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Effectiveness of electronic visual schedules on task completion and independent transitioning of adolescents with developmental disabilities

Katarina Radi
Rowan University

EFFECTIVENESS OF ELECTRONIC VISUAL SCHEDULES ON TASK COMPLETION AND INDEPENDENT TRANSITIONING OF ADOLESCENTS WITH DEVELOPMENTAL DISABILITIES

by
Katarina Radi

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Dedication

I would like to dedicate this thesis to my husband, Ahmed.

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I would like to express my appreciation to Professor Amy Accardo for her patience, relentless help, and thoughtful advice through my research. The skills I have learned through the process will guide my professional career. I look forward to any challenges that come my way knowing that I am well prepared to take them on.

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Abstract

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Adolescents with developmental disabilities are often unable to navigate single daily tasks without depending on verbal prompts. The purpose of this study was to measure the effectiveness of electronic visual schedules on task completion and independent transitioning from one task to another. Four high school students diagnosed with autism spectrum disorders participated. A single subject multiple baseline design was used for the study. During the baseline, students followed a paper based daily schedule. Independence in task completion and transitioning were measured. During the intervention, an application, First Then Visual Schedule High Definition, on an iPod was provided for each student. Individualized tasks were programmed into each device's app and adjusted for individual academic goals and unique needs at the beginning of the academic day. Participants' independence was monitored during academic lessons and during community based instructions for 20 consecutive days. Applying the principles of behavior analysis, an additional intervention condition was presented to one of the participants. The results showed that task completion and independent task transition of all participants increased when using FTVS HD app on an iPod.

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

List of Figures

Figure Page

List of Tables

Chapter 1

Introduction

The growing popularity of electronic devices brings with it an increase in available assistive technology for adolescents with autism spectrum disorder (ASD) and other developmental disabilities (Burckley, Tincani, & Fisher, 2014). Teachers of students with ASD often utilize schedules to provide predictability to daily routines, thereby reducing student problem behaviors (Bryan & Gast, 2000). The use of visual supports has been shown to help students with ASD in the areas of self-regulation and task completion (Bryan & Gast, 2000). According to Stromer, Kimball, Kinney, and Taylor (2006), electronic devices are a great medium for activity schedules because they employ dynamic video, sound, pictures, and photographs. Such electronic visual schedules are interactive and may be utilized to expand the functional skills of students with ASD (Stromer et al., 2006). Similarly, Burckley et al. (2014) report that there is need to explore emerging practices involving electronic devices for young adults with ASD and to teach them how to follow complex schedules with multiple steps.

Statement of Problem

According to Hodgdon (1995) and Knight, Sartini, and Spriggs (2014), in order to fluently run a classroom for students with ASD, practitioners should provide them with a form of visual support. A visual schedule may help students with ASD to understand expectations, sequence order of events, and move from one task to another (Hodgdon, 1995). Literature suggests the need for visual support to help students with intellectual disabilities in transitioning from one task to another (Dettmer, Simpson, Myles, & Ganz, 2000), in exhibiting on-task and on-schedule behaviors (Bryan, & Gast, 2000), and in

eliminating challenging behaviors related to difficulties with independence and self-regulation (Lequia, Machalicek, & Rispoli, 2012). Moreover, with the development of assistive technologies and electronic devices, fast customization and new auditory and visual possibilities may be very effective in increasing independence of task completion by students with ASD (Mechling, Gast, & Seid, 2009).

Results of a single–subject reversal design study reported by Dettmer et al. (2000) suggest that visual supports may facilitate transitioning of students with ASD in home and community settings. The investigation focuses on the effect of schedules on the elimination of verbal and physical prompting. The findings suggest that the use of paper visual schedules and the use of sub-schedules which include finished tasks boxes significantly decrease a need for prompting students with ASD (Dettmer et al., 2000).

Bryan and Gast (2000) investigated the effect of visual schedules on on-task and on-schedule behavior of young students with ASD. Participants showed significant improvement in percentage of steps completed correctly following the use of activity schedules. The results suggest that although the behavior of students with ASD may at times seem dependent, unfocused, and inconsistent (Hodgdon, 1995), the use of visual schedules can significantly help in facilitating independence and decreasing prompts (Bryan & Gast, 2000).

In a recent study by Yakubova and Waganesh (2016), technology based interventions were used in lieu of traditional paper based visual schedules. Three teenagers diagnosed with ASD used visual schedules on iPads to follow steps in making photocopies, stocking shelves, and working in the life skills training room. This multiple probe study was conducted to evaluate percentage of steps completed accurately. A

significant finding of the study was that all the participants increased independent performance and accuracy of tasks (Yakubova & Waganesh, 2016). Yakubova and Waganesh suggest a need for more research conducted with adolescents with ASD. They recommend future research focus on school, community, and job settings which could be salient in identifying functional ways to use assistive technology and prepare students with ASD for adulthood (Yakubova & Waganesh, 2016).

Significance of the Study

Visual schedules may help children with ASD to maintain attention on task completion, and to sequence tasks in their environment (Hodgdon, 1995). Researchers have investigated the incorporation of visual schedules into electronic media (Douglas & Uphold, 2014; Mechling et al, 2009; Koyama & Wang, 2011). Koyama and Wang (2011) conducted a review of the literature on the topic of visual schedules and reported that the electronic delivery of schedules may be highly motivating for students. Knight et al. (2014) suggest that more research needs to be done on the use of portable electronic devices in creating visual schedules.

This study extends the research on the effect of electronic visual schedules on independent transitioning and task completion of students with developmental disabilities.

Purpose of the Study

The purpose of this study is to measure the effectiveness of electronic visual schedules on task completion and independent transitioning of adolescents with developmental disabilities. The specific aim of this study is to examine the effectiveness of an electronic visual schedule, First Then Visual Schedule High Definition iPad

application, on the academic task completion and independent task transitioning of adolescents with developmental disabilities in a special education high school classroom. The study will also evaluate satisfaction with the electronic visual schedule.

The students will be taught to use a visual electronic schedule on an iPod to complete academic and community tasks. For example students will complete a worksheet, read specific pages in a textbook, play a Sentence Game on the student computer for five minutes, or ask a cashier for a stamp in the Post Office or a receipt for the purchase. The tasks will need to be completed independently and students will need to transition from task to task.

The data collected will include observation of task completion and independent transitioning on daily Data Collection Chart. The charts will include information about the prompts necessary to transition or to complete a task.

Research Questions

The research questions are as follows:

1. Will use of an electronic visual schedule (First Then Visual Schedule High Definition iPad application) increase independence in academic task completion for adolescents with developmental disabilities in a private high school for students with intellectual and developmental disabilities?

2. Will use of an electronic schedule (First Then Visual Schedule High Definition iPad application) increase independence in task transitioning for adolescents with developmental disabilities in a private high school classroom for students with intellectual and developmental disabilities?

3. Is support staff satisfied with the use of an electronic visual schedule?

Key Terms

- First Then Visual Schedule High Definition application (FTVS HD app) on an electronic device: For purposes of this study, the term will be defined as a multimedia tool to signal the next task in a sequence through a visual electronic schedule (Haydon, 2016).
- Visual Activity Schedule: For purposes of this study, the term will be defined as schedules that use sequences of visual prompts to communicate when and how much work has to be done (Bryan & Gast, 2000). They are supporting tools that compensate for deficits in following verbal instructions, organizing daily environments, and keeping attention on task (Hodgdon, 1995).
- Independent Task Transition: For purposes of this study, the term will be defined as physically moving from a previous activity on the schedule to the next one or bringing routine materials to the table according to the next task on the visual schedule within time allocated by the teacher.
- Independent Timely Completion of the Task: For purposes of this study, the term will be defined as a full completion of a specific task from the visual schedule as per classroom instructions within allocated time by the teacher.
- Prompts: For purposes of this study, the term will be defined as verbal, gestural, or physical stimuli to evoke a desired response (Cooper et al, 2007).

Chapter 2

Review of the Literature

Educators are encouraged to use improved diagnostic and educational tools in serving students with special needs (IDEIA, 2004). IDEIA emphasizes providing education for all students within the least restrictive environment. In addition, educators are required to use evidence based practices in schools to improve learning outcomes for all students (NCLB, 2001). For teachers who work with children with disabilities, IDEIA also calls for high expectations. Educators are expected to prepare students with disabilities to live independent adult lives. NCLB also addresses elimination of unnecessary paperwork and requirements that do not assist in education. Furthermore, IDEIA supports the use and development of educational technology. Technology and assistive technology should teach, enhance, and generalize important skills to maximize accessibility to learning outcomes (IDEIA, 2004). As per section 606 IDEIA, 2004, there is an understanding of making every effort to employ a young individual with a disability in the workforce.

Much of contemporary literature about independence and self-management of individuals with disabilities concentrates on persons with ASD (Lequia et al., 2012). According to the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5), the following diagnostic criteria are used to diagnose individuals with ASD: impairment in socialization, communication, and restricted or repetitive interests or behaviors (American Psychological Association, 2013).

This literature review concentrates on the self-management skills of students with ASD and developmental disabilities in the area of independent transitioning and

independent task completion. Then, the use of visual activity schedules is described in two forms: paper based and electronic. Finally, research related to the effectiveness of visual schedules on self-management is presented.

Self-Management

Students with ASD often exhibit difficulty in navigating their daily tasks (Bryan & Gast, 2000; Spriggs, Knight, & Sherrow, 2014). Spriggs et al. (2014) report that students with developmental disabilities may exhibit greater need in the area of self-monitoring and navigating tasks. Furthermore, impairments related to ASD can interrupt learning (Spriggs et al., 2014).

A study conducted by Spriggs et al. (2014) examined the effects of visual schedules on self-management of four adolescents in a high school class. In the course of three months, students were presented with steps to be completed in academic blocks. The results of the study indicate that students should be provided with visual supports to increase independence and decrease dependence on outside prompts (Spriggs et al., 2014).

A similar study by Wilkinson (2008) investigated the effect of self-management strategies in a school setting on an 8 year old boy diagnosed with ASD. The boy was taught to follow a schedule and check off an item when completed. This self-management technique reduced the need for continuous teacher supervision and also increased positive behavior. The findings suggest that self-management could be a crucial skill for the participant (Wilkinson, 2008).

In reversal design study with five secondary students with intellectual disabilities, Douglas and Uphold (2014) reported that the process of checking off items from a

schedule could help students with ASD to self-monitor task completion and to evaluate the approximate end of work time. Teaching students with ASD to self-manage tasks with the use of visual activity schedules or electronic visual activity schedules may increase their motivation to complete a task (Douglas & Uphold, 2014; Mechling et al., 2009).

Independent transitioning. A visual activity schedule can help individuals with ASD to transition from one activity to the next one independently (Bryan & Gast, 2000). In their ABAB withdrawal design study, Pierce, Spriggs, et al. (2014) examined independent transitioning of four students with ASD in a resource classroom. Students were transitioning between and within academic centers. The research conditions were similar to those used by Bryan and Gast (2000). The findings suggest that activity schedules significantly increase independent transitioning. Furthermore, participants of this study were able to generalize the skills with a mean of 95% across all tasks. The use of visuals can be useful for individuals with ASD to increase independent transitioning (Bryan & Gast, 2000).

Another approach to increase independent transitioning was examined by Yakubova and Zeleke (2016) in a multiple probe study with three students diagnosed with ASD. This investigation examined the effectiveness of teaching problem-solving to improve transitioning among tasks. Students utilized video modeling and visual schedules. A significant finding was that despite students' cognitive inflexibility, their response to the intervention was effective suggesting that teaching problem solving may increase independence in the transitioning of students with ASD (Yakubova & Zeleke, 2016). These findings support the conclusions of a systematic review by Lequia et al.

(2012). Based on their research, when activity schedules were used in 18 studies to aid transitioning between activities, each participant also demonstrated a decrease in challenging behavior with a high percentage of success.

Independent task completion. Adolescents with ASD face special challenges that impede their ability to be employed as adults (Mcdonald, & Machalicek, 2013). Mechling et al. (2009) investigated the ability to use portable DVD players. The participants were three young adults with developmental disabilities who used portable DVD players to self-prompt cooking tasks. The results indicate that self-prompting via video schedule can be an effective tool in independent task completion. Participants showed a significant increase in the percentage of cooking steps completed.

These results were supported by Mechling et al. (2009) in a study of three male high school students diagnosed with ASD. The study used Personal Digital Assistant, a self-prompting device, to assist with the preparation of a cooking recipe. The results were consistent across all participants in that students were able to maintain a high level of task completion and generalization (Mechling et al., 2009).

Although there are studies focusing on vocational and employment tasks (Mechling, et al. (2009), research on student task completion in the community is scarce (Burckley et al., 2014). Results from a study conducted by Burckley et al., (2014) suggest that an iPad activity schedule can improve the shopping skills of students with developmental disabilities. This investigation focused on the effectiveness of electronic schedules in three different shopping locations. The participant was an 18-year old female with a developmental disability. Overall, the results of the study show that the use

of electronic visual schedules improved community shopping skills and that these skills were successfully generalized to novel shopping items (Burckley et al., 2014).

A systematic review of the literature by Kagohara et al. (2013) reports among other measured variables, upon the findings of effectiveness of visual schedules in the development of employment skills in students with disabilities. The participants used successfully a visual schedule in various work related situations, for example mopping the floor, responding to fire safety instructions, and cleaning the kennels (Kagohara et al., 2013).

Visual activity schedules are effective interventions that support the development of the students' skills in area of vocational tasks (Burckley et al., 2014; Kagohara et al., 2013), independent task completion (Mechling et al., 2009), generalization (Mechling et al., 2009), and independent transitioning (Bryan & Gast, 2000; Pierce, Spriggs et al., 2013). Teenagers with developmental disabilities need to acquire these skills in order to increase the likelihood of future employment or college placement (Mcdonald, & Machalicek, 2013).

Visual Activity Schedules

A visual activity schedule can be defined as a set of visual reminders (in a form of graphic symbols, words, and/or pictures) of a task in a sequential order (Stephenson, 2015). The basic purpose of visual activity schedules is to support students in completing a task in a specific order (Stephenson, 2015), and to promote student independence during transitioning from one task to another (Lequia et al., 2012; Pierce, 2013; Yakubova, & Zeleke, 2016). Individuals with ASD can use visual activity schedules to manage their daily tasks without extensive verbal directions (Knight et al., 2014). Visual

activity schedules can minimize difficulties with transitioning and provide individuals with ASD with visual reminders of the day's progress by checking off or removing completed tasks (Bryan & Gast, 2000). Relatively high development of mathematical and technical skills can help individuals with ASD in self-management via visual activity schedules (Callahan & Rademacher, 1999). Moreover, visual activity schedules increase and generalize many skills of individuals with ASD in school settings and in the community (Knight et al., 2014). Finally, visual activity schedules can be modified for individuals from preschool to adulthood (Knight et al., 2014) and can be effective in diminishing many of the challenges of ASD (Hayes et al., 2010).

Paper based visual activity schedules. Paper based visual activity schedules have been shown to be a useful tool in increasing student independent task completion (Macduff, Krantz, & McClannahan, 1993; Schneider & Goldstein, 2010) and in eliminating the need for teacher provided prompts (Callahan & Rademacher, 1999).

In a study investigating the impact of photographic activity schedules on on-task and on-schedule behavior, four boys with ASD, age 9 to 14, were performing a variety of homework and leisure tasks in home settings. Macduff et al. found that the participants exhibited fewer undesirable behaviors while completing the tasks independently when following the picture schedules (1993). A significant finding of the study was that a picture schedule in three ring binders with the photos of homework and leisure activities significantly improved engagement in appropriate activities (Macduff et al., 1993).

Bryan and Gast (2000) found similar results in their ABAB withdrawal design study of four students with ASD conducted to determine the effect of visual activity schedules on on-task and on-schedule behavior. Bryan and Gast (2000) used picture

activity schedules with picture cards representing academic activities. They measured on–task behavior and the steps completed on a task analysis in academic literacy centers. The results of the study were consistent with the findings of Macduff et al. (1993), and all students learned ways to use the picture schedule and maintained high levels of independence in task completion (Bryan & Gast 2000).

In another study, three men with ASD from an adult service program were asked to complete three tasks using a schedule sheet (Watanabe & Sturmey, 2003). The men were expected to complete the tasks which included handwriting, math drills, job search, and personal hygiene tasks, within 40 minutes. None of the tasks were novel. The results of the study suggest that the strategy of following the schedule sheet was useful for increasing the on-task behavior and task completion of all three participants (Watanabe & Sturmey, 2003).

Schneider and Goldstein (2010) investigated the effect of social stories on socially appropriate behaviors. The participants were three boys. Because one of the participants, a 10 year old boy, was responding to the social stories with limited success, Schneider and Goldstein used a second intervention of pictorial cues. They used a black foam board for pictures with short phrases. The participant peeled a picture symbol off the board every time he completed an activity. The picture schedule intervention increased his on-task behavior and task completion rate from 50% to 72% (Schneider & Goldstein, 2010).

Electronic visual activity schedules. Douglas and Uphold (2014), Hayes et al. (2010), and Kagohara et al. (2013) support the usefulness of paper based visual schedules. Furthermore, electronic devices bring novelty and animation to activity schedules and provide ease in schedule manipulation (Douglas & Uphold, 2014).

Electronic visual schedules may increase generalization and independence in task completion, hence helping students succeed in academic, vocational, and leisure activities (Kagohara et al., 2013; Stromer et al., 2006)

In a qualitative field-based study, Hayes et al. (2010) compared the effect of paper based visual schedules and electronic schedules via mobile communication tools on task completion in children with ASD. This investigation included interviews and observations in three schools with professionals and parents of children of 18 months to 3 years. The findings suggest that activity schedules have to be flexible enough to gain maximum effect. Electronic devices enable teachers more flexibility and real-time customization of schedules (Hayes et al., 2010). Moreover, each student's device can be programmed separately allowing flexibility to create as many steps in the task sequence as needed. Hayes et al. argue that the schedule can be easily presented to each individual differently based on their abilities.

Douglas and Uphold (2014) evaluated the effectiveness of iPad and iPod touch on the use of self-created electronic photographic activity schedules. Throughout the study, which utilized a withdrawal experimental design, students used a First Then Visual Schedule application to self-monitor and self-evaluate the task completion. Study results indicate that the use of an electronic visual schedule may be effective for improving task completion and independence (Douglas & Uphold, 2014).

Stephenson (2015) found similar results in a study utilizing a multiple baseline across students design. Three students with developmental disabilities used the First Then Visual Schedule application to select and complete preferred and non-preferred academic activities. Stephenson (2015) indicates that students with developmental

disabilities can use electronic visual schedules although there may be little difference in the effect of various forms of schedules. Lequia et al. (2012) argue that electronic visual schedules may be significantly beneficial for some students.

Spriggs et al. (2014) investigated the effectiveness of video modeling implemented into visual activity schedules on learning novel academic skills. Four high school students with ASD demonstrated independence in at least some of the academic tasks. Overall, the results of the study show that all students were able to generalize the use of video modeling and visual activity schedules to perform novel tasks (Spriggs et al., 2014).

Burkley et al. expanded the academic instructions to Community Based Learning. They used Book Creator software on an iPad to provide cues while grocery shopping (2014). The participant was able to successfully complete tasks and generalized the skills in different locations using the iPad cues. (Burckley et al., 2014).

Haydon et al. (2016) provides guidelines and resources on how to implement technology in a school setting for students with disabilities. For example, a First Then Visual Schedule High Definition application (FTVS HD) is a scheduling application that allows users to create a systematic checklist of completed tasks (Haydon et al., 2016). Videos and narrations can be added to the visual electronic schedules and can be edited using interactive features of FTVS HD (Haydon et al., 2016).

Conclusion

For many students with developmental disabilities, independent completion of a sequence of tasks could be learned through the use of visual schedules (Banda & Grimmett, 2008; Koyama & Wang, 2011; Lequia et al., 2012). The use of visual

schedules may increase independence in transitioning and task completion (Banda & Grimmett, 2008; Koyama & Wang, 2011; Lequia et al., 2012). Scheduling apps like the First Then Visual Schedule can provide flexibility in design and additional guidance through interactive animation and voice (Kagohara et al., 2013; Stephenson, 2015).

Emerging technological advances may bring more sophisticated capabilities to supporting scheduling devices in the near future making electronic visual schedules more interactive, more individualized, and more effective (Kagohara et al., 2013; Southall & College, 2013). With emphasis placed on targeting functional skills in adolescents with ASD, research needs to concentrate on older adolescents with ASD (Mcdonald, & Machalicek, 2013).

This study will extend the previous literature on electronic visual schedule in several ways. The study will investigate the effect of electronic visual activity schedules on task completion for teenagers with severe disabilities in an academic setting, on the independent transitioning from one task to another in a sequence, and on support staff satisfaction with the use of electronic schedules. Finally, as suggested by Douglas and Uphold (2014), students should play a more active role in programming their electronic visual activity schedule. In this study, students will self-select tasks and teacher will incorporate them into their individual schedules.

Chapter 3

Methodology

Settings and Participants

This study included four high school students, all of them in the ninth grade. The students attend a high school at the Bancroft School, a nonprofit educational facility for students with behavioral and self-care needs. The Bancroft School is a facility with a scope and sequence of care that exceeds services provided by public school systems. Many students of this school are residential and live within the Bancroft housing facilities. The typical academic day in the high school classroom runs from 8:30 am to 11:50 am with instructional periods that last 40 minutes. During this time, students follow their academic schedule. After a lunch break, they follow career exploration programs from 12:30 pm to 2:30 pm with a different teacher.

All of the student participants have a documented diagnosis of ASD. All four students have an individualized education plan (IEP) and all of them have a specific positive behavioral support plan to guide them through their daily tasks. All four students are in one class with one additional student who did not participate in the study.

Participant 1. BH is a 14 year and 11 month old student classified with ASD. He has a one to one aide to assist with his academic and behavioral needs. He displays maladaptive behaviors of high levels of self-injury, and aggression. Among his self-injurious behaviors are skin picking to the point of open wounds, skin biting to the point of exposing flesh, and hitting his chin which creates calluses. Moreover, he exhibits socially inappropriate behaviors. He has a one to one aide to assist with his behavioral and academic needs and to maintain his personal safety. He receives speech therapy and

has a highly individualized educational plan. He has difficulty following verbal or written directions and requires adaptations and modifications to his instructional program, including: functional communication training reminders and visual sequences. He requires frequent verbal and written prompts to accomplish an educational objective. Academically, he scores at the second grade level in mathematics and the first grade level in language arts. At times, he is attentive to external stimuli but is unable to follow instructions and stay within a context in a group.

Participant 2. JS is a 14 year and 7 month old student classified with ASD. He has a one-to-one aide to assist with his academic and behavioral needs. He displays maladaptive behaviors of dropping himself on the floor, self-injury, and aggression. He receives occupational and speech therapy and has a highly individualized educational plan. He has difficulty follow verbal or written directions and requires adaptations and modifications to his instructional program, among which are functional communication training reminders and visual sequences. He requires intermittent verbal and written prompts to accomplish an educational objective. Academically, he scores at the second grade level in Math and Language Arts.

Participant 3. JN is a 14 year and 11 month old student classified as multiply disabled and with ASD. He displays maladaptive behaviors of verbal and physical aggression. He receives speech therapy and has an individualized educational plan. He has difficulty following verbal or written directions and requires adaptations and modifications to his instructional program. He is able to read on the second grade level but his comprehension lags behind two more grade levels. JN is verbal but is not able to use verbalizations in a conversational context. He occasionally repeats words or phrases

he heard instead of following directions or expressing his wants and needs. In mathematics, he scores at the third grade level. During the last school year, his one-to-one support was successfully faded and currently, he no longer requires an one-to-one support.

Participant 4. JA is a 14 year and 8 month old student classified with ASD. He displays maladaptive behaviors including high levels of self-injurious behaviors, and aggression. He exhibits socially inappropriate behaviors. He has a one-to-one aide to assist with his behavioral and academic needs and to maintain his safety. He receives speech therapy and occupational therapy and has a highly individualized educational plan. He has difficulty following verbal or written directions and requires adaptations and modifications to his instructional program. He is highly verbal and very social. He is able to follow directions if presented in an organized visual manner. He exhibits oppositional behavior that sometimes results in high levels of aggressions. Academically, he scores at the second to third grade level in mathematics and language arts.

Table 1

General Description of the Participants

Participant	Age	Grade	Classification	Grade Level Mathematics	Grade Level Language Arts
Participant 1	14y 11m	9	ASD	2	2
Participant 2	14y 7m	9	ASD	3	2
Participant 3	14y 11m	9	ASD	2	1
Participant 4	14y 8m	9	ASD	2-3	2-3

Variables

This study was conducted to examine the effectiveness of an electronic visual schedule, First Then Visual Schedule High Definition iPad-application (FTVS HD app), on the academic task completion and independent task transitioning of four participants. The independent variable was the FTVS HD app. FTVS HD app was accessed on an iPad as a multisensory scheduling tool to signal the next task in a sequence through a visual electronic schedule (Haydon, 2016). This application is available on a public webpage https://www.commonsensemedia.org/app-reviews/ftvs-hd-first-then-visual-schedule-hd . The tool has been provided and approved by the Bancroft's Assistive Technology Department to be used in the classrooms and in the community during Community based Instructions. There are two dependent variables: task completion and independent transitioning.

Experimental Design and Procedures

The study utilized a single subject multiple baseline across participants design. The baseline consisted of 5 sessions and the intervention consisted of a total of 15 sessions for the participant 1. The baseline session was consecutively 2 sessions longer for next participants and the intervention session therefore 2 sessions shorter for next participants. A second intervention session was implemented for the participant 4. During baseline sessions, students were given visual picture schedules to help them in navigating through academic tasks. They were directed to start with the prompt - "Start your schedule." If a student did not respond within 30 seconds, the session was terminated. At the beginning of each intervention session, an electronic device was programmed with the current activities for the student. Students were taught how to navigate through the app prior to the sessions. At the beginning of the task sequence, students were given the instructions and were presented with the associated pictures in the electronic sequence. Then, they were asked to begin. A gestural prompt was delivered after 30 seconds if no response was produced independently and students were prompted to complete the sequence of tasks. Every sequence of tasks ended with the picture "All done" to signal the end of the sequence.

An additional phase of intervention was delivered for participant 4. Participant 4 demonstrated high but inconsistent results for both dependent variables during the baseline and intervention session. Based on the data analysis during the intervention session A, intervention B was added to the study. The intervention B consisted of an additional reinforcer for this participant delivered upon completion of all tasks.

The intervention was implemented over an eight-week period from February 2017 to April 2017. The teacher lead implemented procedures as a part of the regular classroom schedule during various academic activities within the academic schedule. Typically, the students reviewed their individual schedules at the beginning of the lesson by swiping through the individual steps. Then, they were led to the beginning of the schedule and given a specific command "Start your schedule" by the teacher or by one of the support staff.

Materials

The FTVS HD application was chosen in collaboration with the school technology specialist and the classroom teacher. This app, as presented in appendix B on page 53, was chosen because of a function of importing photos from outside sources and because of the existence of a visible indicator that an activity is completed. The schedule offers several presentation modes which can be arranged based on student's needs or preferences. The display of each activity consists of a picture or a photograph of that activity and of a written title that can be sounded out by activating an audible feature. The active picture can be touched and the "voice over" feature of the app will read the title. A checkmark on the right side of a picture can be touched to indicate that the activity was completed. This action deactivates the window of a current activity. Each student then follows the same sequence with the next activity by sliding to the next window. The FTVS HD app offers dynamic sound features and is one of the most flexible schedule applications for students with special needs on the current market. The activities and order of the activities were preselected by the teacher as presented in appendix D through

G. The guided access feature on the iPad was used to prevent students from navigating away from the displayed schedule.

The same types of activities were used for all four students but with a different content and complexity. This allowed not only for comparison among different activities but also for comparison of student performance before and after intervention using different instructions. Activities chosen were in mathematics, language arts, science, technology, and community based instructions. The basic activities to complete: reading a specific page in a book, a classroom file folder activity, a computer activity, a worksheet, and individualized work in their language arts binder, group work, bringing specific materials to student's table, moving a chair to start a group activity in front of the smart board, and community based instructions. To demonstrate a clear initiation of task, all activities were away from students' desks arranged around the classroom. Activities and materials were labeled and always in the same place. Novel activities were presented during the final two sessions and untrained activities were presented during community based instructions.

A portable electronic device Apple iPod touch 16GB Silver (6th Generation) was used for all four students in the present study as presented in appendix A. The device was an upgraded silver model MKH42LL/A with a 4-inch (diagonal) widescreen display. This device featured a Multi-Touch IPS and finger-print resistant coating and had dimensions of 3.9 x 1.4 x 2.2 inches with the item weight 4.5 ounces. The security version on this device was iOS 10.2.1 which enabled accessibility mode of bold large text on every level of the displays. The reading text size was set to large with the Auto-Lock of 2 minutes and brightness to maximum. The settings allowed for the Guided Access feature. The

feature kept the iPod touch in a single app and allowed the user to control which features are available. The Guided Access could be activated by triple-click of the Home button in the specific app and could be deactivated by a code unknown to the students. The four digit code was set to "0001". This feature prevented students from exiting the FTVS HD app and using the device for browsing the internet. The wallpaper of the iPod Touch was changed on each device to display a number specific to a student based on the order in which each of them entered into the intervention session. This action helped easy and quick identification of the devices during the customization of individual steps for individual students in the FTVS HD app and during the use of devices in the study sessions. The devices were fully charged for each session and were not used for any other purpose.

Data Collection and Interobserver Agreement

The classroom teacher and one-to-one aides used the data sheets to record the independence and prompts in task initiation and task completion of all four participants as presented in appendix C on page 54. Two observers scored the participants' behaviors simultaneously but independently during at least one session in baseline and one session in each intervention for every participant. Agreement coefficients were calculated as mean of same responses over all responses. The mean was represented as percentage. The lack of more sessions with two observers taking data was due to difficulty of the one-to-one to taking data simultaneously with all other responsibilities during the classroom time (taking behavioral data, managing personal and behavioral needs of the participants, executing academic goals, taking academic data, etc.).

Baseline data was collected during the baseline and intervention sessions. Students have a well-established rapport with the lead teacher and with the one-to-one aides because they have been working in the same classroom for the past seven months. Following baseline, prior to the intervention sessions, the participants were taught how to navigate the FTVS HD app. The following sessions represented intervention and took place in the same classroom or during community based instructions in the community. The data sheet was assigned to the one-to-one aides and to the teacher. Students received I (independent), P (prompted), or NC (noncompliant) notations on the checklists based on the observations of teachers and staff of their performance. Students could earn a token for following the directions presented on FTVS HD app after each 40 minute period. The token economy earning system was a part of the standard positive behavioral plan followed in the classroom. Students were shown their token board with displayed tokens and it was explained that this was the way to monitor their progress. During the intervention sessions, data was collected on students' performance sheets by the teacher and by the one-to-one aides. Additional observational and anecdotal data was collected to better understand the nature of the individual student progress. For calculation purposes, the independent performance was added up and divided by the total of trials.

Data Analysis

Data was collected from four collection charts filled by the teacher for each individual student and four collection charts filled by a one-to-one aide. Interobserver accuracy was calculated. Independent task completion was calculated as percent independent out of all completed tasks per day and per student. The independent transition was calculated as percent independent transition out of all completed

transitions per day and per student. Data was subsequently plotted into line graphs. Analysis of the data was performed on the basis of comparative statistics. Percent of independence among sessions before and after intervention were compared. Any outliers, trends, and ranges were described and discussed. Finally, any other anecdotal data and observations were described in the context. The support staff discussed the prompts that they used and how that was different from phase 1 of this project. Comparative analysis and statistical comparisons were prepared based on the data. The support staff completed a Likert scale Survey as presented in appendix H on page 59.

Chapter 4

Results

This study utilized a multiple baseline across participants design to investigate the effects of an electronic visual schedule on the two dependent variables of independent transition/ initiation of a task and independent completion of a task. The data of dependent variables were collected and documented on a spreadsheet. The teacher marked an "I" for independence, a "P" if any kind of prompt was used, or a "NC" if the student was noncompliant or if he exhibited aberrant behavior that impeded the performance.

The intervention included the FTVS HD app for all four participants and an additional reinforcer for them during sessions 16 through 20. All participants had prior knowledge of iPad navigation but were never exposed to iPod touch. All participants were familiar with paper based schedules but were never exposed to the electronic schedules delivered through the FTVS HD app.

Interobserver Reliability

Interobserver reliability data were collected during a minimum of 11.25% of all sessions for each student with at least one session per condition. The mean interobserver reliability for accuracy in scoring task initiation or task transition was 100%. The mean interobserver reliability for scoring the independent task completion was 90%. Disagreement between the teacher and the paraprofessional was over the level of prompt used due to the wide range of possible interpretations of students' responses to the instructions.

Effectiveness of Intervention

Graphs of the results for the four participants are presented in Figure 1 and Figure 2. Numerical data and statistical calculations are presented in Table 2 and Table 3.

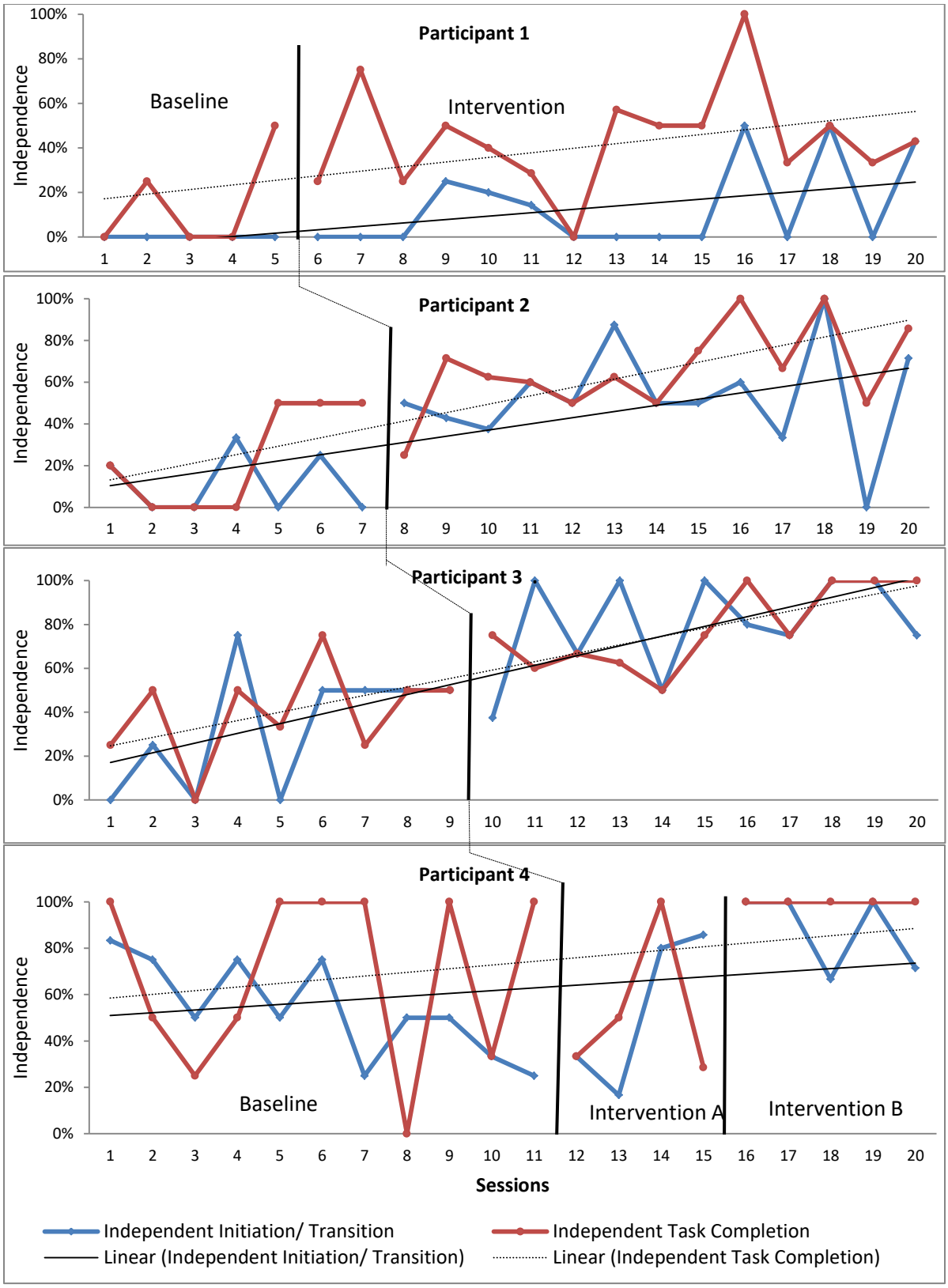

Figure 1. Graph of Independent Initiation and Independent Task Completion.

Table 2

Mean (%) and Standard Deviation of Independent Initiations and Independent Task Completions per Session. One Session Represents One Day with 2-7 Tasks.

	Participant 1	**Baseline**	**Intervention**
MEAN	Independent initiation/ transition	**0.00**	**0.53**
SD	Independent initiation/ transition	**0.00**	**0.81**
MEAN	Independent task completion	**0.40**	**1.67**
SD	Independent task completion	**0.49**	**1.01**

	Participant 2	**Baseline**	**Intervention**
MEAN	Independent initiation/ transition	**0.43**	**2.54**
SD	Independent initiation/ transition	**0.49**	**1.78**
MEAN	Independent task completion	**0.86**	**3.15**
SD	Independent task completion	**0.83**	**1.75**

	Participant 3	**Baseline**	**Intervention**
MEAN	Independent initiation/ transition	**1.33**	**3.36**
SD	Independent initiation/ transition	**1.05**	**1.82**
MEAN	Independent task completion	**1.56**	**3.27**
SD	Independent task completion	**0.83**	**1.48**

	Participant 4	**Baseline**	**Interv. A**	**Interv. B**
MEAN	Independent initiation/ transition	**2.18**	**3.00**	**3.20**
SD	Independent initiation/ transition	**1.19**	**2.12**	**1.17**
MEAN	Independent task completion	**2.73**	**2.75**	**4.00**
SD	Independent task completion	**1.71**	**1.48**	**2.10**

Table 3

Independent Initiations and Independent Task Completions during the Baseline and Intervention Sessions

	# of Independent Tasks During Baseline	All Tasks During Baseline	% of Independent Tasks During Baseline	# of Independent Tasks During Intervention	All Tasks During Intervention	% of Independent Tasks During Intervention
Participant 1						
Initiation	0	17	0%	8	58	13.8%
Completion	2	17	11.8%	25	58	43.1%
Participant 2						
Initiation	3	24	12.5%	33	61	54.1%
Completion	6	24	25%	41	61	67.2%
Participant 3						
Initiation	12	32	37.5%	37	47	78.7%
Completion	14	32	43.8%	36	47	76.6%
Participant 4						
Initiation	24	43	55.8%	12	21	57.1%
Completion	30	43	69.8%	11	21	52.4%
Intervention B Initiation				16	20	80%
Intervention B Completion				20	20	100%

Table 4

Percent Change of Independence from Baseline to Intervention

Participant 1	**% Change Independent From Baseline to Intervention**
Initiation	13.8%
Completion	31.3%
Participant 2	**% Change Independent From Baseline to Intervention**
Initiation	41.6%
Completion	42.2%
Participant 3	**% Change Independent From Baseline to Intervention**
Initiation	41.2%
Completion	32.8%

Participant 4	**% Change Independent From Baseline to Intervention A**	**% Change Independent From Baseline to Intervention B**
Initiation	1.3%	24.2%
Completion	-17.4%	30.2%

Participant 1. The baseline for participant 1 consisted of 5 sessions. During the baseline, participant 1 did not independently initiate any of the tasks. The mean and standard deviation for independent task initiation was 0. He independently completed 2 out of 17 tasks, which represents 11.8% of tasks. The mean of .4 and the standard deviation of .49 represents relatively low independence and low variability from mean. During the intervention condition, participant 1 initiated or transitioned to a task 8 out of 58 opportunities during 15 sessions which represents 13.8%. The mean and standard

deviation was .53 and .81, respectively. The student exhibited independence in task completion on 25 out of 58 opportunities during the 15 intervention sessions. Independent task completion represents 43.1% during the intervention. The mean during the intervention session was 1.67 independently completed tasks per session with the standard deviation of 1.01 independently completed tasks. The graph of independent transition shows that except for an outlier in session 7 and 16, there is a low deviation from mean during the intervention session. Standard deviation of independent task completion is twice as great as independent initiation/transition. The trend lines for both dependent variables show progression on x-axis with significantly higher values for independent task completion. Finally, the percent change from the baseline to the intervention in table 4 reveal relatively small increase of 13.8% for independent initiation/transition and 31.3% for independent task completion.

Participant 2. The baseline for participant 2 consisted of 7 sessions. During the baseline, participant 2 independently initiated 3 out of 24 tasks. This represents 12.5%. The mean and standard deviation for independent task initiation was .43 and .49. He independently completed 6 out of 24 tasks, which represents 25% of tasks. The mean of .86 and the standard deviation of .83 represent relatively low independence and low variability from mean. The intervention condition was performed in a length of 13 sessions. During the intervention condition, participant 2 initiated or transitioned to a task 33 out of 61 opportunities during 13 sessions which represents 54.1%. The mean and standard deviation was 2.54 and 1.78, respectively. The student exhibited independence in task completion on 41 out of 61 opportunities during the 13 intervention sessions. Independent task completion represents 67.2% during the intervention. The mean during

the intervention session was 3.15 independently completed tasks per session which was over 2 tasks more than during the baseline session. The standard deviation of 1.75 independently completed tasks doubled from the baseline condition. The graph of independent transition shows the increasing trend line. The trend line for the dependent variable of independent task completion shows less steep progression compared to independent transition. Finally, the percent change from the baseline to the intervention in table 4 reveal high increase of 41.6% for independent initiation/transition and 42.2% for independent task completion.

Participant 3. Participant 3 completed 9 sessions of baseline during which he independently initiated 12 out of 32 tasks which represents 37.5%. The mean and standard deviation for independent task initiation was 1.33 and 1.05. He independently completed 14 out of 32 tasks, which represents 43.8% of tasks. The mean of 1.56 and the standard deviation of .83 represent similar trend line in both dependent variables during the baseline sessions. The intervention condition was performed in a length of 11 sessions. During the intervention condition, participant 3 initiated or transitioned to a task 37 out of 47 opportunities which represents 78.7%. The mean was 3.36 independent initiations and standard deviation was 1.82 of variation from mean. The student exhibited independence in task completion on 36 out of 47 opportunities during the 11 intervention sessions. Independent task completion represents 76.6% during the intervention which is slightly lower than the independent initiation condition. The mean during the intervention session was 3.27 independently completed tasks per session which was almost 2 more tasks than during the baseline session. The standard deviation of 1.48 independently completed tasks almost doubled from the baseline condition. The graph shows the trend

lines for both dependent variables close next to each other with the point of 12th session crossing each other. Finally, the percent change from the baseline to the intervention in table 4 reveal increase of 41.2% for independent initiation/transition and 32.8% for independent task completion.

Participant 4. The baseline for participant 4 consisted of 9 sessions. Subsequently, he completed 4 sessions of Intervention A condition and 5 sessions of Intervention B condition. During the baseline, participant 4 independently initiated 24 out of 43 tasks which represented 55.8%. The mean and standard deviation for independent task initiation during the baseline was 2.18 and 1.19, respectively. He independently completed 30 out of 43 tasks, which represents 69.8% of tasks. The mean of 2.73 is one third higher in comparison to independent task initiation during the baseline condition. The standard deviation of 1.71 represents relatively high fluctuation from mean. The intervention A condition was performed in a length of 4 sessions. During the intervention A condition, participant 4 initiated or transitioned to a task 12 out of 21 opportunities during which represents 57.1% of a slight increase of less than 2% in comparison to the baseline. The mean independent initiation was 3 responses per session and standard deviation during the Intervention A condition was 2.12. The high standard deviation positioned data in a wide range from 17% to 100%. The student exhibited independence in task completion during the intervention A condition 11 out of 21 opportunities. Independent task completion represents decline of 17.4% to 52.4% in comparison to baseline condition. The mean during the intervention A session was 2.75 of independently completed tasks per session which was comparable to the baseline session. The standard deviation of 1.48 independently completed tasks was lower in

comparison to the baseline condition. An additional phase of intervention was delivered for the participant D. The participant D demonstrated high but inconsistent results for both dependent variables during the baseline and intervention session. Based on the data analysis during the intervention session A, intervention B was added to the study. The intervention B consisted of additional reinforcer for this participant delivered upon completion of all tasks. Implementation of Intervention B during the subsequent 5 sessions increased independence in both dependent variables. 16 independent initiations and 20 independent completions out of 20 opportunities represented 80% and 100% of independence. During the intervention B session, the mean of independent initiation increased to 3.20 and standard deviation decreased in half to 1.17 in comparison to the Intervention A session. Mean Independent task completion increased to 4.00 but so did the standard deviation to 2.10 in comparison to the Intervention A sessions. The graph of independent transition shows the increasing trend line. The trend line for the dependent variable of independent task completion shows higher progression compared to independent transition. Finally, the percent change from the baseline to the intervention A in table 4 reveal very small increase of 1.3% for independent initiation/transition and decrease of 17.4% for independent task completion. After addition of intervention B phase for this participant, an increase of 24% in independent initiation and 30% increase in independent completion were observed.

Survey Results

Table 5 represents the data of a social validity survey. All four paraprofessionals participated in the Likert survey which consisted of four questions related to the

satisfaction with the use of the FTVS HD app to improve independence in students with significant disabilities.

Table 5

Survey Results: Responses of Four Paraprofessionals

Questions	5 Strongly Disagree (%)	4 Disagree (%)	3 Undecided (%)	2 Agree (%)	1 Strongly Agree (%)
I enjoyed learning new app, FTVS HD.	0	0	0	75	25
I liked using FTVS HD during academic lessons.	0	0	25	50	25
I liked using the FTVS HD during CBI.	0	25	25	25	25
I would use the FTVS HD again.	0	0	0	75	25
Comments	One response: "The use of the app depends on individual student and individual situation."				

Three paraprofessionals reported agreement that they enjoyed learning to use FTVS HD, and one paraprofessional reported strong agreement with the statement. The

responses to the second statement, asking if they enjoyed using the app, were more varied with a mean response of "agree." Most diverse were the responses to the third question about the applicability of the app during community based instructions. The responses varied from "disagree" to "strongly agree". In response to statement four asking if paraprofessionals would use the app again, three individuals responded "agree" and one individual responded "strongly agree". Finally, only one paraprofessional responded to the open ended non-structured comments question responding that, in his opinion, the use of the app depends on the individual student and individual situation.

Chapter 5

Discussion

The purpose of this study was to evaluate the effectiveness of electronic visual schedules on academic task completion and independent task transitioning of adolescents with developmental disabilities in a school setting. An electronic application, FTVS HD app was used for the present study. The study also evaluated satisfaction of the support staff with the electronic visual schedule. The study utilized a single subject multiple baseline across participants design. The following research questions were examined:

1. Will use of an electronic visual schedule (First Then Visual Schedule High Definition iPad application) increase independence in academic task completion for adolescents with developmental disabilities in a private high school for students with intellectual and developmental disabilities?

2. Will use of an electronic schedule (First Then Visual Schedule High Definition iPad application) increase independence in task transitioning for adolescents with developmental disabilities in a private high school classroom for students with intellectual and developmental disabilities?

3. Is support staff satisfied with the use of an electronic visual schedule?

Summary of Findings

The research questions asked if the use of FTVS HD app would increase independence in task completion and task initiation or transition from task to task in adolescents with developmental disabilities. All four participants of this study demonstrated an increased independence with varied success. In the area of independent task completion, research data indicated positive results. Based on the trend lines,

participants were able to increase independent task completion from 20% for participant 4 up to 75% for participant 3. Similarly, the data shows that all participants were able to increase independent task transition from 15% in data of participant 4, to 80% in data of participant 3.

Upon review of individual data in the area of independent task completion, participant 3 exhibited the greatest amount of change during the intervention stages using the FTVS HD app. With mean of 1.56 in the baseline and mean of 3.27 in the intervention he more than doubled his success rate of independent task completion. Participant 2 more than tripled his mean score of independent task completion from 0.86 to 3.15 and participant 1 had relatively low independent task completion at baseline (M = 0.4), yet finished the study with the mean of 1.67. Interestingly, participant 4 exhibited limited progress in independent task completion from a mean 1.71 in baseline to a mean of 1.48 during the intervention. Upon daily data review, an additional intervention (Intervention B) was added to the sessions of this student. This addition resulted in an increased mean of 4 independent task completions per session which represented a success rate of 100% during all sessions in the Intervention B phase.

Upon review of individual data in the area of independent task initiation (if the task was first in a sequence) or independent transition (for all following tasks in a sequence) , participant 2 showed a substantial increase from a baseline of 0.43 to a six times higher mean of 2.54 in the intervention phase. Participant 1 started with a mean of 0 in a baseline and increased his independent task initiation/transition more than 5 times in the intervention phase to a mean of 0.53. Finally, participant 4 demonstrated progress from a baseline of 2.18 in independent task initiations/transitions to 3.00 in intervention

conditions. Although the increase was relatively low, his independence during the baseline was already on a relatively high level. After adding Intervention B for this participant, his mean increased significantly to 3.20 of tasks completed independently.

When comparing the percent of independence during the baseline and the intervention phases, Table 3 corroborates the trend line with participants 1 and 4 presenting only a low level of progress. Participant 1 exhibited only a 14% increase in outcomes and participant 4 exhibited a decrease of 1.3%.

High effectiveness of the intervention was demonstrated by the percent increase of independence in outcomes of participant 2 (41.6% for independent task initiation and transition and 42.2% for independent task completion). Participant 3 exhibited similar success (41.2% and 32.8% respectively in independent task initiation and completion). Interestingly, data for participant 4 revealed that the intervention was not effective with 1.3% increase of independent initiation from the baseline to the intervention and with actual decrease of independence of 17.4% from the baseline to the intervention. When the Intervention B was added to the schedule of participant 4, the percent change of independence from the baseline to the intervention B represented a 24.2 % increase in task initiation/transition and a 30.2% increase in independent task completion. These findings suggest that constant data monitoring and analyzing during the study, and subsequent but swift intervention modifications with possible additional motivators are important factors to consider in similar studies.

Another descriptor, a trend line for each of the two dependent variables, was added to the graph. This mathematical feature was calculated to increase clarity in a large data variability and high standard deviation. The trend line helped us (a) see the level of

progression of independence in time (as opposed to standard deviation or mean which gives us only one static number) and, more importantly (b) gain a visual descriptor of how both dependent variables act together. As the Figures 1 and 2 presents, there is a large difference between the trend lines of both dependent variables in the data of participant 1. Similarly, the data of participant 4 displays a relatively large difference. In contrast, trend lines for the data of participants 2 and 3 align more closely. The trend lines show steep inclines for participants 2 and 3 which indicate of effectiveness of the intervention. The most revealing information from the trend lines comes from their position in each of four graphs in affinity to each other. The graph shows a very small distance between the trend lines of participants 2 and 3, and large distance in trend lines of participants 1 and 4. Interestingly, the position of the trend lines imitates the overall results of the effectiveness of the intervention for each participant. Based on this analysis, the proximity of the trend lines correlated with successful implementation of the intervention, where participant 2 and 3 benefited most from the intervention.

Results from this study suggest that the FTVS HD app can increase independence in task completion and task transition in adolescents with developmental disabilities. These results align with the findings of prior studies by Spriggs et al. (2014), Wilkinson (2008), and Douglas and Uphold (2014).

The findings of the present study also corroborate the recommendations of McDonald and Machalicek (2013) as the interventions targeted older adolescents and emphasis was placed on functional skills in academic settings and on community based instructions.

All the participants were able to find the specific lesson from the FTVS HD menu based on the master schedule on the classroom wall and then follow the order of tasks on their iPods. The practices utilized in the study appear to have provided participants with an opportunity to be more independent and display less aberrant behaviors.

Hodgon (1995) and Knight, Sartini, and Spriggs (2014) suggest that academic fluency and independent task completion in the classroom with students with ASD can be achieved with visual schedules. The conclusions of the present study support these findings, as both studies led to an increase in desired independence for all participants in the area of task completion.

In contrast, Spriggs et al. (2014) revealed through findings of a single subject, multiple probe design across participants study that not all students responded to the intervention of visual schedules with high success. One of four participants responded to the intervention of electronic visual schedule with only moderate success of transitioning from a task to another task. (Spriggs et al., 2014) Similarly, in the present study participants 1 and 4 increased independence in transition and task completion with only moderate success levels. This finding, coupled with the findings of Spriggs et al. (2014) warrants additional research to better understand why electronic visual schedules are more effective for certain students, and why electronic visual schedules may be less effective for other students.

An additional benefit of the study was the effectiveness and creativity of support staff. A constant focus of support staff on procedures created by this study, specifically, giving a limited verbal prompt and proceeding with visual support only, created an atmosphere of challenge. By the implementation of the electronic visual schedule

procedures, they were consistently and relentlessly seeking ways to eliminate verbal prompting and to replace it with the electronic visual schedule steps. They were suggesting additional individualized steps for specific academic behaviors as the situations presented themselves. The participants were this way exposed to more opportunities to use the visual electronic schedules and they exercised more independence in novel situations in their natural environment.

An important observation was the higher success rate in independent task completion in all four participants. This finding suggests that it could be easier to acquire the independence in task completion than independence in task initiation or transitioning from task to another one. It is possible that this is due to long history of focus on task completion in the classroom.

It is important to note that the survey results of social validity completed by four paraprofessionals working in the classroom mimicked the effectiveness of the intervention for individual participants. Least agreement with the statements from the Likert Scale was reported by the paraprofessionals who worked as one-to-one with participant 1 and 4. Most agreement reported as "100% agree with all the statements" from the Likert Scale were reported by the paraprofessional who worked as one-to-one with participant 2. One comment "The use of the app depends on individual student and individual situation" came from the paraprofessional who worked with participant 1. These results of the survey suggest that social validity each individual support staff corroborated with results achieved by the student he or she was assigned to. The effectiveness of the interventions was in positive correlation with the satisfaction of the support staff surveyed.

Limitations

There were several limitations to this study. The primary limitation included the sample size of only four participants. Although the involved participants responded positively to the strategies of the electronic visual schedules, additional participant data would strengthen study findings.

Moreover, taking the time to teach support staff the use and preparation of individual schedules may warrant better results. A stronger theoretical background of support staff in the educational and behavioral sciences may also yield stronger results.

Furthermore, the fluidity and variability of each academic day was another limitation of the study. In order to systematically compare data from one session to another, the steps of the schedule would need to be the same in quantity and content from session to session. This was impossible since the academic schedule needed to include variable and novel tasks. Novelty and originality keeps the content engaging for the students. On the other hand, if we would track only a limited number of schedules throughout the day to assure sameness in tasks, we would miss out on reporting additional important changes and achievements. As a result, each instance of task completion or task transition carried different weight on different days and different sessions. For example, if 6 tasks were completed during one session, each task had a weight of 17%. If only four tasks were completed during the session, each task would carry weight of 25%. If a participant completed one task independently each day, it had a different value for each session and therefore the values were difficult to compare. One of the possible solutions would be to create a cumulative graph of task completion in lieu of a standard session by session structure. A cumulative graph would show the

independence progress over time without the necessary distraction of comparing individual sessions.

Finally, the time was the greatest constraint of the study. The participants were observed through a few weeks of the academic year. More robust observation with extended time would be appropriate because it would allow for maintenance and generalization of data collection.

Implications

Implications for practice include the need for teachers to be knowledgeable about the use of electronic visual schedules. Teachers should be provided with professional development and training on how to use and maximize the potential of electronic visual schedules for specific students. Teachers should be also be aware that the field of studies on the topic is emerging and they should actively seek new research in scientific communities in the area of behavioral, educational, and technological fields. Teachers should take under consideration the fact that there is an element of "buy-in" required from paraprofessionals and students themselves in order to plan for proper motivation of all parties.

In addition, this study shows consistently that acquisition of independence in transitioning or task initiation seems to be more challenging than independence in task completion perhaps due to a long academic history of classroom teaching designs focusing more on task completion than on task initiation. An important implication would be to develop consistent curriculum with emphasis on task initiation. The skill of independent initiation or independent transitioning from task to another is especially

challenging for individuals with developmental disabilities and a systematic approach to this problem would develop their abilities in a consistent manner.

The research of this nature matters enormously for future effective development of skills in the population of adolescents and adults with developmental disabilities. With the fast development of superior, inexpensive and accessible technologies, there is an opportunity to teach students with developmental disabilities a considerable amount of new skills. It is important to use every new opportunity because special educators face a challenging task: they are preparing students for jobs that do not exist yet. Educators need to utilize any available technologies that prove to be successful in enhancing students' most important abilities. By learning to be independent and aware of task progressions in time, students have an opportunity to be successful in their future jobs. More importantly, they have an opportunity to be active and contributing member of society instead of being dependent passive members of their communities.

Implications for future research involving the effectiveness of electronic visual schedules include the recommendation for research to use larger scale study methodology with an increased number of participants to yield stronger results. Researchers should also investigate the effect of the electronic visual schedules on the aberrant behavior as the independence from verbal prompts in structured academic or vocational settings increases. Another suggestion for future research would be to investigate possible correlations between the trend lines of two dependent variables and the effectiveness of the intervention participants in larger populations. As indicated, there may be valuable implications for practitioners. Researchers may also consider the effect of composing the schedules by students themselves on required academic tasks. Suggestions and

recommendations to improve implementation of electronic schedules may be gathered from a larger participant population. Finally, extended time frame with intervention, maintenance, and generalization phases may open new suggestions for further research.

Conclusions

It appears the effect of electronic visual schedules may vary for adolescents with developmental disabilities depending on motivation levels, complexity of behavioral and developmental challenges, as well as knowledge level of staff implementing the procedures. Additionally, ensuring that data is reviewed and analyzed immediately is vital to the success and outcome of the intervention. Moreover, with the emergence of new technologies, a larger quantity of research in applied behavioral science, and more vivid applications, it is recommended that more technology be utilized in lieu of redundant verbal reminders. Lastly, it is recommended that adults in all environments of the students with developmental disabilities use the system of visual electronic schedules to ensure generalization.

After examining the results of this study, it can be concluded that the use of electronic visual schedules is an effective intervention for improving independence in task initiations, transitions from task to task, and independent task completion. Participants in this study were successful in independently navigating instructional tasks in the classroom during structured academic activities, novel instructions in special science projects, and in the community where they had to follow a shopping list and make a purchase. It was also clearly evident, throughout the study, that all the participants were able to enjoy a new sense of independence. The use of electronic visual

schedules may produce positive and socially significant differences in the behavior of adolescents with developmental and social deficits.

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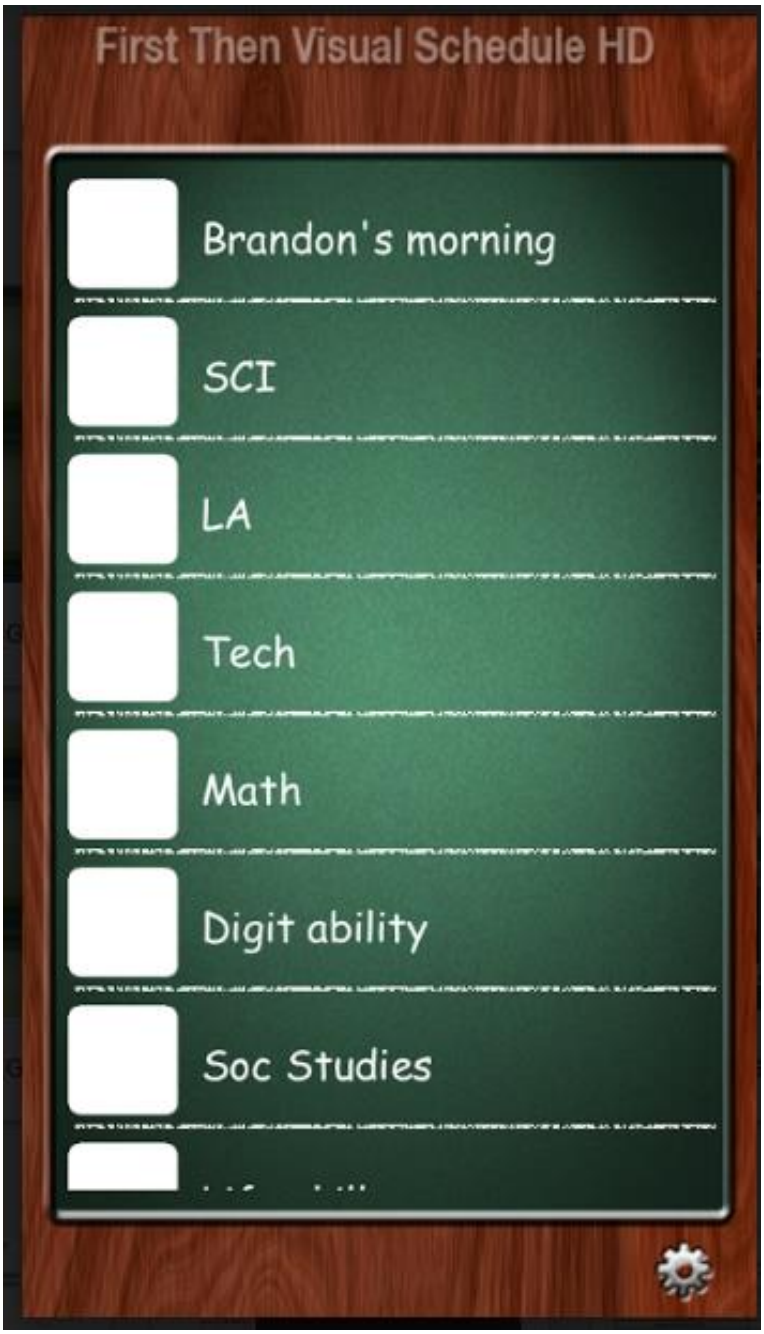
Appendix A

Apple iPod touch 16GB Silver

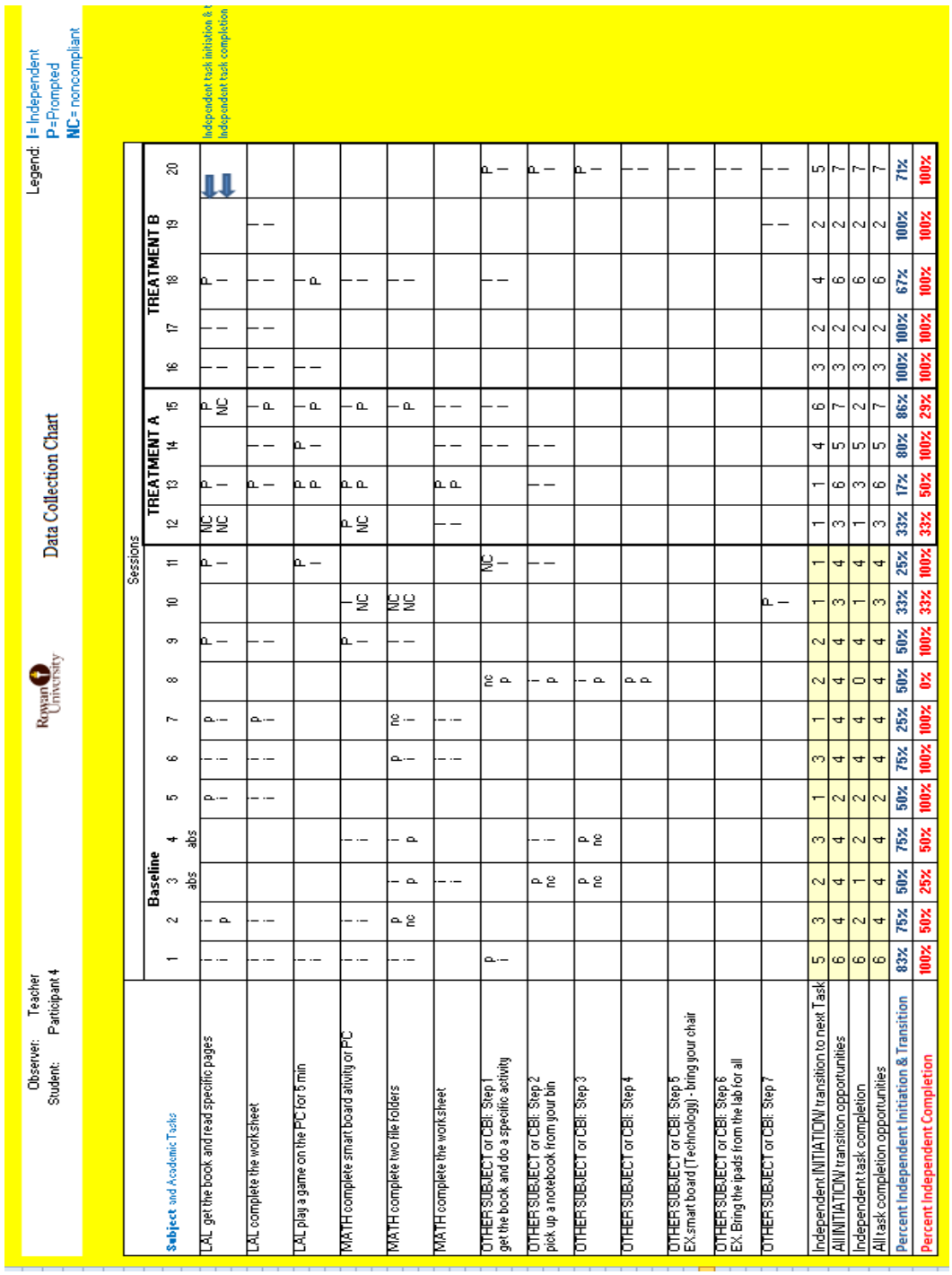
Appendix B

First Then Visual Schedule High Definition application



Appendix C

Data Collection Chart



Observer: Teacher
Student: Participant 4

Rowan University

Data Collection Chart

Legend: I= Independent
P=Prompted
NC= noncompliant

Subject and Academic Tasks	Sessions: Baseline 1	2	3 abs	4 abs	5	6	7	8	9	10	11	TREATMENT A 12	13	14	15	TREATMENT B 16	17	18	19	20	Independent task initiation & t / Independent task completion
LAL get the book and read specific pages	I I	I P			P I	I I	P I		P I		P I	NC NC	P I		P NC	I I	I I	P I			
LAL complete the worksheet	I I	I I			I I	I I	P I		I I				P I	I I	I P	I I	I I	I I	I I		
LAL play a game on the PC for 5 min	I I										P I		P P	P I	I P	I I		P			
MATH complete smart board activity or PC	I I	I I		I I					P I	I NC		P NC	P P		I P		I I				
MATH complete two file folders	I I	P nc	I P	I P		P I	nc I		I I	NC NC					I P		I I				
MATH complete the worksheet			I I			I I	I I					I I	P P	I I	I I						
OTHER SUBJECT or CBI: Step 1 get the book and do a specific activity	P I							nc p			NC I			I I	I I		I I			P I	
OTHER SUBJECT or CBI: Step 2 pick up a notebook from your bin			P nc	I I				I p			I I		I I	I I						P I	
OTHER SUBJECT or CBI: Step 3			P nc	P nc				I p												P I	
OTHER SUBJECT or CBI: Step 4								P p												I I	
OTHER SUBJECT or CBI: Step 5 EX.smart board (Technology) - bring your chair																				I I	
OTHER SUBJECT or CBI: Step 6 EX. Bring the ipads from the lab for all																				I I	
OTHER SUBJECT or CBI: Step 7										P I									I I	I I	
Independent INITIATION transition to next Task	5	3	2	3	1	3	1	2	2	1	1	1	1	4	6	3	2	4	2	5	
All INITIATION transition opportunities	6	4	4	4	2	4	4	4	4	3	4	3	6	5	7	3	2	6	2	7	
Independent task completion	6	2	1	2	2	4	4	0	4	1	4	1	3	5	2	3	2	6	2	7	
All task completion opportunities	6	4	4	4	2	4	4	4	4	3	4	3	6	5	7	3	2	6	2	7	
Percent Independent Initiation & Transition	83%	75%	50%	75%	50%	75%	25%	50%	50%	33%	25%	33%	17%	80%	86%	100%	100%	67%	100%	71%	
Percent Independent Completion	100%	50%	25%	50%	100%	100%	100%	0%	100%	33%	100%	33%	50%	100%	29%	100%	100%	100%	100%	100%	

Appendix D

Examples of Visual Schedules (math and language arts)

Appendix E

Examples of Visual Schedules (science)

Appendix F

Examples of Visual Schedules (morning routine)

Appendix G

Examples of Visual Schedules (Community Based Instructions)

Appendix H

Likert scale Survey

Likert Scale Survey

One Likert Scale will be given to each support staff member who is a 1:1 staff and a Bancroft Employee after the study is completed.

Please indicate with a circle your level of satisfaction using this scale:

	Strongly Agree 5	Agree 4	Undecided 3	Disagree 2	Strongly Disagree 1
1. I enjoyed learning new application, FTVS HD app.	5	4	3	2	1
2. I liked using the FTVS HD app during academics lessons	5	4	3	2	1
3. I liked using the FTVS HD app during a CBI.	5	4	3	2	1
4. I would use the the FTVS HD app again.	5	4	3	2	1

5. Comments: