions increase appropriate responding. Thus, the purpose of the current study was to examine the effects of an iPad-based activity schedule on components of the schedule completed correctly for young children with autism. The current study also examined which activity schedule, binder-based or iPad-based, was preferred by young children with autism. Research questions included the following.

1. Will preschool age children with autism, who have already learned to follow a binder-based activity schedule with at least 80% accuracy, exhibit generalized schedule following behavior, and demonstrate similar levels of performance, during a tablet-based activity schedule, as measured by percentage of independent correctly completed components?

2. When given the opportunity to choose between a binder-based activity schedule or tablet-based activity schedule, which will young children with autism prefer as measured by the percentage of opportunities that each schedule is selected when both are available?

CHAPTER III

METHODS

Participants and Pre-Experimental Observations

Participants included three students who attended a university-based preschool for children with autism—Chris, Rodger, and Warren. Chris and Warren were 5 years old and Rodger was 3 years old. The participants were boys who had a diagnosis of autism made by an outside agency. Each participant had previous experience engaging with a tablet at home to: play games, watch videos, and/or listen to audio books. All participants were fluent binder-based activity-schedule followers and had at least three activities in their binder-based activity schedules. Participants were considered fluent binder-based activity-schedule followers when they completed at least 80% of components independently (see Appendix C), without prompts, for three consecutive sessions. During intervention, we taught participants to use the application. During the pre-experimental observation, Warren completed 29-32 components of 35, Rodger completed between 24-29 components of 29, and Chris completed between 29-35 components of 35.

Participants' parents were given a Utah State University Institutional Review Board approved informed consent form. The form indicated possible advantages and disadvantages of the study. Parents were informed that the students were assigned a pseudonym to protect their child's confidentiality. The child's pseudonym, age, autism diagnosis, and gender were the only identifying information included in the study.

Setting

All sessions were conducted in the common area and a partitioned area of the preschool classroom. The common area was approximately 8 m by 8 m. The common area contained one large table, one small table, approximately 15 small chairs, two large chairs, and bookshelves that contained leisure materials. These leisure materials included books, toys, puzzles, and games. The partitioned area was bordered by one cubicle wall, a Smartboard, and bookshelves and was approximately 3 m by 2 m. The open end of the partitioned area was open to the common area of the classroom. The partitioned area contained two tables and two bookcases. The two bookcases held the iPad, the binder-based activity schedules, timers, and closed- ended activities. Closed-ended activities are activities that have a clear beginning and end (i.e. puzzle, ring stackers, or shape sorter).

Materials

Each participant's binder-based activity schedules varied in complexity, based on the participant's abilities. Participant's case managers were interviewed to determine the number of activities the participant typically complete in their binder-based activity schedule. Chris and Warren completed four activities and Rodger completed three activities. The binder-based activity schedules were placed within a small three ring binder. The cover of the binder contained a colored background. In the center of the colored background, there was a white box with the participant's name printed in black ink. The binders contained between four and five pages. Each page color corresponded to the cover color and was inside a page protector. In the center of each page there was a

small piece of Velcro. Laminated activity pictures were placed on that Velcro piece. Participants' schedules contained only close-ended activities. The last page of the schedule contained a preferred treat picture. A one trial preference assessment was conducted prior to each session to determine which treat would be included in the schedule.

The tablet-based activity schedule mimicked the complexity and aesthetics of the participants' binder-based activity schedules. The tablet-based activity schedule was a prototype application that I developed using the InVision application. The prototype application was downloaded to an Apple ® iPad. When the application was opened, a *bookshelf* with *binders*, shown in Appendix H, were presented that matched the participants' binder-based activity schedule. During baseline, there were four activity pages for Rodger and five activity pages for Warren and Chris, as well as a treat page in each schedule. During treatment and choice assessment the number of pages for both the tablet-based and binder-based schedules increased to eight activities for Warren and Chris and ten activity pages for Chris, and included a treat page. This increase was to show that we could increase the number of activities that they engaged in during free play. Each participant's binder and tablet-based activity schedules used the same color for the background of pages and the cover.

Ten close-ended activities were place on one of the two bookshelves during all sessions. These 10 activities were used in the schedules and rearranged after every session. On the other bookshelves, approximately 20 puzzles and approximately 15-20 other activities and were available during all sessions.

Activity Schedule

My two dependent variables were (1) the total number of activities completed independently during a session and (2) the participants' independently completed activity schedule components. The total number of activities completed independently was calculated by counting the number of activities that the participant independently (with or without the activity schedule) completed during a session. In order for an activity to be considered "completed" the participant needed to complete the activity in the manner in which it was designed and without stereotypy (e.g., placing all of the puzzle pieces into the inset puzzle without repeatedly spinning the pieces). The percentage of activity schedule components completed independently was calculated as a percentage of total components completed without adult assistance or prompting. A task analysis was used to identify the number of steps during the tablet-based activity schedule. Using this number, I divided the number of independently completed components by total components and multiplied by 100 to determine the percentage of independently completed components.

Experimental Design

A multiple baseline across-subjects design (Cooper et al., 2007) was used to examine the effects of a tablet-based activity schedule on percentage independently completed components and the total number of activities completed. A multiple baseline across subjects is used to examine one target behavior across multiple subjects (Cooper et al. 2007). Data were collected during baseline and treatment sessions to examine the percentage of independently completed components and the total number of activities

completed.

During baseline sessions, the research assistant placed the iPad on top of the activity schedule bookshelf open to the *bookshelf* page and gave the participant the instruction, “Go play.” One bookshelf held all activities needed to completed the schedule, while the other bookshelf contained a variety of puzzles and other closed-ended activities. No binder-based activity schedules were present during baseline sessions. The research assistant did not prompt the participant to engage with the iPad or activities. The research assistant would terminate the session after 10 min or if the participant did not engage with either a toy or the iPad for 1 min. Data collection continued until a stable trend was observed (see Appendix A).

During intervention sessions, the research assistant gave participants the same instruction, “Go play.” The research assistant provided physical prompts for the participant to engage with the iPad-based activity schedule. If a participant attempted to make an incorrect response, such as retrieve the wrong activity, the research assistant prompted immediately. Research assistants provided physical prompts only; no verbal or gestural prompts were provided. Prompts were provided for any steps in the schedule if the participant was not responding after 5 seconds. If a participant responded incorrectly, the research assistant would provide the least intrusive physical prompt to assist the student in completing the task. The prompting hierarchy included hand over hand or full physical prompting, prompting at the wrist, forearm, elbow, shoulder, and shadowing. The research assistant remained behind the student and within arm’s length at all times. Data collection (see Appendix B) continued until a stable trend was observed and the

percentage of independently completed components was at or above 80% for three consecutive sessions. If a participant engaged in problem behavior for longer than 20 s or had an accident, the session would have been terminated. No sessions were terminated because of problem behavior although one session was terminated due to a toileting accident. Because of the population of the study many of our participants are either newly potty trained or currently being potty trained. Thus, if a participant had an accident during a session would be terminated. If a participant was to request to use the restroom during a session, we would honor their request. No participants requested during any sessions of the study.

Choice Assessment

Dependent variables and response measurement. The dependent variable was the selection of either the binder-based or iPad-based activity schedule during a choice trial. The selection response was defined as either physically opening the binder-based schedule or touching the binder icon on the iPad-based schedule. The percentage of selection for each activity schedule was calculated by dividing the number of times it was selected by the number of times it was presented and multiplying that number by 100.

Procedures. The researcher assessed participant preference to determine if one activity schedule was more highly preferred than the other (Carlile et al., 2013). The tablet-based and paper-based activity schedule, were placed on the table, an equal distance from the participant, and the participant was told, “Pick the activity schedule you want to do.” The location of the activity schedules alternated in a quasi-random sequence. Both schedules had the same activities in the same sequence as well as the same treat.

The only difference between the two schedules was the modality of the schedule. Once a selection was made, the research assistant would remove the activity schedule that was not selected and the participant would complete the selected activity schedule (see Appendix D). Each participant was provided with 10 opportunities to select a schedule over several days. No more than three sessions were run per day with each participant.

Interobserver Agreement

Undergraduate and graduate research assistants and the student researcher, served as primary and secondary data collectors. To determine interobserver agreement (IOA), a second data collector watched the recorded session and collected data for at least 30% of all sessions. IOA was calculated by dividing the smaller number of independently completed components by the larger number of independently completed components and multiplying by 100. This percentage provided information on the accuracy of data collection during the study. I trained all data collectors prior to the study using videos of tablet- and binder-based activity schedule. They must complete training with three sessions of data collection with IOA at or above 90%. The average agreement was 93.8% (range from 88% to 100%) for Warren, 98.8% (range from 96% to 100%) for Rodger, and 99.6% (range from 98% to 100%) for Chris.

Treatment Integrity

Treatment integrity was collected by a research assistant. Treatment integrity was used to determine the extent to which procedures were implemented as prescribed (Cooper et al. 2007). During baseline (see Appendix E) the procedures that were

examined were (a) iPad is on top of bookshelf, (b) binder activity schedule is not present, (c) application is open with bookshelf showing, (d) 10 toys are on self, (e) treat is on top of shelf, (f) researcher gives instruction: “Go play,” (g) no prompts are provided, (h) session duration is correct. The procedures that were examined for intervention (see Appendix F) were the same as baseline with the exception of only physical prompts were provided and there was no session duration. During the choice assessment sessions (see Appendix G), the research assistant collected data on (a) iPad is placed on table, (b) binder-based activity schedule is placed on table, (c) application is open with binder cover displayed, (d) 10 toys are on shelf, (e) treat is on top of shelf, (f) researcher gives instruction “Choose the schedule you want to do,” (g) only physical prompting from behind is provided during selected schedule.

Data on treatment integrity was collected for at least 35% of sessions during baseline and 40% of all treatment and choice assessment sessions. To determine the percentage of correctly implemented steps, the number of correct implementation steps was divided by the total steps and multiplied by 100%. Agreement was 100% for all sessions for Warren and Chris. For Rodger the agreement was 99.2% (range from 93% to 100%).

CHAPTER IV

RESULTS

Tablet-Based Activity Schedule

Baseline

Warren engaged with the iPad during baseline sessions during two sessions. He completed 2% and 4% of the schedule by selecting his binder during two sessions and opening the binder during one session. Chris and Rodger never engaged with the iPad and thus did not complete any components of the schedule. Warren appropriately completed between 0 and 4 activities during baseline sessions. Rodger's responding was variable and the highest out of the three participants. During baseline sessions he engage appropriately engaged with 3 to 6 activities. Chris' responding was variable during baseline and he engaged with between 1 and 4 activities.

Activity Schedule

During treatment sessions, the number of activities in a participant's schedule was increased by adding four to the highest number of activities they completed during baseline sessions. Warren and Chris' schedules were increased to eight activities displayed in the first and third panel of Figure 1. Rodger's schedule was increase to ten activities as show in panel two of Figure 1. The total number of components in the schedule for Warren and Chris were 58 and Rodger had 70.

Warren's first two intervention sessions were between 60-65% and the during the third session increased to mastery level for five consecutive sessions at or above 80% as

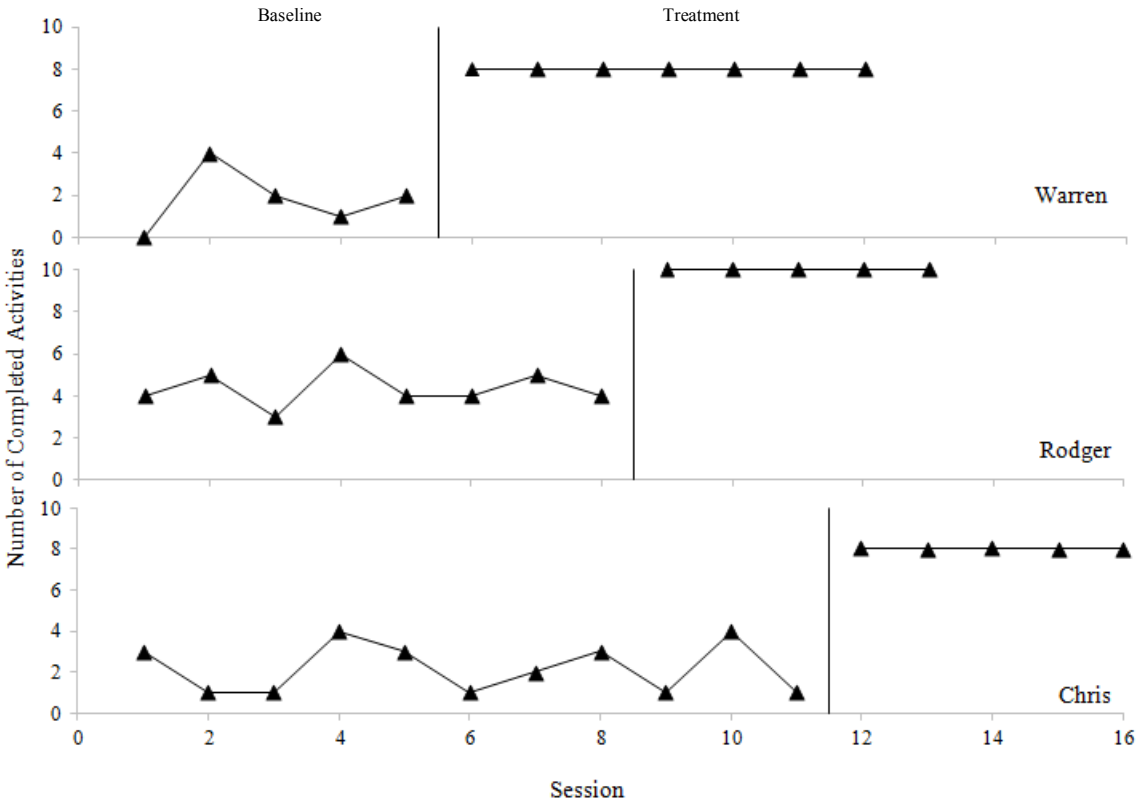


Figure 1. Number of completed activities during the iPad-based activity schedule.

show in the first panel of Figure 2. During treatment sessions, Rodger and Chris required very few prompts to engage with the schedule. When necessary, we used hand over hand prompts to prompt page selection and page turning and light elbow prompts from behind to prompt retrieving items. Both independently completed the schedule with 80% accuracy during the first session, as displayed in the second and third panel of Figure 2. Rodger and Chris had a stable and high trend for five consecutive sessions. During all treatment and choice assessment sessions Warren and Chris completed eight activities and Rodger completed 10 activities.

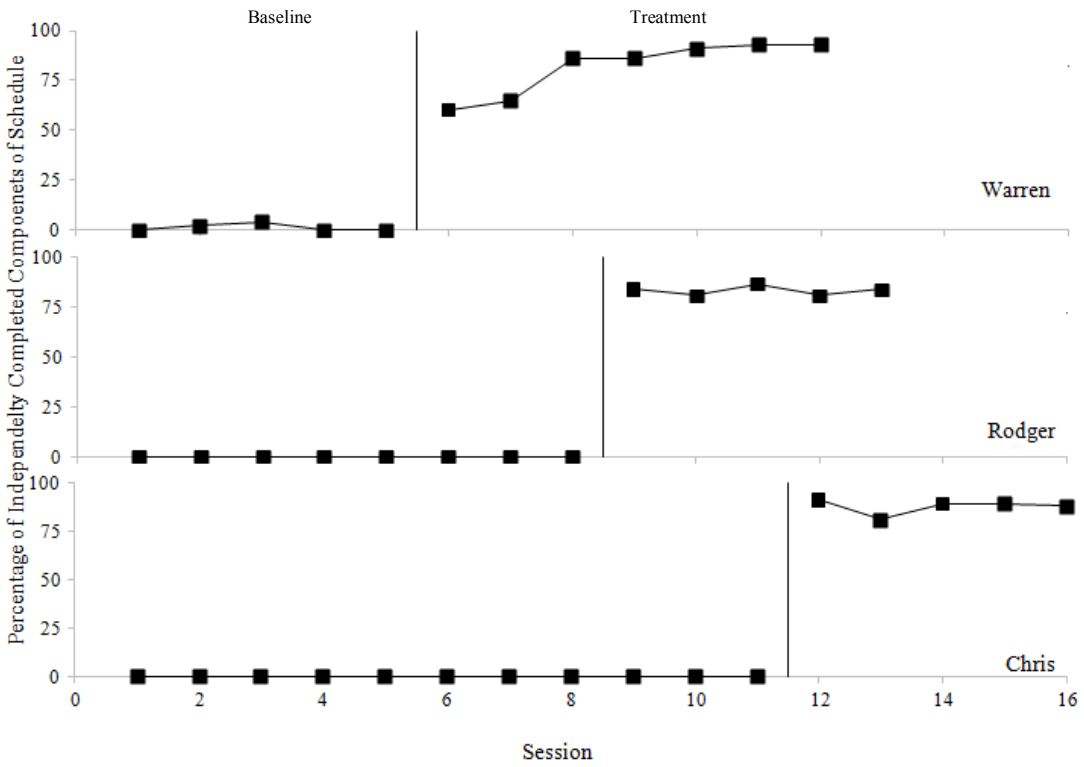


Figure 2. Percentage of correctly completed components during the iPad-based activity schedules.

Choice Assessment

During the choice assessment, two participants selected the iPad more often and one participant selected the binder-based activity schedule more often. Warren selected the iPad 80% of the time, show in Figure 3. Rodger chose the iPad-based activity schedule 70% and the binder-based activity schedule 30% of the sessions shown in the center columns. Chris only selected the iPad-based activity schedule 20% of the time, while he selected the binder-based activity schedule 80% of the time. These results suggest that Warren and Rodger prefer the technology-based schedule, while Chris preferred the binder-based activity schedule.

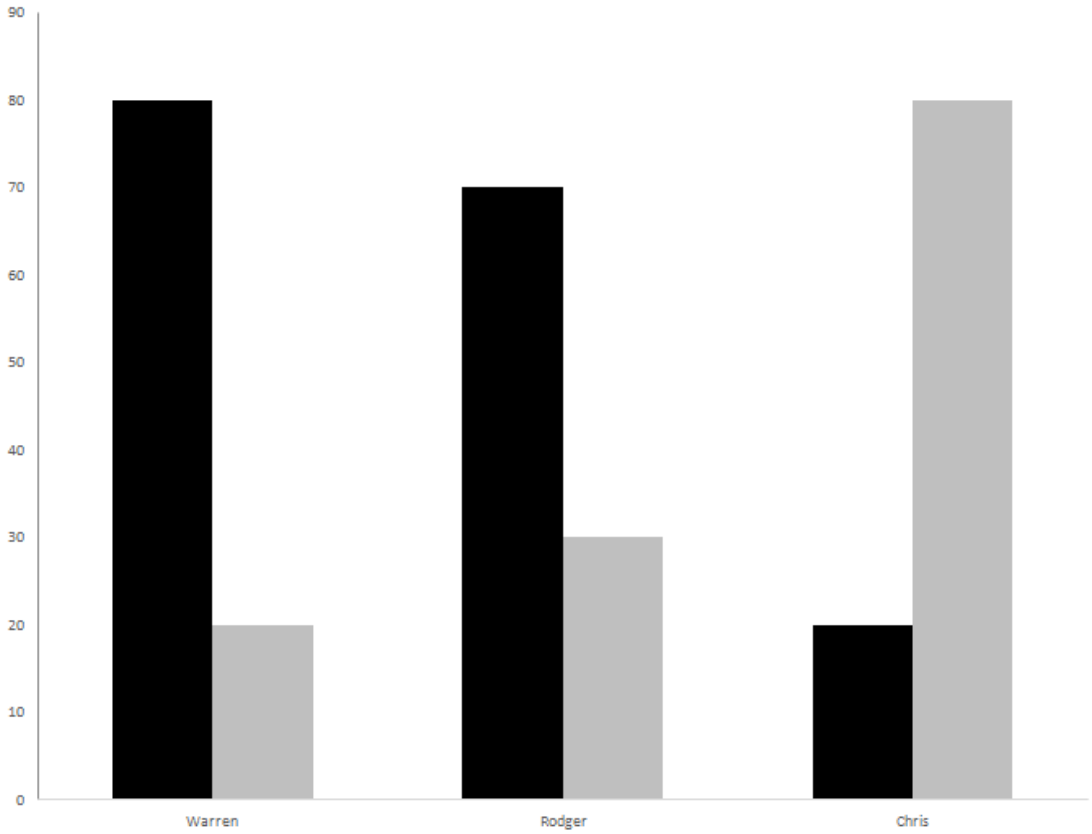


Figure 3. The percentage of activity schedule selections. Black columns represent the percentage of selections that were the iPad-based activity schedule. Grey columns represent the percentage of selections that were the binder-based activity schedule.

A cumulative record of choice is displayed for each participant in Figure 4. In the first two panels Warren and Rodger's data are displayed. During the first five sessions these participants alternated between the two schedules, and then the data separate and the participants selected only the iPad, with the exception of Rodger's final session. Chris selected the iPad during the first two sessions and then selected the binder-based activity schedule for the final 8 sessions, as displayed in the third panel of Figure 4.

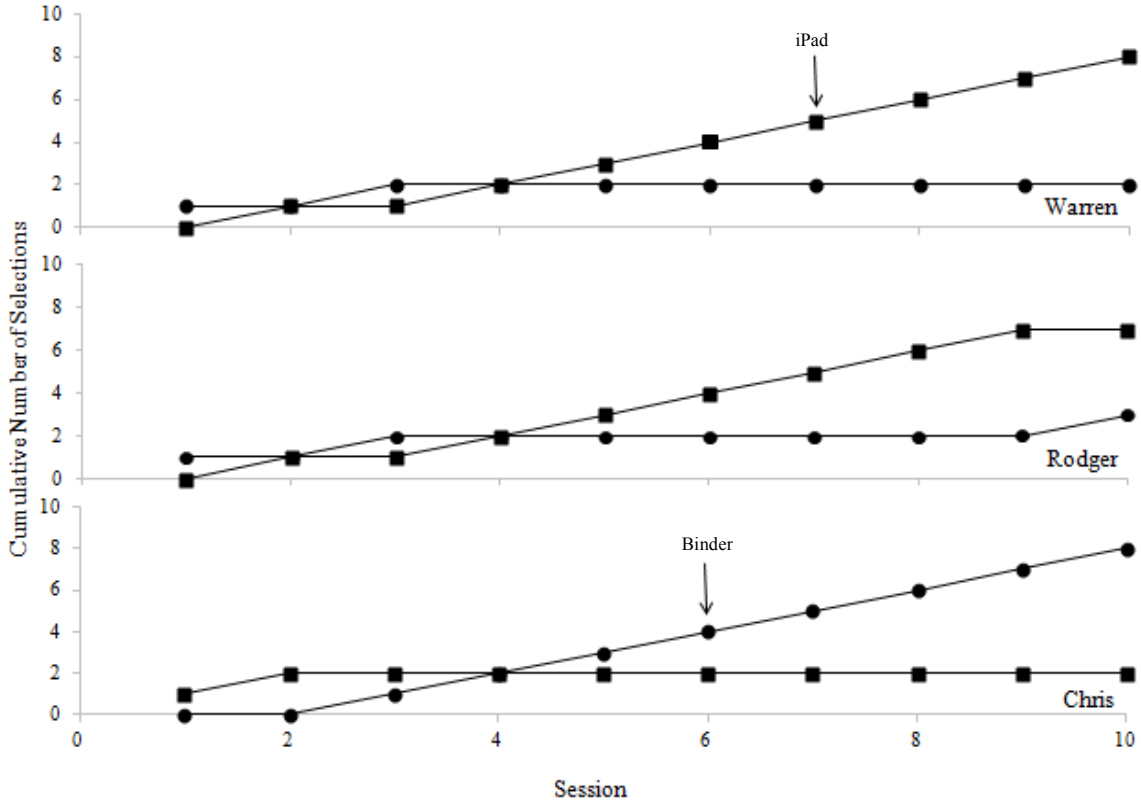


Figure 4. Cumulative record of selections iPad and binder-based activity schedules. Closed circles denote binder-based activity schedule selection and close squares denote an iPad-based activity selection.

CHAPTER V

DISCUSSION

Given these results, I would conclude that the participants' activity schedule following behavior generalized to the novel format of a tablet. Interestingly, very little prompting was needed to teach the participants to follow the tablet-based activity schedule.

We also learned that some participants may prefer the iPad-based activity schedule over a traditional, binder-based schedule. Possible reasons that the iPad may be preferred by some participants are, because of its novelty in this instruction setting or because it often signals reinforcement in our preschool. It is interesting to note, however, that participants engaged in more correct responding during the modality that they preferred, whether or not it was the iPad-based schedule. This suggests that, when selecting interventions for clients, it may be important to select preferred interventions. Not only is this ethical but with the findings of this study, it may increase correct responding rates. Future researchers may wish to examine variable that influence preference for one activity schedule format over another.

Based on our results, it appears that an activity schedule based on the iPad may be an effective tool to increase independent play. This electronic format may increase the accessibility and functionality of activity schedules. Many parents of young children with autism do not have much time to devote to at home interventions. Most have even less time to gather materials and build a schedule. While iPads and other tablets are expensive, many families own them and download apps for the children to play with. By

creating an app, it may increase the accessibility of an activity schedule to families who currently have a tablet. Also, it may also increase the likelihood that teachers and parents will implement activity schedules in locations that are not conducive to long prep times. Teachers could use technology-based activity schedules in setting such as a playground. A teacher could easily rearrange a schedule for a student to complete during recess in a matter of seconds. The pictures would not be easily lost and the schedule, if housed in a protective case, not easily broken. This schedule may facilitate peer interactions with student typically developing peers. Peers may have questions about the schedule and may ask to play with the child using the schedule.

Technology-based activity schedules could also use links to incorporate reinforcers. Terminal reinforcers could easily be delivered for completing the schedule with a link to other applications or videos. Future studies should also examine the use of scripts, both auditory and text, and video models with in schedules. More complex schedules could also incorporate joint activities that would involve peers and also the opportunity to choose activities.

One possible limitation to this study is that participants were already fluent activity schedule followers using binder-based schedules. Future studies should examine if students who have not been taught to use a binder-based activity schedule could be taught to engage in the tablet-based activity schedule. Another limitation of this study is that it was conducted in a highly structured preschool. Future studies should examine if parents and teachers are able to set up and implement the teaching of a tablet-based activity schedule in a less controlled context.

Another limitation of this study is that we used the simplest form of an activity schedule. Future research should examine more complex schedules that include choice components, open-ended activities, and social interactions. Open-ended activities are activities that do not have a clear beginning or end, such as a farm play set or reading books. By increasing the complexity of the schedule in future studies, the population that could benefit from the study would also increase.

In conclusion, the data suggests that young children with autism, who have previously learned to complete an activity schedule, can follow a tablet-based activity schedule. The findings of this study also suggest that some individuals prefer technology-based interventions while others do not. Because this study only included the simplest form of an activity schedule, future studies should examine more complex schedules. Further investigation of other technology-based interventions is needed to insure that practitioners are using the most effective teaching strategies.

REFERENCES

Betz, A., Higbee, T. S., & Reagon, K. A. (2008). Using joint activity schedules to promote peer engagement in preschoolers with autism. *Journal of Applied Behavior Analysis, 41*, 237-241. doi: 10.1901/jaba.2008.41-237

Carlile, K. A., Reeve, S. A., Reeve, K. F., & DeBar, R. M. (2013). Using activity schedules on the iPod touch to teach leisure skills to children with autism. *Education and Treatment of Children, 36*(2), 33-57. Retrieved from http://muse.jhu.edu/journals/education_and_treatment_of_children/v036/36.2.carlile.html

Carson, K. D., Gast, D. L., & Ayres, K. M. (2008). Effects of a photo activity schedule book on independent task changes by students with intellectual disabilities in community job sites. *European Journal of Special Needs Education, 23*, 269-279. doi:10.1080/08856250802130475

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

Dauphin, M., Kinney, E. M., & Stromer, R. (2004). Using vide-enhanced activity schedules and matrix training to teach sociodramatic play to a child with autism. *Journal of Positive Behavior, 6,* 238-250. doi:10.1177/10983007040060040501

Gourwitz, J. R. (2014). *IPads for students with ASD: Comparing delivery modes for visual activity schedule* (Doctoral dissertation). Retrieved from http://etd.fcla.edu/CF/CFE0005339/Gourwitz_Jillian_R_201408_PhD.pdf

Kimball, J. W., Kinney, E. M., Taylor, B. A., & Stromer, R. (2004). Video enhanced activity schedules for children with autism: A promising package for teaching social skills. *Education and Treatment of Children*, *27,* 280-298. Retrieved from http://vsmproject.pbworks.com/f/video_enhanced_activity_schedules.pdf

Koyama, T., & Wang, H., (2011). Use of activity schedule to promote independent performance of individuals with autism and other intellectual disabilities: A review. *Research in Developmental Disabilities*, *32*, 2235-2242. doi:10.1016/j.ridd.2011.05.003

Luczynski, K. C., & Hanley, G. P. (2009). Do children prefer contingencies? An evaluation of the efficacy of and preference for contingent versus noncontingent social reinforcement during play. *Journal of Applied Behavior Analysis, 42,* 511-525. doi: 10.1901/jaba.2009.42-511

MacDuff, G. S., Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to use photographic activity schedules: Maintenance and generalization of complex response chains. *Journal of Applied Behavior Analysis, 26,* 89-97. doi: 10.1901/jaba.1993.26-89

Markham, V., Giles, A., & Kanoujiya, A., (2015, May) *Comparing book and tablet based picture activity schedules: Acquisition and Preference.* Paper presented at the meeting of the Association for Behavior Analysis International, San Antonio, TX.

McClannahan, L. E., & Krantz, P. J. (1999). *Activity schedules for children with autism: Teaching independent behavior*. Bethesda, MD: Woodbine House.

Rehfeldt, R. A., Kinney, E. M., Root, S., & Stromer, R. (2004). Creating activity schedules using Microsoft ® Powerpoint ®. *Journal of Applied Behavior Analysis, 37*(1), 115-128. doi: 10.1901/jaba.2004.37-115

Stromer, R., Kimball, J. W., Kinney, E. M., & Taylor, B. A. (2006). Activity schedules, computer technology, and teaching children with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 21(1)*, 14-24. doi: 10.1177/10883576060210010301

APPENDICES

Appendix A

Baseline Data Sheet

Baseline Data Sheet

Participant _____Session Number_____ BookshelfNumber _____ **Data Collector _____ P R Date_____**	
Activity	**Completed Correctly**
	Total:

Appendix B

Tablet-Based Activity Schedule Data Sheet

Learner _____ Session Number _____

Date:		Observer:					
Takes iPad to Table			Selects Binder			Opens Binder	
Step or task	Points and or Looks	Obtains Materials	Completes Task or Consumes Treat		Cleans up	Returns to Schedule	Turns Page
1 Oreos							
2 Dino Puzzle							
3 Shape Sorter							
4 Bead Shape Sorter							
5 Mice							
6 Peg Board							
7 Ring Sorter							
8 Shape Puzzle							
Treat:							
Closes Schedule			Returns tablet to Shelf				

Number of ccc _____ Total number of components ____59____ % of ccc _____

Appendix C

Binder-Based Activity Schedule Data Sheet

Learner _____ Session Number _____

Date:		Observer:					
Selects Binder			Takes Binder to Table			Opens Binder	
Step or task	Points and or Looks	Obtains Materials	Completes Task or Consumes Treat		Cleans up	Returns to Schedule	Turns Page
1 Oreos							
2 Dino Puzzle							
3 Shape Sorter							
4 Bead Shape Sorter							
5 Mice							
6 Peg Board							
7 Ring Sorter							
8 Shape Puzzle							
Treat:					NA		
Closes Schedule			Returns tablet to Shelf				

Number of ccc _____ Total number of components _____ % of ccc _____

Appendix D

Choice Assessment—Activity Schedule Data Sheet

Learner _____ Session Number _____

Date:		Observer:					
Selected:		Binder		Tablet		Opens Binder	
Step or task	Points and or Looks	Obtains Materials	Completes Task or Consumes Treat		Cleans up	Returns to Schedule	Turns Page
1 Dino Puzzle							
2 Oreos							
3 Rings							
4 Mice							
5 Beads							
6 Shape Puzzle							
7 Peg Board							
8 Shape Sorter							
Closes Schedule			Returns to Shelf				

Number of ccc _____ Total number of components _____ % of ccc _____

Appendix E

Baseline—Treatment Integrity Data Sheet

Date Integrity Scored: _____ Session #: _____ Initials: _____ Participant: _____		
Comments		Yes or No
iPad is on top of bookshelf		Y N
Binder Activity Schedule is not present		Y N
Application is open with "bookshelf" showing		Y N
10 toys are on shelf		Y N
Treat is on top of shelf		Y N
Researcher gives instruction: "Go Play"		Y N
No prompts are provided		Y N
Correct session duration (10 Minutes or terminated after 1 min of no engagement with toys or iPad)		Y N
	Total # of Y:	
	Total # Opportunities:	
	% Correctly Implemented Steps	

Appendix F

Treatment—Treatment Integrity Data Sheet

Date Integrity Scored: _____ Session #: _____ Initials: _____ Participant: ___ _____		
Comments		Yes or No
iPad is on top of bookshelf		Y N
Binder Activity Schedule is not present		Y N
Application is open with bookshelf displayed		Y N
Appropriate toys are on shelf		Y N
Treat is on top of shelf		Y N
Researcher gives instruction: "Go Play"		Y N
Only physical prompting from behind is provided		Y N Y N Y N Y N Y N Y N Y N Y N Y N Y N
	Total # of Y:	
	Total # Opportunities:	
	% Correctly Implemented Steps	

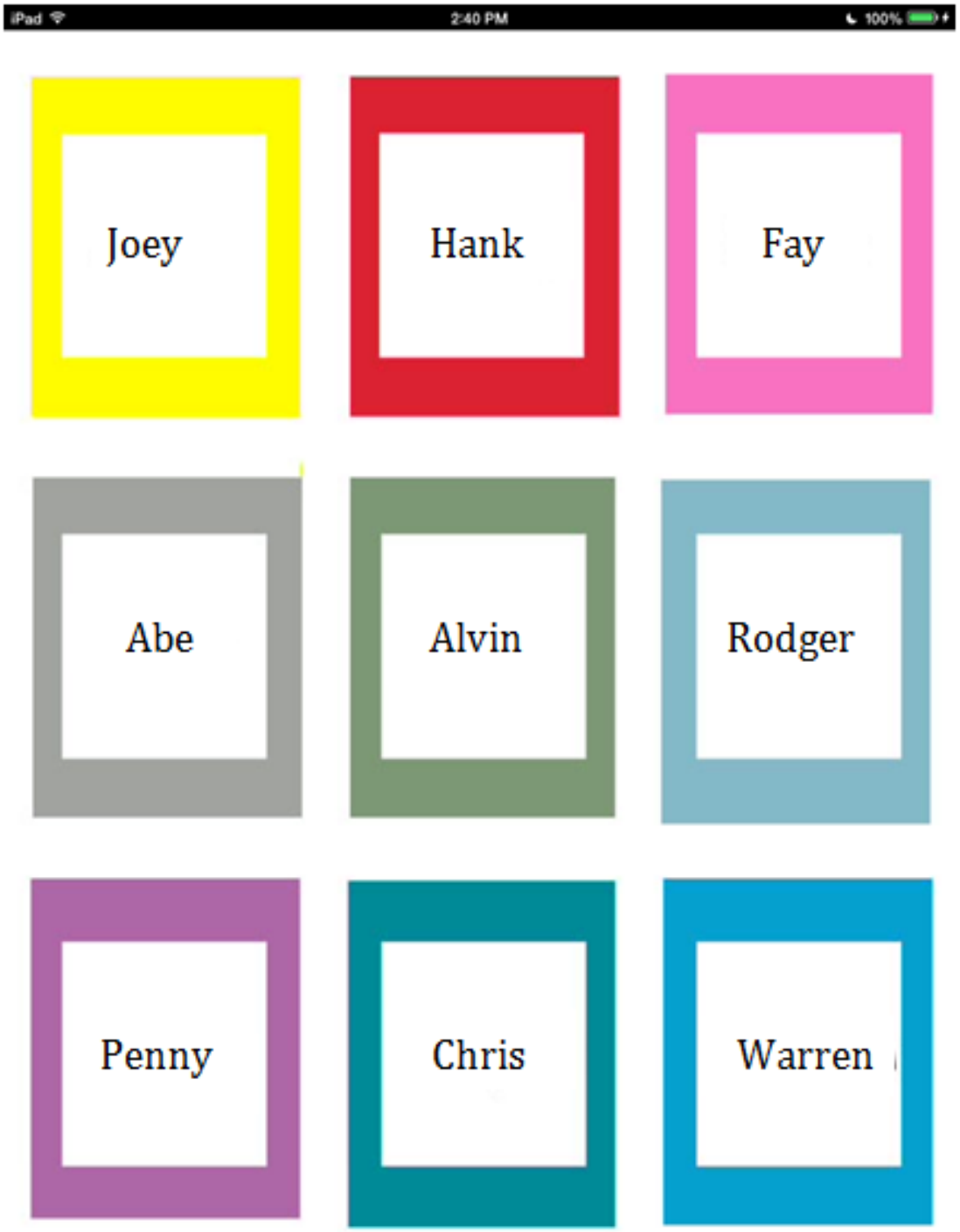
Appendix G

Choice Assessment—Treatment Integrity Data Sheet

Date Integrity Scored: _____ Session #: _____ Initials: _____ Participant: _____		
		Yes or No
iPad is placed on table		Y N
Binder Activity Schedule is placed on table		Y N
Application is open with binder cover displayed		Y N
Appropriate toys are on shelf		Y N
Treat is on top of shelf		Y N
Researcher gives instruction: "Choose the schedule you want to do"		Y N
Only physical prompting from behind is provided during selected schedule		Y N Y N Y N Y N Y N Y N Y N Y N
	Total # of Y:	
	Total # Opportunities:	
	% Correctly Implemented Steps	

Appendix H

Bookshelf—Tablet-Based Activity Schedule


iPad
2:40 PM
100%
Joey
Hank
Fay
Abe
Alvin
Rodger
Penny
Chris
Warren